Exploring the World of Touch

"The Psychology and Art of the Blind" is the title under which this book was first published in 1950. This title has proved misleading, for the interest and value of the book is not confined to those immediately connected with the blind. To emphasize the wider appeal, the book is now being re-issued with a new dustcover.

Dr Révész is one of the foremost psychologists living in Europe today. His book is a revealing study of the world of touch which will be of immediate importance to two groups of people. First, the professional psychologist for whom it defines and traces the development of the science of haptics, and lays the foundations of a new psychology of the blind. Second, it will be of interest to the artist or critic concerned with the mental processes of artistic creation.

The first part of the book deals with the theory of haptics and includes a section on the relationship between sight and touch. The latter part is devoted to a study of what is to many a fresh aspect of æsthetics. The methods and the development of sculptors such as Mansuelli and Kleinhaus are analysed in detail, and Dr Révész includes many illustrations of sculptural works by artists who work not with hands and eyes, but hands alone.

PSYCHOLOGY AND ART OF THE BLIND

G. RÉVÉSZ

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by

G. RÉVÉSZ

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Translated from the German

by

Dr. H. A. Wolff

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PREFACE

The first part of this book deals with my attempt to establish on fundamental lines a theory of Haptics—that is, of the impressions conveyed by the tactile and kinematic sense. I intend to provide the theoretical foundation for Haptics and for the psychology of the blind by bringing together those principles which lead to a deeper understanding and open up new approaches for research work in this field. The second part is devoted to the æsthetic experience and to the sculptural activity of the blind.

Our knowledge of the haptic world is very bare; bare not so much in respect of facts as of leading principles.

Haptics (and therefore the psychology of the blind also) has always been a stepchild of Psychology. The striking advances in the fields of Optics and Acoustics, as well as the practical importance of seeing and hearing, have distracted the attention of research workers from an apparently irrelevant subject. They were also labouring under the delusion that Haptics did not belong to the higher senses, because from a biological point of view the organ of touch represents a far lower stage than the perceptive organs of seeing and hearing. Although our visual and acoustic perceptions show a higher degree of differentiation, and although they may be possessed of a higher cultural value, due to the functions of speech and artistic creation being dependent on them, that does not preclude the function of the haptic sense being on theoretical and practical grounds an important field of the psychology of sense, which deserves thorough investigation.

The tactile organ is in direct contact with the world of objects; its function consists of acquiring knowledge of the material world and checking the correctness of the visual impressions. We are indebted to our tactile and motor organs for possessing an incredibly accurate instrument—our hand—which enables us to master nature and to establish the material foundation of culture and civilisation.

The epistemological importance of Haptics becomes clear when we realise that we are here dealing with a space which is just as

autonomous as the visual space, and that our haptic spatial impressions are possessed of the same originality as the visual spatial impressions.

The first part of my work centres on the discussion of the Haptics of form, particularly on the establishment of the principles of haptic perception. The very fact that it is possible to establish a theory of Haptics endows Haptics with a great importance as compared with Optics and Acoustics. The special nature of Haptics and the fact that the separate stages of haptic perception are open to distinct and accurate observation provide us with an opportunity of ascertaining the importance of the different factors. It could be shown that many of these factors and tendencies are operative in the process of visual perception too; a theory of Haptics might therefore constitute a starting point for a theory of form, for which a more general validity could be claimed than for a theory of form based mainly on visual experiences.

In the second part of my book I have dealt, on the basis of my experiences in the psychology of perception, with the æsthetic problem in the field of Haptics. Apart from some papers on the plastic achievements of blind children, this field had been almost completely neglected. Two important sets of problems were here open to discussion: the æsthetic experience and the creation of form in Haptics. I am offering the first treatise on tactile æsthetics, the first foundation for the Æsthetics and Art of the blind. The investigations carried out on the blind and on sighted subjects working haptically have raised important problems both from the point of view of æsthetics and of psychology, problems which are bound to influence general æsthetics and the history of art. The analysis of the creative activity of blind sculptors has provided an answer to many general questions which had so far not been solved by the æsthetic theories of the fine arts.

I am well aware of the fact that the solutions of the various problems which I have discussed, especially the attempt to give a basic theory of Haptics, are far from being complete. A detailed investigation of the intricate problems, which involve the whole field of Haptics and an important part of the psychology of the blind, is far beyond the ability of one research worker, certainly beyond mine. I hope, however, to have succeeded in

establishing a foundation for the Haptics of form and the psychology of the blind and of defining fairly clearly the basic views and concepts which may be adequate to an elucidation of the intrinsic character of Haptics and of its importance for the structure of the world of our perceptions and of that of the blind.

I wish to express my sincere gratitude to Dr. H. A. Wolff for his willingness to translate my work into English, to Mr. Basil Clarke of the Royal Army Medical College, London, for editorial work, and to Mr. J. C. Longman, who, in spite of these difficult times, has been prepared to publish this book.

G. Révész

Amsterdam,
Autumn, 1949

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PART I

SPACE PSYCHOLOGY
AND
HAPTIC SPACE

A.—THE PROBLEMS OF SPACE PSYCHOLOGY

1. The Sciences of Space

The great controversy on the problem of space, pursued with unremitting intensity from the time of the Eleatic School up to the present, not only by psychologists and physiolcgists, but also by philosophers, physicists, and mathematicians, reached its climax in Kant. In spite of the work of experimental psychologists and of physiologists, through whose efforts we have gained a deeper insight into the mechanism of space-perception, all subsequent workers had to come to terms with Kant's conceptions.[1]

Even those mathematicians who, in dealing with the structure of geometrical space, based their investigations on Euclid's perceptible space have taken Kant's concept into consideration. Other mathematicians attempted a full characterisation of space from the logical-axiomatic point of view by a few accurate concepts and theses: with the help of these axioms every geometrical term is definable, and every true geometrical theorem follows logically from them. Such mathematicians, however, rarely dealt with the epistemological problem of space, and still less frequently with the psychological problem.[2]

However important the epistemological and psychological problem of space may be, the true science of space among the theoretical sciences remains Geometry, both mathematical and physical Geometry. The former attempts to set up a complete system of axioms, free from internal contradictions and as simple as possible, and to derive the geometrical theorems from it. So long as Euclid's Geometry was the only existing one (*i.e.*, a geometry of a homogeneous, continuous, three-dimensional space, that space which gives us the guarantee of a perceptible spatial order) the physicist had no alternative to describing his findings in terms of this Geometry. Following the discovery that Euclidean space is not an absolute necessity of

[1] W. Gent, *Die Philosophie des Raumes und der Zeit*, Bonn, 1926.

[2] H. Weyl, "Philosophie der Mathematik und Naturwissenschaft," *Handbuch der Philosophie*, Abt. II, Munich, 1927.

thought, since in principle other systems of space, logical in themselves, can be described which are equally justified and which mathematically possess the same theoretical value and have laws of even wider validity than those of the Euclidean type, Physics was faced with the question, which of the possible types of space would correspond best with physical experience. It is well known that present-day physics has decided in favour of a non-Euclidean structure of space.

The question as to whether non-Euclidean spaces can be realized must be kept strictly apart from the mathematical and physical problems. This is neither a physical nor a mathematical question, in spite of the fact that physicists and mathematicians have in the first place attempted to answer it. Helmholtz [1] was the first to try to open non-Euclidean spaces to our imagination. This attempt, however, in respect of spherical space and pseudo-spherical space is limited to two-dimensional structures only, and is therefore based on the Euclidean system of space. The same applies to the well-known model of Felix Klein.[2]

Nor does this enable us to visualise the geometry of Bolyai and Lobachevsky. It is merely a concrete demonstration (or interpretation by means of illustration) of non-Euclidean concepts by means of structures in Euclidean space.

I have not made it my task to discuss the various theories of space, nor even to state my attitude towards the more important systems of space-psychology. I might have omitted discussion of the problem of space altogether had not the theoretical interpretation of my findings in the field of psychology of space made it necessary to define my attitude to the question of the origin and nature of our spatial perception. Whether and to what extent my findings and concepts can contribute to a solution of the problem of space remains to be seen.

2. Is Space Conception *a priori*?

In tracing the historical development of theories of space one finds that research has centred on the solution of two basic questions, first, the problem of the *origin of our spatial perception*,

[1] H. Helmholtz, *Handbuch der physiologischen Optik*, 1910, III, 3, 154; and "Über den Ursprung und Sinn der geometrischen Sätze," *Wissenschaftliche Abhandlungen*, II, 640.

[2] F. Klein, "Über die sog. nicht-Euklidische Geometrie," *Ges. Math. Abhandlungen*, I.

and, secondly, the problem of the *order of our sensory impressions* in relation to the perception of space.

From the epistemological point of view Nativism and Empiricism are diametrically opposed. A further distinction is that the nativistic theories stress the question of the origin, the empiristic theories that of the coming into being of the spatial image. This division becomes especially marked on the one hand in the theories of space, based on Kant, put forward by the physiologists and psychologists of the school of Johannes v. Müller, on the other hand in Lotze's theory of local signs. Lotze's conception is most characteristic because it shows how well Nativism and Empiricism are compatible with one another if one tries to explain along the lines of empiricism the localisation of sensory impressions, the orientation in space, and the structure of the concrete, experienced world of space, whilst answering the problem of origin on the lines of Nativism. Lotze, who tried to explain the constant correlation between sensations and points in space, as known from experience, on the lines of this theory of local signs, realised rightly that " the faculty of the mind to perceive space at all " could not be explained by means of the local signs.[1] He did not contest that there exists *a priori* a mode of perceiving space which compels us to apprehend the sensations spatially. "We only mean," he says, " that the original nature of our mind compels us to arrange the elements of our sensations according to a spatial pattern and that a subsequent consideration of the infinite number of such arrangements which we have made consciously leads us to a more or less vivid total concept of an infinite all-embracing space." He expresses himself more clearly in his *Mikrokosmos*, where he states: " Thus we apply these innate intuitive forms of space and time to those impressions, whose reciprocal relationship is thereby transformed for us into the sequence and contiguity of the phenomenal world of sensation. We cannot dissociate ourselves from it, because it is necessary and unavoidably valid, and because it is the outcome of the original nature of our perceiving and transforming mind." [2] At the same time, however, he stresses that we must possess another faculty, enabling us to arrive at particular phenomenal forms; for one can well imagine a being who perceives geometrical proportions in the same way as we do,

[1] H. Lotze, *Medizinische Psychologie*, Leipzig, 1852, pp. 334 ff.
[2] H. Lotze, *Mikrokosmos*, Leipzig, 1869, I, 254.

and so has the same conception of space, but nevertheless receives quite different impressions from objects.

Such a concept may be defended, at least to some extent; but not a concept which explains *haptic perception* of space on *nativistic* lines whilst applying *empiristic* theories to *visual perception*, or vice versa. Confusion has arisen in the history of the theory of space through the fact that many famous research workers have attributed primary spatiality to the impression of one of the space-perceiving senses only, while attributing to the other merely indirect spatiality (*i.e.*, a kind of spatiality which would only be transferred by means of experience and by associative connection from the originally spatial sensory impressions to the originally non-spatial perceptions). Thus Berkeley [1] once tried to derive the visual impressions of space from the tactile spatial impressions; Bain,[2] Riehl,[3] and Heymans,[4] from the data of our kinæsthetic sense; whilst Hagen, v. Kries, and Gelb [5] tried to derive the space-function of the haptic sense from the primarily visual relations of space.

If empiricists defend such a theory, they are either inconsistent in that they want to solve the problem of origin on nativistic lines in the field of one sense and on empiristic lines in the field of the other, or they create unnecessary difficulties for themselves by interpreting experience in a twofold manner. In one case experience is meant to be productive of space, but not in the other. The visual sense is, according to some empiristic theories of space, alleged to arrive at its original spatiality through experience, the tactile sense to arrive at its quasi-spatiality through experience too, but only indirectly by way of the visual sense. Only very special reasons could justify such an assumption, which from the point of view of theory-formation is definitely superfluous. If, however, such reasons cannot be adduced, it is not right to confine the space-forming function of experience to one only of the space-and-object perceiving senses. It is therefore the task

[1] G. Berkeley, *Theory of Vision*, especially pars. 16, 46, 129, 130. (*Works*, by A. C. Fraser, Oxford, 1901.)

[2] A. Bain, *The Senses and the Intellect*, London, 1855, pp. 245 ff.

[3] A. Riehl, *Der philosophische Kritizismus und seine Bedeutung für die positive Wissenschaft*, Leipzig, 1876–1887, II, 138 ff.

[4] G. Heymans, *Die Gesetze und Elemente des wissenschaftlichen Denkens*, Leipzig, 1915 (ed. 3), pp. 205 ff.

[5] J. W. Hagen, Wagner's *Handwörterbuch der Physiologie*, II, 1884; J. v. Kries, *Allgemeine Sinnesphysiologie*, 1923; A. Gelb, *Die psychologische Bedeutung pathologischer Störungen der Raumwahrnehmungen*, IX. *Kongr. f. experimentelle Psychologie*, 1925.

of a consistent empiricism to avoid such an unnecessary complication and to extend the space-forming function to both space-perceiving senses; inconsistent empiricism, however, attributes to the impressions of one special sense only an original primary spatiality, whilst attributing to the other sense only a quasi-spatial perception gained through experience and arrived at by a chain of associations. It can hardly be assumed that the representatives of such an " empiristic " nativism have pictured what such a secondary world of space would be like compared with the primary one. There is no reason why the spatial order in the field of touch should be explained in a different way from that of the visual sense, especially as the spatial order is one and the same in both these fields. Once the original faculty of perceiving space is admitted—an admission that follows from the inescapable realisation that the universality and cogency of spatial perception can only be explained in terms of the apriority of this form of perception—it is absurd to set up an hypothesis which makes the apriority of spatial perception more or less purposeless. We see in such a compromise quite a specific contradiction. The major difficulty, which had actually been removed by the conception of the *a priori*, is re-established by the second superfluous hypothesis.

The consequences of such a " nativistic " doctrine, which actually comprises two incompatible points of view, must not be overlooked.

If the spatial perception of one sense has been based on a primary spatial concept which is independent of experience, it is paradoxical to assume the existence of spatial experiences in the field of a sense to which this assumption does not apply. In this case even so-called " transference " does not help. For the apprehension of space cannot be transferred from one sense to another. All that is possible is the co-ordination of this other sense with the pre-existing empirical space. One can well imagine that by continuous interaction connections might develop between the spatial data of the visual sense and certain non-spatial impressions of the acoustic sense, and that, therefore, an originally non-spatial acoustic perception might become interpreted in a spatial sense. The non-spatial impressions do not thereby gain a true spatial character.

A further consequence, which follows from the distinction

between direct and indirect spatial perception, is of special importance to the psychology of the blind. For if one attributes primary spatiality only to our tactile or haptic impressions the basic problem of the psychology of space in the blind is actually solved; their space really is the phenomenal space. If, however, one attributes primary spatiality to the visual sense alone, all the blind are completely precluded from spatial perception. All that they call spatiality would only be concerned with sensory percepts which could be distinguished qualitatively from one another, but not with spatial experience as we understand it.

It therefore appears possible to admit the aprioristic nature of our spatial perceptions, while at the same time letting the concrete spatial image and the arrangement of objects depend on experience. In just the same way the Kantian *a priori* signifies merely the *conditions* of that empirical perception, without being concerned with the phenomenal structure of our spatial world.

The fact that our spatial perceptions can neither come into being nor develop without the help of experience does not conflict with the doctrine of the apriority of spatial conception, for the latter does not, as we have shown, include any statements on the phenomenal nature of the concrete spatial image.

The same also applies, of course, to the gradual development of the sense of vision in those born blind, following operative treatment—a process which up to the present has been made use of by the empiricists as an argument against the apriorists and the nativists. From the point of view of a radical empiricism those born blind and afterwards operated on should only gradually " learn " the separateness and the coexistence in space of visual objects and build up their visual space on the lines of the haptic space out of originally non-spatial optic qualities. How that might actually happen is a mystery and will remain one. Theories like the theory of fusion of Herbart,[1] or Wundt's [2] hypothesis of mental synthesis, or even more that of a chemistry of the mind put forward by Mill [3] and Donders, according to which a sort of fusion of non-spatial sensory perceptions should lead to a fundamentally new product, a sensory space, are fantasies devoid of any concrete contents. From the empirical point of view

[1] J. F. Herbart, *Psychologie als Wissenschaft*, Königsberg, 1825, pp. 120 ff., and *Lehrbuch der Psychologie*, Königsberg, 1816, pp. 131 ff.
[2] W. Wundt, *Grundzüge der physiologischen Psychologie*, Leipzig, 1902, II, 353 ff.
[3] J. S. Mill, *A System of Logic*, 1873 (German trans.).

one may perhaps understand that the blind man is enabled by his kinæsthetic impressions and impulses to orientate himself in space and to localise his impressions. It may perhaps also be possible to state the criteria which allow him to estimate size, direction, and distance; but such a doctrine will never be able to provide an explanation of how the blind may achieve all that without the framework provided by a system of space. This will always remain impossible, for the simple reason that the behaviour of the blind in space, their apprehension of objects and form, their understanding of spatial relationships, their spontaneous spatial experiences are unimaginable without the existence of a principle of order in space given *a priori*.

The theory of the apriority of our apprehension of space by no means amounts to any prejudgment about which sensory impressions we attribute spatial character to, and which senses possess the faculty of building up out of their own sensory material an objective phenomenal spatial world. Experience teaches us that only the visual and haptic senses are endowed with this faculty. The fact that in those who can see the haptic sense does not build up out of its own perceptions a special integrated spatial image is easily accounted for by the superiority of our visual function, which conveys to us a stronger, more complex, and at the same time a more useful spatial concept from a practical point of view. In view of the fact that the haptic structure of space and the haptic recognition of objects is of secondary importance for us who can see and becomes relevant in exceptional conditions only, we do not try to develop the haptically perceptible world of objects. We have become so accustomed to orientate ourselves on the visual world, that in dealing with haptic perceptions we fall back on visual concepts even in circumstances when we are under no compulsion to do so. The blind, however, are forced to pay the greatest attention to their haptic perceptions and experiences. They succeed, therefore, in building up a haptic world out of the material of their haptic experiences.[1]

[1] The question whether our acoustic experiences are spatial in character or not has been fully discussed by me in my paper "Does an Acoustic Space Exist?" (*Acta Psychologica*, III, 1937). I was able to show that we are not justified in assuming the existence of either an acoustic space *sui generis* or of acoustic experiences endowed with spatial character. Localisation of acoustic impressions takes place in the visual (-haptic) space. See also: *Formenwelt des Tastsinnes*, I, p. 27.

3. The Origins of Haptic Spatiality. The Empirical Approach

This empirical approach was based on the assumption that persons born blind and successfully operated on for cataract were the most suitable subjects for getting insight into the content of purely haptic impressions uninfluenced by visual concepts. Great hopes were entertained of elucidating the genesis of the haptic space, and of ascertaining whether our haptic impressions are of an originally spatial character or whether they obtain their spatial character merely by undergoing an unavoidable association with optical perceptions. The blind person who has been operated on and as a consequence of the operation is placed in a position of comparing his previous haptic perceptions with the newly acquired visual ones, was considered the ideal case. The comparison between his spatial perceptions before and after the operation was meant to provide the solution of the problems that had been discussed so unsuccessfully. In view of the fact that such attempts are cropping up over and over again, and are looked upon as relevant by well-known authors, I shall try to demonstrate the invalidity of the underlying assumptions by means of the scientific material available and from my own experience, hoping thereby to effect the final removal of an incorrectly set question from the list of psychological problems.

(a) *Post-operative Experiments on those Born Blind*

The fact that many people born blind were unable, after being operated on, to recognise well-known objects visually or distinguish forms or make correct statements on differences in size and distance led a number of research workers to the conclusion that spatiality is originally a feature of the *haptic impressions* only and that this spatiality is but secondarily transferred to the visual impressions. It is characteristic of the empirical basis of this theory that on the same grounds other authors were induced to put forward the diametrically opposite view. They interpreted the findings in a different way and denied the spatial character of the tactile impressions and assumed that the spatiality, especially the three-dimensionality of our spatial perceptions, entered our tactile impressions only through our visual perceptions. In support of this interpretation they stressed statements of blind

persons who would have us believe that immediately after the operation they did not localise objects in depth, but projected everything they saw on a two-dimensional plane, as it were.

There is, however, a third theory. This also is based on experiences of the blind, and stands for a haptic apprehension of space independent of vision; it therefore assumes two sensory spaces independent of one another: an autonomous haptic sensory space and an autonomous optic space. The lack of orientation in the visual space experienced by blind persons following operation, their failure to recognise objects, forms, and distances, was explained by assuming that following removal of the cataract a new world of space is opened up to the blind, a world of space which they first have to conquer, just as in infancy they had gradually conquered the tactile space.

So we see first of all that the same data from blind persons following operation can be interpreted differently, according to which facts and which statements are given greater importance.

It is our task to decide whether, in principle, the experiences of the blind following operation can supply an answer to the question of the primary spatiality of haptic impressions, and, further, to ascertain how far the actual experiments satisfy the criteria applicable to every experimental investigation.

(i) *Experimental methods and material*

In experiments on the blind after operation there are certain methodological conditions which have rarely been observed. As a consequence of this omission the majority of the cases mentioned in the literature are devoid of scientific value. The first condition which we have to observe in investigations related to the psychology of sensation and to the problem of spatial perception in the blind after operation demands that the examination should take place *immediately after the operation* (*i.e.*, before the patient has an opportunity of achieving associations between his haptic and visual impressions). All the experiments that are carried out after weeks or even months have elapsed are, if not totally misleading, irrelevant to the question of the origin of the visual images. The demand for an examination following immediately upon the operation is, however, fraught with difficulties which can hardly be overcome completely. In the first place, the eye is not yet in a state of functional readiness, at least

not to such an extent as to enable the patient to make reliable statements on the visual world that is suddenly opened up to him. Neither are the eye-accommodation, the co-ordination of ocular movements, or the ability to focus, sufficient at first to make it possible for the patient *to check his perceptions*. There is the further fact that during the first stages of their life as seeing persons the majority of patients suffer from hyperæsthesia, photophobia, and nystagmus, so that seeing (and, therefore, observing) is markedly impaired.

The subject of the experiment has to be tested methodically and accurately both *before* and *after* the operation, in such a way as to make possible a comparison between his purely haptic and purely visual spatial perception. It is further necessary that the patient should remain under constant observation immediately after the operation, in order to record and check the development of his whole visual experience. This is particularly important, since otherwise one does not know which associations between his haptic and optic impressions the patient has established in the absence of the examining doctors. If all this is not known, positive statements are devoid of value as cogent evidence.

A further element, which plays a great part in the interpretation of the statements made by the blind, is their complete lack of experience in seeing. Everything has to be learnt, even the way in which the organs of sense function. It is not enough to receive sensory stimuli; they must be apprehended, elaborated, and brought into relation to one another. In this respect the blind man after operation must *actually learn to see*, he must learn to make use of the organ of vision as an instrument of perception. The consequence is that negative results in the recognition of objects immediately after the operation are of no decisive importance and no definite conclusions can be drawn from them.

One more difficulty which has mostly been overlooked by investigators is connected with the strangeness of the visual impressions and with the phenomenological difference between visual and haptic perceptions. This heterogeneity of the sensory material is of great importance because it accounts for the patient's lack of assurance and the hesitating way in which he behaves and makes his statements, and, on the other hand, the ease with which he is influenced. As we have stated above, there is no doubt that the haptic and visual impression of one

and the same object belong to two phenomenologically different worlds of sensation. The phenomenological difference becomes most manifest at the *transition* from the tactile to the visual experience—at the moment when the haptically perceived object is apprehended by the eye. One is constantly surprised to note how little the tactile impression has in common with the visual one. This of course becomes even more apparent in persons born blind who compare their visual impressions with purely haptic impressions not yet permeated with visual notions.

We ourselves, always able to see, cannot fully realise what it means to enter a new and unfamiliar world, nor what a blind man experiences after an operation when he is told that the world that is newly opened up to him should " correspond " to his previous world. Before we estimate the value of the achievements of the blind following operation we must, therefore, make it quite clear to ourselves in the first place what we actually expect from them in asking them to state the phenomenological differences and structural similarities of two sensory worlds, one of which—with all its own peculiar qualities—they meet for the first time. An answer to this question is not impossible, but it demands an ability to observe, a logical mind, a verbal facility, and an intellectual capacity, which are seldom found in those operated on for congenital blindness. It follows also that in the discussion of such serious scientific problems it is only possible to consider the replies of such patients as have the necessary maturity and education. If in sifting the known cases of the congenitally blind who have undergone operation we also eliminate, for example, subnormals and children under seven, we are doing no more than the required minimum.

In the evaluation of the experimental material, major difficulties arise from the relatively small numbers of examinations properly and systematically carried out. In most cases the experimental conditions and instructions are not known. Reports and their interpretation are often invalidated because the older investigators usually, and later ones sometimes, have not described the behaviour of the patients during examination.

Such an insufficient record is bound to lead to an ambiguous interpretation of the results. If, for example, the size of two objects is distinguished by a blind person after operation, this does not convey any information as to the criteria of such a distinction,

for it makes all the difference whether such a distinction—which is immediately registered as a positive result—has been achieved through visual comparison or through movements of the fingers following the contours of the objects. In the latter case the result is in reality a negative one (*i.e.*, the distinction of size was achieved on the basis not of visual but of haptic criteria). The same applies to the recognition of two-dimensional figures. In the act of recognising objects the above-mentioned movements of the fingers are less relevant, but the influence of other non-visual criteria comes into the picture (e.g., the sounds characteristic of certain objects, and such other criteria as are connected with the knowledge of the special situation and depend for their application entirely on the patient's intelligence and power of imagination).

M. v. Senden's book provides information on the present position of investigations into the psychology of spatial perception in those born blind and subjected to operation.[1] Let us first leave out of consideration the fact that on the ground of the material available the author felt compelled to deny the sense of touch to any function leading to spatial perception, thereby so to speak placing the blind in a space-free world. Our first task is to ascertain whether the cases which v. Senden mentions in his book and uses to deduce the above important conclusion have been flawlessly investigated from the point of view of scientific accuracy (*i.e.*, whether he was dealing with such cases as could be justifiably made the foundation of a theory of such importance as attaches to the theory of the genesis of space).

Senden had made it his task to collect and to review critically all the published cases of persons born blind and subjected to operation. Although he himself was well aware of the unequal quality of the cases, he made use of the achievements and statements of the patients, and even of the interpretations of the authors, without subjecting them to a critical selection. What, however, strikes me most is the fact that in his theoretical discussions v. Senden does not draw a clear line of distinction between cases who were authentically blind before the operation and those who already had some visual impressions, and therefore confronted the visual world after operation in a quite different way from their totally blind co-sufferers. Senden

[1] M. v. Senden, *Raum- und Gestaltungsauffassung bei operierten Blindgeborenen vor und nach der Operation*, Leipzig, 1932.

has further paid no attention to the time that had elapsed between the operation and the testing, nor to the presence or absence of any psychological data about the condition of the patient before the operation; nor does he mention whether the case-histories give any information concerning the methods used and the precautions observed.

We must add that v. Senden included in his review cases which dated from a period in which there was no question of an accurate experimental technique being used, or, consequently, of even the most *essential* precautions being taken,[1] and cases in which the investigators were still committed to notions certain to compel them to draw wrong conclusions.

It is further difficult to understand how v. Senden could be so careless as to overlook the age of the blind people in question. The result is that achievements and statements of children of pre-school age living in the beginning and middle of the nineteenth century are viewed and evaluated by the same criteria as cases examined in the era of advanced development in physiological optics and psychological methods.[2]

Taking all this into account, and basing our discussions only on those cases in which we can feel justified in assuming that they have been tested and described with the necessary precautions, we are compelled to rule out the majority of the cases published in the ophthalmological literature and reviewed by v. Senden.

I have myself reviewed these cases for their fundamental reliability, and have come to the conclusion that out of the total of sixty-six cases compiled by v. Senden only twenty-two can be taken into consideration; the remaining forty-four cases have to be ruled out for the above reasons.[3]

We have first to eliminate those who were not blind from birth. Secondly, we have to reject all those who had some visual capacity before they underwent operation. Apart from these two

[1] As mentioned above, accidental concomitant sounds that are not taken into consideration by the investigator may lead to the identification of an object that could not be interpreted by the blind person after operation. Statements based on hearsay cannot be guaranteed correct; nevertheless conclusions are based on such statements. The clumsiness of expression may lead to misapprehensions; and this applies to the questions put to the patient as to his first impressions.

[2] It may be said, if with some reservation, that no scientific value can be attributed to investigations that were carried out prior to the work of v. Graefe, Helmholtz, Hering, Uhthoff, Donders, v. Kries, and before the development of new experimental psychological techniques.

[3] See the table at the end of this section.

groups we have to rule out on methodological grounds twenty-two more cases which, as mentioned above, dated from a time when neither accurate methods of investigation nor a correct approach to the problem were available. Furthermore, no value can be attached to statements made by children under the age of 6; and, last but not least, we must rule out the mentally deficient patients.

Generally it may be said that patients born blind and operated on have answered all questions, except those concerned with the recognition of objects, both in the *positive* and in the *negative* sense. This means that the questions cannot be answered unambiguously. Nevertheless, taking into consideration the relative numbers of positive and negative statements, we can reach certain conclusions which can claim a certain degree of probability:

(1) As regards the visual ability to perceive differences of size, it may be the case that patients are able to distinguish dimensions correctly immediately after operations. To what extent ocular movements or movements of the fingers and of the hand play a part in this cannot be gathered from the reports.

(2) The interpretation of the positive cases in respect of the recognition of form is doubtful. All that can be said with any certainty is that the number of negative cases does not exceed that of the positive ones.

(3) Objects previously known haptically were not recognised by the majority of the patients. The ratio of positive and negative cases was 5 : 14.

(4) None of the patients succeeded in recognising persons.

(5) The question whether those born blind are able to interpret movements as such immediately after operation cannot be answered with certainty owing to the small number of available observations. The criteria applied by the investigators in answering that question were all incorrect.

(6) The answers given by the investigators to the most important question—namely, whether persons born blind and operated on are able to perceive the structure of the visual space immediately after operation, to interpret correctly the spatial relationships of the objects, their position, and their distance from one another and from the observer, to perceive concrete objects plastically and in perspective—present a picture which might be

open to different interpretations. In the majority of cases the patients were unable to distinguish a two-dimensional object from a three-dimensional one (*e.g.*, a round disc from a sphere), not to speak of their inability to interpret a two-dimensional picture in perspective. I should like to stress that these conclusions would not have to be revised or amended even if the number of cases were greater. This became clear when we added (to the above-mentioned twenty-two) more cases which v. Senden looked upon as very relevant, though we had ruled them out on general principles.

(ii) *Can such observations explain the genesis of the haptic sense?*

It is important to stress, as against v. Senden and Wittmann,[1] that all these findings have *no bearing whatsoever* on the fundamental problem of the spatial character of haptic perception. It is, of course, true that experiments after operation on people born blind may provide some indications of the structure of the concrete visual and haptic pictures of space, as well as information on the phenomenal nature of visually and haptically perceived objects. The question, however, whether the haptic impressions are of a spatial or non-spatial character is not answered by the statement that following operation persons born blind do not possess any optical picture of space. For even if such a person does not recognise a square or any other object as such, this only means that the phenomenological difference is too great to allow an identification of the two impressions. I cannot understand how such statements can be adduced as evidence of the non-spatiality of haptic impressions nor why v. Senden feels justified, on the grounds of the reported cases, in believing that " the person born blind lacks everything which one had to assume as given in order to be able to talk of a tactile apprehension of space "; for the majority of the blind who have been operated on have especially asserted the spatiality of the tactile impressions.

The statements quoted by v. Senden as made by these blind patients after operation are inconclusive for one more reason. For, quite apart from the fact that the statements contradict one another, the statements as reported can only be interpreted in favour of his point of view if one adheres to the literal wording of the reports and omits to ascertain what the patients actually

[1] W. Wittmann, " Raum, Zeit und Wirklichkeit," *Archiv f. d. ges. Psychol.*, **47**, 1924.

wanted to express and by what means they reached their verdict. Actually one is undoubtedly led to the conclusion that the patients simply wanted to say that their new (visual) impressions differed essentially from their previous (haptic) impressions, and that they were faced with a new unknown world which could not be compared with the haptic one. For how can the author, when he mentions the statement of a blind person to the effect that a house which is actually a mile away is situated at such a short distance that one could reach it with a few steps, come to the conclusion that the haptic impressions lack spatiality? What kind of notion, if not a spatial one, is implied?

The four cases which v. Senden considers to be specially relevant are not convincing. In the first place, they are not actually "statements" made by the patients, but "interpretations" by the authors based on the achievements of their patients; secondly, two of these cases date from 1757 and 1800, and have therefore to be ruled out.

Finally one general observation: If anyone contends that those born blind have no spatial impressions, he must needs show how the achievements of the blind can be explained in the absence of any consciousness of space or of any concrete spatial impression of objects. How would it be possible to move in space and to orientate oneself in the surrounding space without having the least notion of space? According to v. Senden and Wittmann the localisation (*e.g.*, of the sound of a vehicle) is not related to the surrounding space. If so, to what else should it be related? When the blind man moves from one place to another, he is supposed to perceive only the sequence in time and the motion, and nothing else. Is it conceivable that he should not perceive any difference between a progressive motion and a flow of time not accompanied by a change of place? What sort of impression is the blind man supposed to have when he grasps an object with his hand? Is he not meant to perceive it bodily? How can it be explained that the sighted have an irresistible urge to check their visual impressions just by means of the sense of touch? If the content of haptic impressions were devoid of spatial and, therefore, of objective character, it would be quite incomprehensible. Further, how could the blind man make a correct statement about spatial relations, about the geometrical and structural arrangements of objects, if the spatial categories were

to him devoid of sensory foundations? What in the haptic field are the equivalents of the spatial criteria of dimension, height, width, depth, planes, near, far, large, small, above, beneath? What are these mysterious "specifically different qualitative criteria" (p. 26), this "integrative formative connection" (p. 42), which integrates the originally non-spatial tactile impressions into a non-spatial, but tangible entity? And what is meant by the "adequately differentiated system of patterns" that should take the place of spatial structures and spatial qualities? What is their nature? To what sphere do they belong? What must be the nature of this non-spatial system that makes it correspond so extremely well with our visual-spatial impressions?

A point which strikes me as very remarkable is that this non-spatial structure arrived at by intellectual operations should be such as to lead to the same "spatial" illusions as the optics of space.[1] How is it possible that laws governing spatial relations should correspond with laws governing non-spatial relations to such an extent that nearly all the spatial illusions observed in the visual sphere occur in the haptic sphere too? Why does the vertical line appear longer than the horizontal one, and why does this illusion not make itself noticeable in the opposite direction? Moreover, how is one to conceive of handicrafts performed with non-spatial tools or of piano-playing on a non-spatial keyboard? Does it not appear inconsistent that people born blind should be able to model and copy without having a concrete spatial concept of the original? Does not such a fact confront the supporters of the doctrine of the non-spatiality of tactile impressions with insurmountable difficulties? It is rather strange, anyway, that we who see should not yet have noticed anything of such a system of patterns operating in haptic perception and that even the blind should be completely unaware of it.

In conclusion we may say that an accurate review of the available material shows that the investigations so far carried out on those born blind cannot serve as the empirical foundation of a theory of space, the main reason for that being the incompleteness of the reports and the inaccuracy of the methods. Their value lies in raising new questions and in indicating the autonomy

[1] G. Révész, "System der optischen und haptischen Raumtäuschungen." Koninkl. Akademie van Wetenschappen te Amsterdam, *Proceedings*, Vol. XXXII, No. 8, 1929, and in greater detail, *Zeitschr. f. Psychologie*, **131**, 1934, 296–375.

of either of our two space-perceiving functions. We refrain from asking whether further investigations carried out on blind subjects after operation might contribute to the clarification of other problems (*e.g.*, in genetic psychology) provided the work be tackled on the basis of accurately posed questions and flawless methods. It has so far been impossible to give a clear-cut answer to these problems; and this is not so much due to the inadequate material and methods available, as to the fact that *the problem of the spatiality of our tactile impressions does not fall at all within the scope of empirical psychology.* In so far as one remains in the empirical sphere, there can be no doubt as to the spatiality of haptic perceptions.

(b) *Evidence from Later Blindness and from Brain Injuries*

As far as I know, the statements made about their haptic perceptions by patients who became blind at a later age agree with one another except in one single instance. How far their haptic impressions are influenced by manifest or still latently active visual memories can in the majority of cases not be ascertained. It may be said, however, that the spatial apprehension of those who lost their vision in earliest childhood hardly retains any material derived from their now extinct visual sphere. Questioning those who have become blind at an early or late stage on the nature and phenomenological character of their present sensory impressions, one never hears that their tactile and kinæsthetic impressions are lacking in spatiality. Ahlmann, who lost his sight at a later age, seems to be the only blind man who holds an opposite view, therein disagreeing with the statements of his co-sufferers in general, but especially with those who lost their sight at a later age and who were conversant with psychological problems (Steinberg, Scapini, Javal, Cohn, etc.).[1] Ahlmann's arguments provide an instructive example of how self-observations can be influenced by a preconceived theoretical notion.

Attempts have been made at answering the question of the primary character of haptic spatial impressions on the basis of experiments with certain groups suffering from the after-effects of brain injuries. The investigators felt justified in assuming

[1] W. Ahlmann, "Zur Analyse des optischen Vorstellungslebens," *Arch. f. d. ges. Psychol.*, **46**, 1924, and, on the other side, W. Steinberg, "Überdie Raum vorstellungen der Blindgeborenen," *Arch. f. d. ges. Psychol.*, **50**, 1925.

a near relationship between a person born blind and a person who, after injury to the brain with subsequent loss of the faculty of visual apprehension, behaves when working on haptic lines as if he were lacking in ideas of space. This apparent conformity led Gelb and Goldstein [1] to the conclusion that the haptic sense was devoid of spatial character; spatiality was assumed to enter our tactile impressions by way of visual impressions only. Further investigations, however, have made it clear to the authors that in the case analysed by them more than the faculty of visual comprehension had actually been impaired. For the patient was suffering from a disturbance of apprehension of form both in the optic and in the haptic sphere. That, however, is a condition which does not occur in blind patients, since they are blind, but not form-blind. That one is not justified in drawing conclusions concerning the spatial comprehension of people born blind from the behaviour of the patient suffering from cerebral blindness, became clear when it was found that, apart from the severe disturbances of the visual and tactile sensory spheres, certain intellectual functions had also suffered considerable damage.

These findings have ultimately compelled the authors to alter their attitude. This change of interpretation becomes especially marked in a later publication of Goldstein's. He asserts that in his patient there was not only an optical blindness in regard to form, but a blindness in regard to form in the widest sense of the word. The disturbance in that case was not confined to the visual performance of the patient, but the patient's other activities were more or less affected. In every case in which a correct reaction was dependent on the simultaneous synthesis of given elements into a co-ordinated whole, the patient was not up to the task, whilst his achievements were fair, or even good, in all cases, where a step-by-step advance was sufficient for solving the task.[2] The fundamental disturbance in the haptic sphere was, therefore, not based—as the author had originally assumed—on the loss of the faculty of visual apprehension, but on the impaired faculty for

[1] A. Gelb und K. Goldstein, "Über den Einfluss des vollständigen Verlustes des optischen Vorstellungsvermögens auf das taktile Erkennen," *Zeitschr. f. Psychol.*, **83**, 1919.

[2] K. Goldstein, "Die Lokalisation in der Grosshirnrinde nach den Erfahrungen an kranken Menschen," *Handbuch d. norm. u. pathol. Physiologie*, **10**, 600. Cf. the publication by Monat-Grundland, "Gibt es einen Tastraum?" *Zeitschr. f. Psychol.*, **115** and **116**, 1930.

comprehending data as well-structured and integrated wholes. According to a later formulation, all the disturbances observed in this patient could be accounted for by an impairment of rational or so-called categorical behaviour.

The theory of the loss of the haptic space through the lack of visual concepts has thus been deprived of its foundation, and so even this argument speaks against the assumption that no spatial conceptions are possible in the haptic sphere and that therefore those born blind completely lack all original consciousness of space.

We have, then, come to the conclusion that the problem of the original spatiality of haptic impressions cannot in principle be solved empirically. This might have been foreseen, for this is not a psychological but an epistemological question. In the field of Haptics also the doctrine of the apriority of space is therefore the unavoidable assumption which enables us to eliminate all the inconsistencies created by the fact that psychologists trespassed over the boundaries set by psychological methods.

The further problem of the concrete structure of haptic space is an entirely different one. As distinct from the first one, this is not a problem of epistemology, but a real problem of experimental psychology, and by its very nature can be answered only on empirical lines.

Experiments and observations on people born blind or those who have become blind at a later stage and their achievements as well as data gained from the sighted must provide the material required for answering this question. It is, however, no easy task to get from such material satisfactory information on the haptic world of objects and forms. The man born blind or the man who has lost his sight in the early part of his life does not know anything at all about the visual world; he is therefore without any means of comparison. The person who has lost his eyesight at a later stage has once known a haptically determined optical world before he became blind; in the majority of cases, however, he has but a vague recollection of these perceptions; lastly, the seeing person is only able to compare more or less " optified Haptics " with more or less " haptified Optics."

Nevertheless experiments carried out under varying conditions enable us to reconstruct the original haptic world of space and objects and to determine the laws governing such a world.

The following discussions are designed to show to what extent we are in a position, by making use of all sources of information, to gain a clear idea of the haptic world of space and objects, and thereby of the world of the blind.

TWENTY-TWO CASES FROM v. SENDEN'S REVIEW.

No. of the case.	Age of patient.	Author.	Date of publication.	Place of operation.
15	14	Wardrop	1810	London
16	46	Wardrop	1826	London
17	18	Franz	1840	London
26	20	Dufour	1875	Lausanne
27	17	Fialla	1875	Bucarest
28	10	Fialla	1876	Bucarest
29	25	Fialla	1876	Bucarest
31	7	Fialla	1877	Bucarest
32	15	Fialla	1877	Bucarest
35	20	Mauthner-Jäger	1879	Vienna
38	15	Marc-Monnier	1882	France
40	16	Gayet	1884	Lyons
41	22	Dor	1886	Lyons
42	13	Dunan	1888	Paris
45	7	Uhthoff	1890	Breslau
49	15	Grafé	1891	Namur
51	9	Ahlström	1895	Gotaborg
58	10	Seydel-Uhthoff	1902	Breslau
59	22	Miner-Dean	1902	Iowa, U.S.A.
60	30	Latta-Ramsey	1903	Glasgow
63	8	Leprince-Morreau	1910	Saint-Etienne
65	18	" Getaz Case "	1928	Lincoln, U.S.A.

B.—FUNDAMENTAL PROBLEMS OF HAPTICS

I

GENERAL INTRODUCTORY REMARKS

1. The Two Kinds of Haptics

In investigating haptic phenomena we have to pay attention to two different points of view, according to whether we are dealing with Haptics from the angle of the seeing or of the blind human being. In the first case we are dealing with *Haptics of an essentially optical character* (Visual Haptics, or "Optohaptics"), in the second case with what may be called *pure or autonomous Haptics*. It may be assumed *a priori* that the study of the haptic experiences and achievements of seeing individuals, permeated as they are with visual experiences and notions, will necessarily lead to results partly different from those obtained from blind persons, who have been blind from birth or have lost their sight in very early youth. This limitation shows that even in the field of the Haptics of the blind we have to distinguish between the perceptions of those who were born blind or lost their sight at an early age and, on the other hand, the perceptions of those who have become blind at a later age.

The Haptics of the blind and the Haptics of the sighted are not sharply kept apart by psychologists. In this connection authors have been misled by the unjustified assumption that there are no essential differences between these two groups as regards the process and the contents of haptic perception. In spite of this attitude, investigators have nevertheless attributed to the visual images and memories that are operative in our haptic perceptions a special, occasionally even a decisive, importance. These attitudes, self-contradictory though they are, have contributed to the fact that scientific Haptics has not acquired the precise conceptual system that Optics has long possessed.

There can be no doubt that both kinds of Haptics are inter-

connected. To what extent, however, they correspond to one another, how far the knowledge gained from sighted subjects applies to the blind, and vice versa, can only be ascertained by means of comparative investigations with the seeing and the blind. Only such an examination can provide information on the relationship between the Haptics of the blind and Visual Haptics, and give us an approach to the *principles of general Haptics*. As long as we do not know to what extent the haptic perceptions of seeing people are modified by visual concepts, we cannot tell how far the autonomous function of the haptic sense is operative in seeing persons. Our aim is to lay down the principles of general Haptics. The fields of investigation that have already been fully discussed cannot serve as a basis for general Haptics.[1] It was therefore necessary to investigate systematically the haptic problems of form and the fundamental functions of the haptic sense, that is, the form-perceiving, form-shaping, and form-creating functions in seeing and in blind persons. *My hope has been to endow Haptics by means of this investigation with the same scientific significance as is accorded to Optics and Acoustics.* This task, however, requires in the first place the discussion of some general problems, particularly the comparison of visual and haptic impressions with regard to their phenomenological contents. It is further necessary to discuss the two other fundamental spheres of the tactile sense that are closely related to Haptics of form, namely, Haptics of space and Haptics of objects.

2. The Phenomenological Differences between Visual and Haptic Impressions

The fact that there is a very marked phenomenological difference between purely visual and purely haptic perceptions is obvious and does not require further detailed discussion. In

[1] Among the papers on general psychology and on the psychology of the blind that deserve special consideration in connection with the problems of Haptics, I wish to mention the work of D. Katz on the different kinds of tactile phenomena and the ability of the tactile sense to recognise materials, and also the investigations by Th. Heller, Steinberg, and Hippius on the process of tactile apprehension. We owe important information on the spatial concepts of the blind to Ahlmann, Bürklen, Gebhardt, Guillié, on the plastic achievements of the blind to Burde, Matz, Münz, and Löwenfeld, on the world of the blind to Villey, de la Sizeranne, Mell and T. D. Cutsforth. Contributions to general Haptics and its relations to Optics are provided by the observations of Chesselden, Wardrop, v. Hippel, Fialla, Albertotti, Uhthoff, Raelmann, Ahlström, Latta, Ramsey, and v. Senden, on persons born blind and operated on.

connection, however, with further problems it is of some importance to make it perfectly clear what the basis of this difference actually is. But in view of the fact that neither seeing persons who are in a position to compare the two sensory worlds directly with one another, nor those born blind, who, after operation, possess the advantage of comparing their purely haptical impressions, unmodified by vision, with their newly acquired visual experiences, are able to answer this question satisfactorily, this important problem can only be treated by deductive methods. We have, therefore, to ascertain the conditions under which optical and haptic experiences are possible at all.

(a) *The Original Sensory Material*

When we open our eyes we are faced with a variegated field multifarious in the extreme. The objects appear coloured or colourless, transparent or opaque, stable or unstable, moving or stationary, shaped or shapeless, near or distant. When we close our eyes again the whole visual world disappears: the coloured world is shut off from us, it is immediately replaced by nothingness, and a darkness difficult to describe comes into existence, which only sounds and noises endow with something like life. If we remain at rest, our experiences—ignoring for the time being the acoustic impressions—are limited to haptic, especially kinæsthetic memories, to which, under favourable conditions, may be added motor impulses, which provide the total experience with a character of vitality. What are positively given are the bodily sensations and the knowledge that we are in space—in a space of action, in which we are able to perform whatever movements we want. The characteristic egocentric feeling associated with this condition is brought about by the spontaneous experience of our body, which when our eyes are closed constitutes more or less the centre of an unlimited and structureless space of action.

The ambient world is only opened up to the haptic sense when our body comes into contact with objects. That which in the act of touching and handling objects brings into being an impression differing from all other impressions of our senses is the *primary sensory material of the haptic sense as such.* It is not the individual qualities like roughness, smoothness, hardness, and resistance which constitute the primary difference between visual and haptical sensory data, but the *tactile material* as opposed

to the *visual material.* The sensory material does not represent a datum that can be split up into individual qualities or dissolved into its elements; it represents the genetically primary structural material of the specifically visual or haptic sensory world, before that material has undergone phenomenological and functional differentiation or has been resolved into sensory qualities.

Each sense has its own sensory material, out of which its very own world of experience is built up. The fact that certain specific sensory materials overlap one another, so to speak, is an indication of the fact that those sensory spheres have not completed their process of differentiation, as may be observed in the chemical senses, taste and smell, and also in the senses of touch and vibration.[1]

The sensory materials of the different senses cannot be described, and therefore cannot be analysed; they have to be experienced in their specificity, and their difference has to be ascertained on the basis of the immediate impression. The best way of becoming aware of their existence is by moving quite unintentionally from one sensory sphere into another. In the course of this transition a world opens up that is, as it were, formed out of another material. It is not so much the individual qualities of the sensory sphere that become manifest in the first place, but that which constitutes the substratum of the qualities, that from which the specific property seems to emerge: in our special case the truly *original and primal material* of Optics or Haptics. The production of this diffuse, indescribable experience requires, however, that the emergence of the individual qualities and forms be checked for a short while. It is only under such conditions, though they are not easy to fulfil, that one may succeed in getting a transient glimpse of the amorphous sensory material before its primary homogeneity becomes influenced by the perception of objects. That kind of observation is easier to achieve in the tactile sphere than in the visual one, because the slow emergence of the haptic perception and the consequent delay in the perception of objects and forms prolong the transient experience of the amorphous sensory material. The less objective and concrete are the contents of percepts in a sensory sphere, the more are they felt as loose and lacking in structure and the more easily can the primary sensory material be apprehended. For that reason the

[1] H. Werner, *Entwicklungspsychologie*, Leipzig, 1933.

olfactory sensations and the impressions of vibration and occasionally the acoustic impressions are most apt to create such a state of affairs.

The heterogeneity of the sensory materials accounts for the frequently discussed and variously interpreted fact that those born blind are not able to recognise visually the best-known objects immediately after their operation. The first encounter with the new sensory material surprises the patients to such an extent that every other factor that could lead to the recognition or identification of the objects facing them recedes into the background. These patients have in the first place to become acquainted with the new sensory material, they have to force their way into the nature of the newly created sensory world, before being able to become aware of the connections between visual and haptic perceptions. To make that possible the originally diffuse sensory material has to be transformed by means of gradual differentiation into a sensory world endowed with its specific order. Not until such a process of purification, as it were, of the material has taken place will the patient succeed in orientating himself in a new world, in becoming aware of the visually perceptible spatial relationships and of the forms and shapes and in comparing the visual space with the haptic one.

(b) *Sensory Qualities and Specific Sensory Worlds*

The phenomenological heterogeneity of the two sensory spheres becomes especially manifest if one contrasts the *sensory qualities* of the visual and haptic sense as they emerge out of the originally amorphous sensory material with the specific spatial worlds based on these qualities. On the one hand, we perceive the colours in all their shades, tints, modifications, modes of appearance (in respect to plane, surface, and depth), and the infinite variety of the spatial and bodily visual objects; on the other hand, we find the qualities belonging to the sense of touch, vibration, and the kinæsthetic sense, and, further, the finite world of haptic objects as opposed to the visual world. Let us imagine ourselves being completely unprejudiced and subjected to the impressions of these two worlds. It will be very difficult to point to any direct phenomenological relationship between the impressions we obtain through visual and tactile means.

Let us look at a small piece of unpolished, shapeless pink marble,

on which small irregularities, convexities, and protuberances may be seen from a near distance. Let us place this object in front of us, let us rotate it on its axis, alter its distance, first expose it to the rays of the sun, and then place it in the shade, examine it first with the naked eye and then through a magnifying glass; we experience a play of sensations with so many variations that, merely going by the phenomenological impression, we should doubt whether we were dealing with one and the same object. Let us, however, handle the marble with all visual impressions excluded: it remains unchanged in its structural nature as well as in its mode of appearance, whichever way we move it. Let us further add that the *visual* impression is independent of whether the object consists of real marble or whether it is an imitation true to nature made out of some porous material, whereas it gives quite another impression to the sense of *touch* if the material is different. That ought to make clear what we mean by the phenomenological heterogeneity of visual and tactile impressions. Should we therefore, in spite of this heterogeneity, find any conformity between these two sensory impressions, such conformity is definitely not phenomenological in nature.

The specific sensory worlds are the result of the specific sensory qualities. Phenomenologically (*i.e.*, as regards the immediate impression) they are not akin to one another. There exist therefore autochthonous visual, haptic, acoustic, thermal, olfactory, etc., worlds, each of them with its own character and its own contents. These sensory worlds have their very own boundaries; they do not show any transition. There is no visual experience which from a phenomenological point of view has anything in common with an acoustic or a haptic experience. There is no tone or association of tones that could be compared with a colour or any visual spatial structure. Nor could any haptic impression be found that stood in a phenomenological relation to any visual or acoustic one. For that reason statements to the effect (*e.g.*) that the elasticity of an object could be " seen " by direct visual means (*i.e.*, on the basis of certain optical data) are misleading. That one " sees " the flexibility of a branch, the softness of a textile material, the hardness of iron, is not based on the fact that certain haptically perceptible qualities of an object become manifest optically as well, but is due to the fact that certain haptically perceptible qualities of objects enter into

a *reciprocal relationship* with certain optical criteria. We may, for example, draw conclusions from the sponginess, or from the fragility of the superficial structure, to the effect that we are dealing with a soft material. We do not " see " the softness, but we assume it on the ground of *correlative criteria.* Such correlative criteria, however, do not exist between all sensory worlds. We are unable to " see " the smell of a rose or the sound of a bell, whilst certain tactile qualities of materials can, so to speak, be " seen " with the eye.

It would, however, be completely erroneous to assume that this difference is based on the phenomenological similarity of the visual and the haptical sensory qualities. This is simply due to the fact that the perceptions of the visual and the tactile senses are related to the *spatial nature* of the external objects, with the result that, in spite of the phenomenological heterogeneity, correlations become established between the impressions conveyed by the two senses, both these impressions being referred to spatial connections. As regards visual-haptic relations, the main factor consists not so much in correlative criteria but in *associative* concatenations. In such a case we do not at all perceive the haptic criterion visually, but we draw inferences as to the haptical contents of perceptions on the ground of associations, which we have previously established between the two impressions.

Failure to take into consideration the actual knowledge of a thing leads to erroneous notions in describing the phenomenological space. Certain phenomenologists maintain that we are able to " perceive " the space which is situated behind us. In this case, too, the description of the actual state of affairs is incorrect. We do not experience this part of space, we *know* rather that space does not come to an end behind us, but that it continues to exist. We are therefore dealing with the knowledge of a situation—a knowledge which, when supplemented by vivid imagery, may in certain persons create the illusion of a sensory experience. We might with the same justification maintain that we " perceive " the whole house, or even the whole world.

These few instances show how easily the autochthonous character of the specific sensory worlds may be misjudged if one relies merely on an analysis of psychological experience and neglects the general methodical rules of psychological investigation. There is one further cause for the lack of a clean-cut division

between specific sensory spheres, apart from inaccurate observation and analysis. For it frequently happens in the description of a psychological datum that, in default of a precise and adequate expression, a term is used which had originally had a completely different meaning. This happens, for instance, when certain fundamental qualities of acoustic sensations are defined by spatial terms as high, deep, full, sharp, blunt, or by visual terms like bright, colourful. The use *of analogous terms* paves the way for the idea that spatial relations exist in the sphere of acoustic perception and that these relations show a certain degree of concordance with visual relations. That has actually been asserted.[1] What was omitted was to ascertain, by confrontation with undeniable spatiality, whether our acoustic sensations possess a primary spatial character or whether it was just a matter of metaphorical description. Had that been done, it would have become quite clear that acoustic impressions do not possess such properties as we are entitled to expect from spatial structures. It would have been easy to convince oneself that one was merely interpreting the findings on the lines of spatial symbols. The power of *verbal identity* (identity in respect of terminology) led to the assumption of a *phenomenological identity.*

Identity or similarity was assumed to be present where neither actually did exist or had ever existed.[2]

These facts should make us cautious: no conclusion should be drawn from homonymous terms and analogies in respect of the contents of perceptions, before ascertaining whether we are dealing with the primary meaning of the term or with attributions or metaphorical expressions.[3]

[1] M. v. Hornbostel, " Das räumliche Hören," *Handb. d. norm. und path. Physiol.*, **11.**

[2] For further discussion of this whole question of an acoustic space, see my paper: " Does an Acoustic Space Exist? " *Acta Psychologica*, III, 1937, p. 137.

[3] I assume that Hornbostel's theory of " intermodal " relationship between the sensory spheres is connected with the use of homonymous terms. According to Hornbostel, " brightness " is meant to be the intermodal quality that can be found in all sensory spheres (Pflüger's *Archiv. f. d. Physiologie*, Vol. 227). I suspect that here, too, the term " brightness " led to conclusions as to the phenomenological character of the elements of sensation that are assumed to be common to the different sensory spheres. It would, however, be futile to protest against terms like bright taste, bright smells, bright sensations of touch and pain, so long as the word " brightness " is only meant to express the fact that there exists in all these sensory spheres, apart from intensity, another quality liable to graduations and endowed with serial character and with bipolarity (bright-dark, black-white). The pitch of a tone (brightness of a tone), brightness of a colour, sharpness of a smell (brightness of a smell) are all qualities that become manifest in a graduated sequence from dark to bright, from low to high, from sharp to blunt, and which are characterised by opposite terminal points (bright-

It is no more permissible, in discussing the question of the homogeneity or heterogeneity of the sensory spheres, to let the *synæsthetic phenomena* play any part. The fact that in certain persons tactile impressions give rise spontaneously to vivid visual impressions, has nothing to do with the phenomenological character of the two sensory spheres. Nor has the very attractive theoretical explanation of Werner, to the effect that the entire sensory material was an amorphous one at a very early stage of phylogenetic development and became differentiated only at a later stage, any bearing on our problem.

Whether the sensory qualities have gradually become differentiated from a primal quality (*e.g.*, from the quality of the sense of touch—an assumption which is rendered probable by the phylogenetic development of the organs of sense) or whether they have merged in some other way, is completely irrelevant from the point of view of the question of specific sensory qualities. Our experiences are related to the sensory qualities once they have become fully differentiated, and to a stage of development that alone can be considered to be the starting point for phenomenological observations.

In the field of the theory of perceptions we have, no doubt, to look upon the phenomenological attitude as being the fundamental method; nothing but an unprejudiced phenomenological analysis can supply us with information on the primary sensory material and on the primary sensory worlds. This, however, does not imply that we should be allowed to attribute unlimited validity to the phenomenological method. Our very problem has made us conversant with the dangers connected with the uncontrolled application of the phenomenological method. For it may easily make us over-estimate certain experienced differences and in consequence overlook certain similarities and connections. Numerous psychological investigations show that the theory of a complete dissimilarity of visual and haptical spatial worlds was brought into being through an uncritical and uninhibited phenomenological analysis. One further point is that such assertions are mostly the result of an analysis by one investigator only.

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dark, low-high). By assuming, however, from this state of affairs that the opposite pairs of qualities of the different senses are phenomenologically similar (*i.e.*, that high and low in the acoustic sphere are the equivalents of bright-dark in the visual sphere), one gets involved in a serious mistake.

As opposed to the autocratic procedure of the phenomenologist, who usually considers only his observation to be valid, the experimental psychologist works on " democratic " lines in that he is satisfied with counting the votes of his subjects without weighing them as to their value. This method, too, is fraught with disadvantages. For not every judgment that a person makes is valuable. It has become a habit in psychology to register the statements of the subjects of experiments rather mechanically; the authors are thereby led to believe that this incorrect use and imitation of scientific accuracy satisfies the demands of precision and objectivity. They are led to draw important conclusions from such statements. We must admit that it is a very tricky business to select from statements by subjects of experiments, without thereby giving full scope to arbitrariness. These difficulties can only be circumvented by subjecting not only those statements to a stringent criticism, but by applying the same critical attitude to the selection of the subjects of the experiments and to the questions put to them. Observation of these precautions would to a considerable extent put an end to contradictory statements and to superficial and incomplete observations, and would thus benefit research work and its theoretical foundations considerably.

3. The Autonomy of Haptics

Nobody has yet seriously challenged the autonomy of visual function. Even the attempt to explain the spatiality of our visual impressions on the lines of their associative concatenation with the phylogenetically older haptic impressions has never aimed at contesting the autonomy of seeing or at deducing the laws of psychological optics from the laws of Haptics. Nevertheless the autonomy of Haptics was frequently questioned, if in a more or less disguised fashion. In order to evade the momentous contention that Haptics lacked autonomy, the majority of authors avoided facing the problem altogether. They preferred to make vague suggestions of their attitude. It was, however, fairly clear that they were actually inclined to attribute primarily to the sense of vision the laws governing the two sensory spheres. The hypothesis that an assimilative adaptation of the haptic phenomenological world to the visual one takes place—an adaptation that becomes manifest in the harmonious co-operation

of the two senses—appeared to put these authors' minds at rest.

Not merely in the field of "*Gestalt-Psychology*", but in psychology in general the visual impression was the starting point for the theories of space and form. Form was related to the phenomenological *optical* nature of the objects of perception. This extreme bias towards an optical conception is to be found from the age of Aristotle up to our own day. Occasionally, however, we find some allusions to a haptic space, especially in connection with the blind, but there was hesitation to enter into further investigation of it, presumably because the correlation of the haptic and visual space-phenomena led to difficulties. In order to overcome these difficulties attempts have frequently been made to relate the haptic to the optical contents—attempts that led to a kind of Haptics ruled by Optics (*i.e.*, "optified" Haptics) which ignored the autonomous character of tactile space and tactile forms. Thus there came into being what may be called 'Haptics of the Sighted', in which the associated visual concepts played the leading part. Pure Haptics as it is manifest in persons born blind was not even discussed. The overriding influence of visual Haptics on the whole problem of haptic space during the last decades was the result of such an attitude. Optical questions and optical methods governed the whole field of Haptics and of the Psychology of the Blind. This accounts for the failure to realise, in relation to Haptics, the importance of statements made by the blind, and for the fact that they were used only so far as they confirmed observations made in seeing persons.

Thus gradually there emerged the erroneous notion that the sense of touch is governed by laws and principles originating in the field of visual perception. This attitude led to the further result that Haptics was denied autonomy. Haptics played the part of a satellite accompanying Optics and completely subordinate to them. Such an attitude was supported by the fact that in everyday life discrepancies between visual and haptic perception of objects and forms were but rarely observed. It is, however, not permissible to draw conclusions about the *nature* of the two sensory spheres from the similarities existing between them. Let us demonstrate this by an instructive example. It is connected with the studies I made some time ago on the illusions in the field of Haptics. I was able to show that all kinds of illusions known in

the field of Optics occur in the field of Haptics as well, except those which are conditioned by the structure and the special function of the organ of vision. This concordance indicated clearly that the structures perceived by the sense of touch are projected by us into the same spatial matrix as those perceived by the sense of vision, and that the corresponding impressions are to a large extent congruent in respect of their spatial properties, and therefore also in respect of their geometrical–spatial structure. The fact that every type of optical illusion (illusions concerning lines, planes, angles, and directions) is also found in the haptic field, and further that in both fields the subjective deviations are seen to be equally based on objective conditions of stimulation, shows in the first place that the haptic illusions are governed by the same principles and tendencies as the optical ones.

The question that now arises is whether the conformity of the principles has its origin in the fact that one of the two sensory functions *transfers*, as it were, its own laws on to the other, or whether they both obey the same laws of perception *independently of one another.*

The idea that the haptic illusions about space owe their existence to those visual images which emerge spontaneously from tactile and motor impressions, and get transferred on to them, has not the slightest probability in its favour. For, in the first place, there is no reason to assume that the haptic perceptions of form (originally more or less diffuse) would be capable of eliciting visual images, which in their turn not only cause the haptically available pattern to appear, but on top of that the optical illusion observable in this pattern. Secondly, the identical results of experiments with those born blind and with the sighted argue not only against the theory of visualisation, but most decisively in favour of the autonomy of the haptic function. Taking also into consideration the fact that the illusions, as I have shown, do not represent an exceptional case within the field of our spatial perception, but rather that they are striking manifestations of those *general* principles and tendencies which are of decisive importance for the perception and structure of space and objects, we can no longer doubt that the perceptive functions of both senses are independent of one another, in spite of the fact that they are subject to the same laws.

In what terms we are to conceive the laws common to these two sensory spheres is a different question, my attitude to which I have already discussed in connection with the visual illusions.

On the basis of these arguments we may state that Haptics is completely independent of the sense of vision and *creates its world through its own activity and its own laws*, irrespective of whether in this process it makes use of the aid of the sense of vision.

The autonomy of Haptics is no less exclusive than that of Optics and Acoustics. Just as the visual and acoustic worlds consist exclusively of visual and acoustic material respectively, the tangible world can be most clearly represented by means of autochthonous tactile and kinæsthetic data without trespassing beyond the range of what is actually perceived by touch. Just like the visual and acoustic worlds, the haptic world has its own laws, which can only be deduced from the nature of the perceiving and recognising function of the tactile sense. That we, as seeing persons, feel urgently compelled, when we describe objects perceived haptically, to make use of optical terms is easily explained by the fact that we wish to represent and describe the objects as characteristically as possible; therefore the terms derived from the visual sphere are on the whole more suitable than the less striking and less differentiated terms appertaining to the haptic sphere. This pragmatic attitude, however, is related to the expression only, not to the object of haptical perception, and therefore does not contradict the principle of the autonomy of the haptic function.

II

HAPTICS OF SPACE

All the endeavours to gain a consistent idea of the nature, form, and content of the haptic space have so far not had satisfactory results. Although now and then an attempt has been made to unravel the characteristic nature of the haptic space, this interesting problem still appears as something more or less remote from our understanding, and we are still far from having full insight into it. In the various presentations of the matter, it is not always possible to draw a clear line between the really positive findings and the speculative interpretations. One is therefore in constant danger of emphasising too much the rational and epistemological elements in the structure of the haptic world. The research work concerned with normal psychology and with the psychology of the blind got stuck in the sphere of the accidental and did not get down to the essence of the matter. There is no doubt that in certain discussions, especially in the autobiographies of the educated blind, some correct notions vaguely emerge, but one hears hardly anything about the nature of the haptic spatial world or about the concrete phenomenal image of space. The reason probably lies in the fact that the tendency of research work was from the very beginning directed towards the general factors, before the individually typical factors and modes of appearance, depending as they do on the situation, were subjected to a close scrutiny.

The chief aim of research work is to get the phenomenological forms of the haptic space described in instructive situations both by sighted and by blind persons. An attempt must be made to become conscious of the phenomenological nature of the surrounding space and to describe it in terms of such elements as are directly apparent in the phenomena.

Haptics of space has to deal with spatial experience in empty space and in space filled with objects. According as the subject is at rest or moving, the subjective space may be called body-

space or kinæsthetic space. In the first case (*i.e.*, when the mechanism of touch and of motion is eliminated) the sensation of the body of the subject constitutes the actual phenomenological object; in the second case the movement of the body in space becomes the object of observation. In contrast to both of them, space filled with objects represents the haptic space *sensu strictiori*, or, more accurately, the haptic space of objects.

I am convinced that the difficulties connected with this complicated problem can be overcome by drawing sharp lines of division between the three above-mentioned different experiences of space and by making them the starting point of research.

1. Body Space and Empty Space

Let us first try to describe the impression one experiences when one closes one's eyes and remains immobile in free space. We may here proceed in two different ways: firstly, by concentrating our attention exclusively on the bodily sensations; secondly, by trying to become clearly conscious of the space that surrounds us.

(*a*) In the first situation, in the pure " ego " attitude, one can yet hardly speak of an experience of space. What one experiences is the heaviness of one's own body, which becomes noticeable in the arms, legs, and the soles of the feet. The bodily sensations experienced are vague and undifferentiated; only in those parts where sensations of pressure and touch occur do the impressions of tension become somewhat more distinct. One gets the impression of force acting from beneath to exert a counter-pressure. Space and body do not yet appear to be distinct from one another. We perceive neither the form nor the boundaries of our own body. The body appears as something devoid of structure and non-spatial, as something that is, as it were, animated from inside. No surrounding space is perceived. The intentional concentration on bodily sensations provides the most unfavourable conditions for gaining a notion of space.

(*b*) The content of our experience immediately becomes richer when the attention is diverted from our own body and concentrated on space. In this attitude we gain the feeling of being in an " empty space ", a space whose centre is formed by the subject. From this centre space appears to extend in all directions, not, however, beyond a " near space ". Our own person no longer

appears as a compact entity, but as the centre of this " near space ". The latter may expand to some extent, when we receive stimuli from the surrounding world (*e.g.*, acoustic stimuli). The description of the experience of space in this situation is not easy, but the majority of our observers were soon able to give a vivid rendering of their impressions. As regards the features of this kind of space there is general agreement between the statements of the different observers—the seeing as well as the blind. At the outset one is unable to make any statement whatever about it. Gradually even those who first denied the existence of an empirical space begin to " feel " a kind of space surrounding them and to get the impression of an empty space. They use for their experience sometimes the word space, sometimes the term " experience of space ", sometimes they talk of " something around me ". They are unable to tell where their own body ends and where the surrounding space begins; there is no impression of any transition. Ahlmann, who lost his sight at a later age, makes the following statement about his bodily and spatial impressions in the supine position: " I do not know myself that I am lying, I am an ego-like point in space, without any extension, without any concrete consciousness of position." [1]

In practically every case a morphological character is ascribed to space. It is said to appear as homogeneous, unstructured, and not sharply limited; definitely extending further to the front than to the back, upwards, and sideways. Even those who are not able to state anything about the boundaries of this space find it closed to the rear. The shape of the space does not become manifest immediately. It appears to develop gradually; in seeing subjects it assumes the character either of an amorphous extension without definite boundaries or of a well-structured spatiality of a *visual* kind. The concrete form of space appears to vary from one subject to another. In the majority of cases there is some talk of a cone with an elliptical base, at the apex of which the subject is situated, or of a paraboloid whose apex is again occupied by the subject. Occasionally a sphere is mentioned, in the centre of which one is placed and the upper segment of which is cut off.

This is all very similar to what we feel when we observe in

[1] W. Ahlmann, " Zur Analyse des optischen Vorstellungslebens," *Arch. f. ges. Psychol.*, **46**, 1924, p. 200.

a completely dark room with our eyes open the field of vision that extends in front of us. In this case it appears to us as though the field of vision—which must be looked upon as caused by the internal stimulation of the organ of vision—possesses some kind of spatiality. For the most part, all that the subjects of the experiments are able to state about the spatial structure of this " field of vision " is that it is of varying shape, and can best be described as a curved plane, the centre of which is localised at a greater distance than the sides. I personally localise the centre of the dark field of vision at about 25 cm. from my eyes. It is, however, difficult to obtain further information to make possible a more precise description of this spatiality. The impression can neither be compared with a layer of fog, nor with a dark glittering liquid, nor with any sensory impression in daylight or at dusk. Faced with the alternative of choosing between the impression of a plane or a space, I should decide in favour of the former.

Blind people hesitate much more than the sighted to make any statement on their impression of space. In most cases they find space unlimited, though not infinite. The freedom of movement in a free space conveys to them the impression of unlimited extent. Persons born blind or such as have lost their sight at an early age do not attribute to space a definite shape. Occasionally they indicate the special form in which they happen to be (the shape of the room). This intellectual attribution is not based on any vivid perception, however distinct it may be. People who have lost their sight at a later age usually speak of a certain shape of space, just as those who can see do. The blind observer seems to stand between the foci of two hyperbolæ, the lateral walls of which diverged in a convex curve and then at a certain distance bent inwards in a concave curve.

The statements made by the sighted and by persons who lost their sight at a later age show that the peculiar form of space is a merely optical one, when the subject is completely at rest. The image of space appears to them so perceptible that one may well speak of a " visionary " space. Apart from this visionary or optical conception of space there remains the characteristic spatial experience that owes its existence to kinæsthetic impressions. This latter becomes more obvious when the subject makes the transition from complete rest to movement. In those

born blind and in those who have lost their sight at an early age the " shape " of the empty space is determined by the idea of the space of action, a space of quasi-kinæsthetic character. We shall refer to it later.

(*c*) Intimately connected with the phenomenon of empty space is the lack of direction, or rather the diffuseness of direction of that kind of space. All our observers have stated that they do not experience any definite directions in the free " empty " space, especially when they are at complete rest. The only distinct direction is that opposite the face, this being due partly to the orientation of the organ of vision (in the sighted) or of the face, and partly to the position or direction of movement of the body. Even the cardinal directions relating to the subject's own body, such as forwards, backwards, above, beneath, left, and right, do not become particularly noticeable in the resting subject; they become more marked when the body is set in motion.

A very characteristic point is the position and importance of the horizontal and vertical directions in the " empty " space. Neither in the sighted nor in the blind do these cardinal directions possess that marked character which they undoubtedly have in the visual apprehension of space; they are therefore not of equal importance for the experience of space. From the visual point of view these two cardinal directions, together with the direction of depth, represent the general pattern of space. Everything that we experience and comprehend spatially is situated in this system of reference, is taken into that pattern, is so to speak confined within these cardinal directions. Whatever deviates from these cardinal directions appears to contradict without justification our vital and æsthetic demands; we get an impression of the fortuitous, the ephemeral, and the unbalanced. The leaning position of the Campanile in Pisa always disturbs us, well as we know it and much as we admire its charming beauty. A picture on a wall which deviates to any extent from the horizontal direction persistently upsets us; we are unable to pass it without feeling compelled to bring it to the correct horizontal–vertical position. In contrast, the blind who live in the haptic space have but little feeling for deviations from the vertical and horizontal direction. Whether an object which extends in the horizontal direction actually assumes a horizontal position, as seen by us, is mostly quite irrelevant to the blind.

Our observations on the blind show that the widely accepted view, according to which the consciousness of the horizontal and vertical directions is attributable to the erect position and the symmetrical structure of the body, does not tally with facts. It is indeed striking to what a small extent the horizontal and the vertical become spontaneously clear to the blind. Comparative observations on the sighted and the blind show very impressively that the two cardinal directions owe their phenomenological character to Optics. In spite of the fact that the blind person has experienced over and over again objects situated in vertical and horizontal positions, and that he realises very soon the pragmatic importance of these positions and adapts his behaviour to it, these directions are of little or no direct phenomenological importance to him.

The vital importance of the horizontal and the vertical is due to the fact that we orientate ourselves according to these directions. If we try to walk with eyes open and closed alternately, we realise the part played in spatial orientation by the objects that occupy these positions from the visual point of view. With eyes closed, the lack of a definite target impairs not only the direction in which we have to move, but also our balance. The gait becomes unsteady, the body loses in flexibility, the movements become clumsy and inhibited. The feeling of objective security plays hardly any part in this connection. Experiments which I have carried out on a vast athletic field where there was no possibility of running into any obstacle have proved this conclusively. As soon, however, as one opens one's eyes one feels once more completely safe and firmly inserted into space. A blind person will never in his life completely overcome this feeling of insecurity. He is, however, for the most part not conscious of it, but his whole behaviour testifies to that effect.

What is lacking in Haptics is in the first place a fixed target. Acoustic stimuli may well indicate the direction in the field of Haptics, but not the exact target. At any rate the subjects of the experiments we performed in the meadow felt far more secure and their gait became more steady as soon as a sound became audible in the neighbourhood.

The lack of definite points of direction in the field of Haptics is likely to be of decisive importance for the whole behaviour of the blind. For it can be observed that visual objects have not only

an orientating but actually an attracting effect, that is to say, they not only direct the attention of the observer to them, but they induce him to approach them. Everyone has many times had the experience of ending a state of rest—unintentionally and without any conscious cause—merely to get moving, and soon afterwards reverting to the original state.

It would be possible to account for this sudden change of situation by assuming the emergence of an urge towards activity. That may be correct in general, but we must not overlook the fact that such an urge would become operative much less frequently if visual stimuli did not cause us to move. The mere sight of an open door, of a piece of furniture conspicuous through its colour and form, a glance into the distance, a source of light—these are often enough to set us in motion towards a definite target. I look upon this impulse emanating from visual objects as on a kind of tropism. Our unintentional almost reflex movement in the direction of visual objects is, however, of no great importance to us, but, like a phototropism, it is biologically determined.

In the dark we do not notice this urge to activity so much; we are much more at rest and do not feel induced to abandon the state of rest. This accounts for the fact that blind persons are so rarely inclined to go for walks. Free roving presupposes visual targets; that may be one of the reasons why we love walking in mountainous and hilly country and why it takes so much more energy to walk across extended meadows or over a wide plain.

(*d*) The phenomenon of so-called empty space is not confined to the haptic field. Under certain conditions it is possible to enforce a similar reduction of our spatial experience in the field of *Optics* as well. By contemplating the perfectly cloudless sky in the supine position, we experience something around us, that we have perhaps to call space, which, however, is completely different in character from that space of which we become aware under normal conditions. This objectless visual space is in its nature very similar to the haptic empty space: it, too, is perfectly homogeneous, structureless and shapeless (as long as one does not move). We get a feeling that the distance between ourselves and the blue dome is becoming smaller and smaller the longer we remain in that position. Ultimately one has the impression of being situated in some medium indescribable in words, a medium

where the notion of distance loses all significance, one in which it is hardly possible to make any statement about any kind of dimension. It is evident that this medium is situated outside us and is not co-terminous with our body; it is not quite so evident that it leaves us some freedom of movement. This visual impression represents the usual visual space just as little as the impression of empty space represents the usual haptic space. What we experience in connection with that impression lacks the most important spatial criteria of the visual space, such as the depth, spatial pattern, diversity of direction, shape, and structure of the entire world of objects. It is impossible to state in respect of that homogeneous empty space whether it is limited or unlimited; the latter statement would be more in keeping with my personal feeling.

The whole situation changes as soon as an object, a cloud or a bird, comes into our field of vision. The whole visual image, the blue homogeneous, undifferentiated, structureless, distanceless medium is suddenly converted into the dome of the sky; it is drawn into distance, it becomes separated from us by a colourless and translucent void, in which the bird flies and the cloud moves; characteristic directions and marked distances develop—in short, the well-known visual sensory space unfolds in its singular entirety.

(*e*) Finally we may ask whether the " field of vision ", as observed with eyes closed and in the dark—the phenomenological empty space—possesses the same properties as the visual space. In this connection we have to observe that we are not in a position to reject *a priori* the assumption that in the sighted the empty space owes its character to experience of visual space. It is quite possible that the entoptic field of vision does not possess primarily a curved form, the form of a cone or of a funnel-shaped curve, but that it owes its spatiality to the spatial appearance of after-images (reminding one of visual space). As we usually localise after images, like all our impressions of light and colour, at a certain distance from us, it would appear possible to explain the apparent spatial character of the subjective field of vision and the phenomenon of " empty space " on the basis of the tendency towards the localisation of visual impressions. The general tendency towards centrifugal projection is so powerful that even the nebulous entoptic phenomena that become manifest on the

intensely black background become projected outwardly just as the after-images. This assumption does not account for the apparent deepening of the subjective field of vision. It is, however, a feature of sensory perception that a dark " space ", which, as is well known, has no boundaries, shows a tendency to close up on the right and left, and consequently stretch back fairly deeply towards the middle. We experience this phenomenon both in the dark and in bright light, whenever we look into infinite distance. What also favours the assumption that the shape of the subjective field of vision is not of a primary character is the fact that in research workers, who, out of scientific interest, have frequently concentrated their attention on the observation of the phenomena of the visual grey, the spatial character of the inner dark field of vision gradually disappears.

The only ones who can possibly supply a decisive answer to this question are such as were born blind or lost their sight at an early age, provided that they have not lost their sensitivity to light though never having had any practical opportunity of perceiving the visual world of space.

(*f*) These considerations lead us to ask what attitude, what position man adopts in the visual and in the " empty space ". Man experiences the world of reality in visual space irrespective of whether, from a metaphysical point of view, space belongs to the world of reality at all or whether it is merely a form of our intuitive thinking. The surrounding world, the world of objects and perceptible events, comes to life in that space. The visual space is space in the real sense of the word; it is a space occupied by innumerable objects, one in which these objects are situated in relatively fixed positions and one in which they change their mutual relations with each other. In this phenomenological space the sensory image undergoes constant changes according to the subject's movement and to every alteration in the direction of his attention, as well as to every movement or change on the part of the objects. In that space direction becomes endowed with its vivid and rational character and with its emotional value. In visual space man loses his biological and psychological egocentricity, he gains direct contact with his fellow beings, and it is in this space that his manifold social activities take place.

The entire experience of space becomes radically different when we close our eyes, when our limbs are immobile, and when

all other stimuli are shut off. We somehow feel we are in space, but only in so far as we exert our powers of free movement in that space. Space does not live in us as a field of force stimulating us to movement; it represents merely a pattern in which we move. This space becomes immediately alive and acquires content as soon as a perceptible stimulus is created in our neighbourhood, when, for example, a sound is perceived or when a stimulus of radiant heat impinges. These stimuli convey to us a sense of direction; we no longer feel unorientated and abandoned in the dark. Our body, which in the phenomenological empty space had so to speak lost its bodiliness, becomes alive again. The stimuli become localised and develop relations to us. We are on solid ground. The essence of visual space, however, is found neither in empty space nor in a space which an acoustic or thermal stimulus fills with more concrete contents, but only in the space with distance, which is filled with objects, is self-contained, and has become alive through atmosphere, colour, motion, direction, and constant change.

2. Kinæsthetic Space and Dynamic Space

The transition from rest to motion leads to a marked change in the haptic consciousness of space. In this connection we have to distinguish between two situations—namely, movement of the body *with* and *without* locomotion.

(*a*) The very movement of our arms leads to a change in our relationship to space. The consciousness of our body, which in the state of rest had something inextensive and unconnected about it, becomes filled with a new content: our body emerges from its non-spatiality and acquires a vivid extensive reality related to space. Our own bodily existence, which in the state of immobility was hardly perceptible in spite of our egocentric attitude, becomes the object of a very vivid experience. Our relationship even to "empty" space undergoes a marked change. Previously we could hardly tell whether the idea of an empty space was of a phenomenological character or based on knowledge only. In the state of motion, "empty" space becomes concrete, open to experience, even though the concrete content of that spatial experience cannot be adequately described. We become very distinctly aware of how the potential force of our own body—a force that enables us to abandon the state of rest—becomes trans-

formed into the state of activity. Through the transformation of the potential energy into actual energy, the consciousness of our body acquires a firm, objective relation to something that possesses spatial, but not objective character. The relation between our own body and motion is operative in creating space. The motion creates a mass of space which can be distinguished from our own body, a mass of space which is so far devoid of structure, indeterminate in direction, and empty, though its existence is based on experience; it is out of this spatial mass that the spontaneous experience of our own bodily existence emerges. For even if a person—blind or sighted—were to maintain that in the state of complete rest he experiences neither bodily existence nor space, but merely a vacuum, he would have to admit that his entire experience undergoes a considerable change as soon as he moves —that is to say, a reciprocal relationship becomes established between his own bodily existence and external spatiality. Under these conditions our body is no longer spatially undefined; it loses its lack of extension, its lack of boundaries, its " ego-like character of being a mere point in space ". It does not yet actually face the surrounding world, but its asserts its position as a real, active being, relative to the surrounding space.

The most important feature in that experience of space remains the human being, making observations and now active. The egocentric feeling about consciousness of our body, and more especially the experience of the dynamic element connected with that consciousness, still determine the spatial centre.

The form of that space is described by observers in motion in the same way as by observers at rest, but the impression of infinity and lack of limits is more strongly emphasised. This is due to the very vivid feeling of the freedom of movement and, further, to the lack of any resistance—all factors enhancing the feeling of an unlimited possibility of motion.

(*b*) The second situation is characterised by the fact that the observer relinquishes his previous position. The movements of the body become more productive, the surrounding space becomes endowed with a new significance. Under these conditions the " empty " space which had already become concrete through the movements of the arms enters our consciousness with convincing clearness. One has the impression of the surrounding space being grasped by a definite space-perceiving sensory organ.

The free movement in free space, the free choice of the direction of movement, the progression in space of the dynamic centre create, so to speak, the kinæsthetic space. Consciousness of space is a spontaneous experience. But we experience the full vividness of that objective space ruled by movement only to the extent to which we actually govern it (*i.e.*, in so far as we move); we actually experience not so much a static space, but rather our movements as a dynamic datum. It is impossible to say for certain what parts in that singular experience are played by the freedom of movement, by the feeling of anticipation, by the lack of resistance, and by other elements that may be analysed out of the total situation.

The kinæsthetic space appeared to most observers to be lacking in describable form. The criterion of "unlimitedness" is foremost in that situation too. Among the observers, however, some were found who experienced the surrounding space in its primary visual form as a sphere or ellipsoid, and who, as it were, carried it along with them when they moved about. The spatial body is said not to alter its size; it is only its place which moves simultaneously with the movements of the subject.

It is a fact that, with a few exceptions, none of the blind or sighted subjects of my experiments for a moment doubted the existence of this kinæsthetic space. Even the two observers who were not willing to place that kinæsthetic experience of space on the same level as their visual or haptic experience, attributed to their movements the quality of a spatiality *sui generis*. Should anyone try to employ the criteria of visual space perception in connection with the impression of movement, he may easily make the mistake of denying the spatial character of the tactile-kinæsthetic impressions and the existence of a kinæsthetic space. It is, however, a fact that the criteria of the visual consciousness of space are by no means the absolute criteria of the empirical formation of space. The only necessary assumption is the perception of space as such, which, however, is not bound to visual material. It is, of course, not easy to free oneself from the optical image of space; it is even more difficult to place in the same category something which is basically different from a phenomenological point of view.

We are unable to reach that aim by rational means, and even less by analytical examination, for the simple reason that analysis starts from the same empirical-phenomenological stage of ex-

perience. A further difficulty is connected with the fact that the element which binds the two spatial worlds to one another—namely, spatiality, cannot be demonstrated in that special situation (*i.e.*, free motion). There is therefore only one way out of these difficulties: to study the actual spontaneous experience and to provide a theoretical foundation for its content.

3. Haptic Space and Static Space

The third kind of spatial experience which eliminates the visual function is the haptic experience *sensu strictiori*. That experience manifests itself when a human being gets into contact by means of his prehensile and tactile organs with object-filled space. How this experience of contact differs from the other experiences of space discussed above cannot be described adequately; it is something that everyone must experience himself. The most suitable conditions for it are when someone at rest suddenly touches with his hand a stable object (*e.g.*, the arm of a chair or the edge of a table). The whole state of experience suddenly becomes changed. The subjective experience of space or the mental image of empty space disappears momentarily. In the same way the egocentric attitude and the dynamic experience of our body, which played such an important part in " empty " and in kinæsthetic space, become relegated to the background. We are confronted with an object which does not belong to our bodily ego, which is situated outside ourselves, and possesses its own existence independent of us. We are, in short, facing the surrounding world. This phenomenon is most marked and most vivid whenever one touches or grasps objects of the external world; it is less marked, although none the less convincing, whenever one touches one's own body. We never feel in respect of our own body that confrontation, that being-opposed, to which we are used when perceiving objects; but there is no fundamental difference. However natural this experience of physical contact may be, however frequently the transition from the kinæsthetic to the haptic sphere may have occurred, the change, the switching over, is always surprising. We pass from a personal into an objective world, from a phenomenal world into a world made concrete. We become aware of how limited the content of the pure experience of space was as compared with the haptic world of objects. It becomes clear to us that it is not the free space in

which the blind move which constitutes haptic space; parallel with visual space, genuine haptic space is formed by the objects filling that space which we touch, grasp, and use with our prehensile and tactile organs.

The space of objects is that space in which we proceed in certain directions, in which obstacles are overcome, in which a vivid and conscious orientation takes place, in which spatial relations are perceived within a range of action determined by the length of our prehensile organs, and objects are judged for size, shape, and distance. The achievement of these perceptions and judgments is based on the independent function of the haptic spatial sense, which supplies us with rich and manifold knowledge of the objective world without any assistance from the organs of sight. The efficiency and the field of action of the haptic sense are, however, limited compared with the visual sense. But what matters in this connection is not the more or the less, but the basic principle; and we are entitled to say that, except for conditions related to the structure and special function of the eye (such as perspective, apparent displacements, screenings, and overlappings), the space-perceiving function of our haptic sense must be looked upon as *basically equivalent to the space-perceiving faculty of our visual sense.* The fact that the blind, and the rest of us, are unable to obtain by purely haptic measurement a vivid apprehension of distances beyond the limit of the haptic near-space (*i.e.*, beyond a certain range) by no means contradicts such a statement. Even those of us with sight can only picture vividly such distances and intervening spaces as can be observed in one simultaneous act of perception. Greater distances can only be brought into consciousness by separate stages both optically and haptically.

If we allow ourselves to consider without prejudice the impressions of the haptic sense in object-filled space, and if we observe the blind in their manifold activities, we cannot understand—to return once more to that point—the acceptance of a theory according to which haptic space is non-existent and objects touched and grasped lack spatiality of any kind. If anyone in analysing his experience confines himself exclusively to impressions in objectless space—thereby ruling out the very situations which make manifest the reality of haptic space (*i.e.*, the direct contact with the surrounding world)—he may perhaps find some arguments

in favour of such a notion. Objectless space, the purely kinæsthetic space, space in which the experience of the ego may constitute the only fixed point, may well encourage such a view. But the moment when the subject comes into contact with physical structures, when he begins to feel his influence on the world of objects, the magic of fantasy and speculation must necessarily dissolve and give place to plain reality. It would be hard to convince the blind person who seats himself at a table to record his haptic perceptions by means of a typewriter that all his activities take place in a non-spatial medium; he will have no alternative to conceiving as actually spatial that " qualitative quale " in which his movements are now unimpeded by any resistance, now performed by overcoming certain resistances. One eventually has to realise that that " something " is actually space and that the moving through and the overcoming of that " something " is actually the experience of a vivid consciousness of space. I could better imagine someone going so far as to maintain that the visual impression of completely free objectless space lacks any spatial quality, than that haptically perceived space filled with objects could be experienced as non-spatial.

Admitting therefore that the experience of space might be open to different interpretations with the subject in a state of complete rest, we must maintain that, as soon as our body starts moving, the phenomenological haptic space enters our consciousness with such convincing intensity that the question of the spatiality or non-spatiality of our haptic impressions can no longer be a matter for discussion. As soon as actual contact with the world of objects becomes added, haptic space develops quite objectively into an autochthonous sensory space, the wealth and variety of which are not open to the slightest doubt.

III

HAPTICS OF OBJECTS

Haptics of objects is concerned with the perceptive and cognitive function of the haptic sense with regard to materials and objects. Recognition of form plays a part in Haptics of objects only to the extent that form is operative in the recognition of objects.

The first thing which arouses our interest in this connection is the universal function of the hand, its perceiving, cognitive, working, and shaping functions. In order to make clear the manifold uses of the hand, let us briefly examine the activities of the hand before discussing its cognitive function.[1]

1. The Working and Creative Hand

The hand represents a universal tool of incredible accuracy and efficiency. It is endowed with unsurpassed motility and dexterity; it is a tool of the will and the spirit.

The tiny hand of the new-born child curves as soon as it is touched by an object. Through touching and grasping, the child gradually conquers space and the world of objects. Governed by biological needs, the hand undergoes further development until the working hand attains its full instrumental importance. The importance of the hand as a criterion of the human being has been emphasised by such early authors as Aristotle and even earlier by Anaxagoras. Anaxagoras states that man is the most reasonable of all animals because he possesses hands; but according to him it is just as understandable that he possesses hands because he is the most reasonable being. For the hands are tools, and Nature, just as a reasonable man does, doles out each of her presents to him who knows how to make use of them (Aristotle, " On the Parts of Animals," Book IV, Chapter 10, 687 a 7 ff.). Aristotle writes in his book " On the Soul " (Book III, Chapter 8, 431 b 29 ff.), " The concrete stone is not in the

[1] I have dealt with the full significance of the function of the hand in my book *Die menschliche Hand. Eine psychologische Studie* (with thirty-seven illustrations). S. Karger, Basle and New York, 1944.

soul, but only its ' form ' ; the soul is therefore like the hand, for the hand is the tool of all tools and reason the form of all forms ". And in his *Metaphysics* (Book VII, Chapter 11, 1036 b 30 ff.) he adds: " The hand is not in every sense a limb of man, but only to the extent that it is endowed with soul and is thereby able to perform its work."

This concept of Aristotle recurs in Bergson's philosophy, when he writes that the chief criterion of man is found in his ability to work and to manufacture tools for his work (*homo faber*).[1]

The close connection between hand and tool is best expressed in the fact that the primeval tools, utensils, and instruments for gauging can be traced back, as regards their form and function, to the form and function of the hand itself. The hand represents the symbol and primeval model of all the important tools of humanity. The clenched fist represents the hammer, the grasping hand one-half of a pair of tongs, the curved hand the spoon and the spade, the hand with fingers spread out the fork and the rake, and, lastly, the thumb and index-finger in opposition to one another represent the fixed and variable instruments for gauging. Even the most complicated tool machines imitate the position and movement of the hands and fingers.

We know from the primeval history of mankind that the very first kinds of tool, the eoliths, reproduce in plastic form the shape of the hand. The first primeval tool made of stone is said to be shaped in the same proportions as the human hand, length to width being in the proportion of 2 : 1. The absolute size as well as the shape of the hand find very distinct expression in the primeval tool. At the lower end there is a curvature corresponding to the human wrist; this is followed by a gradual extension in the horizontal direction, until finally, imitating the tapering of the fingers, there is an oval taper. The connection can be demonstrated very impressively by an illustration of the outline of the hand and a fist-wedge dating from the Stone Age. The outline of the hand is based on an early palæolithic silhouette of a hand found in the Castillo cave; the outline of the fist-wedge is derived from a tool found in St. Acheul. Numerous examples in support of this connection are provided by the well-known stone instruments, especially the fist-wedges, and also by the scraping and splitting instruments used by diluvial man. This likeness of the

[1] H. Bergson, *L'évolution créatrice*, Paris.

hand to a universal tool accompanies the cultural evolution of mankind through many thousand years and precedes the tool-culture of later epochs.

The production of tools constitutes the main difference between the human hand and the hand of the apes, including the anthropoids. Even neolithic man works, tills the soil, shapes vessels out of clay, and manufactures weapons and tools. The anthropoid, on the other hand, does not work, does not know of any tools, nor does he manufacture any. When a chimpanzee occasionally uses a stick or a bamboo to get hold of food, or uses a stone to crack hard nuts, we are not really dealing with the reasonable use of a tool. We ought to use the word tool only *when some stable material undergoes a useful modification for certain well-defined purposes.* Only when an object or a material becomes shaped or reshaped for a certain purpose does a tool come into being. The primitive human being who drives stakes into the ground by means of any stone lying at hand is, it is true, performing work—not, however, with a tool, but with an object which he just happened to find. The stone gets converted into a tool when man works on it, prepares it, shapes it with another material, and, according to the purpose he wants it to serve, gives it a flat or sharp, a long or a short form. A sheet of newspaper which I fold up to clear crumbs from the table does not constitute a tool, although it replaces the table-brush in this particular case. Similarly, we are not dealing with the manufacture of a tool when a monkey pushes one bamboo into another in order to get hold of food beyond the range of his grasping hands.[1] We are here dealing not with a tool but with a method of lengthening the arm. What is needed in the double bamboo to make it a genuine tool is its transformation by means of deliberate

Fig. 1.—Outline of an Early Palæolithic Hand. (After M. V. Commont).

[1] W. Köhler, *Intelligenzprüfungen an Anthropoiden*, Berlin, 1917, p. 96.

manufacturing activity, as well as an intention directed towards a special use. I should only talk of tools created by animals if, for example, the monkey thought of attaching to the end of the larger bamboo a smaller one at right angles—that is, giving the bamboos the shape of a rake, whereby the double bamboo could serve manifold purposes. But for that the monkey would first have to drill or strike a hole in the smaller bamboo—a kind of work that is possible only when one comprehends beforehand the whole final contrivance and its future function. That, however, has so far never been observed. The manufacture of a tool even in its most primitive form presupposes a purposive modifying and creative ability. To put it shortly, *the instrument of work has to develop out of work itself.*

We have still to consider another element which has so far completely escaped attention. The meaning and importance of the tool are closely connected with its tradition and development.[1] Even palæolithic or neolithic man manufactured his stone tools—his chisels, hammers, and axes—not merely for his own use, but also for the benefit of his relatives and comrades. These products of human work were transmitted from one generation to another, and developed gradually into standard shapes. Such a sociological element, even in a rudimentary form, cannot be detected in apes. When an ape manufactures a " tool " it is not taken over by his descendants and is certainly not improved upon. Every ape or community of apes experiments anew with the production of " tools ", and, therefore, does not show any progress. These objects are completely bound to the concrete situation; they do not aim at stability and solidity, and are lacking in tradition. They are unfit for further development and are not the product of work, and they ought not to be denoted by the same term as the tools created by the work of man which follow the cultural development of mankind and, being adapted to specific purposes, assume typical forms. Our definition is not invalidated by the fact that occasionally natural objects in their original form are used as tools. One must not forget that these objects have by nature the form of well-known existing tools

[1] Pierre Janet feels justified, on the basis of the above criteria of a tool, in attributing to apes the ability to create tools (*Les débuts de l'intelligence*, Paris, 1935, pp. 176 f.). He would, no doubt, have taken another view of the matter had he realised the importance of the sociological and historical criterion of human tools, as emphasised in another passage of his book, viz., their preservation and regular use.

and are only used by those who have previously worked with such tools.

Man and the anthropoid apes have one thing in common—the *instrumental hand*. The working hand with its various joints is widely used as a universal tool by man and by anthropoids. In my opinion it is just the instrumental character of the hand which is largely responsible for the emphasis on the close similarity between man and ape. The anatomical and morphological kinship, the imitative movements, the intelligent look, the industrious activity—all that would not provide the genuinely emotional foundation for a close kinship, if the apes did not have hands. Only such a notion can make us understand not only the feeling of a marked likeness between ourselves and the anthropoid apes, but also between ourselves and the lower apes, and even the prosimians, although we know that dogs which have been reared and educated in a human community are endowed with far greater intelligence and understanding than baboons and small capuchin monkeys. If our domestic dogs had hands and were able to take their meals at our side, they would inspire us with more respect. The specific animal character of these creatures is largely determined by whether they seize their food with their mouth or whether they bring it to their mouth by means of their hands. That is why a bear or even a squirrel impresses us as being more " civilised " than a dog or a camel. From the opposite angle one has to keep in mind that our domesticated animals would acquire through the hand a far wider possibility of development, if they had hands. For the relation between the hand and intelligence is a reciprocal one. On the one side, the morphological structure and the expressiveness of the hand are largely determined by the intellectual level of the organism; on the other, the instrumental hand has a strong influence on the development of the intellect. The difference between man and animal can hardly be made clearer than by contrasting, as in Figure 2, the hand of a man and of a gorilla.

In all apes the animal features of the hands manifest themselves unmistakably in the lack of differentiation, elasticity, adaptation, flexibility, motility, and formal beauty. The shape and development of the simian hand rule out the possibility of performing even the most elementary types of work that we meet in all primitive human tribes. These hands are not developed either

by work or through mental stimuli; they represent only the constructive pattern of a living prehensile organ, certainly not a hand dignified by work and intellect and fit for manifold activities.

FIG. 2.—Hand of a Young Man and of a Young Gorilla.

Another peculiarity of the human hand is that it represents both a tool of will and reason, and also a special source of creative fantasy. The hand is not an inanimate tool, a sort of universal key that blindly obeys the intentions of man. Through its motility and its autonomous play of movement the hand develops an initiative which becomes sanctioned by reason and improves

the work it performs. The hand sets in action the will governed by the intellect, and it is not completely ruled by it. Rather does the intellect follow the play of movement of the fingers; it accompanies the hand and occasionally adapts a man's intentions and aims to the hand's movements. When a man intends to perform manually something which lies outside the range of his usual activities, he generally does not know beforehand what the eventual result is going to be. He leaves the management to the hand, so to speak, follows its activity, checks it, and interferes occasionally with the whole process: a reciprocal interplay develops between our intentions and the spontaneous activity of the performing hand. We are indebted to the creative and forming hand for showing us new ways which we had not thought of and which we could not have thought of, because we did not fully realise the range of possibilities inherent in that instrument.[1]

It may frequently be observed that the hand is more intelligent and endowed with greater creative energy than the head. It happens quite often that one follows the initiative and dexterity of the hand, and not the considerations and the aims of the intellect. One starts working before having formed a clear notion of the work one intends to perform. The autonomous and partly haphazard activity of the hand leads to new ideas; these again are entrusted to the hand for execution, and the work comes into being by way of a process of reciprocal fructification. This process can be easily observed in watching children building and drawing. Such an interplay is also experienced when improvising on the piano; accidentally touched notes or sequences contribute to the development of the musical phrase.

Even in the highest form of productive work, in art, the autonomous creative energy of the hand plays a great part—a fact that will become clear when we analyse the sculptural activity of the blind. However vividly the sighted and the blind artist may be able to conceive their figures, they will nevertheless let themselves be led in their sculptural work by the forming and creating hand; it is by the interplay of nature, hand, technique, and artistic fantasy that the work of art attains its perfection.

[1] For the anthropological importance of the hand cf. the arguments in my paper, "La fonction sociologique de la main humaine," in the *Journal de Psychologie*, 1938.

G. 3.—Position of the Hands of a Young Chimpanzee. From " The Great Apes " by R. M. Yerkes, 1929.)

FIG. 4.—Position of the Hands of a Small Child.

2. The Recognising Hand

When the organ of vision is put out of action the perceiving and discerning hand has the task of classifying the materials of the physical world according to their structural qualities, and gaining experience of the world of objects. Recognition of material and objects is, therefore, the main task, next to the creative activity, of the hand, when it feels and grasps.

(a) *The Haptic Process of Recognition*

Ever since the middle of the last century scientists have been working on the analysis of the tactile process. The universal use of Braille type—reading by means of touch—has repeatedly led to comprehensive investigations of that cardinal problem in the whole field of Haptics. The first decisive step in answering that question was taken by Heller, who directed our attention to the different kinds of touch—namely, touch with the hand resting, moving, or grasping.[1] He showed that in the near haptic space other kinds of touch are used than in the far haptic space, the extension of which does not allow of touch with the hand resting or grasping. Heller was the first to point to the decisive importance of tactile movements for an adequate perception of spatial forms. Although I cannot adopt his distinction between " synthetic " and " analytic " touching in the way he formulates it, I do not want to eliminate these terms from the psychology of the blind, and I intend to give them another significance.

Heller calls " synthetic " touching the kind of tactile activity performed by the resting hand in the " nearer " tactile space, its main task being to gain a schematic total picture of the touched object. He applies the term " analytic " touching to the tactile process performed in the " far " tactile space—a process that enables us to gain an exhaustive perception of the object by means of the moving hand. Heller himself remarks rightly that this distinction is merely an abstract one, since under normal conditions even in the near space both modes of touch are usually simultaneously operative. I believe this distinction to be untenable. The definition of synthetic touch is contradicted by the actual facts: none of the three criteria mentioned by Heller

[1] Th. Heller, *Studien zur Blindenpsychologie*, Leipzig, 1904.

applies to synthetic touch only. Firstly, the schematic total image is attained by means of analytical touch too; secondly, the process of synthetic touching takes place alternately with the hand moving and at rest—actually, tactile jerks regularly accompany the process of resting touch—and, lastly, this mode of touch is by no means confined to the " nearer " haptic space. In classifying the different types of touch we have, therefore, to start from another criterion of classification—namely, the time element involved in the tactile process, that is to say, from the distinction between simultaneous and successive tactile activity.

In *simultaneous touch* the object or part of it is touched in one simultaneous act, irrespective of whether the touch is performed by means of the fingers, the flat hand, or with one or both hands. That tactile process, which necessarily takes place in the near haptic space, may lead either to analytical or synthetic recognition, according to whether one aims at apprehension of the total impression and total form or of particular aspects (form, size, material, etc.).

We are dealing with *successive touching* whenever objects or parts of objects are touched in tactile acts separate in time. That mode of touch serves both analysis and synthesis. Whenever the structure of the haptic object is somewhat complicated, one feels compelled to comprehend the object by means of successive tactile acts. It is impossible to gain anything approaching a correct idea either of the total form or of the relatively independent parts without making use of successive touch. This mode of touch is made use of both in the near and far haptic space.

The process of successive touching represents the haptic process of recognition *par excellence*. In the field of Optics objects and forms are as a rule apprehended simultaneously, and therefore directly, as opposed to the haptic process of apprehension which usually takes place in stages, and therefore indirectly. The element of successivity is of such importance in the field of Haptics not only because it is impossible in many cases to apprehend objects simultaneously (*i.e.*, without change of position of the fingers), on account of their size and complexity, but especially because movement as such is endowed with a creative and formative energy. This accounts for the fact that simultaneous touch *sensu strictiori* does not even take place in cases

when the size of the object remains within the dimensions of the palm.

The distinction between simultaneous and successive touch directs our attention to the actual concrete tactile processes which are made use of in all tactile acts and, therefore, in the tactile apprehension of material, objects, and forms. From this point of view we classify the tactile processes as follows:

(1) The *static tactile process* (*i.e.*, touching with the hand at rest). This mode of touch is only met with in examining the thermal qualities of the material and in investigations concerned with threshold values. It is inadequate for the recognition of objects and material or for the apprehension of form.

(2) The *dynamic tactile process* (*i.e.*, touching with a moving hand). For practical achievement this mode of touch is decisive. We owe to the movement not only the recognition of the elementary tactile phenomena and tactile structures, but their very origin. Katz has shown that all the modifications of tactile activities concerned with surfaces, such as smoothness and roughness, hardness and softness, originate in movement.[1]

As soon as movement is ruled out, the whole of the tactile phenomena, and thus the recognition of the tactile qualities of material, become lost. It goes without saying that the recognition of haptic objects and forms is dependent on the function of the moving tactile organ. With the tactile organ resting immobile on an object any definite statement as to identity and form is impossible. This is not incompatible with the fact that under certain conditions the resting tactile organ may be able to ascertain to a certain extent the shape and even the schematic form of the object and its general structural character. By means of that type of touch, which we may call statically grasping touch, it is possible to state with some certainty whether the object is oblong or extended, small or large, simple or complicated; more precise information as to the structural data cannot be gained in such a manner. It even happens quite frequently that the primary impression of the object disappears completely in the process of resting touch and grasp. Fresh tactile jerks may reactivate the object impression which had almost completely vanished.

Apart from this type of holding-touch, half way between active

[1] D. Katz, *Der Aufbau der Tastwelt*, Leipzig, 1925.

and passive touch, the following kinds of touch may be distinguished within the range of touch performed with a moving tactile organ. They have been dealt with in detail by Hippius [1] in his paper on touch.

(*a*) Touching with to and fro gliding movements, a mode of touch which is made use of in recognising the qualities of the material of the touched objects. It is widely used to discover variations of the surface.

(*b*) The sweeping touch, which is adequate and efficient in the recognition of material, especially in ascertaining planes and lines, contours, geometrical relations (dimensions, directions, basic forms, proportions), and also in examining by means of touch individual details of all kinds. It is performed sometimes with the index finger, sometimes with all three middle fingers.

(*c*) The transition from the sweeping touch to the grasping touch (*i.e.*, to the actual three-dimensional touching) is given by a modification of the former, in which the gliding and sweeping takes place with the assistance of the thumb. In this case, owing to the thumb being in a position of opposition, two surfaces are touched simultaneously, and so data about structure and the arrangement of the parts of the haptic objects become available, beyond what had been accessible to the simple sweeping touch. We may term this modification of the dynamic type of touch the sweeping-grasping type.

(*d*) Finally, in the kinematic type of grasping touch the actual tactile apprehension of bodily structures comes into its own. We are faced with a process of touch which is definite, comprehensive, and simultaneously analytic and integrative; and it enables us to recognise all the material and formal qualities of a haptic object. For the purpose of recognising three-dimensional bodies, of apprehending the tactile-spatial peculiarities of haptic objects, of analysing them from a structural and phenomenal point of view, the kinematic type of grasping touch is alone effective. All the knowledge and experience that we, and more especially the blind, acquire in the haptic space are based on that type of touch. All the results that are communicated and discussed in this book have, with very few exceptions, been obtained by means of that tactile process. Irrespective of

[1] R. Hippius, " Erkennendes Tasten," *Neue Psychologische Studien*, **10**, 1934.

whether one aims at an analytical or a synthetic touch, at a simultaneous or successive one, the tactile process is of a kinematic grasping character. And if it is correct to say that even elementary tactile phenomena can only come into existence through movement, such a statement is all the more true in connection with the origin of the spatial mode of appearance of haptic objects. Without the grasping movement our haptic world would lose its characteristic objectivity and its manifoldness, and not only would the blind thereby be deprived of their perceptual ability and of their creative faculty, but also the spatial world would lose much of its wealth, vividness, and plasticity for those with sight.

The types of touch, in normal people and in the blind, may be represented in the following table:

Basic type (time factor)	Direction of intention	State of the haptic organ	Relation to space	Achievement
Simultaneous	Synthetic and analytic	Static and dynamic	Near haptic space	Immediate total impression, as well as parts, or particular criteria
Successive	Synthetic and analytic	Static and dynamic	Near and far haptic space	Indirect total impression, as well as parts, or particular criteria

Summing up, we may therefore say: The distinction between simultaneous and successive touch is based on the time-element of the haptic process of perception; the distinction between touch with the hand at rest or moving is related to the distinction between the static and dynamic state of the tactile organ; and, lastly, analysis and synthesis are based on the difference in the intention underlying the act of recognition. These categories are in perfect agreement with experience, and the range of their validity includes haptic perception and recognition in general (*i.e.*, both in the blind and in those with sight).

(b) *Recognition of Material*

It is a known fact that substances and materials may be recognised both by the eye and by means of the tactile sense. Differences in the structure of the surface provide clues for their appreciation and recognition both in the field of Haptics and

Optics. Some materials are better and more easily distinguished by the tactile sense than by the eye; others, again, are better recognised when seen than when touched. It is impossible to say as a matter of course whether it will be easier to recognise a material by touch than by vision; whenever, say, thickness and flexibility, thermal qualities, roughness, or smoothness are peculiarly characteristic of a certain material, it will be recognised with a greater degree of accuracy by means of tactile rather than visual examination. In a large number of cases both senses will have to be made use of. If we confine ourselves to the cognitive function of the tactile sense only when given a material, we easily expose ourselves to mistakes that never occur in the visual field. Thus, under certain conditions, a roughly planed piece of wood may, if vision is excluded, be taken for a cotton material, or a piece of bone for a piece of fine leather wrapped round a hard object.

Haptic recognition of material deals practically always with a global identification of the material, not with the distinction between its varieties and modifications. In cases where tactile perception happens to lead to recognition of a specific material, it is not so much the haptic elements of the physical structure as the special situation or some knowledge of concomitant factors which plays a decisive part. We shall not succeed in recognising the material of our suit or the leather of our wallet by means of touch without the aid of such criteria derived from knowledge, whereas visual recognition will take place without any difficulty.

Strictly speaking, the recognition of material by means of vision cannot be compared with haptic recognition, as normally both co-operate continuously and reciprocally with one another. The superiority of visual over haptic recognition of material is not only due to the possibility of recognising the materials on the basis of the manifold visual appearances and of the manufacturing process it has undergone, but also to the strong chains of association between visual and haptic impressions. That vision creates more associations with haptic perceptions than vice versa is due to the fact that the visual sphere deals with more correlative criteria (corresponding to haptic qualities) than the haptic sphere. Thus there are visual criteria suggestive of elemental tactile phenomena like roughness (visible roughness) and smoothness (lustre), whilst in the haptic sphere we do not know of any

correlative criteria of the chromatic peculiarities of objects and of the distribution of light.

(c) *Recognition of Objects*

In the sphere of Haptics recognition of objects does not usually take place directly, but represents an interpretation on the basis of the perception of individual aspects of the tactile object. Where the object is known, tactile recognition of one of the cardinal aspects is all that is needed. Whenever the object deviates from the norm, the aim will be to proceed analytically first of all, and to apprehend the details by touch as they stand out in relief. This successive, analytical tactile process usually leads only to a piecemeal and fragmentary perception of the object. It is not carried out according to a definite pattern or any rational criteria. The parts of the object to be apprehended by touch are perceived partly in their organic context—that is, in the sequence in which they are spatially connected to one another—partly in a haphazard succession, depending on the local conditions. Out of the details obtained by such a successive analysis, the whole object may occasionally make its appearance in one act of intuitive synthesis; when, however, that synthesis does not come into being, recognition has to make use of a rational process of interpretation. The criteria for the recognition of objects are: material, form (partial and total form), position, and their combinations. Occasionally the perception of certain qualities is sufficient for recognising the object because of the concrete situation. Thus the impression of cold, smoothness, and hardness may in a certain situation lead to the identification of a china plate, in another situation to that of an enamelled basin. That the form is frequently the relevant factor in object recognition is well known. Often perception of the schematic form is all that is needed. In most cases an exhaustive recognition of form is not aimed at, as is suggested by the well-known fact that familiar objects can be identified when they are but lightly touched. That is clearly proved by an investigation which could be carried out in any laboratory.

In the first part of this investigation the twenty objects to be identified (match, key, spoon, pencil, electric lamp, box, bicycle lamp, paint-brush, envelope, button, etc.) were only allowed to be touched or grasped with the hand, but not—as is usually

done—touched with the moving hand. In spite of that condition the objects were in most cases identified without hesitation.

In the second part of the investigation touching of the objects was further restricted, so that only part of the more or less familiar objects was allowed to be touched. The subjects of the experiments were expected to identify and to describe the objects on the basis of that partial impression. That experiment, too, led to a positive result in many cases.

These two experiments show how small a part the actual perception of the total form usually plays in recognition of objects by touch. It gains in importance only when we are dealing with the identification of objects which are unknown to us or are distinctly individual in their form, and in cases when an accurate perception of form is expressly intended, as in the sculptural activities of the blind and in psychological experiments.

The fact that in the field of Haptics objects are often recognised by only one of the above-mentioned criteria, and that the haptic perception never aims at an exhaustive recognition of the total contents of the objects (material, form, and fashioning), is connected with one of the most important facets of the process of haptic perception—namely, the *intention towards a total recognition* and the focusing on the general aspects. As I have stated elsewhere,[1] the cognitive intention in the field of Haptics is directed towards "*What* kind", and not towards "*Which* one", not towards the species, but towards the genus. By its general nature the haptic process of perception is a *cognitive* one, and for that purpose the individual nature of the object is irrelevant. Characteristic details of the objects may be apprehended by means of touch; they do not, however, fuse into an individuality in the field of Haptics as in the case of the visual sphere, where this process of fusion becomes manifest in the significance of the total appearance, in the structure of the whole, and in the inseparable unity of material and form. This limitation of the haptic perception of objects becomes most marked when one is dealing with the individual recognition by haptic means of an unknown or less familiar object—*e.g.*, in selecting a special sample out of a collection of generically similar objects. In such cases it becomes evident that in the field of Haptics, in spite of careful

[1] G. Révész, *Über taktile Agnosie*, Haarlem, 1928, and "Psychologische analyse der Störungen im taktilen Erkennen," *Zeitschr. f. Neurologie u. Psychiatrie*, **115**, 1928, 585.

successive and analytical examination, the individuality of the object, the homogeneous whole, cannot be brought to a clear focus out of the singular details that characterise the concrete object in respect of its contents and distinguish it from all other related specimens. The integrative comprehension of the individual reality presupposes vivid observation of the indivisible thing and its many-sided unity. The haptic sense, however, is not endowed with the faculty of clearly integrating that complexity. This deficiency accounts for the fact that in the environment of the blind we rarely meet objects which impress us by virtue of their individuality. They do not mind whether an object in daily use has a characteristic form, provided it serves its purpose and adapts its shape to the prehensile organs. The blind are not interested in the individual form, and to an even smaller degree in æsthetic beauty, but only in usefulness and familiarity.

The limitations of the haptic world of form account for the fact that the blind would never think of adorning an object of daily use with formal ornaments. They would neither observe the ornaments when using the object nor would the sensual impression of the object gain in vividness and æsthetic value through the ornamentation.

From whatever side one investigates the tactile apprehension of objects by the sighted and by the blind, one meets with *pragmatic principles* which are characteristic of Haptics as a whole. The cognitive intention is directed towards the categories of the objects and aims at usefulness and orderliness. This intention is satisfied with ascertaining group criteria, and does not aim at a perception of form adequate to the individual object. Whereas the exact form represents an integral component of the total visual appearance, it is relegated to the background in relation to the totality of the haptic object-impression. What is most striking, and what constitutes a marked difference from the visual approach, is the difficulty of representing vividly a form unconnected with material and object. In the visual field form has an existence of its own, independent of material and object. A church clock is endowed with the character of a circular form apart from its clock character. A church clock can be apprehended in its time-measuring function as a clock or just as vividly as a circular plane, as, for example, an ornamental component

of the tower. Similarly we may look upon a bridge either in its static function or we may admire it in respect of its æsthetic function. In the field of Haptics such a differentiation, such a cleavage, is hardly possible. For here the object as apprehended is so intimately associated with its form that the differentation can only be performed by a special mental operation.

Nevertheless the question of haptic form remains important both for the general theory and for the haptic problem of space. For it is just the difference between the optic and the haptic impression of form, the problems of the active and passive creation of form, the peculiarities of the haptic experience of form, and, last but not least, the creative, formative activity, that make the neglected field of haptic form-perception one of the most interesting chapters in the psychology of space and of æsthetics.

IV

HAPTICS OF FORM

1. Optics of Form and Haptics of Form

The problems of form in the field of Haptics require an introductory analysis of the concept of form. In the field of Optics form is simply given as a result of direct sensory perception. As the optic form in its full spontaneity, vividness, and independence becomes manifest without any rational activity, there is no difficulty in explaining its significance. In the field of Optics form and content become separated from one another without apparently any active interference by the observer. It is as though the form compelled us to consider it as an independent object which we have to observe. It is true that the fundamental conditions of abstraction and discrimination are fulfilled in these cases, for form and content are observed as separate from one another in respect of one and the same object. We are, however, not dealing in this case with a true abstraction *sensu strictiori*, for the impression of form emerges with an energy of its own out of the total experience. It comes into being without the need for any intention to abstract and analyse.[1] The circular form of a clock, the closed figural form, becomes cogently manifest without any abstractive activity.

In the field of Haptics we encounter completely different conditions. Clear distinctions which are obvious in the field of Optics are frequently lost in Haptics. Here the distinction between form and content is based on a conscious, reflective process; the apprehension of form as an isolated dependent datum fused into the homogeneous sensory impression can only be achieved by means of analysis and rational demarcation. It is true that we meet with acts of haptic perception, in which the form appears without a rational abstractive activity, but these cases represent exceptions.

In the field of Optics one does not mistake the visible forms for

[1] G. Révész, "Abstraktion und Wiedererkennung," *Z. f. Psychol.*, **98**, 1925.

the geometrical proportions underlying them. We know that here geometrical similarity or identity is by no means the same as phenomenological similarity or identity, and we know how the impression of form undergoes a change through alteration of position or distance although the geometrical relationship remains the same. On the other hand, we see how in the field of Haptics form and geometrical structure are often inseparably related to one another.

Even the fundamental question of whether one is justified in using the term " form " in Haptics in the same sense as in Optics is not yet solved. That is due to the fact that a clear distinction was not made between haptic and visual problems of form. There was no hesitation in transferring into the field of Haptics the notions gained from visual experiences. Under such conditions Haptics could not emancipate itself from Optics. So research reached a deadlock. The same questions were asked and discussed repeatedly, and this created the impression that the first steps towards a solution—which were determined by the uncertainties of the psycho-physical background (sensitivity, kinds of touch, qualities of sensation, visualisation, orientation, etc.)—represented the final bounds of research. It is true that more recent investigations have yielded certain important results and that modern trends in psychology have not been devoid of influence on that field of research. But apart from a few advances, the situation has remained unchanged on the whole. Even experimental results which have contributed to the clarification of certain of the problems concerned with developmental psychology, such as the investigation of the primary tactile qualities, the analysis of the tactile process and of plastic creation, were unable to alter the position of Haptics. That was only to be expected, so long as one was always and in every respect prepared to be guided by the concepts and criteria of Optics. As the morphological laws of space seem to apply equally to Optics and to Haptics, one felt justified in assuming that not only the general laws of form, but also the concrete applications were similar in both spheres. In this respect Gestalt psychologists have not brought any clarification. By neglecting the field of Haptics they were led to assume that optic laws would be valid also for haptic phenomena. Such an idea was supported by the apparent similarity of the impressions produced by simple geometrical forms in both sensory fields.

Because one rediscovered these elemental spatial forms in touching objects—or rather because one thought one had rediscovered them, and correctly so—one felt that one was dealing in the field of Haptics with the same kind of inner potencies and laws and with the same perceptual content as in Optics.[1] In doing so one fell victim to a great error. The possibility of recognising spatial forms haptically was identified with the phenomenological impression. By referring constantly to the Optics of form, the Haptics of form entirely lost its independent status. The haptic world of forms became degraded to being an inferior, hardly distinguishable, copy of the optic world of form. The fact that æsthetics of spatial form started from the visual function alone, rendered the autonomous nature of the tactile sense in the creation of form even more problematic.

2. Dominance of Optics

So far nobody has attempted to investigate the problem of form from the point of view of Haptics (*i.e.*, excluding the visual element). Even authors like Herder and Hildebrand, who are known to have tried to derive the original appreciation of form from the sensations connected with touch, have been guided in their discussions on the theory of art by consideration of the æsthetic sensibility and creative activity of sight. And although Herder stated as a fundamental principle that " vision is really only concerned with surfaces, images, and figures in one plane, while bodies and bodily forms are dependent on touch (*i.e.*, tactile apprehension) ", and that " everything that is form is only recognised by touch, and only surface is recognised through vision ", he nevertheless attributes to beauty a visual content, when he states: " Beauty derives its name from seeing, from appearance, and it is through seeing, through beautiful appearance, that it is most easily recognised and valued." [2] The same applies to Hildebrand, who expresses his idea of sculpture and architecture in the following words: " All reality is of importance for the creative arts only in so far as it manifests itself in the visual image. The development and cultivation of the visual

[1] The paper by W. Blumenfeld, " The Relationship between the Optical and Haptic Construction of Space " (*Acta Psychologica*, II, 1937), is also determined by these ideas.

[2] J. G. Herder, *Plastik, einige Wahrnehmungen über Form und Gestalt*, Riga, 1778.

image as an expression of reality is its task." [1] If, therefore, even æstheticians who have attributed to the organ of touch a primary importance for the creative act maintain that the form-hegemony of seeing and visual apprehension is an indisputable fact, it is only natural that æstheticians and psychologists who base all their theories on the visual function do not even mention the formative faculty of the haptic sense. The only exception is Riegl,[2] who attributes special importance to the function of the sense of touch, when he attempts to explain the material appearance of the work of art and the so-called near-view. A closer study of his arguments, however, shows that he does not attribute to the haptic sense and to haptic concepts any direct formative faculty, but merely a higher perceptivity in regard to the individuality of the material. In his further discussions on the theory of art his notions on Haptics cease to play any relevant part. It can even be shown —and this is the most important point in this connection—that in his so-called haptic theory Riegl's starting point was not really the tactile function, but the "*tactile*" perception of the *eye*. Riegl's haptic theory is therefore not really a haptic but an optical theory, which takes into consideration the genetic theory of a "tactile" function of the sense of vision.

It is self-evident that art, with all its varieties and means of expression, from the most primitive stages up to its sublimest manifestations, from crude and technically clumsy figures to the production of the masterpieces of traditional beauty, is tuned in to the visible world and to fantasy fructified by visible nature. The contour and the shape, the harmony of the proportions, the urge for clarity, simplicity, and symmetry, the delight in vivid colours and composition, the joy created by the vitality of vital physical existence, motion, and sensitivity—all these basic facts and tendencies, which can be traced back to the decorative art of the Stone Age, are ruled by the visual image, and presuppose a mode of seeing guided and enhanced by artistic aims. As we have suggested above, the first human tools, especially the first wedges shaped on the pattern of the hand and other prehistoric tools, might be seen as the result of the haptic creation of form. But even those objects which were formed on haptic principles are found at a relatively early period in the Madeleine (in the ante-

[1] A. Hildebrand, *Problem der Form in der bildenden Kunst*, Strassburg, 1913, p. 13 ·.
[2] A. Riegl, *Spätrömische Kunstindustrie*, 2nd ed., Vienna, 1927.

diluvial epoch, about 20,000 years B.C.) adorned with engraved schematic figures (horse-head, ornamental fish) and abstract embellishments cut into the material; these designs undoubtedly appeal to the eye, to the visual sense. In a similar manner the adornment of the body is connected with the visual sphere. This is said to be much older than the ornamentation of tools. To the archaic painting of the body plastic adornment soon gets added, and it originally consisted of natural objects arranged in shape of a chain (teeth, shells) and later on took the form of geometrical ornaments.

The question of the extent to which haptic forms play a part in the world of geometric shapes cannot be answered with certainty. But it is beyond any doubt that it owes its existence partly to the gradual simplification and schematisation of natural forms occurring in the world of reality (as can be seen in the infinite modifications of human and animal figures in the rock paintings of Africa and Spain), and partly to a spontaneous urge and to the joy connected with the art of drawing, an element that is again suggestive of the hegemony of Optics.

These geometrical ornaments, which first appear in neolithic pottery as circular figures, spirals, triangular and crenated patterns, and flowers, but later on in the zones of European, especially Mediterranean, culture in many variations, belong to a definitely optical world of form. They are based, first, on the form-perceiving and form-creating function of the eye, and, secondly, on the schematisation, formalisation, and abstraction of visually apprehended objects. Even on prehistoric plastic works made out of bone and ivory, on sculptures and reliefs—all that could best be connected with Haptics and the function of the hand—we find delicate engraving, shading, and curves which could only have been thought of and produced for the eye, and not for the hand.

This art is governed by laws determined by geometrical principles. To the same extent our environment, so far as it comes into being through the human mind and the human hand, is subject to these laws. We are dealing with an order of things which, in its harmony of connected forms, its symmetry and proportion, is rooted in the laws governing the form, connection, and structure of visual objects. It is therefore not surprising that a genuine art of the blind does not really exist, and that the blind, so far as they are given to plastic activities, are necessarily influenced and guided

by the thematic and compositional principles of visual art. The emphasis laid by blind sculptors on the geometrical system, the architectural constraint, the limited freedom in the creation of form, the strict dependence on conventional figures, the restrained fantasy, and the voluntarily inhibited modes of expression, provide strong evidence of the intention of the blind to discover the modes of expression of sighted artists and to imitate them. That accounts for the fact that so many works by blind sculptors convey the impression of having been created by technically rather unskilled sighted artists.

Whatever the nature of a world of forms in an independent Haptics may be, it will certainly be unable to compete with the rich creations based on the visual sense. Our tactile function is not governed by the urge to represent forms as such and to gain a precise image of spatial forms, and even less by the urge to create forms. Nor is the pleasure in the wealth of forms in Nature and art as intimately connected with the haptic as with the visual sense. This is evident in the fact that on the whole the blind have no urge to touch objects of art or gather accurate information about the form and the architectural structure of such objects. Such an attitude on the part of the blind could not be accounted for if form played an important part in the haptic world of perception.

In everyday life, too, the blind show very little interest in form. No blind person, for example, will ever be found to subject the objects of his immediate environment to a close tactile scrutiny. He will be content with a general orientation to the objects that surround him without paying attention to their individual appearance. Even when a blind person remains for any length of time in a room, his tactile activities do not lose their reconnoitring character. He will therefore never think of approaching objects hanging on the wall, for example, and examining them by means of touch, and he will certainly not try to get an accurate idea of their form. I have often been with blind persons, and I cannot remember having noticed that they paid any attention to the form of objects. It is characteristic that blind children have to be specially taught to examine objects accurately by touch. Without such tuition they would do so only in quite exceptional cases. Blind children have altogether much less contact with objects than we with sight imagine them

to have. Most objects do not seem to interest them at all. They do not stimulate their fantasy. As they seem to be unconnected and isolated, they do not merge into entities of a higher order. We have to realise how little the tactile apprehension of the pieces of furniture means to a blind person compared with the total visual impression of a well-furnished and harmoniously arranged room. The comparative irrelevance of the objects manifests itself also in the lack of interest and the discontent of many blind children in object-teaching classes. I have observed pupils who were unable to overcome their inhibitions and their discomfort in such classes (*e.g.*, when faced with topographic maps or zoological models), but nevertheless studied and followed with the greatest interest everything that moved or was associated with production of energy (mechanical contrivances, motor cars, or gymnastic apparatus).

Those who have lost their sight at a later age, and particularly people with impaired vision, pay more attention to form; their interest, however, is a very limited one.

The hegemony of Optics of form has had an important influence on the development of printing for the blind. In the first stage of that development there was an exclusive adherence to lettering (*i.e.*, to signs with optical characteristics, without taking into consideration whether the shape of the letters represented the most suitable form for tactile perception). This accounts for the fact that the print for the blind which was introduced at the beginning of the 19th century—a print which was merely a relief copy of our letters—met with no success. The same applies to the so-called " spike-print ", in which the relief lines of the letters were replaced by a row of points in relief. The failure of both these types of print is due to the misconception of the special mode of function of the tactile sense and the erroneous assumption that the haptic sense should be just as able as the visual sense to perceive and distinguish gross shapes and small details. It was a blind man who had to show the way towards overcoming the difficulties associated with a print for the blind. The blind Louis Braille was the first to free himself from visual notions by suggesting a system of print consisting of embossed points for the use of the blind. That system is based on specifically haptic form-elements. This is proved by the fact that sighted persons who teach Braille print are not able to read more quickly than intelligent blind

persons trained in reading. The development of Braille print, the fact that linear and plane figures have been replaced by figures consisting of dots, firmly warns us, therefore, not to identify visual and haptic worlds of form.

There is no doubt that the appreciation of form is originally and intimately connected with the visual function. The world of forms, its incredible variety, its wealth of associations, and its æsthetic importance are brought home in full consciousness only to the sighted.

Nevertheless the range of perception and the creation of form transcend the visible world. Haptics, too, has its world of form, if only a limited and a different one—one that is determined by other formal tendencies and aims than those of Optics. *The autonomy of the optic world has its counterpart in the autonomy of the haptic world;* the autonomous visual form has its counterpart in the autonomous haptic form and the visual fantasy its parallel in the tactile fantasy.

3. Form and Structure

The emancipation of Haptics from Optics can only be achieved by dropping the traditional assumption of the absolute hegemony of the optic principle of form. To that end it is, however, necessary to establish certain ideas and to draw definite lines of distinction between them. These distinctions concern first the notions of *form* and *structure*, which are of utmost importance for our basic problem.

Two fundamental tendencies are operative in the mode of perceiving objects. The result of one of these represents the figure-image (*i.e.*, the form), the other one the organisation of the whole in its geometrical connections (*i.e.*, the structure).[1]

We therefore mean by the *form* of an object the unity of its parts as emerging out of the process of being perceived, a unity leading to complete fusion of its elements in the total impression.

No precise distinction is usually drawn between form and shape; both terms are alternately used in the same sense. If we wanted to draw nicer distinctions between the two terms, we might define shape as the immediately perceived form, and reserve the expression " form " for the entity of an object pre-

[1] It may be mentioned that these two fundamental aspects are not restricted to objects of the world of space. In music too we meet both aspects in a very marked manner. Cf. below, p. 86.

senting itself in various appearances. So we might say that an object presents itself in different shapes according to the varying positions in which it is seen, while its form remains unchanged. The form of a square remains invariant even when it appears in different positions or in connection with other figures. It is true that its mode of appearance changes (□ ◇). The impressions of shape are therefore related to an identical form, which, as though transcending the phenomenal images of form, expresses the entity of the object.

In the following discussion I shall only take the distinction between form and shape into consideration when it is required in relation to the special problem. Otherwise I shall use both terms in the same sense, all the more since—a point to be discussed later—the distinction between form and shape is of no real importance in connection with the haptic perception of objects.

The formation of spatial objects is based on a general perceptive tendency according to which every structure that is by nature more or less differentiated into parts becomes integrated into a homogeneous image. From the point of view of that general formative tendency there is no fundamental difference between Haptics and Optics. When and under what conditions that tendency becomes operative, and what specific formative laws govern the creation of form or the modifications of form—these are special problems of a general doctrine of form or of psychological æsthetics.

The perception of form does not take into account the composition of the object of perception and the relationship of its parts. One aims at suppressing everything which threatens to impair the integrative attitude. Parts and details, which may be important to the composition of the object but are irrelevant from the point of view of the total form, are neglected.

As distinct from the observation of the form, the investigation of the structure is an analytical process; it is directed towards differentiation, the stressing of the parts. It is not the content of the perception, but the *construction* of the object which is to be attended to.

We therefore use the term *structure* for the order and organisation of the component parts of an object (or of a group of objects) within the framework of the spatial architectonic entity of the whole. The term " structure " as suggested by us differs from

the usual notion generally adopted in psychology. The one and only point they have in common is that the latter concept of structure also refers to whole entities, although to such as are basically different from any integrated form.

The concept of structure has become more and more vague. Anything which appears to be organised, which possesses coherence or is even merely definite in some way, is said to be structured. Thus one speaks of the structure of an optic-spatial object, of a field of perception (field-structure), of a melody, just as of the structure of the talent, the type, the personality of a human being or of the structure of a social group. Such an extension of the concept, however, cannot serve research any useful purpose. The boundaries between structure, shape, and form become completely abolished by the vague and diffuse use of the term structure.

The perception of form referring to space and spatial objects occurs almost exclusively in the field of optics. Here it is in the first place the total form, the coherent figure, which strikes the observer. If, however, one wishes to obtain information on the architectural structure of the separate parts and the geometrical relations between them one has to apply another mode of observation by moving from the sphere of direct apprehension of form to that of the intentional recognition of structure. We thereby free ourselves from the general impression and attempt to ascertain analytically the structural strata of the object and their relations to each other. Fundamentally the same happens whenever we start from the schematic form of the object. We encounter that special mode of structure recognition, especially, in the field of Haptics, but occasionally in the visual sphere as well. The importance for the structural analysis of the schematic impression is based on the fact that the structure of the object is, as it were, written up in the schematic pattern. The last-mentioned mode of analysis of structure occurs almost exclusively in Haptics, where every exhaustive recognition of objects is achieved by means of successive tactile apprehension of the partial structures.

The theoretical distinction between form and structure does not imply any intention to establish an antagonism between the two concepts or to assert their independence. A close relationship between form and structure cannot be overlooked. For instance, the connection between them is expressed in the fact

that the structural apprehension of objects always presupposes the element of form. An amorphous, formless thing cannot be apprehended structurally nor can it be split into its component parts. The difference lies not so much in the fact that the objects are shaped, but rather in the subject's intention to recognise the shape. By the immediate apprehension of form we merely aim at bringing the objects into consciousness, in their own phenomenological form; and in this connection the form constitutes the fundamental criterion for recognition of the object. In contradistinction to this, the structural mode of apprehension is explicitly concerned with the task of recognising the separate parts both as such and in their organic connection. In this case the intention is directed towards the construction and the composition of the whole, and not towards the phenomenological total impression.

In order to attain that end one starts by splitting up the objects into partial forms; then the integrated whole is created out of the parts thus gained by analysis, the result being a structural entity. In the field of Haptics—and that is what we are here concerned with—one usually does not start from the whole, one rather tries to construct a structural entity out of the analytically perceived partial structures. Analysis is, therefore, but a preparatory though important phase of the entire process of recognition concerned with the structural aspect. It is true that one obtains the parts by means of analysis, but these structures only become relevant when they are seen as components of the structural entity. On the other hand, it is only after recognition of the total structure of the object that the partial structures are perceived and examined as separate features and become recognisable as comparatively independent structures.

The interdependence between form and structure obviously does not abolish the difference between them. This applies to Haptics as well as to Optics.

Optical form and structure become very clearly differentiated in figures of the same geometrical design, which are interlaced or separated from one another by means of a rhythmical arrangement of the parts, as can often be seen in ornamental art (*e.g.*, in geometrically ornamented capitals, walls, and tools). When the attention is directed to the (total) form, the (partial) structures recede to the background and vice versa.

In three-dimensional figures the difference becomes even more marked. Let us think of an isolated Greek column. Such a column, when subjected to direct inspection, appears to us as a structure with a special æsthetic effect. By starting with the other mode of inspection one arrives at the structural parts of the column, the pedestal, the shaft, the capital, and so forth. This process of differentiation can extend beyond what is immediately visible, for it perceives the component parts of three-dimensional structures, not as they appear in the total impression, but rather as they exist in themselves. We then no longer have to do with the phenomenal form of the column nor with the interplay of forces, which determine on the one hand the æsthetic impression, on the other hand the form-impression of the column, but rather with the actual physical structure of the column, a phenomenal visual impression of which we can only obtain by rotating the column and, even by doing so, only to a limited degree. The structural apprehension of three-dimensional structures therefore involves, apart from the immediately perceived component parts, such additional elements as are based on knowledge only.

That form is apprehended by an act of immediate, undivided perception, whilst structure is apprehended by an act of recognition and knowing, is further shown by the fact that we are only able to make a concrete statement about the impression of form gained from an object if we make use of the additional knowledge of its structure, by enumerating the separate parts of the structural pattern. What one may state (*e.g.*, about the form-impression of a Doric temple) is mostly confined to the æsthetic effect of the building. We may describe in impressive words how the building affects us, how beautiful and grand we find it, how we detect a harmonic interplay of purpose, expression, and aim, how form and content contribute perfectly to the unity of the work of art. We are, however, quite as unable to express in words the immediate sensual experience of form as to express the sensual impression of a melody. If we want to convey to another person a solid impression of what we see, we are compelled to direct his attention to the structure. After being told that on the narrower side of the temple there is a flight of steps erected out of mighty free-stones, carrying fluted columns, and that these columns carry an entablature arranged and ornamented in such and such a way, etc., we are able to form a fairly clear idea of that portico. One

might go further and describe, say, the structure of the individual parts, the arrangement and allocation of the columns. When we are told that the columns are placed at a distance from one another corresponding to one and a half times their lower diameter, that they taper gradually, that on top of them the epistyle comes forward in a gently swinging line, our knowledge of the structural features of the temple and the architectonic details of its component parts becomes much richer and renders our conception of the impression conveyed by the building far more clear and concrete. It is obvious that the knowledge of the structure can only help us to gain an impression of form provided we have already seen similar structures either in reality or in illustrations.

Such a total form arrived at by means of structural recognition cannot be identical with the phenomenal impression created by the object. That incongruence is not based on the fact that the description is bound to be incomplete, it is rather based on the immanent difficulties that arise from the different natures of form and structure.

A building conveys *different* impressions of form according to the position of the observer, although it possesses *one* structure only. There does not exist any impression of form or shape, which could determine exhaustively the total structure of a building, as obviously happens in the case of a figure or an outline in two-dimensional space. The structure of a thing is made up of dependent and intimately interconnected structural strata which can never be integrated into a visible unity. We may be quite well able to realise the structural parts of the building in a drawing or a projection, so that they are brought into relation to one another, but they remain parts, which can only be fused into a sort of unity by means of intellectual operations and the imaginative completion of the sections not represented, and of the structural elements which cannot be represented. If we attempt to gain a vivid picture of that " structural whole "—in other words, to translate the structural into the morphological—the parts which have been taken up into the structural whole regain their phenomenal independence, their formal homogeneity, and so that which was created on the basis of cognition disintegrates. Just try to unite the front and back view of a statue into a vivid picture. What applies to the statue, applies in principle to all bodies, in so far as they have different aspects or different sides.

We have discussed the fundamental differences between form and structure with reference to visual examples. It becomes even more clear with haptic objects. All that we have mentioned about the autonomy, relative independence, and variability of the visual impression of form as opposed to structure applies to a far greater extent in the field of Haptics. In view of the fact that it is impossible, as soon as one goes beyond elementary forms and tools, to gain a total picture of haptic objects corresponding to the visual impression, one is compelled to fall back on a structural conception in order to obtain a clear idea. Whenever we set a blind or a sighted person the task of describing accurately the "form" of an object which is perceived purely haptically, we are impressed by the way he touches the object minutely and in great detail from all sides, how he is at pains to acquire exact knowledge of the spatial relationship of the parts of the object. He aims at an exhaustive perception of details, not at the apprehension of a total form; his tactile movements are too many and too much divided into separate acts to enable him to arrive at such a total impression. What occupies his whole attention is an accurate investigation of the structure of the object, aiming at an exhaustive recognition of the architectural arrangement of the haptic object. *The intention of structural recognition is an expression of the mainly cognitive nature of the haptic sense*, as opposed to the largely spontaneous nature of visual perception. The synthetic tendency which is predominant in the perception of form and in the æsthetic field is relegated to the background in the process of structural recognition. Here, in fact, one aims at severing what is integrated in visual perception, namely, the entity of the visual image; the dominance of the synthetic principle in the field of Optics becomes transferred to the analytical principle. Although one meets both these principles at work in the process of haptic perception, too, the contrast between the synthetic-formal and the analytical-structural purpose in perception impresses one most markedly if one compares the visual with the haptic apprehension of objects: the optical process is governed by the synthetic, intuitive, passive, and subjective kind of object-perception, the haptical process by the analytical, cognitive, active, and objective nature of the operation of structural recognition.

We therefore see that in the field of Haptics one proceeds by way of structural recognition to the total image—that is, a route

just opposite to that which is used in Optics, where, generally, the total form represents the starting point for a structural analysis. In two-dimensional visual figures the arrangement of the whole lies immediately before us, and the structural view aims only at emphasising that arrangement, the separation of the partial structures which are fused into a unity. Yet even after that separation the total visual image remains manifest as forming a sort of background. It is on that background that the parts appear in all their detail. In the phenomenal appearance the only change that occurs is that the structure of the object emerges out of the total image and that the natural structure becomes more marked. In Haptics we meet quite different conditions. Here the structure, the spatial arrangement, and mutual relationship of the parts have to be brought into consciousness intentionally by strenuous work. The natural arrangement of the object is not always decisive. Parts without a special function of their own and without intrinsic formal importance become the centre of attention, on account either of their size or of their material peculiarities, and are made use of in establishing the structure. In the field of Haptics everything amounts to arranging the parts into a spatial pattern, to forming a scaffolding on which the parts which appear to be structurally relevant find a place in accordance with their spatial relations. We are faced not so much with a hierarchic order largely determined by a partial element especially characteristic of the total image, but primarily with the creation of a pattern uniting the parts, which are structurally more or less independent. In that process the constructive function of structural recognition in the field of Haptics becomes fully operative. The schematic-structural element is so much in the foreground that forms easily become neglected or modified in favour of the schematic pattern. Thus we find a tendency to overlook deviations from symmetry and towards reducing figural impressions to elementary geometrical forms. One tries to simplify the part-impressions to such an extent as to make them easy to apprehend and fix in *abstract terms*. Thus an irregular pentagon is converted into a regular one, and similarly the individual form of any object is reduced to a typical schematic form and fixed verbally.

The marked tendency towards a differentiating structural analysis and towards a constructive composition can also be traced

in the field of Optics, although under special conditions only. If we present a person with complicated figures, telling him to draw them from memory after the visual stimulus has been removed, we find that the observer proceeds in the same way as in Haptics. He is not satisfied with apprehending the offered figure in its total appearance, but tries to apprehend it structurally and in more abstract terms. Without that the proffered task cannot usually be solved. There is, however, a difference. The optical recognition is assisted by the total image, obtained by looking and fixed in the sensorium, while such aids are hardly ever forthcoming in the field of Haptics. In the visual sphere the homogeneous image of perception involves the form *and* the structural arrangement, so far as we are dealing with two-dimensional figures. We require only a special attitude or direction of perception to transfer from form to structure. In the tactile sphere perception of form and structural recognition show a clear disjunction due in the first place to the limitations of simultaneous apprehension. The total image, which in the majority of cases is of a schematic and tentative character, rarely allows a recognition of structure. In the field of Optics analogous conditions can be produced by experiment: We present the subject of such an experiment with parts of a two-dimensional figure which has been cut up into two or three pieces, and set him the task of putting them together into one figure.

It has, then, become clear that owing to the close relationship between form and structure emphasis may either be laid on the sequence " form to structure " or on " structure to form ". The form–structure relation is mostly predominant in the field of Optics, whilst the structure–form relation governs the field of Haptics. In the visual sphere the form of the objects faces us immediately: here the form is primary, and the recognition of structure and the architectonic composition of the objects is a secondary matter. In the field of Haptics conditions are rather reversed as regards the total impression. It is true that in Haptics the impression of form comes into being in an immediate way, but the primary impression of form is mostly limited to that part of the object which can be taken in by one undivided perceptual operation, irrespective of whether it consists of one single act or of a consecutive series of several tactile acts. By contrast, pure summation—that is, the successive union of partial figures—does

not lead to a total form. So the person working on tactile lines (the blind man) does not attempt to arrive at a synthetic apprehension of form. He is satisfied if he succeeds in bringing the relevant elements of an object into conscious perception by means of structural analysis. Occasionally he may try to unite the partial structures into a structural whole by means of the constructive function. He will also decide to do this when asked to represent the whole haptic object in a homogeneous form. That structural whole is, however, something completely different from a formal entity. For if the structural whole sums up the spatial arrangement of the examined parts as a result of intuition and intellectual work, that summing up presupposes an act of conscious arrangement, as becomes manifest in the eventual product. When, however, the total form reproduces from a certain point of view the phenomenal impression of the object, spatially delimited and isolated, purely on the basis on perception, that impression is given spontaneously as an individual unity and does not require any conscious arrangement of structure. The structural whole is therefore fundamentally *a summative arrangement*, while the total form really represents a *totality*; the structural whole has to be elaborated, the formal entity is an immediate datum. The structural whole is obtained with the co-operation of the intellect, but the formal entity is open to intuition only; in Kantian terminology, the structural entity is an empirical product, the formal entity a transcendental condition of the perception of shape.

Theoretical considerations and my experience, therefore, make me see the most important difference between visual and haptic perception of objects in the fact that *our visual sense is directed to the perception of form, while our sense of touch is mainly directed to the recognition of structure.*

The fact that the validity of the two terms form and structure holds in the acoustic sphere as well is indicative of their importance beyond the realm of spatial perception. Nowhere else perhaps is the difference between form and structure so evidently marked as in music, where the term " form " has to be taken not in the sense used in the theory of music, but in the sense of the preceding discussions. The general impression of a piece of music (*i.e.*, in our terminology, its form) can only be grasped directly and in its total aspect, a fact that makes it occasionally

easier for the layman to grasp it than for the professional. It constitutes a phenomenal totality in the same sense as applies to the visual and haptic impression of form. The structural analysis, however (*i.e.*, what the theory of music calls formal analysis), splits up the piece into separate themes and motifs, and follows up their connection and their opposition. Such an analysis is on the whole only open to the professional, and is exposed to the danger of annihilating completely the total musical impression.

We may therefore sum up thus. By form we understand a sensory intuitive entity conditioned by unconscious formative factors, and by structure a consciously acquired knowledge of the spatial or temporal relations and the connections we have ascertained in an object. The form or shape is based on the empirical and homogeneous apprehension of a whole (or of a partial whole), the structure on the cognitive apprehension of the architectonic pattern and the knowledge of the functions of the relatively independent parts of the object. Form therefore belongs to the sphere of experience, structure to the intellectual sphere. Form always pertains to a phenomenal entity, structure to parts arrived at by means of analysis and to their reciprocal relationships. Form is phenomenal, structure real; form is variable, structure invariable; form is based on a simultaneous-synthetic, structure on a successive-analytic process of apprehension. Visual perception is directed towards the total form, haptic perception towards the structural sum: *form governs the visual, structure the haptic world.* These phrases express the fundamental importance of a clear distinction between form and structure for the whole theory of visual and haptic perception.

4. Haptics and Geometry

The discussion on the recognition of the structural arrangement of objects by means of our sense of touch leads us to the problem of the relationship between Haptics and geometry. The basic orientation of the haptic sense towards apprehending the spatial structure of objects is closely connected with the tasks set geometry —namely, the definition of geometrical figures and the investigation of their possible connections and relations. In the first place a marked relationship between Haptics and geometry seems to be based on the fact that both in the structural apprehension of objects and in the estimation of sizes and proportions methods are

used which show a great similarity to the methods used in measuring quantities capable of being subjected to the process of addition. Both in the geometrical and in the haptic space distances and sizes are measured by means of definite units of measurement, in geometry by means of the invariable objective linear measures, in the haptic space by means of the individually invariable measure of the fingers and width of the hand or the length of a stride.

We have to attribute to the tactile organ a *metric function*; and it is by no means accidental that prior to the introduction of the metric system the units carried the names of haptic measures, as thumb, finger, hand, foot. As mentioned above, it is most characteristic of the metric nature of Haptics that the mechanism of a pair of fingers capable of opposition and of being set at variable distance from one another provided the model for the simplest and most widely used of our measuring instruments. A further relationship between Haptics and practical geometry lies in the fact that in the visual space the physical measure changes its size with increasing distance, whilst in the field of Haptics and geometry the measuring unit, once determined, retains its size when transferred to another point. We have further to remember that the haptic space is originally three-dimensional; for that very reason it might be expected to be more closely related to the geometrical space of physics than the visual space, the original three-dimensionality of which, according to a number of authors, still seems to be questionable. The objective metrical nature of Haptics finds further expression in the fact that our mood and our general condition, which in various ways are apt to influence our attitude towards Nature and art, towards reality and appearance, are of no relevance in the haptic and geometrical spheres. In short, our haptic sense apprehends the constant element, the relatively invariable and general one—the sensory substratum of " pure intuition ", so to speak—as it presents itself in geometry.

Well-known mathematicians have repeatedly directed attention to the relationship between Haptics and geometry. Thus Poincaré [1], Helmholtz,[2] F. Klein,[3] and others have supported the view that geometry was based on ideas which we receive direct

[1] H. Poincaré, *La science et l'hypothèse*, Paris, p. 74.
[2] H. v. Helmholtz, *Die neueren Fortschritte in der Theorie des Sehens. Vorträge und Reden*, I, 233, Braunschweig, 1884.
[3] F. Klein, *Elementarmathematik vom höheren Standpunkte aus*, I, 1908.

through the senses, and that the empirical material which is relevant to the establishment of geometrical concepts is derived from the sphere of haptic perception.

H. Friedmann goes one step farther by assigning the Euclidean or common geometry to the haptic sense and projective geometry to the visual sense.[1] Thus he maintains that the elementary planimetric figures are originally haptic in nature and that they have only undergone secondary " visualisation ". However interesting this radical statement of Friedmann may be, it can claim validity neither on *a priori* nor on empirical grounds. Even if it were ascertained that elementary geometry had originally been based on haptic conceptions, that would by no means imply that Euclidean space was purely haptic in character. Further, I do not know what kind of haptic concepts could be associated with Euclid's fifth postulate, the theorem of parallels. It could never be deduced from our haptic perceptions that one parallel only can be drawn through one point. We have no right to assume that the Greeks were guided by the haptic sense in establishing their geometry, which provided an exhaustive survey of empirical conditions and up to our time satisfied the requirements of a scientific theory of measurement. The reason why they did not proceed from the common geometry to projective geometry was not that they were unable to free themselves from the haptic world of space nor that they were unaware of the field of visual sensation, but that their geometry was in perfect conformity with the theoretical and practical requirements of that time and was not contradicted by experience. Nevertheless it may be maintained that projective geometry takes optic phenomena into account to a far greater extent than is the case with elementary geometry. But it is impossible even from a mathematical point of view that these two geometries should express the boundaries of the visual and haptic world and their relative order of rank.

Friedmann's view that the elementary planimetric figures owe their existence to haptic impressions and that their visual realisation is due to the " visualisation " of these tactile impressions is by no means proved. The elementary geometrical figures and their connections are optically simple, and as such they play the most important part in the whole history of art, especially in the ornamental arts. That those simple geometrical figures and those

[1] H. Friedmann, *Die Welt der Formen*, Munich, 1930, p. 38.

ever-recurring invariable decorative motifs should be based on tactile perception is an unproved and improbable assertion. We cannot associate ourselves with Friedmann's basic view that the experience of form is always a visual experience and that the world of form must therefore remain to the blind a transcendental and unapproachable realm. Such a view springs from the misleading tendency for the problem of form always to be discussed from the visual angle. That attitude of dependence on sight leads to over-emphasis of the visual element and precludes us from appreciating the experience and achievements of the haptic sense, which contradict sharply the assertion that only the visual sense is endowed with a form-creating function.

But there is no doubt that Friedmann's view contains an element of truth. The haptic apprehension of space and objects fits into the categories of common geometry, whereas it has no relation to projective geometry. A further fact suggesting a closer relationship is that, like the theorems of congruence in elementary geometry, the instances of congruence are of special importance in the field of haptic measuring. It is further characteristic (a point stressed by Friedmann) that a well-defined stock of concepts is linked to each one of the two sensory spheres, just as a well-defined range of concepts belongs to each one of the two geometries.

For criticism of the attitude of dependence on sight we have to turn attention to the normal curriculum for the mathematical and geometrical education of the blind. We are told by teachers of mathematics that in secondary schools blind pupils learn as easily as equally gifted sighted pupils. Very interesting observations have been communicated by a blind teacher of mathematics. I found it most instructive to see how he taught his pupils descriptive geometry and how he managed to rouse the interest of the blind pupils in his subject.

But the blind are not confined to the elementary and middle grades of geometrical knowledge. We know of a considerable number of educated blind—although mostly such as lost their eyesight at a later age—who decided to study philosophy and mathematics. Some of them have become quite famous by their mathematical investigations.

Cicero mentions his teacher and friend, the Stoic philosopher Diodotus, who enjoyed great fame as a teacher of mathematics and geometry. In his *Tusculan Discussions* (Liber V. cap. 39) Cicero

writes as follows: " Diodotus stoicus caecus multos annos nostrae domi vixit. Is vero, quod credibile vix esset, quum in philosophia multo etiam magis assidue, quam antea, versaretur, et quum fidibus Pythagoreorum more uteretur, quumque ei libri noctes et dies legerentur, quibus in studiis oculis non egebat: tum quod sine oculis fieri posse vix videtur, geometriae munus tuebatur, verbis praecipiens discentibus, unde, quo quamque lineam scriberent."

In modern mathematics I have become acquainted with two blind mathematicians, both topologists, who were remarkable for their excellent ability to visualise spatial relationships. I refer to the French mathematician Antoine and the famous topologist, Tontrjagin, Professor of Mathematics in Moscow. We are told that Antoine invented topographical examples which require an incredible gift for the comprehension of space-relations. It is true that both these scientists lost their eyesight at a relatively late age, but their sensory-spatial imagination did not decrease in the least after many years; on the contrary, it showed a marked increase. Among scientists born blind I have only to mention W. Steinberg, who followed with the greatest interest and understanding the epistemological problems of physics and geometry. Nobody who reads his philosophical and mathematical papers would imagine that they were written by an author who had never perceived the visual world. From that point of view his investigations on the sensory and purely intuitive data of geometrical knowledge are especially instructive.

On the basis of the preceding discussion it is clear that the sense of touch is able to provide us with the sensory experience necessary for the formation of concepts and for research work in the field of pure and applied geometry. The rest is a task of pure intuition, from which the necessity of the geometrical axioms follows, and on the basis of which a number of logically co-ordinated geometries equally valid and compatible with one another can be established. Once a person born blind has proceeded beyond the boundaries of the elementary geometrical relations and has become conversant with the sensory, perceptive contents of elementary geometrical structures—which as a rule does not take longer than would be the case with a sighted person—the road is open to him to comprehend exhaustively the facts of geometry and their logical and perceptual properties, and, according to his gifts, to enrich the mathematical sciences with original knowledge.

V

GENERAL PRINCIPLES OF THE HAPTICS OF FORM

An attempt will be made to establish those general principles and tendencies which govern haptic perception and the recognition of form. The conditions prevailing in the haptic sphere are so varied and our knowledge of the phenomena and processes so incomplete that we have to be prepared to revise sooner or later the principles we are about to establish. Nevertheless I am fairly confident that no fundamental principles have escaped our attention.

We have attributed an autonomous character to those principles because they correspond perfectly with the nature of haptic perception and are universally valid in the sphere of Haptics. On the other hand, we have drawn attention to the fact that some of them can, in certain circumstances, be demonstrated in the visual sphere as well. The difference lies chiefly in the application of the principles or tendencies. In the visual sphere the principles—so far as they apply—are related to the creation of form, in the haptic sphere to the recognition of the structure of objects.

After these general observations I should like to say that the full importance of these principles can only be grasped by realising that it is they which govern exclusively the perception of objects by the blind. This chapter represents, therefore, *a new foundation for the psychology of the blind.*

1. The Stereoplastic Principle

In every haptic process of cognition the stereoplastic principle manifests itself in the preliminary stage of recognition as the almost irresistible urge to apprehend the tactile object as far as possible in its entire corporeality. As soon as anyone gets hold of an object with his hand, vision being excluded, he will not only touch it, but will enclose it in his hand, and will want to ex-

perience its plastic three-dimensional mode of appearance. It is in the grasping and enclosing movement of the hand that this principle becomes realised.

The road along which the haptically perceiving person has to proceed usually passes through this first purely haptic stage. The subject aiming at knowledge wants to make sure of the corporeality of the object; he wishes to gain an impression of the structure and material of the object before proceeding to further activities. As a starting point he chooses the plastic impression of the object, its resistance, its volume-character, without in the first instance taking the perception of form into consideration. In this preliminary stage of cognition the object manifests itself as part of the external world. It provides a vivid example of the division between the subject and the physical world; this distinction becomes most marked in the grasping and enclosing touch; it is less marked when an object is simply touched with the hand, and still more vague when it is touched by other parts of the body. So far, clear subdivision and formal connections do not put any fresh life into that first impression. In the first instance the object has to operate by means of its plastic impression only. It cannot be denied, however, that occasionally certain elemental features of form break through that first plastic impression and that in some simple objects the homogeneous form does actually emerge.

The stereoplastic principle is of the utmost importance in the entire field of Haptics. It constitutes one of the fundamental principles of haptic perception. The stereoplastic tendency manifests itself irresistibly in every genuinely haptic process of perception and recognition. That is why we, and to a greater extent the blind, feel frustrated and disappointed whenever we are unable to touch an object from all sides. To the haptically perceiving person surfaces never appear as actual objects in their own right. There is something unnatural in not being able to become conscious of the hardness, the resilience, the tension—in short, of the object in its entire corporeality, as happens when an object can only be touched on its surface. The urge to take objects which can be grasped into one's hand and to touch them from all sides, even when the visual sense is functioning, is an expression of the stereoplastic principle.

It is only in the field of Haptics that the stereoplastic principle

is of such absolute validity. In the visual sphere this stereoplastic behaviour impresses us as something strange, because we are not accustomed to look at objects from all sides. It takes place occasionally when we look at sculptures from an æsthetic point of view, in which case we examine such objects carefully from different positions. But then we do not intend to experience the work in its whole corporeality nor to obtain a homogeneous image of what we have seen. We cannot gain a homogeneous impression because the different part-views cannot be combined into a total image. A certain degree of plasticity is of course connected with the visual object-impression, but we have to keep in mind that the stereo-optic impression is in character different from the stereo-haptic one.

2. The Principle of Successive Perception

If one wants to get an accurate, reliable picture of the form of any object by means of the haptic function, the only possible approach is the process of successive, piecemeal, tactile apprehension. Tactile apprehension of form can only be a process involving a succession of tactile acts. The statements of our observers and the photographic registration of the tactile process with respect to small two-dimensional objects have proved that simultaneous touching does not even take place when the size of the object remains within the dimensions of the palm of the hand. Even the global impression gained by the superficial, grasping touch, the schematic impression of form, comes into being almost exclusively by means of successive tactile acts.

Biological facts in themselves compel us to apprehend the form of objects by means of separate tactile acts. In the majority of cases only a small part of the hand is called on to function, and even of that limited part only a very small tactile surface—the thumb and index finger, aided by the middle finger—is concerned with the act of touch. That part of the organ of touch which has undergone special development for the perception and analysis of form glides successively over the object, as if searching for elements and connections of form. The very nature of that subtle kinematic function of the organ of touch implies that the mastering of the haptic world of forms is necessarily connected with the principle of successive progress. Without successive tactile activity neither the relatively independent parts of the

object nor the details which may be relevant to the form will emerge.

The process of successive progress manifests itself in the reproductive activity as well. When blind persons are asked what is present to their mind when they accurately picture a chair, for example, the process of successive perception seems to repeat itself. They often mention the following sequence of ideas: right arm of the chair, left arm, seat, back, legs.[1]

We have to ask whether the total form of the object can emerge out of these successive impressions. In connection with our discussion of the constructive process, we shall show that the successively apprehended elements of form cannot lead to a vivid formal picture or to a homogeneous cognition of structure without the aid of other tactile factors.

We ought, however, to mention that even in the visual sphere the apprehension of a total form may occasionally take place in a successive fashion. A cathedral which faces us at a certain distance cannot be taken in at a glance. We wander from one part to another, from a side wing to the central part, from the main mass of the building to the tower, from the portico to the roof, until we grasp the complexity of the architectural structure, its arrangement and its connections. This succession, this gradual progression to reasonable order and synthesis, is, however, fundamentally different from the development of the haptic image of an object. For the visual image (*e.g.*, the total view of a cathedral) lies immediately before us in its undivided wholeness. Even in cases when the spatial form to be apprehended can only be perceived by means of successive observation, as when we enter a closed space, the spatial body becomes apprehended immediately, for we do not build it up out of separate parts, but we become absorbed in the spatial composition. Visual object-perception would only proceed in a fashion analogous to the haptic perception, if the separate parts out of which the total form is built up *objectively*, *i.e.*, the separate components of the object, were taken in successively (at least in the first approach) without any sort of natural interrelation, as though one were to perceive first the separate walls of a room, then the ceiling, then the floor, etc. Such an approach is given in " futuristic " art, in which the formative principles of visual-spatial composition are thrown overboard.

[1] C. F. Fraser, " Psychology of the Blind," *Amer. Journ. of Psychol.*, **28**, 1917, p. 229.

Experimentally, however, it is possible to create conditions in the visual sphere, too, which are comparable with those prevailing in the field of Haptics. That can be achieved by presenting the subject successively with parts of total figures in topographically correct positions and asking the observer to reconstruct the whole figure visually out of the separate parts.

This experiment will be dealt with in full in connection with the constructive principle.

In the successivity of impressions music seems to show a special similarity to the world of touch. That impression is, however, based on a superficial analogy, for there is a marked difference in the way in which haptic and acoustic perceptions enter consciousness. While in the haptic sphere the succession takes place in a rather haphazard way and is in the first place conditioned by the magnitude, nature, and cognitive quality of the object, the succession of musically connected acoustic impressions takes place according to fixed musical and æsthetic rules. A further difference lies in the fact that with haptic impressions the time factor is only a necessary means of perception and recognition, while musical experiences represent events taking place in time and bound to rhythmical, dynamical, and numerical laws. The musical forms owe their very existence to regularities of time, tempo, rhythm, and metre. Ultimately, in the matter of the association of the impressions obtained successively, music is, in spite of its successive character, more closely related to Optics than to Haptics, although here the scope of unitarily apprehended successive structures is more narrowly limited.

As sequences of notes (time-periods) are from the very beginning closely connected to each other by musical relationships, they fuse into larger complexes than the haptically perceived parts of an object; and such complexes far surpass the scope of the immediately and vividly experienced musical units. To what extent metrically structured periods undergo fusion and association and to what extent these associations become synthesised into higher units, is a question which must be answered by the psychology of music and by musical æsthetics.

3. The Kinematic Principle

The principle of successivity is clearly connected with the kinematic principle. In spite of their intrinsic relationship the

two principles cannot be subsumed into one term, for the kinematic component is by no means unequivocally determined by the succession of impressions. One need only think of so-called passive touching, when objects are made to move along our tactile organ, and the fingers apprehend the plane of touch without movement but in succession. We have further to realise that it is the *movement*, and not the succession as such, which brings form into existence. For if, for example, we should touch an object in successive acts, while keeping our fingers motionless, we could not possibly gain an adequate idea of it if it were complicated or unknown.

Experience therefore shows us that for successively progressing impressions and their connections movement is indispensable.

The supremacy of the kinematic principle expresses itself biologically in the fact that it is impossible to suppress movement of the haptically functioning fingers even when one strictly intends to refrain from moving the fingers in the process of tactile apprehension. The enforced immobility is felt as something unnatural and very unpleasant. The tactile twitches of the blind seen in the act of static touching are suggestive of the irrepressible urge to make use of movement in the process of tactile apprehension.

The importance of the kinematic principle for the haptic apprehension of form can best be proved in cases where there are anomalies of the kinæsthetic sense. Once the motor mechanism is upset, the patient will never succeed, try as he may, in recognising the form of objects. I have found severe disturbances of the ability to recognise form in a patient suffering from tactile agnosia, a case in which the motor disturbance was the cardinal feature. The patient was unable to recognise or to describe satisfactorily the great majority of regular wooden figures and bodies with which he was presented. A cross was once drawn as a square, another time as a rhomb. Tactile distinction of the objects was impossible even when they had previously been shown visually to the patient.[1]

In the visual sphere movement does not constitute a form-creating factor, as is shown by tachistoscopic observations. It seems rather to inhibit the process of form-creation. This becomes manifest if one produces phenomena of form by motion

[1] G. Révész, *Über taktile Agnosie*, Haarlem, 1928.

under conditions similar to those prevailing in the field of Haptics. A. Michotte has devised an apparatus enabling us to follow the movement of a luminous point which describes planimetric figures. Under such artificial conditions it is possible to make observations in the visual sphere similar to those made in the field of haptic perception in respect of the external process, the direction of attention, and the whole psychological attitude. My observations proved that when the luminous point moves at a moderate speed even the simplest figures were incorrectly apprehended or estimated. All observers except one described a parallelogram as an irregular figure the form of which could not be stated accurately. Even when the experiment was repeated three or four times it did not lead to any satisfactory result. Although the process underlying this experiment does not correspond completely to the haptic process, it becomes clear that the successive-kinematic principle has just the opposite effect in the visual sphere to what it has in the haptic sphere.[1]

The kinematic principle is not only a principle of the haptic apprehension of form, but, next to the stereoplastic principle, is the most important general principle of Haptics. It is by means of movement that the blind recognise objects and perceive their form; it is by rotation of the head that they localise the source of a sound, by strides that they ascertain a distance, and by the tactile movement of the hand that they read Braille and examine the models in object-teaching.

4. The Metric Principle

The structural recognition of an object presupposes in every case an orientation in respect of the position and quantitative relations of the parts to one another and in respect of the whole. The visual function is capable of recognising these spatial relations in one immediate act of perception, while in the field of Haptics we cannot count on an immediate recognition of the quantitative proportions which are closely connected with perception of form. Only inaccurate data can be gained by haptic means. One is therefore compelled to make use of a method which is somewhat

[1] The great importance of the kinematic principle in the field of optics becomes clear from the latest investigations of Michotte, in which surprising illusions are brought about by movements (*La perception de la causalité*, Louvain, 1947.)

unusual in the visual sphere[1]; that method is *the process of comparative measuring*.

We have already mentioned the importance of the metric functions of the haptic sense. We have shown how the hand, by means of its static and dynamic functions, is a measuring instrument and how it actually represents the prototype of such instruments. We have further drawn attention to the relationship between the haptic sense and metric geometry. Even if that relationship is not close enough to justify far-reaching philosophical and psychological deductions, there can be no doubt that measuring is intimately connected with tactile activities. It is true that both our space-perceiving senses are endowed with the ability to compare and estimate spatial quantities, but only one of these senses—the haptic one—is capable of actually measuring sizes. The fundamental condition of measuring is realised in the haptic sense: it possesses in the width of the thumb, the length of the finger, and in the distance between the thumb and the small finger or the index finger more or less invariable spatial units, which can be laid on the objects to be measured just as with our conventional units of measure. The hand represents a measuring instrument of many possibilities; all the varieties of geometrical figures in one, two, and three dimensions can be measured quantitatively within the limits determined by the size and form of the tactile organ. Such a comprehensive measuring activity entitles us to speak of the haptic sense as of the geometric sense.[2]

Two different types of measuring process may be distinguished in the field of Haptics, the static and the dynamic.

Static measuring with constant spatial units—that is, with the invariable distances between the fingers or equally long strides—represents a mechanical measuring method, associated with the counting of the units superimposed on the length to be measured. It aims at determining objective quantities and at expressing them in terms of the number of units. This method of measuring is in full accordance with the measuring methods of practical geometry.

Dynamic measuring is less ambitious in its aims. It is satisfied with statements about more or less, and larger or smaller, in-

[1] Under exceptional conditions, however, something similar takes place in the visual sphere. Occasionally an attempt is made to estimate sizes by means of ocular movements (*i.e.*, kinæsthetically), analogously to the haptic approach.

[2] Buffon has already called the tactile sense the *sens géometrique*.

cluding gradations (slightly larger, much larger, approximately twice as large, etc.). As opposed to static measuring, the result of dynamic measuring is dependent on psychological factors, in the first place on training and on the accuracy of the power of discrimination for impressions of tension, velocities, and time intervals. One might conclude from this that the moving hand is only capable of estimating distances roughly, but not of really measuring them. Strictly speaking, that is actually the case, for one has to keep in mind that with this method of measuring, just as in estimating sizes by means of ocular movements, everything amounts to a statement of " equal ", " larger ", or " smaller "; on the other hand, our observations on the sighted and the blind show that the accuracy to be achieved by means of " estimate-measuring " need not be markedly inferior to the process of " measuring by counting units ".

Magnitudes and distances in the haptic sphere are mostly judged by a combination of measures of space and time, with the result that static measuring is used far less frequently than dynamic measuring.

The metric function of the tactile and kinæsthetic sense is also operative in the recognition of form, as when one has to decide whether a triangle is isosceles, equilateral, or scalene, whether one is dealing with a regular or irregular hexagon, whether a figure appearing round is a circle or an ellipse, whether the handle of a knife is larger or shorter than the blade. The measuring method is also widely made use of in ascertaining symmetry, congruence, and proportions. Lastly, the blind use the metric function of the tactile organ in their modelling activities. Whenever they want to copy or reproduce an object, they constantly use the hand as a measuring instrument. Even in creative sculptural work blind sculptors use the organ of touch, when it happens to be useful, as will be described in detail in Part II of this work.

5. The Receptive Attitude and the Purposive Attitude

The above principles—the stereoplastic principle, the principle of successive progress, and the kinematic and metric principles—are related to the external course of the haptic perceptive process. Let us now pay attention to those principles, tendencies, and attitudes which are relevant to the qualitative content of our haptic experience. In this respect we have to distinguish between

two fundamental attitudes, viz., the receptive and the purposive attitudes, which represent, both in the haptic and the visual sphere, two opposite ways of perceiving form and objects.

We speak of the *receptive attitude* whenever the perceiving subject abandons himself passively and contemplatively to the object-impression, whenever he lets the objects and their material content act on him freely, without interfering actively in the formative process of the impression. In the receptive act the only activity which emanates from the subject is that of spontaneous, immediate intuition and the tendency towards integrative synthesis: both of them fundamental prerequisites for any intelligibly structured impression of form. These activities do not contradict the general notion of receptivity, for they come into being and operate instinctively, without our active participation. They are immanent elements of sensory perception, and so become manifest in any experience of form.

We speak of the *purposive attitude* when we set ourselves the task of acquiring knowledge of the form and structure of the object as seen or touched—a knowledge transcending the immediate impression. It is obvious that by this attitude special processes are set in motion by the subject whereby the intellect and will become activated.

In a previous publication I maintained that in the visual sphere the receptive, passive attitude was prevalent, while in the haptic sphere the purposive attitude played the leading part.[1] Although I still adhere to that statement, I must define it more accurately in order to avoid giving the impression of looking upon the two attitudes as providing some differentiating criterion between the visual and the haptic perception of form.

The actual state of affairs is as follows:

In the visual sphere there is no relevant difference between results obtained by the receptive and by the purposive attitudes: fundamentally both attitudes lead to the same kind of form-content. The impression of the form of a façade remains intrinsically the same whether we apprehend it receptively or purposively. It is true that when we adopt the purposive attitude we shall perceive a greater variety, a greater differentiation than when we are purely receptive, the object will have sharper con-

[1] G. Révész, "Über die Natur der optischen und haptischen Formwahrnehmung," *Koninkl. Akademie v. Wetensch.*, Amsterdam. *Proceedings*, Vol. XXXIV, No. 5, 1931.

tours, it will stand out more clearly against the background, it will even occasionally take on another emotional value; but in respect of its phenomenal nature, and therefore of its total form, no important change will occur. Similarly there is a difference according to whether an object is looked at from near or from far. The clearness of the lines and planes diminishes with the distance, the contours become more vague, the object fuses into the background, but within a certain range of distance there is no sudden qualitative change, no change in the total character.

In the haptic sphere we meet with quite different conditions. It is just the receptive attitude which conveys to us the unique haptic impressions of form, such as cannot be obtained by means of a purposive attitude. The strictly receptive attitude makes it possible for truly haptic impressions of form to come into being free from any admixture of alien elements from other than haptic sources.

At first sight it may appear strange that just that attitude which is not primarily directed towards form should be relevant and essential for the development of pure haptic form. Nevertheless that is the case. For, on the one hand, the passive attitude allows the haptic process of perception to run its course unimpeded, and, on the other hand, it inhibits and prevents the appearance of such ideas and such mechanisms as become operative through a conscious purposeful activity in perception and enhance the structural analysis instead of the perception of form. Thus in haptically perceiving sighted subjects, and particularly in blind people who have lost their sight at a later age, the emergence of visual images becomes markedly inhibited, whilst in subjects born blind or those who lost their sight early in life, cognitive elements and interpretative elements are ruled out.

Such impressions of form as originate from the haptic sphere and come into being through a receptive attitude will be termed *haptomorphic*. They are figures or forms which are exclusively or to a large extent determined by the nature of the haptic sensory world and manifest the tactile-kinæsthetic form of an object—that is, an impression of form free from details and from prominent particular features, similar to a sketch that represents the object in its fundamental outline only. In the field of Haptics we speak of a global impression of form, when the object is but lightly touched with the aim of obtaining a provisional notion of it. To

identify that global impression of form with the haptic impressions gained in the receptive act is a mistake which has led to many misconceptions.

The tactile approach to the object by means of the receptive act may lead to a " global " impression of form, but it by no means necessarily does so. On the contrary, that attitude leads rather to pure haptic forms, which from a haptic point of view are by no means to be looked upon as schematic. These autonomous forms can only be called global, sketchy, unstructured when compared with visual perceptions—an unjustified comparison, for from the point of view of the haptic formative function they are formal impressions of high quality and fully characteristic of the haptic world of perception.

The purposive attitude leads to a completely different situation in the haptic sphere. For it presupposes a process which aims at gaining an accurate image of the tactually examined object by means of *activity*. To that end it is necessary to acquire by means of fractioned tactile processes (partial touching) an accurate idea of the separate parts, and it is further necessary to connect the loose and separate tactile acts by a synthetic process. We know from the preceding discussion that the latter is possible only to a very limited extent. Without a connecting activity, however, the form would not come into being; neither would the successively perceived parts and fragments of form fuse into a homogeneous impression; nor would the abstract elements which necessarily manifest themselves in the case of any rather more complicated structure contribute to such a fusion. However, it must also be asked whether in the active process of the creation of form some kind of total form (or whatever other term one wishes to apply to the phenomenal synthesis of a primarily existing diversity) is achieved. In one respect that question must be answered in the positive, in another in the negative. If in the purposive attitude visual notions and memory images make their appearance apart from the purely haptic impressions, the coming into being of a total form is warranted: the haptic impressions become fused with visual notions into a homogeneous entity. As opposed to the purely *haptomorphic* forms, we shall have to call these visualised haptic impressions *optomorphic forms*. The association of visual and haptic contents which takes place in this case must, however, not be looked upon as a fusion, for the haptically

apprehended structural elements become visualised whenever possible, and it is only in this indirect way that they become fitted into the image.

Whenever the observer intends to unite both the perceptive *and* the cognitive elements related to the tactile object into one homogeneous whole, the purposive attitude leads to entirely different forms which cannot be exhaustively described. In view of the fact that a homogeneous picture cannot emerge from those heterogeneous components, the observer will try to create by constructive means an object including the essential formal and structural features of the haptically apprehended object. The form is mostly represented by the schematic image, whilst the abstract elements that are labile and fluctuating in character are, so to speak, assembled round the idea of the object. We want to call those strange forms, which are never met in the visual sphere, integration-forms or *constructive forms*, to distinguish them from the above-mentioned forms.

The character of these 'optomorphic' and constructive forms, the way in which they become differentiated, the question to what extent they are embedded in a certain homogeneous sphere—these are all problems which have to be discussed later.

Summing up, we may say that in the haptic sphere the receptive attitude leads to the purely haptic, the so-called haptomorphic forms, whilst the purposive attitude leads either to optomorphic forms, owing their existence merely to visual ideas and to the visualisation of haptic impressions, or to constructed forms which come into being out of heterogeneous impressions and cognitive elements. The receptive attitude only leads to hapto-morphic forms, and it is on the whole the purposive attitude which is looked upon as the basic attitude for the haptic perception of form; for one starts from the assumption that the purposive attitude produces an impression of form similar to the immediate visual mode of perception, an impression just as exhaustive and individualised. We shall soon realise that such an idea is unjustified and that it owes its existence to the fact that we are not fully aware of the specific function of the haptic sense.

6. The Tendency to Establish Types and Schemata

Every visual object, provided it is fairly well isolated and within a range of distance corresponding to normal vision, is

apprehended as a formal entity. If we see on a table five forks differing from one another, they will all be apprehended as forks of different sizes and proportions, although they all represent fundamentally the same formal type.

This principle of the *individualising* nature of the perception of form in the visual sphere can be contrasted with the principle of the *typifying* nature of the apprehension of form in Haptics. In the sphere of Haptics the individual differences of size and proportion become relegated to the background, with the result that different forks presented to the observer under the same conditions and from the same angle become apprehended simply as " fork ".

When a figure enclosed by our hand appears square or circular, we usually refrain from further analysis. We have reached our aim as soon as, on the basis of the haptic group-character " square " or " circle ", we have classified the touched objects as belonging to the pattern of a square or of a circle. It may well be that we have actually been dealing with a rectangle or with an oval figure.

This typifying tendency, the importance of which has been especially stressed by the adherents of Gestalt theory, plays a most important part in Haptics. The very fact that in haptic apprehension the attention is directed to general criteria substitutes for a form which corresponds to the objective structure a shape which, although less accurate, is simpler and more akin to the schematic form. The first and only aim is to find the representative criteria of the objects and to fit them in one of the known typical groups of forms.

The tendency towards typification and schematisation does not rule out the schematic figure being occasionally supplemented with details, in order to enable us to recognise it. These details, however, need not modify the schematic image; they may remain isolated and apart from the haptic formal image. Thus, in the process of haptic apprehension an irrelevant hair-style which does not in the least influence the total impression may operate as a cognitive criterion for a certain statue. That detail distinguishes the tactile object from any other object, without thereby interfering with its typical and schematic form.

We may anticipate that in cases in which recognition demands an apprehension of individual form, the schematising attitude may prove to be an obstacle.

I have often found with blind pupils that they were unable to recognise as their own work the plastic figures which they had themselves modelled a few days before. Similar findings have been reported by other authors. Thus an eighteen-year-old blind pupil did not recognise his own works after a few months, and so far as we were able to identify some of them, he could not recognise the expression represented (*i.e.*, the inner content). It was only through certain details, which had attracted his attention whilst at work, that the blind modeller could be put on the right track.[1]

The typifying tendency is deliberately encouraged in the teaching of the blind. As the teachers of the blind start from the assumption that their pupils are on the whole unable to gain a total image of objects, they try in the object-lessons to give them an approach to the objects by starting from their structure and from the tectonic pattern. In that endeavour they start by splitting up the object into simple geometric forms. This didactic method explains why, in the process of perceiving objects, the blind are always on the look-out for elemental forms, of which they can establish abstract ideas and why in copying models they sometimes make exclusive use of elemental forms. Thus three young pupils, born blind, built the following churches (see Fig. 5) out of two or three cubes and one pyramid.

It is thus clear that tactile examination of objects (unless one aims at an exhaustive knowledge of the form of the objects) normally leads to a merely schematic form free from structural details. We have further learnt that the typifying and schematising tendency is just as well based on the intrinsic nature of haptic perception as the individualising tendency is based on the nature of visual perception. Haptic perception is from the very start focused on typification, on the aim of apprehending the general features of objects, and on classifying them according to well-known types and groups. Such a schematisation leads to a modification of the perceived image, in so far as it adapts itself to

[1] Statements to the effect that blind persons rely mainly on the impression of the hand which they grasp, when trying to identify a human being, are based on inadequate observation. My own observations have not confirmed that view, which is held by blind persons as well. Experiments on seven blind pupils at a boarding school, who in the course of different activities (work, games, walking arm in arm—which is so frequently practised among the blind) had innumerable opportunities of touching one another's hand, led to negative results. There could be no question of an accurate identification; even mistakes over sex were made. In older blind persons I had better results, because they paid more attention to the characterological element involved in the handshake.

the type-image. In this way the haptic type-images become the basis of the concrete formal figures. We shall shortly see how occasionally, in spite of the schematising tendency of the haptic sense and its limited faculty for the apprehension of form, there emerges the possibility of advancing in the direction of an individually characterised formal image.

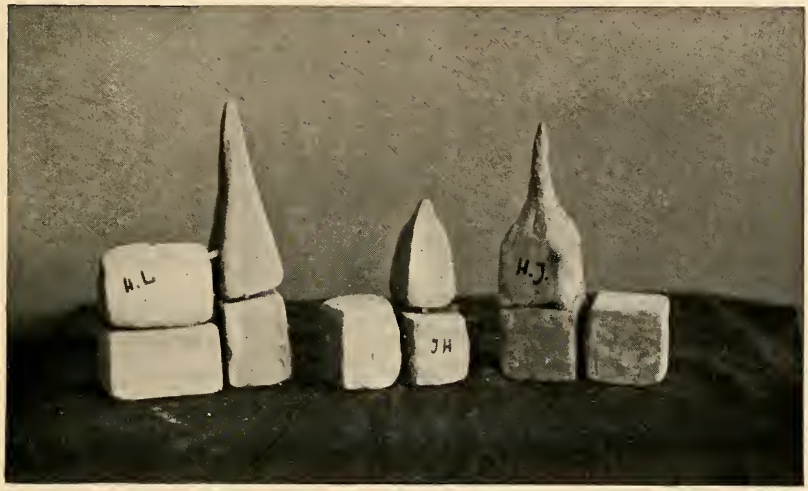


Fig. 5.—Churches Built by Pupils Born Blind.

7. The Tendency to Transpose

The sighted and the blind who have lost their sight at a later period of life remain unsatisfied with the vague and rather undifferentiated haptic impressions of form. We, who are accustomed to the richly differentiated and individualised visual forms, cannot derive any real satisfaction from unstable contents of perception which lack sharp form and can often only be apprehended through their succession in time. From the feeling of the inadequacy of that type of form-perception there emerges in us the irresistible urge to give our haptic forms such a content as we usually experience in the visual observation of objects. The desire to obtain an accurate idea of the form of a haptically apprehended object awakes in us a stimulus to approximate the haptic image to the visual picture. That tendency towards perfecting

and supplementing the haptic impression of form is achieved by a *transposition* of the contents of our haptic perceptions into visual images.

The process of transposition may take place in either of two ways: in the majority of cases, no immediate transposition in the strict sense of the word is performed with objects known individually or generically, but the tactile process evokes by means of association a more or less adequate and comprehensive visual object-image. Whenever we touch, say, a pipe with a long stem, the visual image of a known pipe or a visual pattern may emerge into our consciousness by way of association and may represent the tactile object.

It need hardly be said that in such cases we are not dealing with a transposition of haptic contents, but with the *reproduction* of visual images of objects or forms.

The term transposition, taken strictly (*i.e.*, the "optification" of haptic data), only applies, if one purposely tries to visualise a tactile object, that is, transpose it into the visual sphere. It is possible to ascertain experimentally to what extent an approximation of tactile to visual impressions of form can be achieved. If one unexpectedly asks the subjects of the experiment to draw on paper the tactually apprehended figure, a certain confusion usually arises as soon as the first lines have been drawn. They feel somewhat hesitant as soon as they see the well-known haptic image translated into the visual sphere: there emerges a picture which seems to have little relation to the original haptic one. The movement of drawing comes to a halt, the drawing remains unfinished. But when the instructions do not come unexpectedly, the observer does not rely on the motor pattern for the reproduction of the movements performed; he tries to fix the idea abstractly, and thereby to transpose the haptically apprehended figure into the visual sphere. We are therefore no longer dealing with optification, with the transposition of haptic impressions, but with a fixation by means of words and abstract ideas of tactile and kinetic contents, a fixation which tries, by means of its abstract character, to bridge the gap between the two sensory spheres. *The concept is the link by means of which the haptic form is brought into relation with the visual figure.*

This, too, is a kind of transposition, and a very important one, though not genuine. There are therefore two types of visual

transposition; one of them is the genuine one—namely, when kinetic and tactile impressions are directly translated into visual ones—the other is met when haptic impressions arouse in a productive way, by means of the abstract fixation of the formal data, the corresponding ideas of form.

The tendency to transpose may best be observed in those who have become blind at a late period of life, especially when the loss of eyesight has occurred recently. I have known a boy who, after he lost the sight of both eyes through an accident, visualised with untiring energy during the first months following the injury any object he got hold of. His visual notions were still so vivid that he lived in the illusion of actually seeing everything he touched. This urge towards exhaustive visualisation handicapped him in the lessons for the blind, especially when he had to learn reading and writing—subjects which are entirely based on Haptics. Gradually he desisted from visualising and was able to adapt himself to the spirit and the aims of the Institute.

We shall discuss in connection with the whole problem of blind sculptors the effect of transposition and the part played by the visual sphere in the modelling of the blind who lost their sight at a late stage in life. At present we only want to mention that the tendency to transpose is not always operative in connection with sculptural work. It can quite frequently be observed that those who were born blind are able to model quite well without the aid of original and transposed visual notions, and merely on the basis of primary haptic forms.

8. The Principle of Structural Analysis

The urge to represent the form of the haptically apprehended object pictorially makes the haptically perceiving normal person as well as the blind person examine the object for its *tectonic structure*. That examination is directed towards the structure of the objects, their geometrical-spatial qualities, and the relationship of the relatively independent parts to the whole. Although the principle of structural analysis also plays a fundamental part in the recognition of objects, because that alone makes possible the identification of unknown or complicated objects, I shall, in view of its special importance for the haptic perception of form, deal with it in connection with the Haptics of form.

By means of structural analysis entire parts or fragments are

isolated and examined separately. One proceeds in this way from one component part to another, one examines them separately and brings them into relation with one another, until the object or one of its parts becomes distinct in its structural arrangement.

In the majority of cases the haptic apprehension of structure is preceded by a global tactile examination of the object, with the aim of identifying the haptic object and then ascertaining its basic pattern. That preliminary tactile activity must not be interpreted as a synthetic activity. The global and orientating tactile activity initiates the subsequent splitting-up of the whole. It therefore enhances the basic tendency towards organising the tactile object according to the structural pattern. On the basis of the general pattern and the tectonic arrangement, the process of structural comprehension becomes organised. One usually follows the sequence of the structural pattern by examining in detail prominent parts or such as are striking in themselves.

Structural analysis is, as the term implies, not originally directed towards perception of form or creation of form, but towards *recognition of structure*. In the haptic structural analysis the cognitive character of the haptic function becomes especially manifest. We do not touch for the sake of touching. Even the form that we perceive by our haptic sense is in the last instance only a means towards the recognition of objects. In observing visually a meadow or a range of mountains we usually do not adhere to any cognitive purpose. Even in this case it is possible for us to adopt a purposive attitude by setting ourselves the task of recognising the structural character and the spatial relationship of the separate mountains to one another. But what happens only exceptionally in the visual field is the rule in the field of Haptics.

In examining the process of structural analysis we realise that the structural elements are not merely grasped as perceptions, but that they become at the same time fixed in verbal terms. Thus the subject of an experiment when shown an unusual object characterised the structure as follows: On top there is a globe; from it emerges a tapering round bar; then there follows a part shaped like a ring, ending in a point; the whole thing is symmetrical and has the length of a long pencil.

The abstract fixation of the structurally relevant parts of an

object strikes us at first as strange. Closer examination of that process, however, makes us realise immediately that the verbal fixation of what has been perceived is only the natural result of the purposive perceptual process. For the cognitive purpose, as related to structure, presupposes verbal fixation.

This implies automatically that the verbal fixation of successively obtained partial forms cannot be limited to Haptics, but represents a general characteristic feature of *any structural analysis*. Whenever I want to recognise visually the structural arrangement of a complicated object, I have to proceed analytically, just as in Haptics, and I have to achieve a verbal fixation of the separately observed parts. Here, too, I shall have to say: "The plane figure I am shown has a central square part, which on one side passes over into an S-shaped, on the other into a parabolic curve, etc." We also employ the abstract fixation of structural and formal peculiarities in the field of Optics, whenever we have to represent a visual image in drawing from memory.

It is noteworthy that in the sphere of Optics there is never as strong an urge towards structural analysis as in Haptics. That is probably due to the fact that in the visual sphere the perception of form does not demand a structural analysis; whereas in the haptic sphere we often aim at comprehending the total form through the recognition of structure. In the visual act of perception the verbal fixation of details follows upon the clear recognition of the total image, the analytical process presupposes the total image and is based on it; but in Haptics that same process starts before the intended synthesis and operates in a constructive way. In Optics the analysis and the abstract fixation play only a small part in the creation of form; in the field of Haptics we have to attribute to it, apart from the cognitive function, a certain formative importance also.

In order to give a correct idea of the process of structural analysis, we will describe some characteristic results of a few out of many experiments.

In order to follow up the process of the haptic apprehension of form better we asked the subjects of the experiments to interrupt the tactile process from time to time and to illustrate each stage of the process by means of drawings, that is, visually.

From the drawings of Fig. 6 it may be seen how the subject of the experiment proceeded. After about one minute he had success-

fully built up the touched figure out of structural elements obtained analytically. The drawing, however, did not satisfy him at all. He therefore carried on the haptic examination until after a further one and a half minutes he was able to draw the figure correctly on the basis of the structural analysis.

The process of structural analysis becomes still more manifest with the following more complicated figure (Fig. 7).

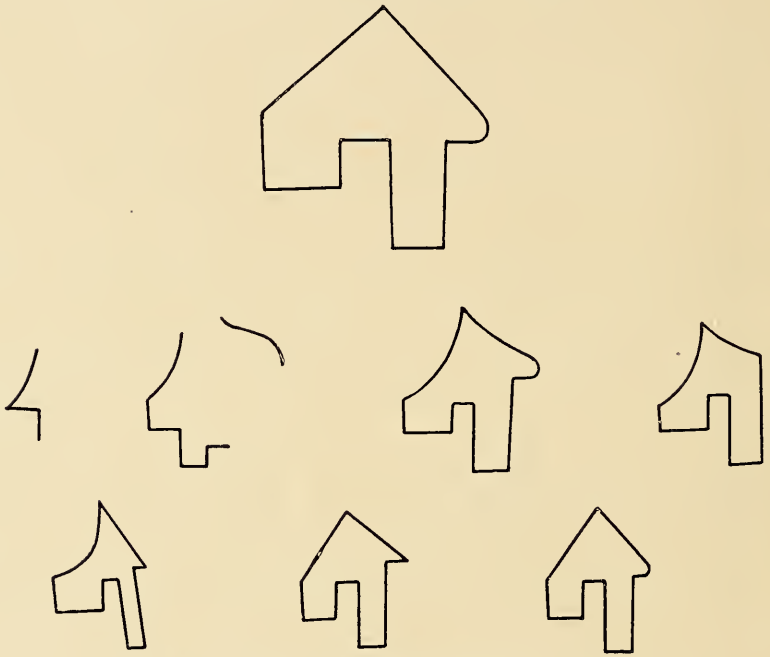


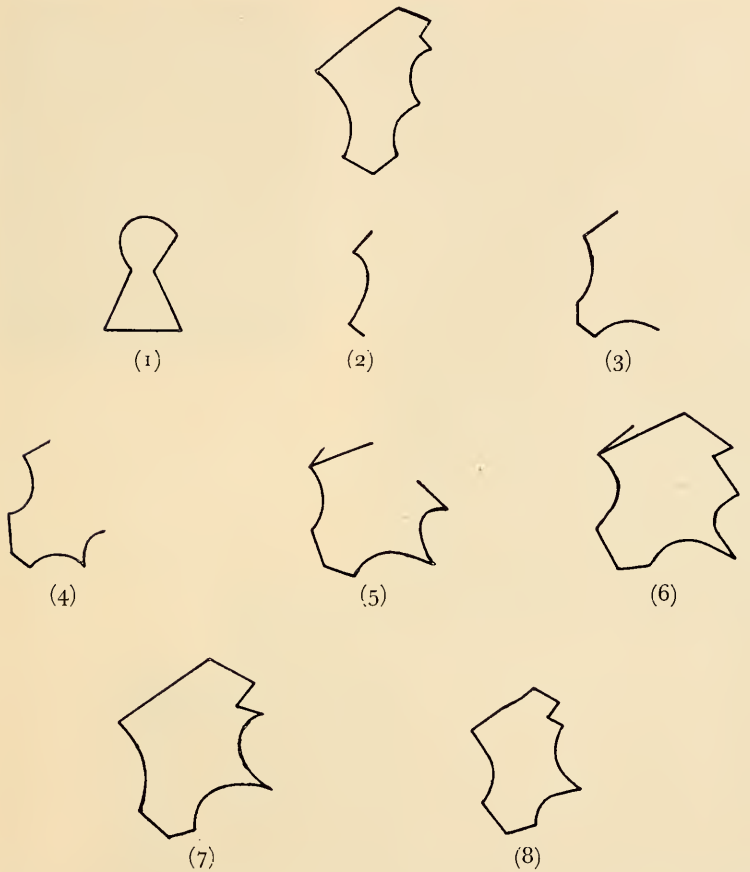
Fig. 6.—The Course of the Haptic Recognition of Form.

In this case the subject of the experiment first subjected the figure to global touch, in order to get some idea of the structure and form of the haptic object. Drawing 1 represents the image obtained by global touch; it does not even reproduce the pattern correctly. It is only after that stage that the structural analysis starts: the successive stages of it become clear in Drawings 2–8.

A very instructive picture of the process of structural analysis is given by experiments in which we have fixed on one photographic plate the successive stages of the haptic movements (Figs. 8–12).

The lines of light seen on the photographs represent the move-

ments made, during haptic examination, by a hand to which is attached an electric bulb. The bulb was attached to the middle finger. Fig. 8 shows the hand with the bulb in the act of touching.



Tactile Object: (1) after 10 sec. (2) after 20 sec. (3) after 40 sec. (4) after 1 min. 10 sec. (5) after 1 min. 20 sec. (6) after 1 min. 50 sec. (7) after 2 min. 15 sec. (8) after 2 min. 30 sec.

FIG. 7.—Process of Structural Analysis of a More Complicated Figure.

In order to gain a picture of the movements of the examining hand with more depth, the haptic process may be recorded stereoscopically. The stereoscopic photographs give a surprisingly plastic image of the process and of the movements in space.

If one wishes to study not only the path covered by the hand

or the fingers, but also the time required for the individual movements, the light can be interrupted twenty-five times per second, say, by means of an electrical interrupter. With a magnifying

Fig. 9.—Analysis of Movements (each point corresponds to $\frac{1}{25}$ second).

Fig. 8.—Arrangement of the Experiment for Tactile Examining Movements.

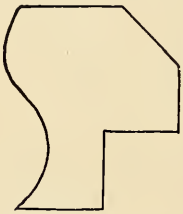
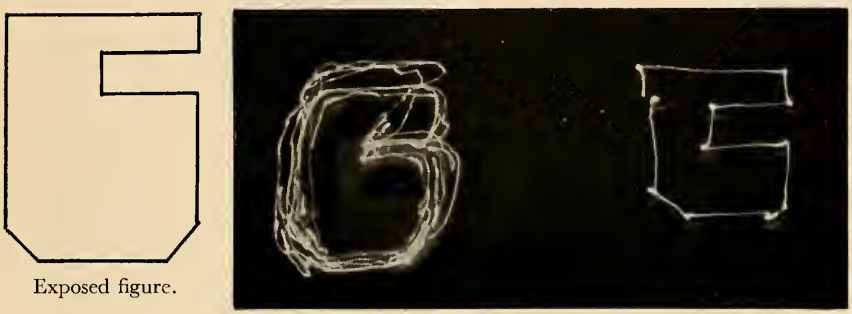


Fig. 10.—Left, the exposed figure. Right, the haptic process.

glass it is quite easy to ascertain down to fractions of a second the exact time required for every movement. A picture obtained by this method is given in Fig. 9.

The photographic records in Figs. 10 to 12 show that the parts of

the figures which were the most difficult to interpret were touched most frequently and intensely. As may be seen from the great number of small luminous points separated by two longer strokes



Exposed figure.

FIG. 11.—Left, the haptic process. Right, the copy made with eyes closed.

the greatest attention is paid to the transition points. The accurate tactile examination of the transitions is very important, as it is only through knowledge of them that the direction of the contours or the size of the angles can be ascertained. This is shown in the

Exposed figure.

FIG. 12.—Left, the haptic process. Right, the copy made with eyes closed.

simple model in Fig. 12, in which the sharp bend on each side and the semicircular end-piece necessitated a detailed analysis.

The photographic copy on the right side shows how, in spite of long and exhaustive tactile examination, the subject of the experiment was still far from a correct appreciation of the form.

Nothing can illustrate better the intricacy and difficulty of haptic as compared with visual apprehension of form than the density of the luminous lines visible on the photograms. It seems quite incredible that so many separate acts of touch should be needed for the apprehension of such simple figures.

I also want to describe the way in which the structural analysis of a small bronze statue representing a boy sitting with his legs crossed took place.

In the course of the first orientating tactile acts the bronze figure was recognised as such. The initial impression of form created a general pattern of directions, of a horizontal and of a vertical direction. That pattern corresponds to the kinetic shape of the statue: a trend of movement from above to below (from the head to the rump) and another trend of movement from left to right (from the rump to the extended legs). A repeated " global " tactile act did not lead to any more distinct apprehensions of form. The subject of the experiment got stuck in the general scheme " vertical–horizontal ". The structure analysis started with the tactile examination of the head. It was investigated in all its details: on the whole the interpretation was correct, but some of the details were misinterpreted. Then the two arms and legs were examined, and it was found that the latter were crossed. As the subject had no clear notion of the headgear and of the hand, these were subjected to renewed examination. According to his own statement, the subject had by means of these tactile acts recognised many details which had remained unnoticed in the schematic impression, but " the impression of the form of the whole did not become clear ". The pattern, the scaffold which had already become apparent prior to the structural analysis, emerged again without, however, absorbing the partial forms obtained analytically.

The photographic records of the tactile movements and the representation of the external course of the haptic process of perception make us realise the difference between visual and haptic recognition of form. We become aware of the immediacy, simultaneity, homogeneity, accuracy, and speed of visual perception as opposed to the indirectness, the successive and partial character, the inaccuracy and slowness of the haptic perception of form. We see how circumstantially and with what detours form is recognised haptically, and yet it still remains doubtful whether

the observer actually gets an idea of the total form of the haptic object, or whether he only fits together the fragmentarily apprehended parts of the total form, in a way similar to what happens when in playing the piano one links together the successive movements of the fingers, without having a unified idea of the total kinematic image.

Under special conditions a similar state of affairs to that prevailing in the haptic sphere may be observed in the visual sphere. Let us present the observer with a common figure and ask him, after the exposure, to find the exposed figure out of a collection containing, apart from the first figure (which has been rotated through 90° or 180°), four further similar figures: he will be compelled to apprehend the figure structurally, as in the haptic sphere, and to make notes of the parts, thereby proceeding—as in the haptic process—to the perception of form via the structure. Two sets of figures may serve as examples.

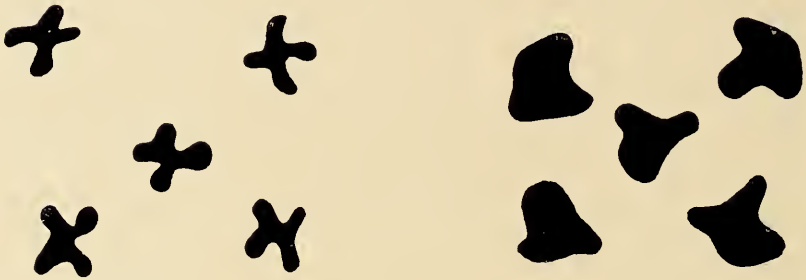
The main figures of these two series were shown to the subjects for as long as they wished. Immediately after exposure both group A and group B were presented to the observer, who was asked to recognise the main figure. Even the first pilot experiments showed that with short exposure, which allowed only a global apprehension, recognition became very difficult: failures or mistakes occurred very frequently. Some of the observers tried to overcome the difficulties by attempting to apprehend the figure presented as an object with some meaning. Thus it happened that one thought he recognised the shape of Africa in one of the figures of the group B.

The recognition-time was very short; but even under these conditions there seemed to be a tendency to go beyond the immediate apprehension of form and to proceed to an active shaping and to an abstract fixation, instead of letting the total form be apprehended passively.

But when the figures to be recognised were exposed long enough, that tendency became completely dominant and governed the process of perception and recognition. Nearly all the observers working under these conditions proceeded to a structural apprehension. As in the field of Haptics, the figure became split up into characteristic parts, which were then subjected to analysis and were occasionally even memorised. Even in the process of objective apprehension the attention was directed to

certain striking parts which appeared favourable for the purpose of recognition, such parts becoming fixed in verbal terms.

Exposed figures.



Group A. Group B.

FIG. 13.—Structural Analysis in the Visual Sphere.

9. The Principle of Constructive Synthesis

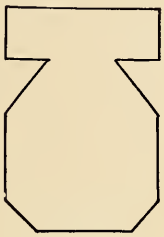
It must be admitted that it is not easy to discuss the principle of constructive synthesis as separate from that of structural analysis, in view of the fact that analysis actually merges into synthesis. That, however, does not make it at all difficult to differentiate the two processes from one another in the act of perception (and not only in the abstract, but also empirically).

The constructive formative process begins when the unitary form of an object cannot be perceived or realised on purely haptic lines, without the aid of data belonging to another sensory sphere or of abstractions. The constructive principle comes into operation especially when in the field of Haptics one starts with the intention of bringing the shape of a complicated or unknown object to consciousness with the same clarity and in such detail as the object exhibits in the visual sphere.

The structural process governed by the constructive principle is preceded, determined, and accompanied by various perceptive acts. In most cases the constructive process starts with a structural analysis, which leads, apart from the haptic content, to visual, visualised-haptic, or abstract elements, in addition. It is only

after such preliminary activity that the constructive process begins, its aim being to unite the part-sensory, part-cognitive components of form into a cogent whole.

We have already seen that such a process, governed by a synthetic tendency, does not usually attain its intended end. The result is in the first place *an abstract, verbalised linking of the partial structures within the framework of the schematised formal image.* Exceptions to that rule are well-known objects of a simple structure, such as regular geometrical figures, familiar ornaments, the most common kinds of objects of everyday use and shapes of a specifically haptic character. But whether even in those cases the



Exposed figure.

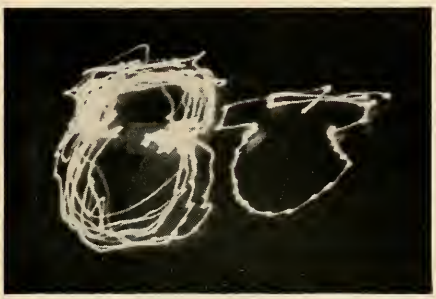


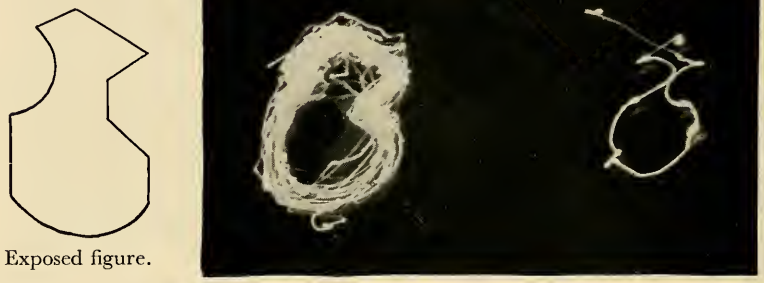
FIG. 14.—Course of the Process of Structure Analysis.

comparatively independent partial structures become really and fully absorbed into the unitary tactile image remains an open question, which I am more inclined to answer in the negative than otherwise. In regard to structures of a higher order one hardly ever attains a unified image comparable to visual unity of form—that is, an image which integrates the partial shapes and their reciprocal relationships into a unified total form. This is not to be expected if one realises out of what various impressions, ideas, cognitions, and relations the so-called total haptic form has to be built up.

Before we discuss in detail the peculiarities of the constructive process, especially the difficulties that are encountered over the active creation of form, let us illustrate the process by a few examples.

One of the subjects of such an experiment made the following statements while haptically examining the model shown in Fig. 14.

" I find the figure very complicated. It is impossible for me to get a correct idea of the form on global-synthetic lines. I now want to observe the details accurately. First I examine the upper part of the figure: I do not understand what it is really meant to be. I am trying to find the parallel lines, in order to orientate myself, but I cannot find them." (Notice the many movements in the right and left upper part.) " Gradually I realise that I am after all dealing with a fairly symmetrical figure. So then I suddenly grasp the structure of the figure. I know now what I have to examine carefully and what I may neglect. By means of that knowledge I get a steady orientation." (Never-



Exposed figure.

Fig. 15.—Course of the Process of Structure Analysis.

theless it takes a long time for the spatial relationship of the upper contour to the two smaller lateral lines to become clear.) " I decided to look upon the two upper horizontal lines as parallels, whereby the upper part of the figure took the form of a parallelogram." " The lower part of the figure first appeared to be round, similar to a circle. This impression soon changed into that of a polygon with about twelve angles. I was never able to understand clearly the proportions between the separate parts and the whole of the figure." The handling time amounted to two minutes fifty seconds; the visual time to eight seconds.

Another subject found Fig. 15 very complicated.

In spite of all his endeavours he could not find a starting point. An attempt to think of the figure as being symmetrically arranged and thereby to get a unified grasp of the form was unsuccessful. After prolonged searching a kind of symmetry or relation between

the two halves of the figure was eventually ascertained. " I come to the conclusion that the left upper half of the figure is co-ordinated with the right upper one, although the left one is more extended, larger than the right one. The lower part of the figure appears to be more regular; I am, however, annoyed that I cannot find out whether the lower line, the base, is a straight or a curved one." In memorising the figure in order to make a drawing of it the subject spoke aloud to himself: " There is first a small sharp line towards the left, then a small curve, then a fairly straight line with a corner point. Here the direction changes and takes the form of a curve, then the curve bends upwards. Now a new curve starts, corresponding to the left one, but larger than that one. Then follows a longer oblique line, directed upwards and closing up the whole figure."

Such a verbal fixation of the structure of the figure, which took place on purely analytical lines without taking into consideration the overall form of the model, was repeated three or four times and checked on the figure. The figure was visualised; the visually represented image, however, completely lacked individual character and correct proportions. The haptic time of recognition amounted to three minutes and twenty-four seconds, the visual time to ten seconds.

It is self-evident that concrete and abstract, sensory and cognitive elements of an object cannot be fused into one homogeneous entity. Even if one attempted to associate these elements with one another (completely eliminating any abstract element), it would remain very doubtful whether a real fusion would be possible. One always has to remember that constructive integration does not mean creation of form. The mere fact that all the elements which are perceived as isolated parts are derived from one and the same sensory sphere does not imply that they can be fused by means of spontaneous activity into a morphological entity; not even when one is dealing with fairly simple objects. If such obstacles are encountered even in the case of simple structures, it is easy to realise what a difficult task will have to be performed in the case of objects with a complicated structure, and even more so in the case of unknown objects. With three-dimensional figures these formative difficulties become more marked and more or less insuperable.

This state of affairs can be clearly observed when parts or frag-

ments of an object are presented. Many instances will be found in the second part of this work, where I shall discuss the tactile recognition of works of art by blind persons. Visually such fragments are quickly recognised by means of the immediate image and by the supplementary function of the sense of vision. Haptically, however, one feels completely lost in such a situation. Structural analysis does not help here, because the relatively independent separate parts do not stand out owing to the lack of structure, and because fantasy is inhibited by the fact that recognition does not take place.

The complete failure of the creation of form becomes most marked when those born blind are shown forms which can only be recognised or understood on the basis of the total form, *e.g.*, the schematic two-dimensional figure of a bear.

Fig. 16.

In such a case the blind lose their total basis for the comprehension of form and for object-recognition. They cannot comprehend the formal entity on the basis of the total form, which they perceive only in a piecemeal fashion, nor can they achieve any constructive form-creation because of the lack of intelligible separate parts. An identification of the haptically examined object is therefore nearly impossible. A subject, born blind, exclaimed on handling a sculpture of an animal, which was most impressive from a visual point of view: " I cannot understand how the parts are connected to each other, everything runs apart." He was unable to visualise how the simple contours ran and how they formed one whole. Whenever anyone born blind is asked to reproduce an object in clay, he has to construct the whole object from the separate parts, and so the contour of the object as a whole becomes lost. The copy reflects the development of haptic object-perception and form-perception, but not the appearance of the object. (This point will be discussed in detail in Part II.)

A further difficulty is connected with the successive character of the haptic process. The succession in time would not in itself necessarily have an inhibiting effect. In the musical sphere notes perceived in succession unite into a melody. But there is a great difference between the sequence in time in the acoustic and in the haptic sphere. Every musical sequence of

tones is bound to a definite order in time, which accounts for its musical and æsthetic impression. No single note can be omitted without endangering the character of the melody. In contrast to this the synthesising process in the sphere of Haptics begins only after the structural analysis has made available certain part-structures endowed with a definite contour and specific content. The total impression is not bound to the order in time of the successive haptic acts, and omissions or repressions of separate parts do not play any part in the haptic sphere so long as they do not belong to the essential elements of the type-image. On the contrary: the taking in of all the relatively independent separate parts is quite compatible with the nature of the haptic formative function. The exaggerated diligence which wants to include every single separate tactile act in the total image has a very disturbing effect on formal integration, because it aims at something which cannot be achieved by haptic means.

The discrepancy between tactile examination from all sides and unified comprehension becomes especially well marked in the form impression of three-dimensional figures.

It is well known that in the field of Optics the impression of shape is always got from a certain position. When the position of the observer changes the impression of form changes too. This accounts for the fact that in the visual sphere we are unable to co-ordinate the impressions gained from different observing points into one total image. Were we able to achieve this, there would be no impediment to our merging the south, west, east, and north views of a building into one vivid and unified image. But we are not even able to visualise simultaneously the profile and the front view of a face.

In the field of Haptics we are able in principle to comprehend far more details in one unified form. The stereoplastic principle compels us to touch and to cognise the object from all sides. It is therefore inconsistent to aim, on the one hand, at a universal total impression and, on the other, to expect the total impression of the "one-view" visual form as obtained from one position. The most incorrect, most inadequate way towards haptic creation of form would therefore be to attempt to overcome the difficulties by visualising the haptic impressions. Such an attempt can very rarely be successful, because the eyes cannot achieve stereoplastic apprehension of objects, and it is therefore hardly possible to

transpose an object originally apprehended as a cube into the sphere of visual form. The futuristic and cubist painters (Picasso, Marinetti, Braque) have tried to solve that conflict and to project the stereoplastic or cubical figures on to a plane. But they have not succeeded in doing so; they have simply juxtaposed or fused the different visual aspects. The aim to transpose the multi-aspect haptic image into a one-aspect, visual-perspective one is frustrated by the fundamental difference between haptic and visual perception of form.

When the sighted are engaged in haptic perception, the almost irresistible tendency to translate the haptic-*kinematic* shapes into haptic-*static* ones exerts an inhibiting effect on the creation of form. Usually that transfer takes place through transposition into the visual sphere. The static transposition may perhaps be achieved with small objects; as soon, however, as the tactile observation is carried out by means of the moving hand, there is no other way but that of visual transposition. But by this the haptic form loses its dynamic, its essentially haptic character.

The problem of constructive synthesis has special importance in the *blind.* The fact that with them the visual component is not in existence makes itself strongly felt in the emergence of the total impression. It is true that one might expect that the coming into existence of form would be facilitated by the fact that in this case the total form of the object has to be built up out of purely tactile and kinematic impressions.

Here again we are faced with the question whether tactile-kinæsthetic impressions free from any visual formative elements are at all adequate to create a formal structure that is to any degree as good as the visual one.

We do not doubt that the blind are able to get haptically clear impressions of the form of objects when these are of a simple structure. Nor do we wish to deny the blind the ability to unite simple forms or elements of form into higher entities by active synthesis. What we do deny is the assertion, which is decisive for the whole psychology of the blind, that it should be possible, by purely haptic perception, to get a homogeneous idea of the form of objects which differ from well-known or less complicated spatial figures.

I am quite willing to admit that irrefutable empirical grounds for such a denial are lacking. We have, however, to consider

the tendency to analyse structure, the irresistible urge towards verbal fixation, the large number of incorrect identifications, the inability to apprehend the structural appearance of individual objects, the fragmentary character of the haptic image; we have further to take into consideration the subjective feeling of uncertainty connected with haptic activities, the surprise felt by seeing subjects when the haptically examined objects are made visible, and, last but not least, the very limited ability of the blind to create sculptural works; all this compels us to admit that haptic perception is only able to achieve an approximation to a unified impression of form which includes all the relevant formal elements.

Lastly I want to draw attention to a special feature which I consider to be of considerable importance in the constructive creation of form—namely, the small influence of "general tendencies" in the field of Haptics. In a previous paper [1] I have shown that the functions concerned with spatial perception are governed by certain tendencies which play an important part both in the comprehension of spatial relationships and in the creative formation of objects and their spatial structure. These tendencies seem to have a threefold influence: one concerning the creation of form, a further one directed to the modification of form, and finally one effecting corrections of form. Thus the creative tendency, by means of which three points are apprehended as a triangle, acts as form-creating. A further form-creating and form-modifying influence is given in Lipps' "empathy" (Einfühlung), by means of which we endow even elementary spatial forms with activity and movement, such as we experience in ourselves, in the expressive movements of our fellow-beings, and in Nature.

The formative and modifying effects of these and related tendencies can, however, become operative only in respect of an object which is given as a whole. But when the object is not present as a whole, as is usually the case in the field of Haptics, the interplay of forces cannot become operative through the dynamic connections of the parts, and so these tendencies either cannot exert their formative influence at all, or are restricted to simple objects. This is in full accordance with our own experience. We were able to ascertain that the sphere of Haptics is only ruled by the same tendencies in the case of simple figures, which

[1] G. Révész, "System der optischen und haptischen Raumtäuschungen," *Zeitschr. f. Psych.*, **131**, 1934, p. 296.

can be apprehended as a whole. That those form-modifying tendencies, which underlie the geometrical optical illusions, are fully operative in the haptic field as well, is accounted for by the fact that the subjects were faced with very simple figures.

Further experiments will have to show how far the validity of the form-creating and form-modifying tendencies extends into the field of Haptics, and to what extent these tendencies are operative even in the active creation of form. It is quite possible that the manifest haptic perception of space, just as in the case of the visual sphere, depends to a certain extent on the collaboration of modifying factors. For the objects of external reality are always perceived with such modifications as must be attributed to those tendencies. The difficulty in the world of haptic perception lies in the fact that, compared with the visual field, we do not, in the spontaneous act of spatial co-ordination, become so clearly aware of the effects of the tendencies to which the apprehension of form is subject. There is, however, no doubt that they are nevertheless operative.

We have reached the conclusion that in the haptic sphere successively perceived and structurally conditioned partial elements cannot as a rule be fused into a unified formal whole, this being due to the specific nature of the haptic process of perception. In the first place formative activity is impeded by the heterogeneity of the elements (concepts, movements, visual images, haptic impressions), in the second place by the successive and schematising nature of the perceptive process. Further inhibiting factors are the tendencies towards an exhaustive comprehension of the total structure and towards visualisation, and the fact that the subject is bound to the material elements. Finally we have to consider the restricted influence of form-creating and form-modifying tendencies. Formative activity aims at endowing the schematic haptic image with a sharper structure, at making the proportions of the parts in relation to one another more distinct, at starting the visual transference, and at supplementing the general pattern with details which assist the task of recognition. The constructive process tries to overcome these difficulties, although mostly unsuccessfully. Although the constructive process will never lead to a purely haptic form, we nevertheless obtain by haptic means a richly structured and specific total impression supplemented by important cognitive elements.

Parallel visual experiments, which I have not mentioned in this context, show that, although as a rule visual formative activity is of a receptive character, and is thereby distinguished from the haptic formative process, certain experimental conditions may be achieved (*e.g.*, in the task of uniting fragments of an object in one's imagination) under which most of the specific features encountered in the haptic process become manifest even in the visual sphere.

10. Autonomous Formative Activity

It would be wrong to assume that we wished to attribute to our haptic sense recognition of structure, but not perception of form. Once one concedes the haptic sense an autonomous function of perception of space and objects, it is no longer possible to deny it the capacity for the perception of form. Our theoretical discussions and our experiments have made it clear that recognition of the simplest structural organisation presupposes apprehension of form. In view of the fact that in those born blind and in those who have lost their sight at an early age the visualisation of haptic impressions can be ruled out, we must necessarily assume the existence of an autonomous haptic perception of form. Such an assumption is not only supported by the very positive statements of those born blind and by their ability to recognise objects and to orientate themselves in the world of objects, but also by the sculptural achievements of the blind, which can only be understood on the basis of the perception of form.

The autonomous formative energy is operative in all haptic activities. It must be admitted that it plays a smaller part in the sighted when they are engaged in haptic perception than with the blind, who have to rely almost exclusively on that function. We encounter it in connection with the receptive as well as with the purposive attitude, although in the latter case the autonomous formative energy becomes less marked through the action of non-haptic factors.

In this connection we do not wish to discuss fully the similarities existing between the achievements of the visual and the haptic senses. In connection with the principles of form we have repeatedly stressed the relationship between visual and haptic impressions of form. Recently Blumenfeld has tried to establish a number of so-called parallel laws which are meant to govern

both visual and haptic spatial perception in spite of all phenomenal differences.[1] I do not want to discuss to what extent he has succeeded in his attempt. I should only like to say that his statement, unsupported as it is by any evidence, is completely invalidated by the results of my experiments. I gave strong support to my argument when I succeeded in showing that the majority of the illusions of spatial relation which are well known in the field of Optics occur in the haptic sphere as well. This striking coincidence suggests strongly that there exist space-creating tendencies, which are equally operative in both spheres.

It is difficult to determine how far a certain experienced similarity goes with the conformity of simple spatial structures. We have to consider that tactile apprehension of form is mainly the result of a formative activity, and further that the total impression of linear, plane, or solid structure, which we want to apprehend haptically, is made up out of separate forms which retain their fragmentary character; and lastly we have to keep in mind the heterogeneity of the sensory material of the two senses. All this should make it clear that the phenomenal similarity of haptic and visual impressions is confined within narrow boundaries.

The discussion of the principles and tendencies of the haptic perception of form constitutes an important contribution to the psychology of perception, especially to the theory of form.

To begin with, it has become clear that the haptic perception of space and objects is governed by laws and principles, which necessarily follow from the nature of the haptic sense. The notion that Optics and Haptics of space are governed by the same rules must therefore be abandoned. Visual and haptic perceptions cannot be compared in respect of the specific impression of form; they are phenomenologically different. The apparent similarity is due to the geometrical structure of the objects, which both senses apprehend in the same way, and to the visualisation of the haptic impressions, whereby the schematic visual image replaces the haptic type-image.

The autonomous character of haptic laws does not imply that they have no validity beyond the sphere of Haptics. When one adopts an attitude in the visual perception of objects and forms similar to the one normally adopted in haptic perception—that

[1] W. Blumenfeld, " The Relationship between the Optical and Haptical Construction of Space," *Acta Psychologica*, **2**, 1936.

is, an attitude directed towards stressing and analysing partial structures—as when one aims at a deliberate union of the parts which have been apprehended analytically, such principles as are usually only discernible in haptic perception become operative. From this partial conformity it follows that certain principles and tendencies are not so much based on the *senses* as such as on the *mode in which the senses* function. Whenever the eye sees " in a tactile way " (*i.e.*, successively and analytically) the principle of successive progress and the principle of structural analysis becomes operative. Other tendencies, like the schematising tendency, find their visual counterpart in the " goodness " of the form; the transformatory tendency becomes optically operative in the search for haptic correlative criteria. On the other hand, fundamental haptic principles, such as the stereoplastic, kinematic, and metric principles, do not operate in the field of Optics, whilst the constructive synthesis which is essential for the haptic perception of objects can only be detected under quite exceptional visual conditions.

Faced with the task of establishing the unity of formative principles and tendencies in regard to spatial structures, we cannot be satisfied with the rules established by the Gestalt psychologists, rules which are confined to the field of Optics. We are compelled to include in the theory of form the laws that we have found valid in Haptics.

Two ways are open to us there. We can discuss separately the laws of form valid in the field of Haptics and those valid in the field of Optics, and then we should have to examine which of those laws apply to both spheres. Such an investigation requires an intensive examination of the laws of visual form and their reduction to a minimum number, from which all others can be derived. The other way would consist of ascertaining generally valid principles and, in addition, the special ones, viz., those valid for visual or for haptic perception only. However that may be, the psychology of form has to take into consideration the differences we have been able to ascertain, and should only proceed to a general Gestalt theory after a thorough examination of all the relevant facts.

At the time of the publication of this work in the original German edition I was convinced that it would provoke some lively reactions in the camp of the Gestalt psychologists. They

would notice, I reckoned, that my experimental results and theoretical explanations formed a strong challenge to the pretended *universality* of the so-called Gestalt laws of perception—the strongest challenge, in fact, since the origination of that theory.

Some of the principles and laws which I found to be valid in the haptic field also hold good, it is true, for visual perception; I stated that in its place. But there are also principles, tendencies, etc., which are valid in the process of haptic perception only (such as the stereoplastic tendency, the measuring and schematising tendency), and others which characterise visual perception only (*vide* W. Köhler, *Gestalt Psychology*).

The most important fact is, however, that the two fields are governed by some fundamental laws which are diametrically opposed; for instance, the immediate perception of the Gestalt of visual objects in Optics as against the successive, piecemeal, constructive approach in Haptics. Only in exceptional cases created by special conditions can we sometimes find simultaneous form-perception in the field of the tactile sense, and perception by successive steps in optics. The prevailing principle is successivity in Haptics, simultaneity in Optics. The same applies to the stereoplastic, the measuring and the schematising tendencies. Structural analysis is, in optics, only used when a given whole (totality) is *reduced* to its elements and not—as in haptics—when the subject wants to *build* a whole. Constructive synthesis is not met with at all in visual perception, and hardly ever in auditory perception, either: possibly the case of somebody hearing an unknown piece of music and wanting to analyse its structure in order to re-create it synthetically, could be considered something of an analogy.

Every unbiased reader of my work will be amazed to hear that those psychologists who represent or favour the Gestalt theories did not take any notice of it. They did not even mention my study in their periodicals. Their silence had, besides, the effect that even authors like Guillaume and Katz, who published general surveys of Gestalt psychology, passed it over. This attitude of the Gestalt theorists is the more curious, since my book has been amply and always positively reviewed in numerous periodicals (psychological, biological, psychiatric and opthalmological). Moreover some of the leading Gestalt theorists, among others M. Wertheimer and A. Gelb, did personally express their apprecia-

tion; and the book itself was widely circulated: it was out of print in four years.

How is this silence to be explained?

Probably it is due to the unpleasant feeling caused by the necessity to give up the pretended *universality* of the Gestalt doctrine—which at the time undoubtedly meant great progress for empirical psychology. The field of application of that doctrine now has to be reduced. A comparative study in the several fields of form perception cannot but lead to a revision: that would be the implication of my work, when faced squarely by Gestalt psychologists. By this revision the theory will lose something of its elegance, but that will be compensated for by a gain in real strength and conviction. One of the results of such a revision will probably be the recognition of *special* Gestalt laws, depending primarily on the nature of the sense organs, alongside of *general* Gestalt laws.

I shall be very pleased if this English edition leads to such a revision of Gestalt theory. For only so would it be possible to establish the principles of a general theory of perception, an end towards which Gestalt psychologists have been striving.

VI

FORM AND STRUCTURE AND THEIR RECIPROCAL RELATIONSHIP

1. Recognition and Experience of Proportion

We have shown in the foregoing discussion that in Haptics the cognitive intention is directed towards general recognition and not, as in Optics, towards individual recognition. Individuality, as it can be recognised in the field of Optics by the suitability of the total appearance and the structure of the whole, cannot be grasped by our haptic sense, or at best only to a limited extent after a complicated and tedious examination. But it would be wrong to imagine that the lack of individualisation in the field of Haptics is due to the complete lack of the ability to apprehend proportion. In the absence of any perception of proportion, the haptic form would have to be given up, and the recognition of objects would suffer a marked deterioration. Whoever denies to Haptics the experience of proportion or rather the apprehension of proportion, presumably has in mind those well-developed phenomena which are the monopoly of the purely visual image of the world, which endow the objects with apparent permanence and solidity and secure their æsthetic significance. It is true that visual perception is synonymous with seeing form and that the latter presupposes the proportions of the parts in relation to the whole and those of the whole in relation to its parts. The fact, however, that visible objects attain a firm and individual formal significance through the comprehensive impression of proportion they give does not imply that Haptics, which lags behind the visual function in regard to the formal characterisation of specific objects, lacks the impression of proportion. Such a view is based on a misconception of the nature of the tangible world and is contradicted by the actual facts of haptic recognition. It is true that the haptic impression of proportion is a limited one; it is restricted to the proportions of the pattern, and it does not, as in Optics, include the reciprocal pro-

portionality of the parts. It is further true that in Haptics the many interrelations of proportions, which in the field of Optics are embedded in a unitary system of proportions and are immediately realised in the individual impression of form, do not become operative. The haptically perceiving person has to be satisfied with a vivid *pattern of the proportions* of the object. But the emergence of such an image-pattern can only be realised by actual experience of the proportions.

Let us illustrate the conditions prevailing in the fields of Optics and Haptics by the following example.

If we put a series of crosses of different proportions before sighted subjects, they will not only be able to distinguish the crosses from one another—an achievement which could be as well accom-

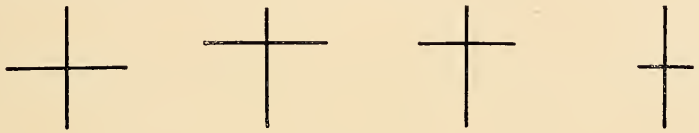


Fig. 17.

plished by our tactile sense through its metrical function—but they will also apprehend each figure in itself as a typical form, as may be seen from the attached drawing.

If we present the same cross-figures in plastic relief to blind subjects, we shall see that although the difference in length between the horizontal and the vertical lines and the proportional lengths of the upper and lower parts of the vertical lines are always recognised, that fact scarcely becomes apparent in the general impression. It is true that in schematic form the Greek cross differs haptically from the Latin one, but typical forms, such as owe their existence to the impression of proportions, do not become clear.[1]

So the fact that a blind man is able to make a correct estimate of the relative length, and even go on to obtain an impression of proportions, does not imply that he is likely to be able to integrate spontaneously the quantitative differences of the parts into a homogeneous impression of form. In contrast to the visual

[1] This special example is not entirely convincing. More complicated figures and objects make things much more clear. I have, however, chosen this example on purpose, in order to demonstrate with simple figures the difference between the impression of proportions and perception of form.

sphere, where form and proportion are integral components of the optically perceived image, these two data may become dissociated in Haptics. The more complicated the object is, the more clearly form and proportion undergo such dissociation.

When I look at a bronze figure standing in front of me, I experience in one single act the whole formal complexity that is included in the figure. We do not apprehend separately the spatial relations, among which we have to reckon the proportions of the parts, nor do we pay any attention to the individual parts. It rarely happens that we examine the proportions as such. The haptically perceiving subject who is unable to grasp the desired integrated object-image by tactile activity, *will instinctively be urged towards the perception and representation of the main proportions.* He hopes to attain thereby a comprehensive expression of form as adequate as the visual image.

It was presumably the difficulties which have to be overcome in the process of a haptic perception of form and the fact that, in spite of laborious apprehension of the main partial structures and proportions, the haptic image of form differs so markedly from the visual impression that led Friedmann to deny the apprehension of proportions by means of the sense of touch. In his theory of form he points out that Haptics aims at apprehending the quantitative relations in objects, whilst Optics is directed towards the perception of proportions. According to him the actual realm of Haptics is the field of relationship between equivalent parts—that is to say, congruence and symmetry—whilst Optics is concerned with the proportion of magnitudes with differences of value. In view of the fact that according to Friedmann the blind can only become conscious of proportions by means of measuring, they should actually be incapable of real perception of form, and so incapable also of the æsthetic appreciation of plastic works.

Apart from the fact that such a statement is incompatible with our experience of the blind, I felt compelled to examine this question experimentally, all the more as it was not known by what means the apprehension of proportion in Haptics is achieved.[1]

The main point was to create conditions under which the question put to the subject could only be answered when he had actually experienced the proportions *as such.* That condition was

[1] G. Blomhert, " Contribution to the Study of Haptic Perception," *Kon. Akad. v. Wetensch., Proceedings*, Vol. XXXVIII, No. 8, 1935.

fulfilled by asking the subject to select haptically out of a series of different rectangles the one that showed *the same proportions* as the main rectangular figure. A further experiment consisted of constructing, both haptically and visually, a haptically given rectangle, on a different scale but with the same proportions, by means of an apparatus with variable co-ordinates. In either case it was thus a question of transposing a figure in regard to the sense modality and to absolute size. There can hardly be any doubt that (haptic) transposition can only be achieved if the figure to be transposed is apprehended, with its spatial relationships, as a single shape. We can never achieve a transposition by measuring the parts ; that would merely lead to a purely geometrical construction.

In the haptic selection experiment we made use of main figures with proportions 1 : 1·4 up to 1 : 4 and of selection figures with proportions 1 : 1 up to 1 : 6·3. Answers were considered to be correct when the selected rectangle either conformed exactly to the proportions of the main figure or when it differed from it by no more than one point at the most (one degree thinner or thicker). Thus, with the main figure 1 : 3 selected proportions of 1 : 3, 1 : 3·3, and 1 : 2·8 were recorded as correct, figures under 1 : 2·6 and over 1 : 3·6 as wrong. In by far the greater number of cases we found that the selected figure conformed to the proportions of the main figure. It can be seen that in Haptics the maximum was — 1, in Optics 0 (*i.e.*, within the range of correct solutions). The scattering of values in the haptic experiment is slightly more marked (between — 5 and + 5) than in the optic one (between — 4 and + 4). Haptically there is a tendency to select thinner rather than thicker figures, as becomes apparent in the asymmetrical way the dotted curve falls off.

On the basis of our everyday experience we should be inclined to assume that the results in the haptic sphere would be far less accurate and constant than in the visual sphere. The visual experiments carried through under identical conditions led to very similar results.

These results, however, by no means solved our problem. We had further to find out whether the subjects of the haptic experiments had achieved these results by means of a direct impression of proportion or by means of some kind of estimation and measuring. For that the process of the recognition of proportions had to be subjected to an accurate investigation.

With the help of cinematographic records Blomhert has distinguished between three kinds of tactile activity which are used in turn by all subjects in experiments concerned with free tactile apprehension. The first method (*a*) consisted of grasping the rectangle with both hands and holding it with the thumb and index finger applied to the two opposite shorter sides. That is to say, the sides were not examined by means of touch, the impression

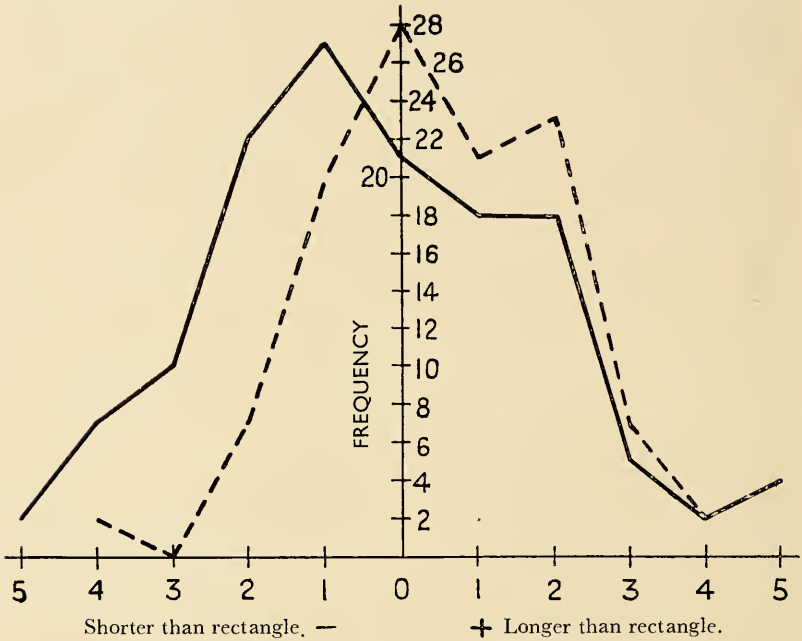


FIG. 18.—Results of Haptic and Optical Proportions Experiments. The two graphs give the results of the haptic (uninterrupted line) and the visual (dotted line) experiments.

of proportion being merely based on the static sensations of tension in the two fingers of both hands and in similar sensations produced in the hands or arms.

The second method (*b*) follows upon the first one. Starting from the first position the two fingers move towards the opposite angles, so that the longer sides are tactually examined, and then the index fingers glide along the shorter sides towards the thumbs. Thus all four sides of the rectangle are examined. In the third mode of haptic examination (*c*) the index finger of the right hand usually feels round the whole outline of the rectangle.

The attached graphs show the results of the tactile method (*a*) (dotted line), of (*b*) (broken line), and of (*c*) (continuous line).

Fig. 19.—The First Method of Assessing Proportions Haptically.

With all three methods the maximum is situated at + 1, *i.e.*, in the majority of cases a slightly more elongated figure is selected. (Compare with this the shift to the negative side in the process of free tactile examination—Fig. 18.)

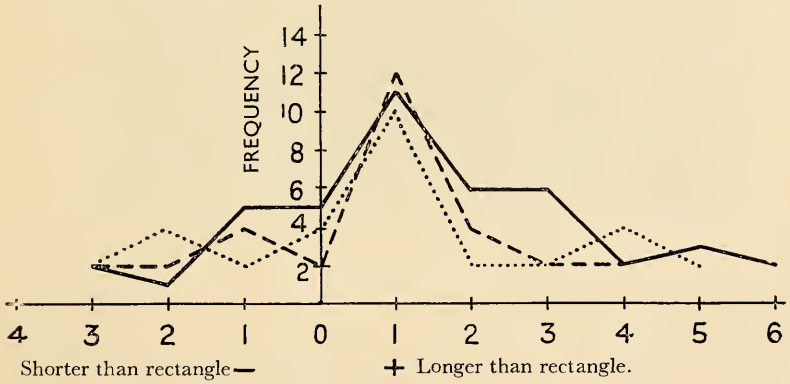


Fig. 20.—Results by the Three Methods of Haptic Examination.

Blomhert has summarised the results of his investigations in the following three points:

" 1. It is possible to perceive the proportions of a rectangle haptically. This appeared from:

" (*a*) the fact that the subjects themselves thought that they indeed perceived a certain proportion;

" (*b*) the fact that this proportional impression might be transformed with hardly more difficulty than the visual one;

" (*c*) the fact that this haptic proportional impression could

be compared without great difficulty with the visual impression of the same rectangle.

" 2. The haptic proportional impression of a rectangle is quantitatively similar to the optical one, but qualitatively different.

" 3. According to a prescribed, consciously one-sided tactual movement a rectangle seems taller than it is geometrically."

These experiments have taught us that our haptic sense not only possesses the ability to perceive spatial proportions, but also

FIG. 21.—Copying of a Model in the Original Size and on a Reduced Scale with the Eyes *Open.*

the ability to transpose the perceived proportions, *i.e.*, to transfer them to another scale. It became evident—a point which is of decisive importance for our problem—that the perception of proportions in the haptic sphere may also come into being on the basis of a *spontaneous impression of proportion.* The first method of tactile examination, in which any tactile movement is ruled out, and the proportion is apprehended solely by sensations of tension, rules out any other interpretation. It further became evident that, at least in simple proportions, the visual sense is by no means superior to the haptic one as far as accuracy is concerned.

We were able to reach the same conclusion by means of a modelling experiment.

The task consisted of copying a simple three-dimensional model

once in its original size, then on a smaller scale with eyes open (visual experiment) and with eyes closed (haptic experiment). Both in the visual and in the haptic experiment the model was presented to the subjects of the experiment haptically only. The diameter (width of the base of the cylinder) of the model shown in the figure was, in the optical experiment, 2·3 cm., its height 5·4 cm., and that of the handle was 1·2 cm. The relation of the width to the length of the cylinder was therefore 1 : 2·3.

One of the more skilled subjects gave the following values in the *visual experiment*:

	Model.	Copied on the same scale.	Copied on a reduced scale.
Diameter	2·3	2·5	1·7
Height	5·4	5·0	3·5
Handle	1·2	1·3	0·9
Proportions: Model 1 : 2·3; Copy in the original size 1 : 2; on a reduced scale 1 : 2·06.			

In the *haptic experiments* the length of the model was slightly changed. The results were as follows:

	Model.	Copied on the same scale.	Copied on a reduced scale.
Diameter	2·3	2·0	1·6
Length	4·4	4·1	3·3
Handle	1·2	1·2	1·0
Proportions: Model 1 : 1·9; Copy in the original size 1 : 2·05; on a reduced scale 1 : 2·06 (cf. Fig. 22).			

These results suggest that both the copy in the original size and the copy with altered proportions achieved either by visual or by haptic means conform very satisfactorily to the proportions of the model. The transformation from the haptic to the visual sphere seems to have a somewhat unfavourable influence. The proportions of the copies in the haptic experiment are usually in better agreement with the objective proportions than in the visual experiment. In no case did the visual sense improve the achievement.

Whenever a task requires the consideration of more than one quantitative proportion, more marked discrepancies between model and copy naturally become manifest, as we were able to see when the task of copying a tetrahedron was set.

There can, however, be no doubt that the direct impression of proportion plays a considerable part. Whenever we glide our hands across an object, the reciprocal relations of the parts contribute directly to the total impression. It is only through its own proportions that any typical form becomes endowed with its

Fig. 22.—Copying a Model in the Original Size and on a Reduced Scale with the Eyes *Closed*.

characteristic features. The proportions need by no means be apprehended with the same degree of distinctness and with the same wealth of reciprocal relations as is the case in visual perception. It is quite enough if they conform to the requirements of the schematic form-image. Such an impression of proportion is, as we have seen, too schematic to allow of the individualisation of the tactually apprehended object, but it is quite sufficient for the purpose of recognition. In view of the fact that in practical Haptics we take the form into consideration only as a cognitive criterion of the haptically examined objects, it is sufficient if the direct perception of proportions is operative within certain limits.

The existence of an autonomous haptic impression of propor-

tions does not exclude the part played by the metrical function in apprehending, and especially in creating proportional relationships. It is true that it is not so much a case of actual measuring by means of the hand or the fingers, but merely of a kind of tactile activity akin to measuring. Whenever sighted subjects are asked to transpose geometrical proportions accurately, the organ of vision acts similarly to the haptic organ: the eyes move along the lines, one " touches " the sides with one's eyes, one then transfers that movement to the object of comparison until one gets the impression that the two objects are comparable in regard to proportion. That under given conditions the same method is made use of in both the visual and the haptic sphere is confirmed by the quantitative agreement of the experimental results.

Such is the position as regards the simplest linear and plane forms. The more complicated is the tactile object, the more difficult is the haptic apprehension of proportions and the more marked becomes the superiority of the visual as compared with the haptic sense.

2. Congruence and Morphological Identity

Whenever the metric function becomes focused on the recognition of the geometrical structure of haptic objects—which is and remains its main task—the structural congruence becomes the centre of all activity in measuring and estimating. According to our experience, when linear and plane figures are compared with each other, the first examination is concerned with the question whether they are congruent or incongruent. The solution to that geometrical problem is usually achieved by means of static or dynamic measuring (cf. p. 99). The blind whenever possible make use of a simpler method, the supraposition of the figures to be compared. If they find that the figures are congruent, they attribute to both forms morphological identity, since in Haptics the theorem (questionable on *a priori* grounds) according to which structural congruence or incongruence coincides with morphological identity or non-identity respectively seems to be valid. But as soon as we subject that attitude to a closer examination, we become aware that there is after all no complete concordance between haptic-metrical *congruence* and haptic *identity of form.* In Haptics the impression of morphological identity or dissimilarity is occasionally determined on the basis of criteria which have

nothing to do with form. We were thus able to ascertain in our experiments that sometimes dissimilarity in respect of material was sufficient to create the impression of dissimilarity in figures which had previously been looked upon as congruent. On the other hand, we come across opposite cases, in which, in spite of incongruence, the impression of formal identity is obtained. This happens especially in the global recognition of form, when the geometrical relationship is relegated to the background.

We must also remark that the tendency to ascertain the relation of congruence by measuring or estimating is not altogether absent in the sphere of Optics. For whenever we are faced with the task of making very accurate judgments, and when the objective difference between two figures is very slight, the organ of vision starts measuring and comparing in a manner similar to the haptic sense. In concrete cases, however, it will not be easy to judge what we have to attribute to the metric and what to the spontaneous form-perceiving function of the eye.

3. Perception of Symmetry

In my tactile experiments I have always been able to observe that the haptic examination of objects starts with a superficial orientation as to measurement and symmetry. Whenever the object appears to be non-symmetrical, the subject tries to ascertain the extent of the asymmetry (*i.e.*, to what extent the two halves as divided by an imaginary plane of symmetry differ from one another). When they are dealing with symmetrically structured linear or plane figures, seeing as well as blind observers do not go to the trouble of examining haptically *both* symmetrical halves during the course of subsequent investigation. They confine themselves to the structural analysis of one half and try to gain a haptic image of the form on the ground of it. It becomes clear, however, that such a haptic image is only related to the one half, whilst the other half is merely a product of additional rational thought. A genuine impression of symmetry in the visual sense does not actually come into being. One remains fixed at the stage of recognition and verification of the symmetrical structure, without integrating the two halves into a unified image.

The whole process of haptic recognition of form is well illustrated in the following symmetrical figure (Fig 23).

In the first place, the observer took in the schematic form of the

object to be examined, he realised the symmetry (*i.e.*, the regularity of the figure), and was satisfied with the examination of one half of the figure which he drew as shown in Fig. 24.

Then he began to study the proportions of the lateral lines more closely and to memorise his findings in words. Thus he

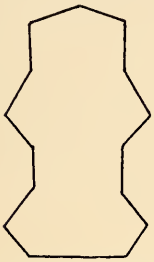


FIG. 23.—Haptically Examined Figure.

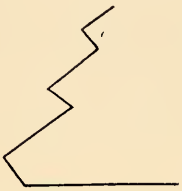


FIG. 24.—Drawing after Two Minutes.

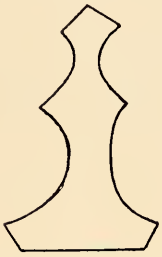


FIG. 25.—Drawing after Eight Minutes.

noticed that the upper "curve" was less "deep" than the lower one and that the distance between the angles was larger in the lower than in the upper part. After eight minutes (!) the observer decided on the form given in Fig. 25.

The observer seemed to be satisfied with the total form, but not with the proportions.

After two more minutes devoted to examination by means of structural analysis the figure assumed quite a different form, as shown in Fig. 26.

Checking up the proportions once more, the observer found them incorrect. Only after further haptic examination lasting five minutes did the observer find that the contour consisted of straight lines and not of curves. This surprising correction made the figure appear in another form and with other dimensions, as shown in Fig. 27.

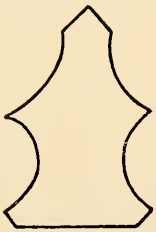


FIG. 26.—Drawing after Ten Minutes.

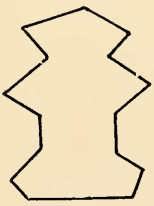


FIG. 27.—Drawing after Fifteen Minutes.

Haptic examination even of the simplest symmetrical figure requires a fairly long time, but in spite of that considerable errors do occur. I asked a subject to examine Fig. 28 haptically with

his index finger for ten seconds. I then interposed a short interval, followed by a further examination lasting ten seconds, and so on up to six repetitions.

After a series of six tactile examinations (one minute) the observer had not succeeded in ascertaining the form of the figure. The drawing produced after haptic examination shows very strikingly the very limited ability of the haptic sense to recognise regularities (Fig. 29).

When the subject is faced with figures not quite symmetrical, we meet just the opposite mistakes, and the asymmetrical figures are looked upon as symmetrical.[1] It takes a long time before the observer becomes aware of deviations from symmetry.

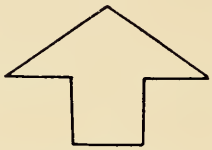


Fig. 28.—Haptically Examined Figure.

Fig. 29.—Drawing after Six Examinations.

I should like to demonstrate the conditions obtaining in such a case by an example.

The model to be examined haptically had the shape shown in Fig. 30.

In the first experiment the object was considered to be symmetrical. The observer first drew the object as seen in Fig. 31.

When I placed the figure once more in his hand and asked him to check his drawing, he would not believe that he had previously examined the same figure haptically. Only now did he start on the actual analysis of form, which lasted a very long time—approximately seven minutes. The correct form of the figure, however, was by no means grasped by this detailed formal analysis.

The knowledge of an object may occasionally facilitate the apprehension of form; such a knowledge on the one hand enhances the correct apprehension of proportions, on the other hand it evokes the cognitive image of a picture representing the hapti-

[1] The haptic type of "Prägnanz." Similar observations can be made in the visual sphere by tachistoscopic experiments.

cally examined object. The construction of the haptic-visual image may then orientate itself according to such an image. If one knows, for example, that the figure represents a star-like object, the formal analysis will be guided by the familiar notion of a " star ", and the examination will be confined to ascertaining the differences prevailing between the schematic-visual idea of the star and the tactile-visual impression of form.

The fact that in the haptic sphere the symmetrical structure of an object is as a rule only recognised through structural analysis does not of course imply that in Haptics the specific impression

Fig. 30.—Figure Examined Haptically.

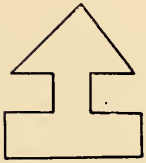


Fig. 31.—First Impression before Examination by Structural Analysis.

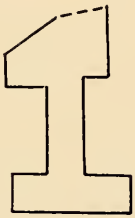


Fig. 32.—Drawing after Two Minutes.

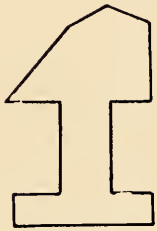


Fig. 33.—Drawing after Three-and-a-half Minutes.

of symmetry is lacking altogether. It cannot even be asserted that the perception of symmetry in the tactile world is less spontaneous than in the world of Optics. It appears, however, that the experience of symmetry is not related to the *tactile image*, but primarily to the symmetrical *kinematic form* (kinematic image), which is not bound to the knowledge of the geometrical structure. It is in these kinematic forms that the spontaneous haptic impression of symmetry becomes most manifest.

That the haptic form of symmetry is never experienced so impressively as the visual one is probably due to the fact that in Haptics the centre, the actual pivot of the symmetrical figures, is related to the background. The central point is not experienced

as the centre of force. So the intrinsic motion of the symmetrical lateral parts, which appear to start from that central point and to return to it, loses much of its vividness and its impetus.

The above experiments have shown that in the field of Haptics the judgments about congruence and symmetry are in many cases not based on immediate sensory apprehension, but on recognition through structural analysis. We are therefore justified in saying that in Haptics the impression of identity and symmetry is mostly related to structures, and not so much to forms. On the other hand, we realise that genuine cases of the perception of identity, and especially of symmetry, are by no means completely absent from the sphere of Haptics, but that they become really vivid and clear only in the motor sphere as unified kinematic forms.

VII

IMPRESSIONS OF FORM IN THE FIELD OF HAPTICS

We distinguish in the field of Haptics two types of form, the " haptomorphic " and the " optomorphic ".

1. " Haptomorphic " Forms

The genuine autonomous forms based exclusively on tactile and kinematic experiences, which owe their development to the autonomous function of the haptic sense, appear in three ways: as purely tactile forms, as purely kinematic forms, and lastly as purely haptic forms.

(a) *Purely Tactile Forms—Resting Touch*

Whenever an object is enclosed and grasped by the hand, *i.e.*, whenever it is examined by the *resting tactile organ*, it is felt as an object well defined in itself, continuous, and at the same time fairly well structured and determined as to position. In spite of the fact that such a tactile impression does not convey any information about the precise form of the object, there can be no doubt that what we hold in our hand is not diffuse and shapeless but a dimensional and formed object. This phenomenon is best experienced when a hand grasps an unknown object. Under these conditions the purely tactile form becomes particularly clear through the difference of the impressions. Everybody may convince himself of the existence of such tactile forms without any special apparatus. The fact that with resting touch an object hardly ever shows the same contours or the same definite structure as with moving touch can, of course, not be used as evidence against the existence of pure tactile forms.

The existence of pure haptic forms is of special theoretical interest. One often meets the view, intrinsically correct, that in the sphere of the tactile sense movement represents a shaping and formative energy (Katz). But we cannot generalise that statement

so as to assert that in the haptic world of experience forms owe their existence exclusively to movement.

The fact just mentioned that even in the completely motionless hand tactile objects become endowed with form suggests that the experience of form created through movement cannot possibly be the one and only factor in the haptic creation of form. It is true that one could contradict such a view by asserting that the factor of movement is always operative, that it is never completely ruled out even in the state of rest, not so much on account of tactile twitches but also on account of those kinæsthetic sensations, which, as we know from experience, are closely connected with tactile perception. It must be admitted that such a view cannot be rejected out of hand. We deny, however, that that is the whole explanation of the tactile creation of form. Firstly, in purely tactile forms kinæsthetic ideas are only encountered exceptionally, and even those—as far as my experience goes—occur only in connection with a purposive attitude, a mode of behaviour which is unnatural in static tactile activity. Secondly, we can provide evidence of purely tactile experiences of form in cases where it is impossible to suggest any co-ordination between tactile and kinæsthetic perceptions. Such is the case in the so-called tactual space-illusion, which occurs even when only the sense of touch is functioning (*i.e.*, when the kinæsthetic sense can be ruled out completely). It cannot therefore be doubted that there exist purely tactile forms which come into being without the help of actual motor activity.

(b) *Purely Kinæsthetic Forms*

Pure sequences of movement completely dissociated from tactile qualities may impressively be ascertained in spontaneous movements. I apply the term "*autogenic movements*" to the specific, autonomous movements of the body which owe their existence to motor impulses or to stimulation from within the body. They represent movements of an expressive character. Whenever one waves one's hand or performs rhythmical movements in walking, running, jumping, or dancing, or whenever one expresses feelings, affects, volitions, or thoughts by means of gestures—briefly, whenever one expresses through movement the stirring of one's inner life—one is dealing with autogenic movements, which express themselves in *purely kinæsthetic forms.*

It need hardly be mentioned that apart from these autogenic kinæsthetic forms there occur other purely kinematic impressions of form. All our bodily movements, irrespective of whether they are performed spontaneously or voluntarily, create purely kinematic forms, as long as they are performed without the co-operation of tactile impressions. Having sight, we do not pay any attention to them, because we orientate ourselves visually; all the more do the blind attend to them. They note carefully the motor patterns, as we, when forced to do so, perform habitually certain activities in the dark.

So far very little attention has been paid to the purely motor patterns, although they actually pervade our whole everyday life. This is due mainly to the fact that they are very difficult to conceive and even more difficult to fix in abstract terms.

We perform a lot of movements spontaneously or imitatively (*e.g.*, gestures, movements associated with writing, working, and dancing), without necessarily having clear ideas of the movements we perform. One does not visualise the motor patterns; it is only as motor impressions that they become manifest. Such a state of affairs can be experienced especially clearly during the performance of a piece of music learnt by heart. The movements follow one another with absolute certainty, without our being conscious of their sequence.

We must add that occasionally purely motor patterns may come into being in the tactile examination of objects. For there are objects whose contour or superficial structure adapts itself so closely to the hand that in the tactile examination of them the motor pattern becomes manifest in its entire sensory purity. Under such conditions the tactile impression is as a rule completely relegated to the background. In these forms, which are related to autogenic movements, we do not observe any urge towards visualisation. Such almost pure kinematic experiences of form occur in following the outlines of curved lines or planes and of symmetrically structured simple ornamental figures with a symmetrical structure (*e.g.*, double spirals).

(c) *Purely Haptic Forms—Moving Touch*

These forms are identical with the purely haptic impressions of form obtained in a receptive attitude; they represent the *essentially* "*haptomorphic*" *forms*. The appearance of those haptic forms is

bound by two conditions: first, the tactile object must be examined by the hand moving, as in striking or grasping; secondly, no visualisation or any abstract fixation of the experience should take place during the tactile process. It is certainly not easy to find the attitude which allows the haptic peculiarities to become manifest and yet prevents the occurrence of visual ideas and the initiation of a cognitive act. Once, however, such an attitude is adopted, the road to the haptic creation of the form of the object is open.[1]

A particularly good example of the creation of such a haptic form-impression is the tactile approach to small sculptural models, when one touches them without any purpose or intention. With such a purely receptive tactile activity even a finely modelled statue executed in full detail merely appears as a structurally differentiated bodily pattern without any details or any finer structure. There is so far no question of any expression in the content of the perception, and any organic connection between the structural elements recedes to the background. One merely feels the sweep of the lines, the contrast between the retardation and acceleration of the tactile movements, the moments of rise and fall. It is only after repeated tactile examination that the structure of the figure gradually becomes manifest, the latter being associated with some sort of kinematic and formal entity. When one tries, however, to recognise the figure, and to get an idea of the structure and architecture of the statue, visual images or visual–haptical patterns emerge almost automatically, or the geometrical plan of the model occupies the foreground to such an extent that the haptic experience is disturbed even while it is forming.

It may be superfluous to mention that haptic patterns become purely manifest in those born blind, since with them the haptic formative energy cannot be influenced by visual ideas.

2. "Optomorphic" Forms

We have known for a long time that in connection with the tactile approach to objects visual ideas do emerge either spontaneously or on the basis of haptic experiences. However diverse the phenomena of our haptic and visual world may be, it is never-

[1] One gains very clear haptomorphic impressions in the buccal cavity, when one passes one's tongue over rough areas of the mucous membrane or over broken bits of hard food.

theless difficult to separate the visual and haptic contents in the concrete total experience in view of their rich associative links. The spontaneous emergence of visual concepts in tactile activity and the close connection between visual and haptic contents support the view that form can only be experienced through the visual sense. The majority of the investigators overlooked the fact that in those cases in which visual notions were observed conditions for their emergence were most favourable. For if someone is asked to make a detailed statement on the form of a touched object, he will adopt a purposive attitude, and in doing so he will make use of all means at his disposal. There is no doubt that *visualisation* plays the most important part among those means. When, however, the observer adopts a receptive attitude, visual concepts will not emerge, or only to such a limited extent that they will not play any important part in the creation of form. When we let our hand glide over our hair, when we lean on the arm of a chair or slide our hand over objects, we experience formed objects in great variety, without being assisted by visual concepts. It cannot in any case be denied that our haptic impressions are frequently associated and intermingled with ideas which have their origin in the world of visual experience.

We have to distinguish between two kinds of visualisation: *passive* and *active* visualisation. We use the term passive visualisation when speaking of those visual ideas which occur necessarily in connection with tactile activity, so far as those ideas are related to the concrete haptic object. We speak of active visualisation when the haptic impressions are deliberately given a visual character, in order to make it possible to recognise a complicated haptic object or to obtain a sharp outline of the touched objects. Both kinds of visualisation are the foundation of the " optomorphic " tactile forms.

(a) *Passive Visualisation*

Passive visualisation comes into being through the innumerable associations which are constantly established between the two sensory spheres during the whole of our individual life, and of which extensive use is constantly made. Although the two sensory functions are by nature devoted to different tasks, they constantly support and supplement one another. This interaction becomes very clear in the passive visualisation of haptic impres-

sions, but also in the passive process which gives visual perceptions a haptic character. Visual concepts accompany tactile activities just as tactile experiences accompany visual perception. In concrete cases it is difficult to decide whether and to what extent visual mental images are operative in tactile processes, because in the passive receptive attitude the sensory components of the whole of the experience are not perceived in isolation and because the retrospective reflection on which we have to fall back in that case cannot give us any reliable information about the truth of the matter, in view of the vague image created by the preceding sensory perception.

The relatively easier visual *transposition* of haptic impressions is due to the fact that the visual sphere possesses a greater wealth of *co-ordinations* with the tactile sphere than vice versa.[1] The basic haptic qualities of smoothness and roughness, and even the qualities of hardness and softness, have their phenomenologically corresponding correlates in the field of Optics, while the colours and differences in brightness are completely devoid of such correlates. It is thus natural that in haptic perception a sort of synthesis with visual notions should more easily occur than a synthesis with haptic notions in visual perception.

(b) *Active Visualisation*

Let us now consider the problem of active visualisation, *i.e.*, the active translation of haptic impressions into the visual field. In connection with the purposive attitude, which activates visualisation, the visual elements emerge in their specific mode, so that it becomes possible to separate what was united in the total impression.

The answer to the question what it is that actually becomes visualised as a result of the purposive attitude, directed towards the recognition of a tactile object, is that it is a schematic form and

[1] I use the term transposition and not transformation quite deliberately. We speak of transformations when haptically perceived *spatial relations* are translated into the visual sphere. In that case the transposition is concerned with adequate sensory contents, as in both spheres the same objective spatial data have to be apprehended. In cases, however, in which we are dealing not with spatial relations, but with the transferring of *sensory qualities* to which in the other sphere correlative qualities only correspond—as is the case in the haptic sphere—we ought not to speak of transformations or if so only in a figurative sense; for here there is no actual " transformation ", it is only the case of a criterion of one sensory sphere taking the place of another criterion of the other sensory material. It follows that the term " fusion " is also meant in the figurative sense.

not at all the total visual image. What is aimed at is not a visualised image of the haptically perceived object corresponding to the visual impression, but merely a schematic visual concept of form. In that respect the visual transposition not only comprehends the form of the whole object, but is mostly limited to single successively touched parts. A synthesis in the visual sense is not achieved for the simple reason that the three-dimensional tactile image obtained through haptic examination of all sides cannot, as has been previously mentioned, be grasped visually as a unitary body.

Here we have to make a reservation. Closer investigation shows that it is not the haptic *form*, but rather the *structure* as recognised by the sense of touch which becomes translated into visual terms. Hand in hand with the recognition of the structure of the tactile image or the tactile object the visual forms emerge by way of association. By reason of the association with structure the transformation of the haptically perceived image leads to schematic visual images. That is bound to be the case, for the structural image only allows of schematic sensory representation. Under certain conditions that structural transformation may occur so rapidly that one gets the impression of transformation of the haptic image into the visual one taking place directly. Accurate observations, however, reveal the indirectness of the process. That the transitory phase is sometimes concealed and is occasionally in abeyance does not impair the general importance of that fact.

Recognition of the fact that the visualisation of the haptic perception of form is confined to a schematic form or structure does not constitute the ultimate stage of our insight into the matter. We may ask the further question why visualisation takes place at all and why the haptic form, gradually apprehended through tactile investigation, does not suffice. In order to answer that question we must refer to what we have said before about the urge towards an exhaustive apprehension of form in the haptic sphere.

To the sighted form means the visual formation of objects. To them the world is shaped according to visual principles. We are not able to get a correct idea of what we have never seen. In spite of the fact that we have touched our buccal cavity and our teeth with our tongue many times, we do not possess any clear idea of the form of these parts. If we could shape the

haptically investigated objects by means of the sense of touch only, the impressions of form would remain only haptic structures and we should never obtain objects with clearly defined outlines and of individual character. Such typified form images can, however, hardly be fitted into the world of visual forms, from which we have gained all our general and special concepts and ideas about form. The tendency to visualise, constantly operative in those with sight, aims ultimately at transferring the haptic perceptions of objects into a sphere in which we feel at home and to which we owe our most important experiences of our spatial surroundings. These considerations give us a certain insight into the world of forms of the blind.

Finally I should like to remark that the visualisation of haptic data is also required for expressing *in words* what has been observed haptically. Whenever we want to make a statement on the form or structure of an object, we have almost exclusively visual terms at our disposal. The whole set of terms required for the presentation of spatial structures has its origin in the Optics of form; we are therefore compelled, so to speak, to make the haptic impressions of form visual.

(c) *Visual and Haptic Transposition*

Just as in the transposition of haptic impressions of objects the process is directed towards the form or, more accurately, towards the structure, so the transposition of visual impressions is in the first instance related to the object-character. In the field of Haptics, therefore, there is a tendency towards replacing the *haptic form* by the *visual* one; in the visual sphere we meet the tendency towards replacing or supplementing the visual *perception of material* by primary tactile images. The emergence of tactile images can best be observed in the visual perception of the surface-structure of massive objects and of the degree of consistency of soft materials (cotton-wool, soap, flour). It is well known that one is inclined to touch objects—for example, sculptures, vases, small objects of art—when they are made out of a precious material or out of one which has a pleasant feel. When one sees these objects again, tactile images emerge spontaneously, which are in the first place related to the structure of the material and to the tactile kinæsthetic impressions. The extent to which the reproduction of haptomorphic forms is de-

pendent on the structure of the material is shown by the fact that tactile memories emerge strongly in the case of bronze figures, only rarely in the case of glazed ceramic products, hardly ever in the case of unglazed terracotta figures, and even less in the case of plaster casts. In the case of glasses, their not very pleasant thermal qualities seem to work in a direction unfavourable to haptic transposition.

As long as one relies on laboratory experiments and observations one will be inclined to under-rate the importance of haptic transposition. As soon, however, as one remembers what an important part our haptic impressions play in our everyday life, and how essential it often is to check the sense of vision by means of the sense of touch, one has to recognise the great importance of the haptic images which constantly accompany our visual experiences.

A further difference between Optics and Haptics lies in the fact that, while in the sphere of vision haptic images emerge merely by reason of a mode of seeing akin to touching (" haptic seeing "), in the field of Haptics such a relation between the tactile function and visualisation cannot be demonstrated.[1] This explains why one speaks of " haptic seeing ", not, however, of " visual touching ". As mentioned above, it is due to the higher stage of development of the sense of vision that it has certain functions in common with the sense of touch, but not vice versa.

(d) *Visualisation in the Blind*

All that I have said here about visualisation applies primarily, of course, to us as sighted and also, though with certain reservations, to those who have lost their sight at a late age. We know well enough from the literature on the psychology of the blind that in this particular group of the blind there is a very marked tendency towards visualising the contents of their tactile perceptions. It is true that in the course of time visualisation is more and more

[1] There are cases in which our eye behaves similarly to our tactile organs. It glides successively over the objects, checks the structure of the surface, follows the minutest unevenness, and even compares the dimensions " metrically." In such cases seeing is in a way similar to the tactile function in not aiming at the apprehension of form, but at the recognition of material, substance, and size. As the organ of vision here seems, as it were, to imitate the mechanism of the sense of touch, we are justified in calling tha mode of seeing " haptic seeing ". Authors who proclaim the primacy of the tactile function or who, like Hildebrand the sculptor, trace back the seeing of form, and all our experiences of plastic form, to tactile examination by means of the hand or the eye, have been influenced by that mode of seeing. We shall deal in further detail with this problem later.

relegated to the background, but it never disappears completely. A considerable number of blind people have said that they are still able to recollect their old memories visually long after becoming blind. The descriptions they have given of their experiences when they were still able to see, and the literary works of authors who lost their sight at a later age (characterised as they are by surprisingly numerous visual images and descriptions of nature) and lastly the works of blind sculptors belonging to that category have convinced me that although genuinely visual concepts are exceptional, *tactile experiences permeated with visual experiences* remain operative for a very long time after the disappearance of the sense of vision.

I want to emphasise these last spatial experiences. They do not belong to the true visualised haptic impressions but are nevertheless determined by visual experiences. These haptic experiences of form come into being through the co-operation of vision. Such haptic impressions of form play a considerable part in blind sculpture, a fact which I shall discuss in detail in the part of this work devoted to the problems of æsthetics.

It would, however, be wrong to assume that these visualised tactile perceptions occur only in those who have become blind at a later age. In the sighted the majority of their haptic perceptions have come into being and developed under the influence and with the constant co-operation of the sense of vision. When we touch some common object, the tactile impression is always permeated with visual experiences. It is true that it is not easy to demonstrate the visual components in the phenomenal impression of the object; but there are experimental conditions under which it is possible to demonstrate the visual elements operative in the process of haptic perception.

I was very interested to find that even such blind persons as were unwilling to admit the occurrence of visual transposition were able to convince themselves after a few tactile experiments of the error of their view. Others who did not attribute any importance to their remote and incomplete visual memories had to admit that the manifest contents of their dreams were of an essentially visual nature. It is very difficult to say how far that is correct; but there can be no doubt that visualisation plays a more important part than is generally assumed in those who lose their sight at a later age. I was also able to show that many blind

persons of intellectual high standing, university teachers, artists, school teachers, and clerks, cling to their old visual experiences for a long time, and retain their ability to visualise for a comparatively lengthy period by means of constantly and actively making use of visual transposition.[1]

Lastly, I want to make an assertion which will appear rather strange at first sight, that even those born blind are not able to free themselves completely from the world of the forms of sight in their apprehension of form. Nothing is easier than to prove the correctness of such an assertion.

Blind persons live in a world of seeing people. They are surrounded by things, objects, and tools which have been created and are used by seeing people. They are taught about things to which only the sighted have access (landscape, paintings) and are introduced to subjects (botany, the history of art, etc.) that are vital realities only to those who have sight. Their attention is drawn to spatial relationships which are in complete contradiction to their own experiences and their own haptic-spatial imagining, as, for example, the facts of perspective. Even the objects of art and the products of industry with which they come into contact have all been shaped according to visual principles, and are expressed in terms which make sense only for the sighted. Through becoming conversant with objects formed according to geometrical and optical laws, through the intellectual mastery of these laws, and through the constant contact with seeing people and with their visually orientated interests (literature, arts, sports), those who are born blind develop a world of form intimately bound up with that of the sighted. Although from a phenomenological point of view the world of form of the blind differs from that of sighted people, the two worlds are nevertheless structurally congruent. As the structure of things is intimately related to the creation of form and constitutes its objective basis, the form known to the blind cannot possibly remain independent of the world of forms of the sighted.

[1] One must, however, be warned against taking such statements of the blind too literally. Mostly it is not a question of visual memories but of communications fixed in certain terms and frequently repeated, so that it is often impossible to ascertain whether they are originally their own or are taken over from others.

VIII

HAPTICS AND BLINDNESS

FUNDAMENTALLY it should not be necessary to deal in a special chapter with the relations of Haptics to the psychology of the blind. Our detailed discussions on space, the object, and form in the field of Haptics should convey a picture of *the nature and the character* of the spatial and bodily world of the blind. If I nevertheless decide to deal again with the world of the blind, I do so once more with the aim of recapitulating everything I have mentioned on that subject and to add some general considerations.

It needs no argument that the description of the spatial images of those born blind must be undertaken independently of that of sighted people. The spatial image of the former differs from the haptic spatial image of the sighted in the first instance in the total lack of visual experiences and images. It represents the so-called haptic space and the haptomorphic spatial forms in their original character.

Even the world of those who lose their sight at a later age is so deeply influenced by visual memories and is so much permeated with visualised images that it must be dealt with apart from the world of objects of those who are born blind. Although, as we have seen, the haptic space of the sighted and those who lose their sight at a later age corresponds in many respects with that of the born blind, it cannot serve as a model for the purely haptic space, the specific space of the blind.

In discussing the spatial consciousness of those born blind we have to start from so-called empty space. The impression of space in the resting condition in those blind from birth does not differ from that in seeing persons and in such as lose their sight at a later age, except for the fact that the intrinsic quality of that space does not show any visual form. Most of those examined by us who were blind from birth became perturbed when they were asked about the formal character of that space. Usually the space which surrounds one's own body, and is therefore intimately

connected with the person, is termed " near space ". It represents a system of correlates in the centre of which the ego, the psycho-physiological person, is situated. This " near-space " extends—occasionally to infinity—as soon as a blind man begins to move. The empty static space develops into the " space of action ", which gains in content and importance especially through the feeling of freedom of motion. In spite of the fact that it extends beyond the near-space, the space of action is not yet experienced as distant space. According to the consistent statements of many blind persons, kinæsthetic impressions and the idea of freedom of motion are not sufficient to create a distant space. It is only the occurrence of an actually non-spatial, but spatially localised sensory impression (*e.g.*, an acoustic stimulus originating at a greater distance from the blind observer) that converts the near-space into a distant one. The blind person feels his vital sphere suddenly extend beyond the boundaries of the near-space, and space becomes determined in respect of direction and relation to the external world. By means of localisation the kinæsthetic space becomes endowed with content and the blind observer is on firm ground.

The concrete space of the blind is, however, not yet determined as to direction in an objectless kinæsthetic space. Experiments carried out on blind subjects have made it clear to us that their tactile–kinæsthetic impressions do not provide an adequate basis for creating a concrete spatial image. It is only when the blind subject comes into direct contact with the world of objects and apprehends objects by tactile examination, that the concrete haptic space becomes manifest. This space is very limited, however. As for the possibility of perception, it includes merely that part of the space which is open to tactile examination, and the perception it encloses does not extend beyond the haptic perceptions of objects which are given at a particular moment or which have only just been formed. The blind man cannot be content with such a limitation; and he is therefore constantly aiming at extending his world of objects in one way or another. That is achieved partly through abstract additions to the perceived image, partly through making use of cognitive data and taking them into consideration. The latter plays a special part in establishing the world of space and objects.

That the spatial concepts of the blind, enriched as they are by

haptic images and cognitive contents, are totally different from our visual space, has been fully discussed. The very fact that space as perceived by the blind completely lacks perspective, renders any approximation to our spatial concept most problematic. A blind person is totally unable to gain any vivid notion of perspective. Neither what he may be told about the experience of perspective by the sighted nor an explanation of the laws of drawing in perspective can make an image in perspective clear to a blind person. It would even be possible to represent the gradations which come about through perspective in space, in just the opposite way to someone born blind. He would find so-called inverse perspective, in which the objects at the back appear larger than those in front, just as natural as the right one, and would thereby get an idea of the world of sight which would conform to representations in many miniatures and paintings of the fourteenth and fifteenth centuries, where the main figures in the background are depicted as larger, the secondary figures in the foreground as smaller, in contradiction to normal perspective.

The concepts of objects situated side by side or one behind another have a quite different phenomenal content and a different significance in the space of those born blind from the visual sphere. Objects perceived by touch are in the first instance brought into relation to the subject and not to each other. Objects situated side by side or one behind the other form an image group which is poorly, if at all, integrated; they carry on their individual existences and play hardly any part in the constructive build-up of the concrete space. The difficulty of uniting the haptically perceived objects into a homogeneous spatial structure is further increased by the lack of a background. The part played by the formative function of the background and the importance of a plane of projection to give the objects contour and sharpness are never more marked than in comparing visual and haptic group-formation. Phenomenal space cannot become active in objects which are perceived in isolation. It is only through its structure, clarity, and variety that space has life and motion. The perceiving eye always apprehends space and the objects that fill it as an integral system. That system is never dissolved, its basic structure is never abolished. The fundamental laws of our apprehension of visual and æsthetic space see to it that this is so. It is quite possible that in this system individual structures

occasionally stand out by virtue of colour, special proportions, marked contrast, or deviation from symmetry, and command an outstanding position in phenomenal space, but they are not able to abolish the architectonic basis of the spatial object or the dependence of the object's appearance on the surroundings.

Things are quite different in the space of the blind, to which the objects give neither life nor tension nor motion. It is the *statics of objects* that governs the haptic space. The objects do not alter their phenomenal appearance. The tactile impression always remains the same, in whatever way one may touch the objects. There is nothing analogous in the field of Haptics to the position of the observer, the change of light and shade, and the change of distance in the visual sphere. The lack in vividness and diversity becomes especially marked through the fact that impressions of movement, which make the spatial image emerge from its static condition, do not occur in the purely haptic world. Acoustic impressions and movements do not enable the blind person to experience that perceptive effect of movement, which by means of the movements of objects of the ambient world (a man, an animal, vehicles, clouds) fills the visual image of space with life and endows the whole with a character incomparable to that of any other sensory space.

The blind man is not less handicapped in comparison with the seeing individual in the perception and observation of nature. Leaving out all that we owe to our sense of vision, such as colour, light, shade, diversity of form, perspective, atmosphere, and vista, our perception of Nature shrinks to a miserable residue. What remains of the beauty of a flower if one is not able to perceive anything but scent and material? And what can beautiful mountain scenery or a picturesque town mean to a person who is unable to perceive colours, formal unities, and vistas?

And, last but not least, what is the position as regards the fine arts? To judge from the limited perceptive capacity and apprehension of form by the blind, one might deduce that they are completely unable to apprehend forms of the plastic art as such or to appreciate their æsthetic value. It is really most unlikely that an attempt to include the tactile elements in a haptic whole or to unite these impressions with cognitive elements would lead to satisfactory results. On the other hand, it is an established fact that, apart from those who lose their sight at a later age,

people born blind occasionally start to model out of a spontaneous urge and create works which are not completely devoid of features of artistic expression.

The question of how the very limited æsthetic function of the haptic sense can be reconciled with these facts presents a special problem in the psychology of the blind. That, however, is a task which can only be mastered after a deeper insight into the æsthetic attitude of the blind. It is nevertheless a fact that up to now this whole chapter in the psychology of the blind, *i.e.*, both the æsthetic attitude towards plastic works of art and the plastic productions of those born blind and of those who have lost their sight later, has been sadly neglected. Part II of this work is meant to close that gap in psychological literature. We want to attempt the discussion of that complex of problems, which is equally important from the point of view of the history of art and from the psychological point of view, on the basis of extensive material which I have mainly collected myself and supplemented with experimental observations.

PART II

THE ÆSTHETICS OF FORM
AND
THE ART OF THE BLIND

A. THE ÆSTHETIC EXPERIENCE IN HAPTICS

I

INTRODUCTION

It is an old and ever-recurring question, although an unsolved one, whether the blind go through any æsthetic experience when touching plastic works, and if so, of what kind these experiences are and whether they conform to those of sighted people.

Psychologists dealing with blind people and teachers of the blind are on the whole inclined to assert that the blind possess the ability to enjoy plastic works æsthetically and to judge their value. Others again deny the blind any ability without, however, adducing sufficient grounds for such a statement.

The authors who explicitly assert the existence of æsthetic experiences connected with the haptic perception of plastic works base their assertions on various grounds. The obvious thing to do seems to make the solution of that problem depend on the statements made by the blind themselves. Those statements are contradictory, however, although the majority of the blind claim such æsthetic experiences. Statements which have to be looked upon as an inevitable result of tuition received by the blind from the sighted possess not the slightest evidential value without an accurate analysis and examination of the alleged æsthetic experience and the æsthetic attitude of the blind.

How cautious one has to be when judging statements made by the blind is shown by a case observed by me, in which the man asserted that he experienced æsthetic pleasure, at the same time expressing his displeasure with a bust of a beautiful youth, because the basis of perception, here primarily the brittleness and roughness of the material, did not appeal to his purely sensory feelings.

The fantastic statements made by the deaf and blind Helen Keller seem to have exerted a considerable influence on the views of the

psychologists of the blind.[1] It is self-evident that what Helen Keller reports about her experiences when touching works of Greek sculpture was not determined by æsthetic experience, but merely by knowledge and emotional motives. She says among other things:

" Museums and art stores are also sources of pleasure and inspiration. Doubtless it will seem strange to many that the hand unaided by sight can feel action, sentiment, and beauty in the cold marble; and yet it is true that I derive genuine pleasure from touching great works of art. As my finger-tips trace line and curve, they discover the thought and emotion which the artist has portrayed. I can feel in the faces of gods and heroes hate, courage, and love, just as I can detect them in living faces I am permitted to touch.

" A medallion of Homer," she goes on, " hangs on the wall of my study, conveniently low, so that I can easily reach it and touch the beautiful, sad face with loving reverence. How well I know each line in that majestic brow—tracks of life and bitter evidences of struggle and sorrow; those sightless (!) eyes seeking, even in the cold plaster, for the light and the blue skies of his beloved Hellas, but seeking in vain; that beautiful mouth, firm and true and tender. It is the face of a poet, and of a man acquainted with sorrow. Ah, how well I understand his deprivation—the perpetual night in which he dwelt.

" I sometimes wonder if the hand is not more sensitive to the beauties of sculpture than the eye. I should think the wonderful rhythmical flow of lines and curves could be more subtly felt than seen. Be this as it may, I know that I can feel the heart-throbs of the ancient Greeks in their marble gods and goddesses."

Nothing could be more evident than that this intelligent and gifted woman was perceiving the blind eyes of Homer not with her touching hand but with her " seeing " mind.

The statements made by the deaf-blind Laura Bridgman must be interpreted very similarly to those of Helen Keller.

From these examples it becomes clear how essential it is to find out by what means the blind reach their æsthetic judgments and by what factors they are guided. One has to ascertain whether in their case the effects produced by plastic works belong to the æsthetic sphere or not. If that question is answered in the

[1] Helen Keller, *The Story of My Life*, London, 1903 (Stuttgart, 1907).

affirmative we have to examine what, within that sphere, has to be attributed to the effect of sensory pleasure and to all other factors outside æsthetics and what to the genuine artistic experience.

Apart from the statements made by the blind, which originate in a world alien and hardly intelligible to us, other facts which seem to prove that the æsthetic experience results from the tactile apprehension of plastic works are alleged to exist. These are, first, the plastic achievements of blind pupils and, secondly, the creations of blind sculptors.

The plastic achievements of blind children and adolescents which are so often adduced as irrefutable evidence of the ability of the sense of touch to mediate æsthetic values (without taking into consideration the degree of blindness or the period in life at which the loss of sight took place) can be judged in various ways, according to the standards one applies to young workers. Leaving out of consideration the blindness of these children, and judging the achievements on their intrinsic merits alone, one cannot attribute any æsthetic and artistic value to these productions. These plastic works are by no means concerned with the corporeal representation of artistic ideas, and not even with the artistic reproduction of models comprehended as wholes. They rather give the impression of very clumsy attempts at modelling made by sculpturally untalented but sighted children. On the other hand, if one starts from the biased assumption that the beauties of sculpture should be open to the blind in a way similar to the way we apprehend it, one is inclined to attribute deficiencies to technical clumsiness, but that creates a problem in the psychology of the blind which really does not exist. The same happens when one is misled by the very fact that one is dealing with a child, and sees in the first compositional attempts of a musically gifted child the infallible signs of an original creative talent.[1]

The importance of prejudice becomes even more marked in the appreciation of the productive activity of blind sculptors. If the haptic sense engenders pleasure in plastic works when all visual perception is excluded, the creations of blind sculptors, so long as they are not merely copies of existing pieces, should provide irrefutable evidence of such an assumption. The opposite view, according to which the blind are basically unable to experience

[1] G. Révész, *The Psychology of a Musical Prodigy*, London, 1925.

æsthetic effects in plastic works of art, would be contradicted by the fact that blind persons who create plastic works of æsthetic value ought to exist. This contradiction must either be removed or one of the two opposite views has to be given up. The fact that such cases occur but rarely does not relieve us of the obligation to examine such achievements very accurately. The very exceptional cases impose on us the duty of investigating whether the creations of the blind possess any artistic value apart from their technical qualities. This again leads to further questions which would be of very great and decisive importance for the whole Haptics of form—namely, whether it makes any difference when the sculptural activity starts—*before* or *after* loss of sight. That is, the question whether we are dealing with sculptors born blind or such as lost their sight at a later age. A further problem is whether the achievements of blind sculptors are determined by autonomous haptic principles or whether they correspond to our own æsthetic norms. Finally, we want to know whether sculptural production is really so closely connected with the ability to experience æsthetic pleasure as is generally assumed.

In dealing with this problem it appeared to me important in the first place to subject the haptic-æsthetic process in general to a close scrutiny before proceeding to the question of the æsthetic appreciation of sculptural works by means of the sense of touch. I then analyse the total haptic image—an analysis which leads me to a discussion of the haptic perception of the physiognomy of man, and of the question of the æsthetic approach to simple spatial forms. After that I deal with the theoretical problem of whether and to what extent a theory of so-called æsthetics of touch—*i.e.*, æsthetics based purely on haptic impressions, is justified. These investigations refer both to blind persons and to sighted persons engaged in haptic perception. Finally, I discuss in detail the problem of the creative activity of blind sculptors and suggest a solution of that problem.

II

THE ÆSTHETIC PROCESS IN HAPTIC PERCEPTION

1. Fundamental Difficulties of the Æsthetic Process in Haptic Perception

There are three relevant arguments on which the supporters of "Tactile Æsthetics" can base their claims: the statements of the blind about their experiences when subjecting plastic works to touch, the modelling achievements of children and young persons born blind or deprived of sight later, and, lastly, the remarkable creations of blind sculptors. This catalogue is meant to supply the outlines for a critical and systematic discussion of the æsthetic element in Haptics.

There are two ways of examining the first argument. The first consists of asking the blind or the sighted about their intentions when engaged in the process of haptic perception, and receiving information from them about the criteria of these æsthetic judgments.

This method is, however, open to objection; for we may by our very questions and by the situation they create suggest to the subjects an attitude which determines their answers from the very start and renders them completely invalid. We do not want to reject completely the type of experiment associated with interrogation; but we want to make use of it only after first getting a clear idea of how such statements have been produced. A critical attitude to such statements may be developed by choosing the alternative way, by ascertaining what consequences for the æsthetic approach result *a priori* from the very nature of the haptic process of perception.

Our knowledge and our experience of the haptic perception of form make it clear to us that the haptic process of perception is not fit to fulfil the conditions for an æsthetic approach.

As we have already seen, the whole situation in the haptic perception of objects is governed by pure apprehension of objects as

such, and only in exceptional cases, especially in the process of interrogation, does the subject go beyond the purely tangible content of the object. We have further learnt how limited is the ability of the blind to apprehend spatial forms as a whole and how difficult they find it to proceed from one detail to another, to neglect one part here and to emphasise another part there, and to create connections between individual contents which go far beyond the immediate content of the given object. Their apprehension and recognition are almost entirely governed by the search after landmarks and by the interpretation of the content of their perceptions. In this the blind completely lack that degree of spontaneous intuition which, according to Kant, forms the basis of all æsthetic experience.[1] It is of course not possible to deny them the possibility of sensory intuition altogether, for the function of touch leads just as directly to intuitive apprehension as the visual or acoustic function. But the content of that tactile intuition is not sufficient to apprehend an object of art æsthetically and to realise in it the artist's intention and, as it were, to recreate it. In those who are born blind or have lost their sight at an early age the difficulty is connected with the successive apprehension of the parts, by which the unitary development of intuitive apprehension is impaired; while in those who lose their sight at a later age the inadequate transformation of haptic impressions into visual ones has an inhibiting effect. The visual imagination which arises out of successive transformation lacks the spontaneity of the intuition which is required for æsthetic pleasure.

Our experiments show that the blind are unable to apprehend objects, and therefore works of art also, as individual entities. The individuality of a work of art does not become manifest in the recognition of the separate proportions, but in the perception of the total work, whose form is determined by its parts, and in the accentuation of certain parts as determined by the whole. The cognitive character of the haptic process of apprehension, its basic tendency to create schemata and types—all this prevents the coming into being of an individualised impression. The cognitive tendency stresses details which may be of importance as cognitive criteria but hinder the integrative apprehension of the work of art.

It need not be emphasised that in a perception in which the

[1] Kant, *Kritik der Urteilskraft*, 1790.

principles of structural analysis and constructive composition play a greater part than synthesis there is little room for æsthetic apprehension. The same applies to the experiences of symmetry and proportion which are of such great importance in æsthetics, for they are of only secondary importance in haptic perception.

Our experience of many blind people has been that the unified and spontaneous apprehension of form—that basic condition of all æsthetics—is limited in the field of Haptics to the most simple structures and part-structures; and this certainly suggests that the *æsthetic function of the haptic sense is very restricted.* It is impossible to build up a work of art out of partial perceptions intuitively. The development of form, similarity, and contrast, the principles of higher and lower levels of order, the character and the individuality of the matter represented can only be expressed in the work of art as a whole. The same applies to the laws governing form and to deviations from the norm; these, too, can only become manifest in a unified perceptual image.

The haptically perceiving person is incapable of experiencing the formal wealth of objects for the very reason that in the haptic field the position of the observer is practically invariable, as opposed to that of the visual observer. The manifold views which a statue conveys to us according to whether we observe it from the front, the back, the side, or with some perspective foreshortening, must all necessarily be ruled out in the process of haptic perception.

The nature of haptic perception has the further result that only the surface, the external aspect of the plastic work, and not the forces operative from within are actually perceived. In touching a bust we therefore never experience these inner tensions, the resultant of which is the living outer form.[1] What we experience in Haptics are at the best the sensory experiences of form, but not the all-embracing formation of the artistic idea.

Haptics is realistic. The intention of haptic perception is directed towards the material content and not towards the ideal

[1] " Quand tu sculpteras désormais, ne vois jamais les formes en étendue, mais toujours en profondeur. Ne considère jamais une surface que comme l'éxtremité d'un volume, comme la pointe plus ou moins large qu'il dirige vers toi. . . . Au lieu d'imaginer les différentes parties du corps comme des surfaces plus ou moins planes, je me les représentai comme les saillies des volumes intérieurs. Je m'enforçai de faire sentir dans chaque renflement du torse ou des membres l'affleurement d'un muscle ou d'un os qui se développait en profondeur sous la peau." (A. Rodin, *L'Art*, Paris, 1911, pp. 64–65.)

form. That is why the haptically perceiving subject cannot free himself from the immediate reality; it is difficult for him to find the way leading from the sensory-realistic to the ideal-æsthetic sphere. That explains why haptically a bust is usually only felt to be the copy of a concrete head. Even idealised heads are interpreted realistically as portraits of persons.

Haptics lacks further in what we may call the " supplementary function ", without which plastic and architectonic works cannot be apprehended as structured and organised entities. The haptic function completely lacks the possibility of concrete or ideal completion, *i.e.*, of adding the parts which have not been actually apprehended by touch, although they are actually present, or of filling in gaps. For the haptic sense is a perceptive instrument which is bound to material and entirely determined by it. What is not concretely given and what is not touched does not constitute any part of the total impression. A gap remains a gap, a torso is bound to remain a fragment, which does not allow of any æsthetic apprehension. It is in vain that we try to provide the missing part; we do not succeed.

It has become clear that the haptic perception of objects lacks the conditions required for an æsthetic appreciation. The principles which govern pictorial art in general, and especially sculpture, are not operative in the field of Haptics at all, or they operate only indirectly, by means of their conscious application. The spontaneous and largely unconscious æsthetic attitude which we adopt towards the visual world does not exist in the world of Haptics. If even the unitary apprehension of form requires a special intention and laborious activity, activity of the whole mind will be demanded to a far greater degree when it is a matter of judging the æsthetic value of objects. Every blind person feels that such an appreciation transcends his competence. As a way out of this predicament he looks out for data which he believes to be a second best approach to æsthetic criteria. We shall now see that such a conscious intellectual activity cannot possibly lead to satisfactory results.

2. Perception and Aesthetic Appreciation of Plastic Works by the Haptic Sense

After these general observations on the relationship between the haptic process of perception and æsthetic experience, we must

deal with the special problem of the haptic perception of plastic works, in the first place from the point of view of general principles.

Simple geometrical figures may be apprehended integrally by way of the sense of touch. That, however, does not imply that plastic ornaments in geometrical style are perceived haptically in a manner similar to visual perception. This has to be stressed the more because the view has been propounded that ornament-art—that earliest manifestation of artistic endeavour—was originally a kind of " haptic " art. If we start from the nature of the haptic process, there is nothing easier than to disprove such a view as lacking all empirical foundation. Let us first realise that the hand has, for a start, to examine every part of the ornament haptically in order to obtain in some degree a clear impression of it. Even if the same geometrical pattern or the same figure, *e.g.*, crosses, spirals, or plant motifs, is repeated over and over again in a horizontal sequence of ornament, the tactile organ still has to grasp and touch the single motifs in succession one after the other, in order to get the impression of a continuous ornament of a particular kind. Unless one does that, one only perceives periodically recurring reliefs with a most vague structure.

Whenever we look at or touch a continuous ornament we experience visually as well as haptically the equality of the parts and the periodicity of their recurrence. In the visual sphere there is added to these successive perceptions the simultaneity and the persistence of the total impression—that is, the constant and essentially invariable perception of the ornament as an entity in which the rhythmically structured parts become fused into an integral system. By contrast, the content of our spontaneous perception in the field of Haptics is always restricted to one element or at the best to a few elements of the sequence. The remaining elements either persist as memory-images endowed with the character of actual presence or arise as anticipatory images. It is true that when our tactile organ moves quickly across the object we may gain the impression of a " whole ", but, as mentioned above, that entails the loss of fusion, of schematisation and of the coalescence of the independent elements. These difficulties become more marked when the independent parts of the ornament increase in number. When the pattern does not consist of one recurrent figure, but of several periodically recurring ornaments, like $a, b, c, a, b, c,$ or $a, b, c, c, b, a,$ or in antithetical groups, full

haptic comprehension of formal patterns becomes less and less possible.

If even the ornamental filling up of one ribbon-shaped oblong surface confronts haptic perception with great difficulties, it is understandable that a ribbon or serial decoration with several ornaments arranged one above the other cannot possibly be apprehended by haptic means. Take, for example, rows of ornaments consisting of angular patterns, star-shaped figures, triangles, systems of meandering lines, rosettes, such as may be found from the neolithic age through the Greek art up to our age. It is obvious, and does not require any experimental confirmation, that such an ornamental system owes its great æsthetic effect to the very homogeneity and simultaneity of apprehension, and is therefore impervious to haptic perception. The haptic impression of such an ornamental design may perhaps best be compared with a polyphonic piece of music, of which we always hear but *one part*, the melodic relations of one part only, whilst the other parts, and therefore the polyphony, disappear completely. That applies in an even higher degree to surfaces which are covered by a network of geometrical motifs or floral designs, where the continuous and recurring motifs interlace and coalesce, as in ornaments of decorative sculpture in the Roman period. As the effect of the decorative ornament presupposes the perception of a integrated entity, we are justified in saying *that ornamental designs on a flat surface are not accessible to the haptic sense*, and are therefore unable to arouse any æsthetic effect on haptic lines.

The various observations made by myself and my collaborators on decorative design make it clear beyond any doubt that the above view tallies with experience.

If no æsthetic function can be attributed to the haptic sense in that field, that holds all the more when it comes to representations of human or animal figures.

It is true that we are well able to distinguish haptically between different human or animal sculptural forms; for there are many contributory plastic features which determine the haptic impression, and which may be used as differentiating criteria. It is, however, not so much the perception of differences that is relevant, but the comprehension of total forms, which are not only determined by the tectonic structure—the recognition of which presupposes the apprehension of a unified image anyway—but also

by the ideal life of the creature represented, as expressed in the work of art. The image transcends the sphere of physical reality, it aims at expressing the ideal side, the character and the atmosphere of the subject represented. The pictorial representation of that vital connection accounts for the relaxation of geometrical strictness, the deviation from abstract constructive principles and static laws, and arouses those subtle vibrations which create the impression of organic life in the rigid object. This inner life, these tensions and forces acting in all directions become expressed in the shape and attitude of the body and most of all in the facial expression and features. Our tactile and kinæsthetic organs are, however, unable to convey to us those very forms of expression. Only strongly accentuated bodily attitudes or facial features very clearly marked plastically might convey some information about the essential sense intended by the artist. To how limited an extent, however, even those criteria actually do characterise the image, may be seen from the fact that young blind persons who model are unable to recognise their own plastic works after a comparatively short time.

On the ground of all these facts we must expect the blind to be able to perceive sculptures representing human beings only in a schematic manner and omitting the individual features. Blind persons will therefore presumably be unable to distinguish limestone figures of the tertiary period and certain creations of primitive Negro-art from some portraits produced by modern artists as far as style and mode of expression are concerned, unless they are guided in the process of perceiving and appreciating these plastic works by the quality of the material and the technical execution. The specific and individual quality of those sculptures, that which constitutes the essence of artistic representation, those plastic works in which every period and every nation, every creator and every observer cast their thoughts and their feelings and to which the work of art owes its existence—all these lie completely outside the range of haptic comprehension.

After these fundamental arguments nobody will presumably wish to deny that it is impossible to distinguish haptically the expressive artistic value of plastic representations of human heads which are similar as regards total form, but totally different as regards style, and which almost belong to another world. This, however, means that we have to deny absolutely the ability

of the blind to enjoy plastic works æsthetically. We want now to support that view by statements made by persons born blind or by others who have lost their sight at an early or later age.

3. Haptic Æsthetic Experiments with Blind Subjects

(a) *Sculpture*

I presented a man, fairly well educated, but born blind, with the beautiful head of the young Nero (Fig. 37).

He began to examine the bust and said: "Ears—a face—eyes closed—nose—mouth closed." The recognition of the separate parts of the face gave him pleasure. He then went on: "Old face, full of wrinkles; it must be an old man." (He had interpreted the strands of hair extending over the forehead as wrinkles.) Asked how old the original might have been, he answered: "Judging from the wrinkles on the forehead I should say that he is about sixty years old. He looks rather like a man who once worked with me at the Institute for the Blind." Asked whether he found the face beautiful or ugly, he said: "Not beautiful, for the form is too rough and the face is not oval". When I had explained to him that the bust represented a child of about six to seven years, he suddenly found the face beautiful, "as the round face might well fit a child, but not a grown-up man". And he added: "I am thinking of a laughing child, with his mouth somewhat open, just as a boy should be."

Fig. 34.—Head of the Young Nero.

The reactions and the statements of this blind man are instructive in many ways. First of all we meet with the successive process of recognition and the method associated with it, and with the general cognitive tendency. It is further characteristic that during the whole process of recognition the blind man did not touch the bust in a global (synthetic) way, in spite of repeated and accurate examination of some parts of the face, and he was therefore unable to gain a total impression. That led to his

interpreting the bust by a single criterion (a fringe of hair wrongly taken to be wrinkles). The question as to the æsthetic content of the experience was also answered in accord to our views, for it became quite clear that the judgment " beautiful " or " not beautiful " was not determined by the total form or the harmonious proportion of the parts, by intuition, but by *extra-æsthetic motives*, by knowledge. The very fact that the blind man could reach diametrically opposite judgments, according to whether he interpreted the bust as that of a child or of an old man, is evidence of the intellectualisation of the process.

Broadly the same results were gained in an experiment with the portrait-head of a Greek woman.

FIG. 35.—Head of a Greek Woman.

On account of the hair knot the work was quickly identified as that of a woman. It is true that in this case the blind subject tried to get a preliminary total impression of the object by means of global tactile examination, but he did not succeed. In this case, too, the details were examined very accurately; in the first place the forehead and the mouth (which was thought to be drooping) were observed. This blind man believed that the head represented an old lady though not a very old one, for the forehead did not show any wrinkles. The damaged nose was first left out of consideration. It was only when I drew his attention to it that it struck him. It appeared to him to be too broad. The shape of the face impressed him as " beautiful ".

A very instructive experiment was carried out on two busts representing one and the same negro. The likeness of the two portraits was evident, but one was artistically and technically on a higher level than the other. Our blind subject said that sculpture A was a woman because the nipples were slightly more marked and sculpture B was the portrait of a man. In A the subject was especially struck by the thick lower lip, the protruding cheekbones, the short nose, and the strongly developed shoulders. On the ground of these " anomalies " he found the face ugly, even

repulsive. He was, however, much more satisfied with bust B. He was especially favourably impressed by the tangible and sharply defined details (*i.e.*, by features of technique and material), to which the pleasurable effects connected with the haptic examination of works of art may in most cases be traced.

The bust of a Roman statesman was examined by a person of about forty-five years of age, born blind.

A. B.

FIG. 36.—Torso of a Negro, by Two Sculptors.

This observer also did not feel the slightest urge to apprehend the bust globally, for he used both hands only at the start, to find out what he was dealing with. As always, special attention was devoted to the forehead, partly because one is used to judging age by the presence and depth of the frontal wrinkles, and partly because the " beauty " of the face seems to depend on the plastic development of the forehead. A high forehead is looked upon as the main criterion of " beauty ", whilst a low one suggests the opposite. In spite of the wrinkles the age of the person represented was assessed as not more than forty, since in the face " everything else is smooth ". " The wrinkles ", as the blind subject added, " are not due to age, but to worry." Eventually

the model was judged as being handsome, trustworthy, and merry. The subject had therefore been unable to apprehend the characteristic features of the portrait.

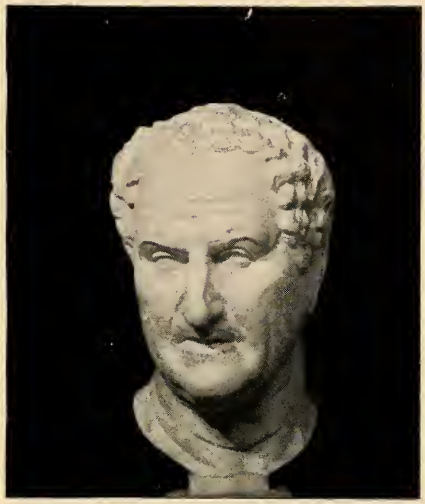


FIG. 37.—Bust of a Roman Statesman.

To what extent the judgment of the blind depends on individual signs and how little they are guided by the haptic total impression said to be obtained—in other words, how fundamentally different are the visual and haptic cognitive processes, which have to precede the æsthetic approach—was nowhere so clearly shown as in the haptic examination of the famous bust of Homer.

After a very superficial global examination with both hands, the blind subject's attention was drawn to the headband. At first he did not know whether the bust represented a man or a woman. "After all, it's a woman", he exclaimed eventually, when he recognised the curly hair. When in the course of his detailed examination of the face he later reached the beard, he started laughing and said: "A woman with a beard?" He was unable to make any statement about the facial expression, since the very features which had to guide him in that respect were covered by the beard. He then returned to the headband, which he ultimately identified as a wreath. "Perhaps Christ with the crown." Asked whether the person appealed to him he answered: "Basing my judgment on the forehead, yes". He did not answer the question about the beauty.

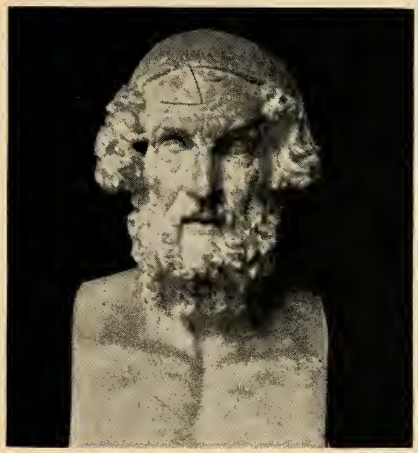


FIG. 38.—Bust of Homer.

How a strange unknown object is gradually recognised through careful interpretation and combination, how incorrect interpretations may slowly be corrected, and what a small part the total image plays in the process of recognition, can very well be demonstrated by an experiment performed with a portrait of a Pharaoh.

As in most cases, the investigation started with a cautious, slow tactile examination of details. There was no global orienting examination. In the first instance the blind subject was taken aback by the strange headcloth, because it concealed the hair-style and the back of the head—two features which deserved special attention. Eventually he thought that the bust represented the portrait of a nun, although the strong shoulders appeared to be too heavy for a nun. The blind subject experienced a new surprise in examining the chin part. After long but unsuccessful tactile examination to and fro he proceeded, for the first time in the course of our experiments (he had already examined five different busts), to synthetic touch, hoping by simultaneous touching of the cheeks and chin to find out about the queer chin part. (One sees that the global tactile examination aims not only at recognition of form but also of objects.) Suddenly he burst out laughing and exclaimed: "After all, there is no such thing as a nun with a pointed beard!" He then returned to the head-cloth, trying to interpret it in another way. But all in vain. "No, I am at my wits' end," he said quite unhappily. His ultimate verdict on the smooth cheeks was: "Bust of a young man of about twenty to twenty-five years."

Fig. 39.—Bust of a Pharaoh.

Asked what impression the face made on him, the subject answered: "Certainly not a pleasant one. The drooping lips are ugly, and the forehead, too, is not beautiful; it is much too low. He seems to have been an unpleasant man, a really stupid person." This judgment, however, did not satisfy our subject. He was unable to get over the fact that two apparently

important points could not be recognised. He therefore decided to examine the head-cloth accurately once more. It was only in the course of this second investigation that he discovered the bird at the back of the head. "I understand now," he said happily; "it is an old warrior, a halberdier. It must be that; I see it clearly. The bird is perched on his helmet. I find him attractive, warrior-like. The mouth, too, is not as ugly as it appeared to be at first; he must have a stern expression."

In an experiment carried out with another blind person who had to identify a head of Christ the cognitive process took a course similar to the one observed in the appreciation of the Egyptian sculpture.

Fig. 40.—Head of Christ.

At first the subject was unable to decide the sex of the person represented. Later he thought that the sculpture represented an old bearded sailor. But he became confused as soon as he noticed the unwrinkled forehead and the smooth cheeks. "Is the man cheerful?" I asked. "Yes, his mouth is slightly open," he answered, and added, "A laughing face, certainly not an old one, for the cheeks are far too smooth. The forehead is beautiful, certainly more so than in the last model. It reminds me of a doctor I knew, who had a most pleasant face." Asked whether he could imagine the head he had just touched having long hair, he answered briefly, "In that case it is Jesus!" Further conversation showed that he identified "beautiful" with "pleasant".

Another blind subject reached a very surprising interpretation when he examined the bust of the beautiful Florentine girl.

Because the girl wears a rather strange hair style, the blind examinee thought he was dealing with a plastic representation of the devil. In the course of further investigation, however, he made incompatible findings, but in view of the queer hair style he was unable to free himself from his original impression.

How little the haptic process of perception and the æsthetic appreciation of works or art depend on the educational level of the blind can be realised from the statement of an especially intelligent and well-read man, who lost his sight at an early age.

This blind man examined the bust of Homer very attentively for a considerable length of time. He found him forceful, vivid, and unusual. He was specially impressed by the contours of the face, by the forehead, and the nose. "The high forehead suggests pride," he remarked. "It must be a 'child of nature' to whom one ought not to come too near." "But I had nevertheless the desire to become better acquainted with him," he added later.

Fig. 41.—Bust of a Florentine Girl.

The subject was very much surprised when he was told that the bust represented Homer.

In examining the bust of the young Nero the subject made use of global investigation for a longer time than most of the other subjects. He judged as follows: "Face of a woman; a stern, quiet face." Only then did he start to examine the details of the bust. On account of the prominent chin, the hair style, etc., the person represented was thought to be about thirty years old. The question whether the face was beautiful was answered in the negative. When asked again, he adhered to his statement that it was a stern, thoughtful face. Later on he found the face somewhat strict, even slightly pathetic, on account of the slightly drooping angles of the mouth. Asked whether he had gained any total impression of the face, he answered: "In examining the details I am always trying to remember the parts I have just touched, but I rarely succeed. So far as I achieve any synthetic conception, it is restricted to a small area."

In the bust of Aphrodite, the blind observer noticed the broken nose at once. From then on he dealt almost exclusively with the nose and the mouth. "I cannot find out what that really means. The head of a man, forceful. The nose is crooked. The whole thing is rather distasteful to me, especially the crooked

nose, but not less the mouth and the protruding lower lip. Really a very unpleasant face."

Nothing can better illustrate the inadequacy of haptic apprehension when faced with incomplete objects. The inability to rise above sober reality and supplement or spiritualise the data of sensory perception is clearly shown in such statements. When at last we explained to the blind observer that the nose of the bust was damaged, the whole scene became suddenly changed, and he was faced with quite another person. " The man represented here has a strong face expressing a forceful mind; he is energetic and active. It is true that I become gradually accustomed to the damaged nose, but I am unable to overcome the feeling it gives me." [1]

(b) *Work in Relief*

It has become clear to us what difficulties face the blind in regard to sculptures in the round—that is, such works of art as may be touched from all sides and present their full stereoplastic reality to the haptic sense. It is obvious that these difficulties become much more marked when the blind are dealing with the haptic apprehension of reliefs. That has to be emphasised, because occasionally the view is expressed that the relief represents the true " haptic " art. Nothing could be less correct: representation in relief is a specifically *visual affair*; it is based on the impression of a distant image. The planes which in a relief create the impression of perspective and which constitute the specific character of relief-art are not always surface layers spatially separated from one another, but frequently " imaginary layers arranged one under the other which in turn become fused to give an appearance of homogeneous masses in depth ".[2] It is therefore only natural that the blind are at a loss when faced with an image in relief and that they do not grasp connections which are obvious visually. They become confused because they are vainly trying to find parts which are non-existent. Further, we meet

[1] We have taken a film of this young man, which shows very instructively the whole process of perception and recognition in the blind. In the first part of the film is seen the spontaneous and uninhibited haptic process in examining a bust in all its details; in the second part we observe the behaviour of the blind subject when he has to make statements on sex, age and expression, beauty, etc. Almost all the principles discussed in the first part of this work, such as the stereoplastic, the kinematic, the metric, and the constructive schematising principles, are most impressively demonstrated in the film.

[2] A. Hildebrand, *Das Problem der Form in der bildenden Kunst*, Strasbourg, 1913, p. 58.

with mistakes in blind observers over the spatial layers, and with mistakes over the arrangement of the planes in regard to the people portrayed. Even when figures in high relief emerge out of the plane in sharp three-dimensionality, the blind observer is unable to orientate himself.

With the help of our imagination we can understand how difficult it must be for the blind first to abstract a group of relief figures from out of their context and then to reunite them into a higher form and to integrate them into a sensible whole. How is a blind man expected to distinguish principal and subsidiary figures in a series of portraits which is often not arranged in accordance with any principle at all? How is he to guess, from a situation which he has not really grasped, the development of the scene enacted? How should fantasy and symbolical interpretation come into action when the necessary pre-condition, viz., the perceptual basis, is incomplete, and the possibility of synthetic apprehension limited?

One need try only once to apprehend blindfold the group of figures from a Roman sarcophagus or a Renaissance relief, for example, to realise the insuperable difficulties connected with the haptic perception of a spatial composition with figures. The complete failure of such an attempt is so unequivocal that any further discussion becomes superfluous. The overlapping blots out completely the planes representing the distances. One is at a loss to say where the limbs are stretched out and where they recede towards the background. Perspective foreshortenings and reductions are often not grasped as such; the distinction between the separate figures can sometimes not be realised, on account of the fact that a clear delineation of the planes of perspective can only be realised by visual means. Very often the human or vegetable objects are not recognised; one does not know what is in the foreground and what in the background, and what in the image is meant to represent the near or the far distance. In reliefs which contain a great number of figures one tries in vain to allocate to each head the corresponding limbs; in one case one is confronted with too many heads, in another with too many limbs, and so one is faced with anatomical monsters, like figures with three legs or two heads.

The more the relief differs from sculpture in the round, the less is it open to haptic perception. That is why bas-reliefs, such

as Egyptian temple-walls or Greek sculptured reliefs, confront the blind with insuperable difficulties. High relief (such as that belonging to the Hellenistic period, in which the raised parts become more and more marked and the figures emerge more and more three-dimensionally out of the plane), and also the mediæval and modern sculptures which stand half-way between the fully rounded and relief, provide far more clues for the perception and the psychological elaboration of the haptically apprehended relief.

Experiments which we carried out with subjects born blind and with others who had lost their sight early confirmed our assumption. We presented them with reliefs of human figures, creations of different cultural climates (Roman, mediæval, French, Javanese), and asked them to examine and to describe them. At first the subjects were completely puzzled; they did not know what it was all about. After a while they discovered heads. But as certain heads set in a deeper layer were partly covered by others, the subjects became once more confused. As they wanted to follow up haptically the lines of the body, they found it quite incomprehensible that two or three heads should belong to one body.

My views received an unexpected confirmation through a conversation I had with the blind sculptor Jacob Schmitt. For he pointed out to me that modelling in the round was the only form of art which he, and presumably his blind colleagues also, could possibly achieve. He told me that he had once tried to model a relief, but that the result was most unsatisfactory. I asked him to show me that relief. I was really surprised to see that everything looked exactly as I had assumed a relief done by a totally blind sculptor to be like. The work was a complete failure both from a technical and from an artistic point of view. Schmitt had proceeded rationally by saying to himself that a head or an arm in a relief should " look " such and such. Accordingly one part of the body protrudes out of the background now here, now there, to disappear again later. The whole thing gives more the impression of being a plastic representation of a very queer mountainous country than of a figural group.

Nothing is so revealing as that failure. For, in the first place, the blind subject lacks a faculty to supplement perception; the fundamental pre-requisite for understanding relief and all stereo-perspective images is not met; and he is furthermore unable to perceive, still less execute, the overlappings or the subtle

transitions from one plane to another, activities which are entirely dependent on a visual check.

It may strike some readers that this chapter, notwithstanding its title, deals almost exclusively with the recognition of objects and hardly at all with the æsthetic attitude of the observers. It is, however, characteristic that the blind, irrespective of their educational standing, pay no attention to the æsthetic content of outstanding sculptural creations when they subject them to tactile examination. The blind always adopt the same attitude. They aim at recognising the object, irrespective of whether they are presented with common everyday objects or with works of art.

Once a blind person has recognised the object and ascertained certain details which he considers to be important, his task is completed as far as he is concerned. Unless somebody influences him in that direction, he does not think of judging their æsthetic value. Our experiments show unmistakably that even in a situation like that of the tests, when they knew exactly what was intended, the blind are quite satisfied with the recognition or interpretation of the object and refrain from developing any other attitude.

Such unequivocal behaviour, such a confinement to the recognition of objects, which can be observed over and over again in subjects born blind or in those who have lost their sight later, prove that in the haptic sphere the æsthetic approach does not, as in the visual world, belong to the natural psychological activity. The urge towards æsthetic pleasure and towards delight in æsthetic form, which is so natural to us who can see, is almost completely absent in the sphere of Haptics. That in itself is strong evidence against any possibility of tactile æsthetics.

In conclusion, I would add that I am not alone in asserting that the blind are unable to enjoy spatial forms æsthetically. Apart from all the authors who on principle refuse to attribute to the tactile sphere any perception of form and shape—*e.g.*, Friedmann,[1] according to whom the world of forms is, as it were, a transcedent world to the blind, and v. Senden, who denies the blind even consciousness of space, and therefore all apprehension of spatial forms—there are a number of psychologists of the blind who share my view.

The blind psychologist Steinberg showed that the spatial forms

[1] H. Friedmann, *Die Welt der Formen*, Munich, 1930.

which the blind experience when observing plastic works of art haptically are based on quite insufficient perceptions of the purely spatial correlations.[1] The blind Hitschmann comes to the same conclusion in respect to the æsthetic sense of his fellow-sufferers: "What is the main source of æsthetic pleasure to the seeing—namely, the lifelike representation of expressions of spiritual life by the sculptor—is of no value whatsoever for the blind, as he has obviously never had the opportunity of perceiving haptically the manifold changes brought about by emotions in the human face. Apart from such superficial features as the impression of coldness, hardness, and so on, I have myself when touching statues never experienced any other pleasure beyond the satisfaction of ascertaining that such and such a position of the hand, the foot, etc., was a faithful reproduction of reality so far as I was able to check it; and I would point out that I have made such observations both in good and in poor works of art without any difference whatsoever." [2] Moudrý, too, the blind Moravian modeller, mentions that he is rather bad at modelling human figures, because one has to endow them with individual artistic character, which he is unable to achieve.[3] Leymarie, the biographer of the blind French sculptor Vidal, states after personal experience of Vidal's method of working: "comme il était naturel, son talent diminuait au lieu de se développer, à mesure que s'effaçait en lui souvenir de l'impression que la nature avait faite sur son œil d'artiste; car le tact à lui seul ne saurait donner aucune véritable sensation esthétique". [4]

Lastly, the blind Italian sculptor Masuelli, whose works surpass the creations of other blind sculptors from the artistic point of view, told me expressly that this sense of beauty was not roused by tactile examination of works of art, and that he therefore did not feel any urge to touch them.

4. Haptic Æsthetic Experiments with Sighted Subjects

In this connection we have still to deal with the question of whether and to what extent we meet with different conditions,

[1] W. Steinberg, *Die Raumwahrnehmung der Blinden*, Munich, 1920, p. 146.
[2] F. Hitschmann, "Über die Prinzipien der Blindenpädagogik," *Päd. Mag.*, **69**, 1895.
[3] H. Moudrý, "Wie ich als Blinder Modelleur wurde," *Zt. d. Österr. Blindenwesen*, **1**, 1914, p. 45.
[4] C. Leymarie, *Quelques notes sur Vidal, le sculpteur aveugle.* (Réunion des Soc. d. Beaux-Arts des Départements, Paris, 1893.)

when by means of " transposition " the haptic impressions approach the visual sphere to some degree. This question is actually answered already by the fact that those who have lost their sight at a later stage in life behave in a manner very similar to that observed in those born blind. We want, however, to give further support to our views on the non-existence of tactile æsthetics by showing that the limited character of the haptic æsthetic function finds expression in the sighted, when perceiving haptically, just as in the blind, if they try as hard as possible to visualise their haptic impressions.

We presented an observer with a head of Christ. He examined the bust symmetrically with both hands in a manner similar to that observed in our blind subjects. Similarly he enumerated the parts successively touched: " A man with a beard—the head reminding me of that of Homer—hair—low forehead—oval face. Not young, because the cheeks are sunken—no moustache—normally long nose—the eyes are too close to one another. I cannot understand the hair above the forehead, nor the posterior part of the head. The occipital region may be bald. In that case he must be older, about sixty years old." The bust was characterised as follows: " Serene face; above the cheeks the face appears younger than below. Not a specially striking face. What gives the portrait an individual character are the high cheek-bones, the closeness of the eyes to one another, the sunken cheeks, and the rather long nose. The face cannot be beautiful; rather ugly."

It strikes the impartial observer as strange when well-educated subjects start enumerating in a loud voice like small children, without any attempt to grasp the figure in its entirety: " That is the hair, that is the forehead, the nose, the mouth, the chin, here is a part of the neck: that is a kind of blouse with buttons, how many buttons?—six; but where are the ears? are there ears, or aren't there? "

When asked what the bust might represent, the subject was unable to answer. When, however, he heard that it was a head of Christ, his impression and his judgment changed suddenly—just as with our blind subjects. He investigated the head once more and announced: " Nose very finely cut, eyes closed; if the bust really represents Christ, the open mouth expresses pain. The sunken cheeks render the face ugly, but they are not the sign of advanced age but of suffering."

Another observer was shown the Renaissance bust. She began straight away with partial tactile examination, without having ever subjected the bust to global investigation. Just as in the case of the blind she used only individual features as cognitive landmarks. Such a mode of judgment was bound to lead to incorrect identification. Actually the bust was interpreted as a head of Christ on account of the hair style, which was taken for a wreath of thorns. When at a later stage the hair-style was correctly interpreted, that led again to a wrong identification. For after repeated examination the subject imagined that the bust represented the head of a page.

Another observer, too, concentrated his fullest attention on the hair style, because he hoped to guess the sex from it. After a stage of the greatest uncertainty he came to the conclusion that the bust could really represent neither a man nor a woman, because for a man the cheeks and the mouth were too finely modelled and for a woman the nose was too marked. The bust must therefore represent a child, except for the fact that the shoulders were too broad in proportion to the head.

Like the sex, the age was not immediately given by the total appearance; it was rather arrived at by means of deduction. The general criteria in that respect were exactly the same as in blind observers: in the first instance, of course, the hair-style; then the presence or absence of wrinkles in the face, and the smoothness of the cheeks and forehead. When the observer was asked the approximate age, the hand was immediately directed towards the region of the mouth and nose. When it happened that small wrinkles were met round the eyes, that was also taken into consideration in estimating the age.

One might well expect that artists, whose main occupation was in modelling and who were therefore accustomed to endow their visions with plastic expression, should behave in a manner different from us and from the blind when engaged in the tactile examination of plastic works. It becomes evident, however, that such differences do not exist.

I asked a sculptress to examine the bust of the Roman statesman haptically. She started with global tactile examination. Immediately afterwards she proceeded to a detailed investigation of the most important parts of the face. The wrinkles on the forehead and the strongly developed muscles of the neck led the artist to

consider that the man represented was old. The marked folds extending from the root of the nose to the corners of the mouth were taken as signs of a smiling expression. In regard to the eyes the observer made the following statement: "I cannot understand the eyes; they show no expression whatsoever" (!). After a short while she said: "Now the face begins to become more distinct, but only as a type; a laughing face in general (!), but not individually; the eyes lacking in expression, neutral." We see that all that the sculptress said, even the sequence of her statements, corresponds fully with the statements of our other sighted and blind observers. If we further take into consideration that the bust was constantly on view in the studio of the Academy of Fine Arts, where the sculptress had been working for many years, and that she was nevertheless unable to recognise it by haptic means, this case illustrates most strikingly the fundamental dissimilarity of the haptic and visual contents of perception.

The behaviour of the sighted working blindfold corresponds therefore to that of the blind. In their case, too, the attention is completely absorbed by the cognitive purpose. They do not make any attempt at a comprehensive grasp of form, and omit any spontaneous statement about their "æsthetic" sensations. When asked to express their views on the artistic value of the works of art, they are just as vague and at a loss as the blind, and they merely adhere to the same non-æsthetic piecemeal criteria. In the case of the sighted also, when perceiving haptically, simplicity, clearness, and apparently correct proportions are positive criteria of the beauty of the object, while objects which are difficult to understand are judged to be ugly, unpleasant. In one word: Everything which the sighted are able to say about the "æsthetic" impression of the haptically perceived work of art is based, just as with blind persons, not on an immediate apprehension of the whole and on an æsthetic attitude, but on criteria which are derived partly from the non-æsthetic and purely sensory sphere, partly from the knowledge of æsthetic factors such as correct proportions, balance, symmetry, etc.

5. The Haptic-Visual Type-Image

The statements of our normal and blind observers made clear beyond any doubt the outcome to be expected from our theoretical discussions—namely, that purely haptic perception

cannot possibly lead to an individual image of the haptically apprehended objects and portraits. This fact is of fundamental importance for our problem. For let us realise what " artistic " impression Greek, Roman, or Gothic images and statues would make on us if they were deprived of their individual character. The heads of Greek poets and philosophers would appear to us as mass-produced busts, which would fulfil no other purpose than to adorn, let us say, the façade of a building. The only relevant difference between them would lie in the fact that one portrait would have a longer beard, another a shorter one.

Whenever sighted observers assert that they have finally obtained a genuine image out of the details which they had gained haptically, a more accurate investigation will show that they have actually not proceeded to a haptic individual image, but merely to a *visual type-image*. The total image alleged to be haptic proves in such cases to be a more or less clear intuitive idea, in which the visual component is the ruling factor. Such an idea, based on visual and supplemented by haptic images, is mostly very labile; its form and its content are subject to constant change. It is often represented by an individually known image, which, however, does not really correspond to the haptically apprehended image. It suffices if certain especially characteristic features—*e.g.*, the hair-style, or the beard, or a garment—show any similarity to the imaginary image aroused by means of associations. So we need not be surprised if a Greek or Roman head with long hair and beard and with a high forehead arouses the idea of the well-known bust of Homer, or if an oval face with beard and regular features is mistaken for a head of Christ.

The visual type-image became especially clearly manifest in the statements of one of the subjects of my experiments. In the process of spontaneous visualisation of the Renaissance head he made the following statements: " I am thinking of a pictorial representation of a boy of the Renaissance. (!) I know that that portrait does not correspond to the portrait I have touched; but as I am unable to gain a clear idea of the latter, it does not matter what image I substitute for the touched one."

In the case of those born blind or those who have lost their sight at an early age, the type-image is determined either by memory images of a haptic character—or by the associative activity of

fantasy. As the blind naturally have only a very small number of haptic type-images at their disposal, they are often guided, when identifying works of art, by knowledge acquired either through reading or through descriptions given by those who can see.

As far as my experience goes, I feel justified in assuming that the blind—as opposed to the sighted—will rarely fall back on types like Homer, a Teuton, a page, etc., when examining a bust haptically. In most cases they get stuck at the first stage of the cognitive process—the perception and description of the individual high-points and clues. Only when the fantasy and the powers of association are outstandingly well developed (as in the case of Helen Keller) does a blind person proceed beyond concrete statements and try to get a fairly comprehensive idea of the haptically examined object. But in that process illusion plays much too large a part.

6. Haptics and Physiognomy

The inability to comprehend the total appearance and individuality of works of art haptically becomes further increased through the fact that the capacity to recognise different expressions clearly by haptic means is extremely limited. Anyone perceiving haptically can only try to interpret the facial expression of a bust by certain important clues. Every moderately intelligent blind person knows very well that bodily expressions are open to more than one interpretation and can only be judged correctly in connection with other signs. That is why he concentrates the greatest attention on the forehead, on the soft parts of the cheeks, the mouth, and the chin. His whole aim is directed towards establishing the character of the person represented by looking for and interpreting the physiognomy. In that respect he meets with great difficulties, because he is unable to distinguish the permanent physiognomical features from the expressive ones. Moreover, within the field of expression itself he lacks discriminating ability. The sighted experience the contrasting expressions of joy and pain immediately and directly. By means of our intuitive faculty, which is rooted in the visual impression, we are able to distinguish between anticipatory joy and the joy caused by an actual event, or between the revelation of inner pain and a superficial displeasure. By contrast, such a distinction confronts the blind with insuperable difficulties, as they are compelled to proceed by means

of intellectual reflection without the support of a clear uniform picture. Unconnected partial impressions, as haptic impressions are, cannot lead to a correct interpretation of the ambiguous expressive features. Such an interpretation requires certain partial impressions emerging out of a total image already present since these partial impressions are only significant in relation to that total image. But partial impressions of this kind are only contained in the visually perceived image. It is only visual perception which enables us to apprehend the full variety of an expression and to follow its coming and going and its entire course. It is that intuitive experience which enables us to distinguish the constant from the variable factors in a bust.[1] This is connected with the fact, emphasised by Klages, that every criterion of expression seems to possess both a conditional and a characteristic significance, according to whether the emotion is founded on the presence of an energy or the absence of the opposite inhibition.

In the haptic examination of busts the only resource left to a blind man is to achieve that connection by means of abstract association. In interpreting the expression he has to rely on analogous cases, which he has encountered either in the actual process of tactile examination of figures or in object-lessons, and those which he has experienced "autokinetically". Blind sculptors, who know the limitations of their abilities as blind persons, distinguish themselves by the very fact that they do not succumb to the temptation to give their busts any individual character, but rather remain within the framework of the typical, and that they try to make up through the bodily attitude of their models for what they are unable to represent in facial expression.

In connection with the problems of physiognomy we are faced with an interesting special problem of Haptics: the possibility of perceiving haptically the expression of the eyes.

The statements of all my observers suggest that from the point of view of Haptics the eyes have no significance whatsoever either for the blind or the sighted: they appear to be simply "blind". The blind are so deeply convinced of this that they hardly ever

[1] This accounts for the lack of interest of the blind in the faces of their fellow-beings. When a man born blind had been operated on and learnt to make use of his eyes, he was most surprised to find that every human being had a completely different face. Before the operation he had imagined that all faces were practically alike except for irrelevant differences in shape and size (v. Senden, *Gestaltsauffassung bei operierten Blindgeborenen*, p. 46).

take the eyes into consideration in recognising the facial expression. By contrast, normal persons perceiving haptically, but working on the basis of their visual experience, imagine it is just in the eyes that they find an absolutely reliable physiognomic criterion. It is true they are soon deeply disappointed. What is the reason?

There can be no doubt that the eyes are most characteristic of the expression of the individual human being. If we ask ourselves what actually endows the eyes with full life and inner spirit, we shall, to begin with, make the *look* responsible for it. Now the look is not necessarily bound to the movements of the eyes or to the position of the pupil. Sculptural works show that the absence of the pupil need not necessarily destroy the impression of vividness connected with the eye.

Ancient gods and heroes cut in marble or cast in bronze " see " and " look " although the drill has not driven a hole into the eyes. The Hermes by Praxiteles and the Idolino in Florence see and look just as do the gladiator from Herculaneum with his inserted eyes or as the famous granite statue of the Reader in Cairo with his painted eyes.

This leads to the further question which is not only of psychological importance but also relevant to the art-historian, how the vivid impression of the eyes comes about when there is no suggestion of a pupil? Several factors co-operate to produce that effect, but primarily the shadows. When the eyes are in the shade or only partially in the light (which can be most easily achieved by lighting them from the side), they " live ", they " see ", they " look ". But when they are evenly illuminated, so that the eyeballs protrude clearly, they appear to be blind. It therefore often depends on the lighting whether a face has normal vividness or not.[1] Good examples of this may be seen in the Idolino in Florence, in the head of Demeter of Knidos in the British Museum, and in the Niobides in the Museo degli Uffizi.

We give as example the head of a Greek athlete one of whose eyes is lighted and therefore appears blind, whilst the other is in the shadow and so gives an impression of sight.

Another determining factor is the position of the head, the way it is turned, elevated, or depressed. A head which is directed

[1] There is no doubt that sculptors have frequently had that experience. In order to achieve a more marked shadow-effect they insert the eyes deep into the sockets. Photographers too make use of this knowledge to enhance the vivid expression.

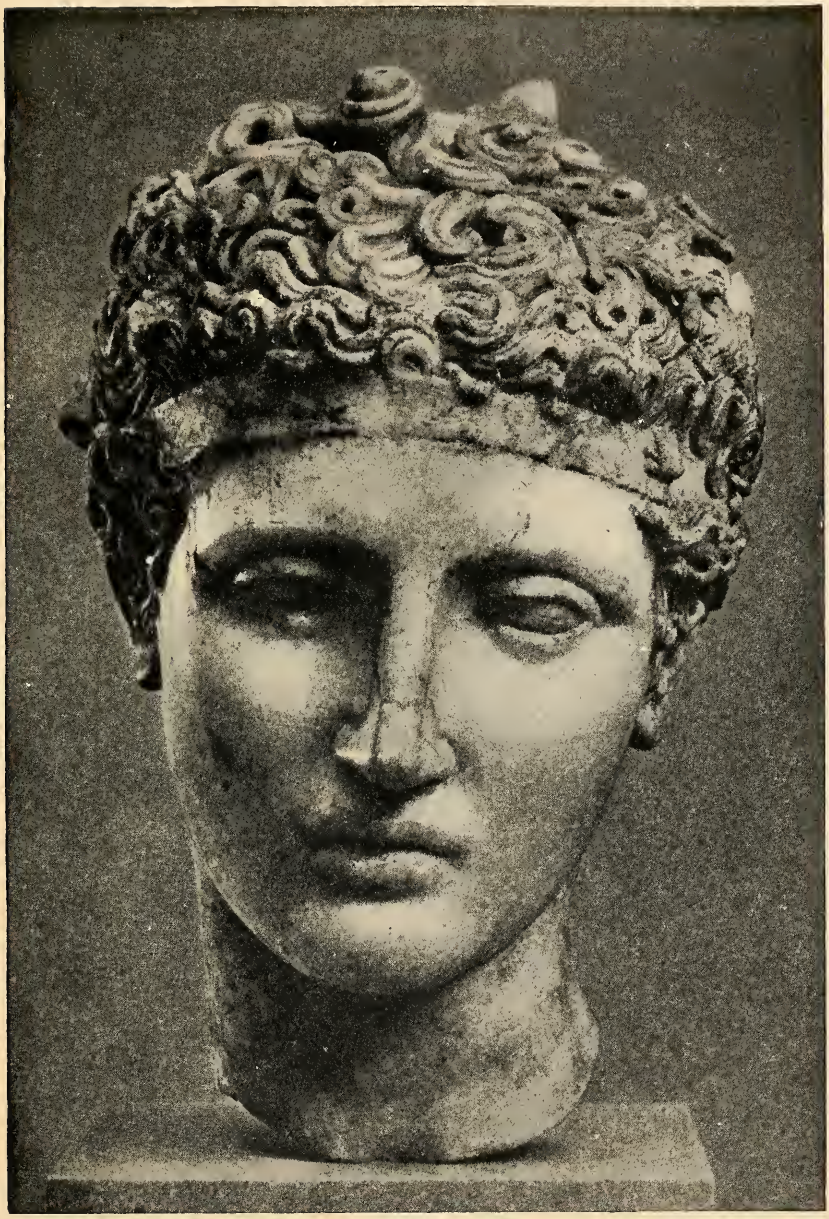


FIG. 42.—Head of a Greek Athlete.

stiffly forwards, as we may observe in archaic figures, diminishes the vividness of the facial impression considerably and therefore that of the eye. When a human statue (or a living human being) stands in front of us with the head flexed and depressed, we transfer the depression of the head to the look of the eye. The same applies to deviations of the body to the side, when the representation is of a human being engaged in some action.[1] We attribute the blind expression of the well-known bust of Homer to the strict observation of those two rules: the head is not tilted to either side, he sits unmoved in an expectant attitude; the eyebrows and the skin of the forehead are purposely drawn upwards; and the eyeballs are thereby deprived of any effect of shadow, even of any shading frame, lighted as they are from the front. To this must be added the rather stiff facial expression brought about by the tension of the muscles of the face and the large beard. Assuming that the Greek sculptor had become aware of those rules in the representation of blind figures, I cannot follow E. Loewy,[2] who considers it especially difficult to give a vivid representation of the features of a blind person.

It is not only the position of the head, however, but also the general attitude of the body which influences the expression aroused by the eyes. A man who strides along with free unimpeded movements, with his head erect or even thrown back, who is engaged in action, or in a violent forward thrust, cannot possibly be blind. On the other hand, a figure in a stiff, tense attitude, standing erect, " looking " straight ahead, the arms symmetrically fixed to the thighs, may easily evoke the impression of blindness, especially in unfavourable light. The bodily attitude of a sighted person is so different from that of a blind one that all which in one way or the other suggests a certain attitude may play a contributory part in determining the fundamental character of the face.

Lastly, the style has a certain part in determining the expression of the eyes. When the eyes are represented schematically, as in the archaic period of Greek sculpture with its conscious aim of schematisation, the heads will easily appear to be blind; but when in accordance with the whole figure, the eyes are endowed

[1] The Greek sculptors were well aware of this. After the archaic period one hardly finds any heads in a completely stiff attitude; in most cases some slight torsion round a vertical axis can be observed.

[2] E. Loewy, *Greek Sculpture*, Leipzig, 1911.

with a personal quality, the image appears to represent a human being seeing and looking. From that point of view the similarity of the statements made by our blind and sighted observers appears obvious and even necessary.

They always found the eyes " dull " or " blind ". One blind observer said he could not make anything out of the eyes, while another considered them to be blind; a third, who incidentally imagined that he could get an adequate idea of the portrait, was eventually obliged to admit, when he examined the eyes: " I am not in the least certain of being able to understand the eyes at all."

I think I have made it clear why the sighted manage to experience *a vivid connection between physiognomy and emotion* through the power of synthesis and completion possessed by their visual function, and why the blind are unable to do so. In so far as the latter insists on making use of his haptic impressions in characterising a person, he tries to interpret the haptically apprehended parts on the basis of a very simple physiognomic pattern of correlations (correlation between height of the forehead and intelligence, wrinkles and age or temperamental type, shape of the face and beauty, etc.), a procedure which is bound to lead him astray in many cases.

7. The Æsthetic Appreciation of Simple Figures and the " Golden Section " in Haptics

Our experiments and discussions have not solved the problem, whether objects which lie within the range of simple structure, and may therefore be apprehended as unitary forms, are open to æsthetic appreciation.

That question is difficult to answer. For whenever we present the blind with simple figures, which no doubt have some æsthetic charm for us, or when we ask them to select from a series of geometrical ornaments those which appeal to them, we have to conclude from their attitudes and statements that the selection, which always takes place very hesitatingly and reluctantly, is not based on an æsthetic experience. The blind cannot quite make out what one expects them to do, what should be beautiful or not beautiful in these figures. Some of them find the question just as queer as we should if someone asked us whether a piece of music were more like red or yellow. There does not seem to be any trace

of a natural æsthetic attitude, as we know it in the visual or the acoustic sphere. The question is so interesting that we have tried, in connection with an investigation to determine the range of experimental methods in the field of æsthetics, to find out how the blind decide, when they are asked to select from a number of structurally and morphologically similar simple figures, those which appear to them to be " pleasant " or " nice " (to avoid the term " beautiful ").

Our concrete question was as follows: Among rectangular figures of different proportions are there some which the blind (or sighted subjects working haptically) prefer to others on account of their special proportions?

It has long been known that in the visual sphere such a preference actually occurs, and that it seems to be one of universal validity. In the last century Zeising ascertained that a certain proportion, the so-called Golden Section (a division, in which the whole is to the greater part as the latter to the smaller part, the proportion of the smaller part to the greater one being expressed by the value 1 : 1·618 or approximately 21 : 34), plays a part of outstanding importance in the visual arts. Zeising has, however, considerably over-rated the æsthetic value of the golden section in attributing to it a universal validity in art and nature.[1] In several publications Fechner has protested against the over-rating of the æsthetic principle established by Zeising, but without denying the relative æsthetic value of the Golden Section as a norm.[2] He even went one step farther by ascertaining statistically the most favoured proportions in the simplest spatial forms. His experiments concerned rectangular figures, as in his opinion the pleasantness of those figures is almost entirely determined by the form itself and not by other associative factors. It could be shown that out of a large number of rectangular figures those which were proportioned according to the golden section or came closest to it were given preference, and that on the other hand squares, as well as very narrow rectangles, were repudiated as being unpleasant in their proportions. Even if it is not possible to attribute to the golden section the universal importance which

[1] A. Zeising, *Neue Lehre von den Proportionen des menschlichen Körpers*, 1854. Also, *Normalverhältnis der chemischen und morphologischen Proportionen*, 1856.

[2] W. Th. Fechner, *Vorschule der Ästhetik*, Leipzig, 1876, p. 184. Also, " Zur experimentellen Aesthetik," *Abh. d. math. Physik, Klasse der sächs. Gesellsch. d. Wiss.*, 1871, p. 553.

Zeising attributes to it, it has been shown that it occupies a place of special relevance among the different proportions found in rectangular figures.[1]

Since certain misgivings had been expressed in respect to Fechner's method, I decided to subject his findings to a further investigation. In these experiments I first made use of Fechner's series, ten rectangles of the same area (25 sq. cm.) but of varying proportions, and, in addition, a series consisting of larger and smaller rectangles, which differed from one another in height only. Each series consisted of twenty-six items.

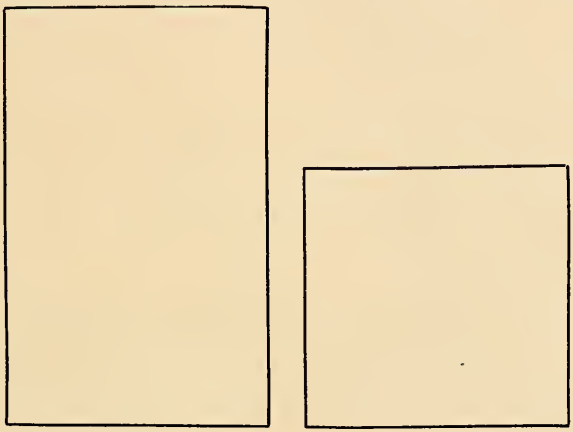


FIG. 43.—Preferred Proportions.

Both in the Fechner series and in our own series the subjects showed in most cases a preference for the rectangle whose sides conformed to the golden section (1 : 1·6); occasionally proportions coming very close to it were chosen—*e.g.*, 1 : 1·55 and 1 : 1·65, and rarely 1 : 1·7—and quite exceptionally a proportion below the golden section—*i.e.*, in the direction of a square—was selected.

An entirely different result was obtained when the same experiment was carried out by means of the haptic sense. When we present the same series of rectangles (with the same instructions) to the sense of touch, we get quite an unexpected result.

[1] In Fechner's experiment the golden section was selected by men and women in 35% of all cases, whilst all other proportions ranging between 1 : 1 and 5 : 2 were chosen in 65%, and the square polled only 3% of all votes.

The blind as well as sighted subjects perceiving purely haptically select, with few exceptions, not the golden section but the *square*, or a rectangle very similar to a square. They therefore show a preference for the very proportion which is almost universally rejected by sighted subjects working on visual lines.

It would be a mistake to assume that the preference shown in respect to the square is connected with an æsthetic impression; this selective act is rather determined by the *metric principle*. Since the metrical proportions play a decisive part in the field of Haptics, and since among the simultaneously presented rectangles the square occupies a position of its own as metrically the simplest figure, it is understandable that our subjects should select the square. From the haptic point of view the square is of all rectangles the easiest figure to grasp, it is the most convenient figure for being apprehended by movements following the outlines, it is the simplest figure from the point of view of kinæsthetic rhythms, and the figure which is most easily retained in memory, apart from having the advantage of saving us the trouble of tediously examining proportions.[1]

[1] In this connection I should like to mention that sighted children between ten and fourteen years of age working visually show a preference for the square. They therefore behave visually in the same manner as haptically. This paradoxical phenomenon is accounted for by the fact that children of that age adopt not a morphological but a " structural " attitude, so that the equality and the harmony of the parts become of major importance compared with the proportion of parts of different significance.

III

HAPTICS AND ÆSTHETICS

1. Æsthetic Appreciation

Through our comparative experiments we have reached the conclusion that the way in which the blind perceive, recognise, and appreciate plastic works is not due to the mere fact that they are blind and lack visual concepts, but exclusively to the special nature of the haptic process of perception and recognition, a process which takes place in an almost identical manner both in blind and in sighted subjects. So it does not make any difference whether we are dealing with sighted subjects trained in haptic methods, or with subjects born blind, or with those who have lost their sight early or late in life, or with the degree of education among observers. Admittedly there are differences of type and individual differences, but there is complete similarity in respect to haptic perception, recognition, and interpretation. In view of the fact that a total image of haptically observed objects, representing the complete morphological and phenomenological significance of the data, cannot be obtained, it seems justifiable to assume that in the field of Haptics one can hardly speak of an æsthetic appreciation in the stricter sense. In that field the synthetic function will on the whole be confined to ascertaining the proportions and the spatial arrangement of the haptically observed parts, to recognising the structural organisation of the whole, and to making clear the schematic form. In so far as blind and sighted subjects working on haptic lines make use of the so-called synthetic tactile approach, they attain only a vague, indistinct image, a form with unsharp contours, whose parts are still more indistinct, unstructured, and incomplete. What they recognise by analytic touch becomes lost again in the synthetic process. The impression is somewhat akin to the very first design of a statue, with the mass of stone just chiselled out, before it loses its inflexibility and its massiveness through the process which renders its surface alive in the first stages of the sculptor's work. How

little confidence the blind put in synthetic perception is shown by the fact, mentioned above, that they only exceptionally make use of the method in examining works of art.

Our experimental examinations of blind and haptically perceiving sighted subjects, as well as our theoretical discussions on the fundamental problems of Haptics, allow us to state with certainty that Haptics leave only an extremely restricted scope to the æsthetic element. The very fact that here the principle of monarchical subordination, of integration into a homogeneous whole, is only operative in especially favourable conditions, and even then only within rather narrow limits, suggests the non-æsthetic nature of haptic perception. What emerges prominently out of the totality of tactile contents, what appears to dominate the picture, is, as we have seen repeatedly, not conditioned by æsthetic principles, and dependent not on æsthetic considerations, but on the *haptic structure* of the tactually apprehended parts.

In the æsthetic field the dominant and subordinate elements aim at a fusion. This tendency is enhanced by immanent qualities of the acoustic and visual functions, whereas in the field of Haptics, in which the comparatively independent parts tend to retain their independence, one can hardly speak of an integrative function.

The fundamental condition of any æsthetic view of a work of art is the apprehension of artistic values. It is not through knowledge or recognition that we achieve an insight into the æsthetic value of a work, but through the spontaneous experience of the artistically beautiful. The æsthetic experience seems, however, to be entirely incompatible with the basic character of haptic apprehension, with the analytical and constructive nature of the object. If we could, by way of analysis, attain a vivid apprehension of the work of art, it would be possible to find in the field of Haptics also an approach to æsthetics. But an exhaustive comprehension is only possible to a very limited extent in the haptical world of forms, whatever the " Hapticists " and some psychologists of the blind may enthusiastically assert; the fragmentary material, with its undeveloped formal structure, is far from yielding all the vividness of the object to the æsthetic approach.

The statements made by our observers, blind as well as seeing, leave room for no other interpretation. We have seen how in

Haptics the question whether a bust is beautiful or not is actually misleading. " Beautiful ", " not beautiful ", and " ugly " are terms which appear to have no primary sense in the field of Haptics. The haptically perceiving sighted subject and the blind repudiate such questions energetically and try by roundabout methods to get clues, which are quite inadequate as the basis of an æsthetic verdict.[1]

As in the whole field of haptic recognition and judgment, so in the process of " æsthetic " appreciation, it is the details which they stress. They never make any statements as to the appearance as a whole, nor do they actually pay any attention to the total object. Their explanations of their appreciation give us the impression that they had looked at the busts through a small aperture, which allowed them to see only a minute part of the whole at a time.

When working haptically sighted subjects consider an object " beautiful " when it or its parts do not deviate in respect of form, proportions, and size from the norm which they usually apply in the æsthetic appreciation of visual objects. This norm represents in the visual sphere only an ideal demand, which we repudiate as soon as it is incompatible with our spontaneous æsthetic experience. (Thus the æsthetic norm of Greek sculpture has to be given up when we are faced with a medieval figure.) Well-educated blind subjects adhere to such norms as they have developed through tuition. These norms are imperative in character, as opposed to those of the sighted subjects. They are beyond approval or disapproval when the subject is perceiving and judging. That implies that the blind person does not stand in a free relationship to pictorial art. He is bound to the principles which have been imposed on him by his " æsthetic education ". The beauty of the human face will therefore depend in his case on whether or not the shape of the haptically apprehended face conforms with criteria which have already been permanently established. As this is hardly ever the case, the

[1] The answer of some blind observers when asked about the beauty of a Renaissance figure was as follows: " I cannot say. It is obviously no classical beauty, for the nose is too long and broad." " I don't know; the face is certainly too regular to be called ugly." " The face is crudely executed. Nose ugly, upper lip thick, the expression can therefore not be beautiful." " Nose long, chin too small and almost no forehead. I am more inclined to find the person ugly than beautiful." " I cannot find that beautiful. The eyes are deeply sunk, the eyebrows somewhat drawn upwards and the whole face slightly asymmetrical. Not regular. and so not beautiful."

blind person will either find all faces more or less ugly, or his judgment will be determined by other features. It is true and right that the norms taught in the education received by the blind are from classical art; for the very principles of Greek sculpture, such as the geometrical lucidity of the contour, the symmetry, the poise, the harmonic distribution of the details, the slight changes in facial expression, etc., belong to those qualities of the work of art which are easiest to grasp by haptic means. As a result of being tied to such criteria the blind reject plastic works which are based on other artistic principles. A blind person whose æsthetic education is based on classical works will therefore feel at a loss when he is presented with a medieval sculpture. Because the latter contradicts *his* " æsthetic norm ", because his canon does not apply to that kind of artistic creation, works like that will not impress him " æsthetically ". It would hardly be possible to train the blind with works of Roman or Mexican sculpture, for an art which allows the artists more freedom or favours the disintegration of harmonic forms or one in whose products the basic geometrical forms cannot be detected, is quite unsuitable as a guide for the æsthetic appreciation of sculptural works in the teaching of the blind.

Such reflections, to which further arguments could easily be added, suggest that the blind, who in the appreciation of artistic values can at best base their judgment on the recognition of the structure and on the intellectual mastering of the general principles of form, are actually *beyond the sphere of æsthetic experience.* The judgment of the haptically perceiving subject is not determined by the rules of pictorial art and the norms of æsthetic apprehension, but by structural elements of a simple realism. The blind are unable to derive æsthetic principles from the haptic reality, nor are they able to realise such ideals in images born from their fancy. As they cannot realise the inner tensions caused by the interaction of different proportions, they miss the impression of dynamics, of living energy, of inner stirring beauty, which endow the lifeless material structure with artistic significance.

M. Geiger, in his remarkable publication *Approach to Æsthetics*,[1] has tried to trace back artistic effects to two basic forms. One of these modes he calls effect in depth, the other surface effect.

[1] M. Geiger, *Zugänge zur Ästhetik*, Leipzig, 1928.

The contrast between these two modes of psychological reaction is said to find expression in the fact that the surface effect is related to the vital sphere, to the production of pleasurable sensory experiences, while the æsthetic " depth effect " affects the personality " in the sphere of the deep Ego, and thereby passes from the stratum of pleasure into the stratum of happiness " (p. 54).

According to this view, whenever we are faced by surface effects only—such as impressions of colour, or tactile and kinæsthetic impressions—we are moving in the non-æsthetic sphere, in a field where we look in vain for specifically æsthetic experiences. But when the personal stratum is involved, our inmost self becomes affected, and the essence of art becomes manifest. If a blind person imagines himself to be in the grip of an æsthetic sensation when he touches plastic works, that is due to concomitant stimulation of tactile and kinæsthetic sensations leading to the emergence of pleasurable emotions. The pleasure that both we and the blind feel in softness, coolness, and the buoyancy of movement, determines the emotional attitude of the blind man and his so-called æsthetic appreciation. To this must be added frequently occurring musical and other moods in the case of the blind, and, in addition, associations which intensify the pleasure derived from haptically perceived works of art and are in turn enhanced by that vital pleasure, but can only find a way into the field of pictorial beauty through the intermediary of music.

We see therefore that the absence of æsthetic effects in the field of Haptics can be deduced from the fundamental facts of Haptics. The pleasure which sighted subjects when perceiving haptically, and to a greater extent the blind, derive from works of art, is *a sensual pleasure, a joy created by the clearness of the structure and the architectural arrangement, but not a blissful appreciation of artistic values.* The blind remain in the psychological sphere, in the sphere of slightly differentiated sensations of pleasure and displeasure, and are unable to force their way into the realm of Æsthetics.

The æsthetic pleasure associated with plastic works is a *specifically visual one.* All the principles of form creation, all the forms of æsthetic contemplation, all the criteria of æsthetic appreciation are based on visual perception. The visual approach and visual fantasy are the sources of æsthetic experience throughout the realm of plastic art. Even the specifically plastic works that have so often been attributed to our haptic function are visual in char-

acter. So the æstheticians who trace the æsthetic pleasure in plastic works back to a haptic or kinæsthetic element make a great mistake.[1]

The objection that sculptural works arouse instinctive tactile movements, that they stimulate the motor sphere, is not irreconcilable with our view. Motor reactions are aroused by many objects irrespective of their æsthetic value. That works of art should be especially liable to arouse motor reactions is not known to me. The placards found in museums forbidding the visitors to touch the objects are not meant to deprive the art-loving public of the higher æsthetic pleasure. Even without such warnings we should not touch most of the exhibits. I do not believe that we should find any special pleasure in palpating the Moses by Michangelo from head to foot.

Æsthetic attitude and æsthetic experience are therefore a field to which a person working haptically has no access or only a very restricted one. To repeat briefly what we have discussed above, the haptic æsthetic experience is mainly directed towards the simplest symmetry and order, and beyond that to such elements as, strictly speaking, lie outside the æsthetic sphere—namely, towards pure sensuality, towards the emotionally stimulating effects of material and object (occasionally enhanced by an erotic element), and towards the accuracy of the execution. On the other hand, the manifoldness of the world of forms, macrocosms and microcosms, the unlimited development of new forms and structures, the close relationship between artistic creation and artistic contemplation—those two important sources of experience —remain the monopoly of the sighted human being in his æsthetic creativeness and his æsthetic enjoyment.[2]

2. Haptics of Form in Æsthetics and the History of Art

After our experience with normal and blind subjects we must be surprised by the fact that in æsthetics we are always meeting

[1] A similar view is held by the Finnish philosopher H. Friedmann. The æsthetic impression aroused by sculpture is in his opinion based exclusively on specifically visual relationships, which alone are adequate to allow the creation of portraits. Friedmann therefore denies the existence of an artistic haptic experience of form, and considers the forms of nature and art to be one that is transcendent and inaccessible to the blind. The last proposition, however, requires some qualification.

[2] In dealing with the works of blind sculptors we shall further discuss the problem of the extent to which the visually based tactile experiences of those who have lost their sight at a later age can make up for the absence of spontaneous visual apprehension.

attempts to trace back the emergence and the evolution of the plastic arts to the perceptive and creative function of the sense of touch.

In German æsthetics Herder [1] and his adherent Zimmermann [2] have supported this view of the Haptics of form in the most radical manner. It is nowadays quite superfluous to refute Herder's theory. We find it almost incomprehensible when Herder says: "For everything which constitutes the beauty of a form or of a body is not a visible but a tangible concept: every single one of these beauties is originally based on the sense of feeling" (*i.e.*, on the tactile sense, on kinæsthetic sensations). And further: "To the eye the effect of the whole art [of sculpture] is completely lost. There is therefore no sculpture for the eye. Neither physically nor æsthetically! Not physically because the eye is unable to see bodies as bodies; not æsthetically because, when in sculpture that bodily whole disappears, the whole essence of its art and of its special effect disappears as well." We should not do justice to Herder, however, if we only stressed the negative side of his theory. In contrast to later authors who have denied the blind the conceptions of space and form, and thereby all creativeness, Herder has drawn our attention to the primary nature of the haptic spatial ideas, and to the specific nature of the plastic experience in Haptics, and lastly to the creativeness of the blind.

Far greater was the effect on the elucidation of the problem of the relationship between Haptics and Optics caused by the interesting theories put forth by the art historians. The theory of Haptics of form was embodied in a general theory of art by Alois Riegl, one of the outstanding representatives of modern history of art. In view of the fact that Riegl's theory has been the subject of attacks from several sides on account of its haptic character, I shall attempt to elucidate the misconceptions connected with Riegl's views and to explain his actual attitude.

Riegl distinguishes three phases in the development of pictorial art of ancient times: a haptic phase, which finds its purest expression in Old Egyptian art, a haptic-visual phase first appearing in the creations of the Greeks, and lastly a visual phase, which found

[1] J. G. v. Herder, *Kritische Wälder oder Betrachtungen über die Wissenschaft und Kunst des Schönen. Sämtl. Werke*, **4**, 1878, pp. 52 and 64.

[2] R. Zimmermann, *Allgemeine Ästhetik als Kunstwissenschaft*, Vienna, 1865.

its fullest expression in the last period of ancient art when the early Christian basilicas and the central buildings came into being.[1] To what extent these statements are still valid and to what extent the evolution of style in the classical and late-classical periods is correctly defined by these phases, are questions outside my range and my competence. I want to confine myself to the *psychological foundation* of Riegl's theory, to that aspect of his basic view which has been misunderstood by the majority of his critics.

It is true that the psychological foundation of Riegl's theory of art is open to criticism. He attributes to the sense of touch a function which it does not actually possess; and he takes a view of the evolution of our conception of space not nowadays shared by any psychologist or theoretician of space, now that obsolete physiological theories have been superseded. Assertions such as that what we perceive haptically on the surface of objects is not an extended plane but consists merely of singular points, or that the apprehension of two-dimensional, and especially three-dimensional figures takes place only with the aid of fairly intricate intellectual processes, strike us nowadays as rather strange. Nobody would now trace back to the intellectual construction of disparate perceptions the apprehension of surfaces and bodies, although in the sphere of Haptics such a conception has not altogether lost its validity, as I have shown in the preceding chapters.

But we must now ask: Has Riegl's theory, based as it is on inadequate psychological foundations, lost all of its validity, or does the inner nucleus of the theory remain untouched, in spite of its psychological foundation? I support the latter view.

In carefully studying the fundamental work of Riegl, one reaches the conclusion that his real aim was not to explain the origin and the first evolutionary manifestations of art on *psychological* lines. He had merely set himself the task of showing tendencies and characteristic features of ancient and late-classical art, and, by establishing a new conception of art history, of creating an instrument which would be useful to us for a general orientation, and for a description and analysis of the works of art of those periods. With brilliant intuition he recognised that in the very first stages of development of Western art, both in Greece

[1] A. Riegl, *Spätrömische Kunstindustrie*, Oesterr. Archaeol. Institut, Vienna, 1927. (Reprint.)

and in Egypt, surface-art, in which the surrounding space was practically denied, was predominant. This tendency towards " the limitation of space " was later interrupted by the opposite tendency towards expansion of space, or in Riegl's terminology " space-formation ", which again opened the way for full three-dimensionality and for the animation of space by colour. Riegl wanted to define these artistic tendencies by specific terms, for which purpose he felt urged to make use of the double term " haptic-optical ", certainly a most impressive expression for the change of style he had in mind.

Whatever view one may take of this terminology, there can be no doubt that the antagonism between these terms contained an element of truth and represented an intuitive recognition of criteria which found a concrete expression in the creative work of those periods. These terms, though belonging originally to the field of psychology, can be made good use of in a study of art, provided that they are given a modified meaning. Riegl omitted to define his terms with the necessary accuracy, and thus created the impression of wanting to understand the terms " optical " and " haptic " in their original sense.

But when the necessary transformation of the two terms is performed, and when the terms " haptic " and " optical " are not understood to signify concrete perceptive functions or concrete contents of perception, but *principles of art-creation and the attitudes of the æsthetically observing human being*, those terms lose their psychological significance and become useful terms for the study of art and the appreciation of art.

It would be unfair to say that Riegl himself had defined the content of his terms vaguely. Actually Riegl has achieved the transformation of the terms from the sensory sphere by defining the content of Haptics in architecture as a strict avoidance of foreshortenings, shadows, and effects of colour, as the marked prominence of contours and, in general, as the emphasis on the limitation of space. He only trespassed beyond the scope of these very specific terms by bringing the whole complex of the above propositions into association with the function of the tactile and kinæsthetic sense.

I see the development of Riegl's " haptic " theory as follows: When Riegl came to the conclusion that the Greek and Egyptian artists were ruled in their creative activity by the material, the

objective substance, by the apparently stable and invariable world, a world which had to be looked upon as comparatively independent of the transitory object qualities of Optics, he suspected at once that that principle was closely associated with the world of haptic appearance. By this, however, he did not mean to imply that artistic works in the first period of antiquity had actually been governed by that sensory function. For Riegl the term " haptic " did not signify haptic perception, but " haptic seeing ". In his case it was not a question of the priority of a biological function, in one case the haptic, in the other the visual function, but of *two kinds of artistic outlook and æsthetic attitude.* Both these kinds of artistic outlook belong to the sphere of our visual function, with the one difference that we sometimes stress such qualities of the objects as are originally (or also) perceived by means of the sense of touch, at other times such qualities as are almost exclusively perceived by the visual sense.

Thus, in opposing Riegl for holding the view that experience and recognition of form had originally developed out of the tactile function, one misunderstands the cardinal point of his arguments, for his " haptically " orientated art presupposes seeing and has developed through the controlling and supplementary activity of the visual perception of form.

Had Riegl coined other terms which would not be charged with a special significance through their biological and psychological use, as is the case with the terms " haptic " and " optic ", his theory would no doubt have met with the appreciation it deserves. That may perhaps best be seen in the success Wölfflin had with his " Fundamental Concepts ", although they are based on an interpretation of Riegl's ideas.[1] For the pairs of terms which Wölfflin uses in order to characterise the development from the early Renaissance to the Baroque—viz., the linear and the pictorial elements, the surface and the depth, the open and the closed form, and the absolute and relative clearness of the objects —can quite obviously and easily be subsumed under the more comprehensive pair of terms " haptic-optical." Wölfflin himself describes the course of the development from the linear to the pictorial with the following words: " The comprehension of the body according to its tangible character—in contours and planes—on the one hand, on the other hand a comprehension which is able

[1] H. Wölfflin, *Kunstgeschichtliche Grundbegriffe.* Munich, 1920.

to yield to the merely visual appearance and renounces the ' palpable ' drawing. In the former case the emphasis is laid on the boundaries of the objects, in the latter the appearance transcends the boundaries."

It will not be difficult to recognise in these arguments both the tactile and the visual element, as well as the antithetical terms of spatial limitation and spatial creation. According to Wölfflin that development can be characterised by saying that the earlier art stratifies the parts of the total form in planes, while the later style emphasises the stratification in respect of different depths. This statement, too, conforms to Riegl's views, who established the fundamental difference between plane and space, and who sees those antithetical tendencies on the one hand in the predominance of planes and contours, on the other in the dimension of depth. Wölfflin's " closed form " and " open form " coincide with Riegl's " absolutely closed individuality " of external objects and the " loosening and interruption of the articulation of the parts "; and, finally, the absolute and relative clearness of the object data does not actually represent a new term, but merely an antithesis which is implicit in pairs of terms like linear and pictorial or haptic and optical. That becomes quite clear in Wölfflin's statements " the representation of objects as they are, taken separately and open to the plastic tactile sense " (haptic) and " the representation of objects as they appear, seen as a whole and more according to their plastic qualities " (visual and coloured). Riegl might well have formulated his ideas in the same terms.

It cannot, however, be overlooked that Wölfflin's terms compared with those of Riegl have the advantage of being objectively accurate and exhaustive. Freed as they are from remnants of psychological content they do not lead to any misapprehensions, and are put in a form which is more suitable for the analysis of works of art. I see the difference between the two authors in the fact that Riegl intended to reduce the antithetical factors to a common denominator, to the haptic-optical complex, while Wölfflin did not perform that reduction, but tried, following Riegl and Wickhoff,[1] to subordinate to a system of antitheses the tendencies operative in the development of art, in order to provide both analytical and synthetic research in the field of art

[1] F. Wickhoff, " Die Wiener Genesis," *Jahrbuch der Wiener kunsthistorischen Sammlung*, 1895.

history with leading concepts. If one wishes to eliminate the pair of terms " haptic-optical ", one should give preference to Wölfflin's ideas, which are not based on elementary sensory functions and are given logical lucidity. On the other hand, there is no doubt that in spite of their ambiguity and vagueness Riegl's terms comprehend the often vaguely defined and overlapping terms of Wölfflin.[1]

Although I am not in a position to judge the relative methodological merits of the two points of view, I feel inclined to suspect that Wölfflin's notions are more useful in analysing individual works of art than in characterising whole periods. There is no doubt that certain artistic trends and styles are conditioned more by the linear and surface element than by pictorial and three-dimensional qualities; but these terms cannot be demonstrated in every period with that degree of clarity and absoluteness that Wölfflin has shown to be valid for the Renaissance and for the Baroque period.

To sum up and supplement the above arguments: Riegl's theory of art can be criticised neither from a phenomenological and morphological nor from a genetic point of view. Riegl did not teach either the identity nor the heterogeneity of our tactile and visual experiences of space, neither did he follow in the footsteps of those authors who alleged the primacy of our tactile perceptions. His discussions were not concerned with the question of the origin of our experiences of form, and he was far from dealing with Optics and Haptics by axioms. He was only concerned to show that the whole development of art was governed by antithetical principles, that those principles could be considered from a universal and comprehensive point of view, and that, by starting from this point of view, the struggle for artistic modes of expression could be better understood and the development of artistic conceptions could be more easily followed. He taught that both these attitudes, the haptic and the optic one, at once sensual and spiritual, alternated with one another more or less distinctly in the development of the arts and exerted a determining

[1] It is only in Wölfflin's book (*Die Kunst der Renaissance in Italien und das deutsche Formgefühl*, Munich, 1931) that he frees himself markedly from the influence of Riegl. Where Wölfflin, in keeping to his philosophical attitude, once more tries to reduce the stylistic criteria of the Italian and German Renaissance to antithetical terms, his concepts become more general and can no longer be subsumed under the basic categories " haptic-optical."

influence on the character of the works of art within a period. In periods of transition they represent a twofold movement, which comes to a (relative) stop as soon as and for as long as one tendency preponderates over the other. The late Roman as opposed to Greek art, the Baroque period as opposed to the Renaissance, impressionism as opposed to Neoclassicism, and the linear-plastic trends of the most modern periods are clear examples of the rhythm underlying the rule of those two basic artistic principles.

I hope that I have been able to clarify the relationship between Haptics and Optics in the field of æsthetics by the preceding discussions. Their interplay has been described by Goethe when in his well-known Roman Elegy he makes the seeing eye partake of the haptic function, the feeling hand of the optical function:

"And do I not teach myself by observing the sweet bosom's
Delightful forms, by letting my hand glide down the hips?
Then do I really understand the marble; I reflect and compare,
I see with a feeling eye, I feel with a seeing hand." [1]

[1] "Und belehr' ich mich nicht, indem ich des lieblichen Busens
Formen spähe, die Hand leite die Hüften hinab?
Dann versteh' ich den Marmor erst recht; ich denk' und vergleiche,
Seh' mit fühlendem Aug', fühle mit sehender Hand."

B. THE CREATIVE ACTIVITY OF THE BLIND

I

INTRODUCTION

In the foregoing chapter we have substantiated our views on the lack of æsthetic experience in the blind. The statements of the majority of psychologists on the æsthetic experiences of form in the blind could not be confirmed. Our observations on blind and seeing subjects have, on the contrary, proved the correctness of the opposite view. In this connection the question arises how to reconcile with this the fact that blind workers may create sculptures which are remarkable from an artistic point of view and which appeal to our æsthetic feelings. Before attempting to reconcile these apparently contradictory facts, we have to decide whether we are justified in looking upon the sculptures of the blind as creations of genuine artistic value. Not until we have answered this question can we deal with the problem of the sculptures of the blind. In the first place, there can be no doubt that those born blind are in an entirely different position from those who have become blind at a later period of life and, owing to their previous experiences and visual memories, might more easily be capable of artistic achievements. We shall therefore have to deal with these two matters separately. We shall need to follow the part played by the visual functions in the creation of haptic works and get further information about the relation of those who have become blind at a later period of life to the sighted when the latter use haptic ways of perception and creation. So, in addition to our psychological observations on the blind, we shall report on experiments performed, first, on two sculptors in possession of all their normal senses, who performed their work purely by haptic means, and, second, a blind sculptor. Finally, the entire course of the development of the so-called blind

sculptors will be discussed in detail together with a psychological and æsthetic analysis of their works. In this connection we shall deal with the fundamental problem of the artistic creativeness of the blind, a problem which will at the same time elucidate the general problem of artistic creation.

II

THE SCULPTURAL PROCESS

1. Plastic Achievements of those Born Blind

The literature on the psychology of the blind does not provide much material on the problem of the achievements in modelling of those born blind, and the few facts available convey a very unfavourable picture of the plastic abilities of the blind. In order therefore to avoid drawing rash conclusions based on insufficient material which might have failed to reveal more remarkable achievements, I approached two well-known Institutions for the Blind, asking them to let me have reproductions of plastic works produced by the most gifted of their pupils.

On the whole the achievements of the blind seem always to be judged too favourably. Teachers of the blind often characterise as the " best " achievements of young blind children clumsy representations which cannot be placed on a level with models by sighted children either in respect of the proportions or of formative ability. Remarks such as " The works of the blind are not very much inferior in quality to those of normal individuals " convey a totally wrong idea of the ability of the blind.[1] I can quite well understand the attitude of teachers of the blind. Taking into consideration the enormous difficulties which their blind pupils have to overcome in the object-lessons and modelling lessons, they are instinctively inclined to over-rate their pupils' achievements. This attitude, however, makes it from the very beginning impossible to compare their work with that of sighted children, and it also leads to incorrect theories.

In judging their works we have to compare them with the works of trained but only averagely gifted normal children and adolescents; nothing short of such a comparison will give us the necessary data for answering the question.

The difference in creative activity between sighted children and children born blind may probably best be demonstrated by

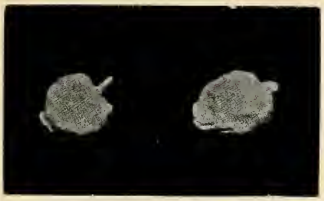
[1] K. Bürklen, *Blindenpsychologie*, Leipzig, 1924, p. 211.

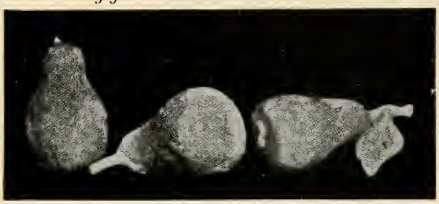
Best representation of animals.

A. Cat (Boy, 10;9 years)

B. Camel (Boy, 13 years)

Best representation of fruit.





C. Apple and Pear (Girl, 11;7 years.

D. Pears (Boy, 13 years)

E. Man (Boy, 10;9 years)

Best representation of the human body.

F. Washerwoman (Girl, 13;9 years)

G. Man (Boy, 9;10 years)

Worst representation of the human body.

H. Woman (Girl, 13 years)

FIG. 44.

comparing the plastic works of *untrained sighted pupils* modelling blindfold with those of *untrained pupils born blind.* Some of the reproductions in the publications of Burde and Matz may serve this purpose.[1]

Fig. 45.

Although neither of these groups attains a high level, the difference between them is striking. One need only consider the best representation of the human body achieved by a blind child. It consists of completely unproportioned limbs and a head, on which only the ears are completed. Compare it with the representation of the "Washerwoman" by a sighted child (Fig.

[1] A. Burde, "Die Plastik der Blinden"; and W. Matz, "Eine Untersuchung über das Modellieren sehender Kinder," *Z. f. angew. Psychologie*, **4**, 1911, and **6**, 1912.

44, E and F). We encounter the same difference in the representation of animals and fruit (Fig. 44, A to D).

The difference becomes even more marked if one compares plastic works performed under the same conditions by *trained children born blind* with those by *trained sighted children* and adolescents(Fig. 45). In the worst representation of the human

Fig. 46.—Model and Copy by a Boy Blinded at a Fairly Late Age.

body it strikes us that the seeing child at least succeeded in giving the general plan of the body as well as a certain attitude, while the works of the blind are really unintelligible. Even the worst representations of human figures by untrained sighted children are in every respect on a much higher level than the best work achieved by trained blind children.

There is also a definite difference between the two groups of blind, between those born blind and those who have become blind at a later age. Figs. 46 and 47 are taken from a series of experiments carried out by one of my collaborators. The

pupils were asked to reproduce in clay the grotesque figure of a camel.

Fig. 46 gives the model and the copy made by a pupil who became blind at a comparatively late age, Fig. 47 the copy made by a pupil born blind. Both were trained in modelling.

Although the works of pupils born blind, aged thirteen to fourteen, from Institutions for the Blind convey a better impression

Fig. 47.—Model and Copy by a Boy Born Blind.

of the creative activities of the blind, they are on such a primitive level from a technical point of view that they cannot be compared with the works of young sighted pupils fairly well trained in modelling.

From my collection I contribute three works by pupils born blind. One of these (Fig. 48) represents the " Adoration of the Magi ", the second (Fig. 49), " An Ox ", the third (Fig. 50), " A Washerwoman ".

The group does not completely lack expression. But this is not so much due to the form and attitude of the separate figures

as to the subject and the situation. The representation of the people is extremely primitive; the features of the faces and the limbs which one would expect to convey the expression are not

Fig. 48.—Adoration of the Magi.

Fig. 49.—An Ox.

represented even in a schematic way. The face appears as a completely unorganised and shapeless surface without eyes, ears, nose, or mouth. The ox is comparatively well modelled, although here too there is a complete lack of genuine structure.

One can hardly make any statement about the artistic value of these works. They are incompatible with our æsthetic feeling and our æsthetic criteria. They may in themselves be interesting, just as many primitive children's drawings are. They may further convey some insight into the haptic conception of form and into the emotional world of the blind; but they have nothing to do

Fig. 50.—A Washerwoman.

with artistic tendencies or artistic fantasy. What urges the blind to creative activity in spite of everything and what their works mean to themselves will be discussed in the next section.

2. Plastic Creation by those Born Blind

The question we have to ask is the following: What do the plastic works of the blind mean to their creators? What significance do they hold for them? An answer to these questions can only be provided by such plastic creations as have been produced quite spontaneously and free of any restrictions imposed by principles of method and by the objects in the modelling lessons—

i.e., when the pupil was clearly told not to pay any attention to the question of likeness or the routine principles of the modelling lessons.

The conditions were fulfilled in the experiments of Münz and Löwenfeld.[1]

They told seven pupils born blind and seven pupils who had a little vision remaining to make plastic representations of just what was in their minds. They were in no way told how to express what they felt.

The process of modelling by blind pupils shows that *their creative activity is largely governed by the same rules as the perceptive process operative in the haptic examination of plastic objects.* This surprising conformity strongly supports our views on the haptic perception of form.

The first thing which strikes us in this modelling activity is the fact that the separate parts of the sculptures are modelled each by itself and independently of one another. In modelling a face the most important features, like the eyes, nose, mouth, ears, etc., are executed and laid on separately. The tendency towards piecemeal structuring with which we have become acquainted in discussing haptic perception becomes still more noticeable. Two hollows are gouged for the eyes, two eyeballs are inserted, each wrinkle on the forehead, each tuft of hair is set next to its neighbour, the separate features are shaped plastically, and afterwards they are fitted on to the plane of the face. These characteristic parts are not executed in accordance with reality; on the contrary, there is a tendency to find a schematic form, which *symbolises* the feature in question according to the feelings of the blind worker. The other parts of the face, such as cheeks, eyelids, sometimes even the ears, which are of no symbolical significance for the blind, are rather neglected, or even entirely omitted.

It would, however, be quite wrong to deduce from this piecemeal way of sculpturing that the blind modeller has conceptions of the parts only, as opposed to a conception of the " whole ". Even at the early stage of modelling the separate parts there must be present to his mind some sort of " idea of totality " forming his activity right from the beginning. It is, however, difficult to describe the exact nature of this notion of unity. It cannot be looked upon as identical either with our visual perception of form

[1] L. Münz and V. Löwenfeld, *Plastische Arbeiten Blinder*, Brünn, 1934.

or with the integrative haptic impression of form. It is probably much more a complex of experiences, including certain motor and formative tendencies connected with the emotional and volitional life. We are dealing with the results of an actualisation of an urge to create, which shapes the amorphous mass with a peculiar experience apparently involving purpose, concept formation, and motor activity. The fact that this tendency, which is rooted in the emotional life and striving for expression, is so strongly marked in the creative work of those born blind, is due to their limited perception of form, a feature which seems to arouse in the blind the urge towards spontaneous production. When therefore one born blind chooses human figures as the means of expressing his emotional attitude, he does not make any attempt at giving realistic reproduction; he is quite satisfied with so-called symbolic "forms" and he neglects everything which is not a vehicle serving his expression, irrespective of whether these neglected parts are relevant for the total form and meaning. This accounts also for the fact that in most cases the blind sculptor, in contradicting the stereoplastic principle, refrains from creating figures with many facets, palpable from all sides, and confines himself to the execution of the frontal view. As soon as he has achieved his aim of expressing himself by giving a full-face representation of a head, he no longer bothers about the remaining parts. Expressionistic art does not actually require realistic representation. The young blind modeller therefore confines himself mostly to those parts of the face which express his intentions clearly.

Fig. 51.—Old Man.
Artist Born Blind.

Accordingly, in modelling an old man he works out the characteristic part only, the wrinkles on the forehead, the orbits and the hollow cheeks(Fig. 51). In the mask " Horror " (Fig. 52) the

open mouth and the region of the eyes are given prominence, while the remaining parts of the head—the forehead and ears, etc.—are completely neglected. Similarly, a blind girl found it quite obvious to omit the back of the heads in a model called " Two Kissing People ", since the contact of the mouths expressed all that was relevant. This attitude accounts also for the tendency to overstatement, to exaggerate dimensions and all that is connected with the intended expression. These are the lines along which, for example, the face of the old man was produced; it consists mainly of two huge orbits with crudely inserted eyeballs, an enormous nose, an abnormally large mouth, and exaggerated wrinkles on the forehead. In a case where the hand is meant to convey the expression, it becomes too large in proportion to the other parts of the body, as in the figure of " Deserted " (Fig. 53), where the symbolic position of the hand dominates the whole picture, or in " Mourning " (Fig. 54), where the head takes up more than a third, nearly half, of the whole body.

Fig. 52.—Horror.
(By a boy blinded at 7 years.)

On the whole it may be said that the size of a part and its differentiation is in proportion to the importance which it has for the emotional life of the blind.[1]

This tendency towards the exaggeration of the size of certain parts is not a peculiar feature of the plastic art of the blind only—we meet with it in all types of expressionistic art. It would, however, be a mistake to assume on the basis of this element a relationship between the expressionistic work of primitive tribes and of mediæval and modern artists on the one hand and the creations of

[1] We must mention that this applies to the first stage of evolution only, to the period of so-called pseudo-naturalistic and strictly structural creation. In the next and last period, the " realistic " stage, where the representative parts become subordinate to the total form and where an approximation to the plastic forms of normal persons is aimed at, we meet also with tendencies towards the creation of form.

the blind on the other. The differences are far more important than the similarities. Such parallels between the artistic creations of the blind and those of primitive tribes are quite misleading, because they are based on the assumption that in their creative activities both these groups are governed by identical purposes and tendencies. This assumption is completely erroneous. The primitive sculptor is not motivated by his own emotional experience nor by the wish to express his feelings plastically—as is the

FIG. 53.—Deserted.
(Artist born blind.)

FIG. 54.—Mourning.
(Artist born blind.)

case with the blind—but by the intention to execute a work of art serving a definite traditional aim, and one which has been executed many times before in the same cultural community. His work is not the product of his emotions, but rather of the tasks set by the community, of the ideas deeply rooted in it and of the traditional patterns of the tribe. Primitive man does not work for himself, as the blind do to an extreme degree; he works for the community. The blind artist does not aim at objectivity. He is not motivated by an intention to project into his work his productive personality, the intensity of his creative urge, but solely or mainly by the wish to enjoy the exercise of his powers of expression through his work.

With the primitives all centres on the *work* and object; with the blind it is the creative *activity* as such that matters.

Münz has rightly recognised that the spontaneous plastic creations of those born blind are fundamentally only the *symbolical expression of their feelings* and that they do not pretend to be anything else. He takes the view that the artist born blind creates his figures *out of himself*, out of his own body sensation. In modelling, the blind artist becomes absorbed in the world of emotions or moods which he wants to embody in the figure. This attitude releases kinæsthetic sensations as well as sensations related to tensions which *act directly as creative impulses*. The blind artist tries to express these physical sensations in his plastic creation; and these sensations are related to emotional complexes and become manifest as activities in space.

When an artist born blind wants to represent plastically the condition of tense attention, say, he will be guided by the very marked sensations of muscular contraction, and will therefore work most vigorously on the orbits, the regions round the eyes, and the forehead. Everybody can realise for himself how distinctly and for how long one is aware of the wrinkles on the forehead, whenever one produces them on purpose, and how little they actually are when one observes them in a mirror. It is a fact that there is a definite discrepancy between the sensation of muscular contractions and the visible changes they produce on the surface of the skin. We meet with a similar experience in attempting to imitate blindfold the attitude of the " Deserted ". By placing one leg over the other and at the same time stretching out the arms far from our body, we get the feeling that our hands became larger and our legs shorter. This experience corresponds exactly with the plastic representation of the blind. In the attempt to represent this condition, in which he is guided merely by his body sensations, the blind modeller will of necessity produce oversized hands and neglect certain other parts which do not give rise to definite sensations. We find striking examples of this symbolical and expressionistic mode of representation in " The Deserted " (Fig. 53), " Mourning " (Fig. 54), " Raving " (Fig. 55), " Fatigue " (Fig. 56).[1]

[1] Some of these works are the creations of people born blind, and some are the creations of others who lost their sight at an early age. Provided they are working free from direction there does not seem to be any marked difference between the two groups.

The fact that bodily sensations become more vivid under the influence of sensory attention leads to a definite relationship between the intensity of emotions and the degree of disproportion seen in the plastic creations. This explains why sculptures by artists born blind do not correspond with our visual conceptions and further why they are inconsistent even with our haptic experiences. The plastic figures of the blind cannot therefore be called naturalistic, if naturalism means a representation based on our

Fig. 55.—Raving.
(Blinded at seven.)

Fig. 56.—Fatigue.
(Blinded at ten.)

visual and haptic impressions; but in another sense they are super-naturalistic, for they depend entirely on elemental bodily sensations.

In order to illustrate further the so-called "*autoplastic*" *representation*, I should like to add the observation that the blind modeller need not actually perform the movements or assume the attitude he wants to represent; nor is it necessary for him to feel his own body in order to get a correct idea of the special structure of the figure he wants to model. All he needs is *to experience the physical and psychological situation personally* by means of sensations of muscular tone. Münz gives a few illustrative examples of this autoplastic modelling. One of his pupils working on a figure called "The Proletarian" wanted first to make both arms with the huge hands equally long and vigorous. For this effect he tried

to transfer the proportions which he had given to the right arm by measurements on to the left arm. This conscious operation, however, was not successful. He had to be told simply to model the left arm according to his feelings, without bothering whether both arms would be of equal length; this enabled him to overcome the difficulty.

The plastic works of workers born blind provide an answer to the question we asked at the beginning of this chapter—namely, what is the significance of their plastic creations for this group of blind people if they do not pursue any æsthetic or artistic aims? The answer is: the production of plastic figures provides the blind with means of expressing their feelings, wishes, and emotions through creative work and of satisfying their urge to self-expression by means of autoplastic representation. Modelling should therefore not be looked upon as a method of communication used by the blind, but merely as form of utterance serving purely personal aims. The blind work for themselves, not for others. By their plastic works they want to express their present feelings, just as we do by mimicking. They are not searching for forms of artistic representation, but for means of expression.

Forced inactivity induces intelligent and energetic blind workers to look for means of releasing their urge to be active. Modelling is one of the few possibilities at their disposal. The advantage of modelling compared with other creative activities lies in the fact that in the process of modelling forms and figures become alive, which in the process of touching remain dead and bare of expression. It is only by means of his formative activity that a blind person gains real contact with the shape of objects, a contact which sighted subjects gain directly by the act of perception.

By taking this view of the free plastic creations of the blind—a view which I consider to be the only correct one—we are enabled to understand their mode of expression, which appears so strange to our natural feelings.

Finally, we have to answer two questions connected with the above problems. Firstly: Do the autoplastic works of those born blind express their intentions in such a way as to be adequately understood or interpreted by other blind persons—that is, in accordance with the intention of their creator?

Among the autoplastic works there are some which, because of

the attitude of the figures or certain distinctive features (disproportions, symbolical representation), allow of unequivocal interpretation—*e.g.*, " The Deserted " or " Horror ". Except for such sculptures, however, the vast majority of autoplastic creations are either not understood at all or are wrongly interpreted by the blind. Most of the modellings represent the intended expression so inadequately that the creator himself does not recognise them after some time.

This fact is rather surprising at first, but is well in keeping with our view that the blind sculptor who works on autoplastic lines is only stirred by the one urge to transfer his feelings and fantasies into an activity which, like all activity, at bottom possesses only temporary value. According to his present bodily condition, the blind sculptor will express his urge in different ways; that accounts for the fact that in spite of similar tendencies the forms of expression may vary considerably.

The second question we have to ask is the following: Do the creative intentions in autoplastic works manifest themselves in such a way as to be intelligible to the seeing as well? The negative answer which we had to give to the first question makes us expect a negative one to this question, too. To clarify the point my students were shown a number of reproductions of such works and were asked to state the meaning of the modellings. The result was that except for a few works the majority of the sculptures (which on the basis of the above-mentioned criteria were mostly interpreted correctly) were open to the most different interpretations. Even works which in my view gave quite a good interpretation of the expression of horror or of sadness met with quite different, sometimes even contrary, interpretations.

The best agreement over interpretation was met in the sculpture " Deserted ". It was described once as jilted love, eighteen times as various kinds of desire, twice as suffering. There were in addition twenty inadequate and twelve incorrect descriptions. The judgments on the figure of the " Smiling Person " showed less satisfactory results. In ten cases it was interpreted fairly correctly, in twenty cases it was characterised in terms of rest (death, sleep, tranquillity), in seven cases in terms related to thinking and attention.

From this investigation we may draw the conclusion that the autoplastic method of representation is entirely unsuitable for ex-

pressing emotion and feelings in a manner generally understandable. It is and remains an *unartistic personal expression of subjective experiences, and is not governed by any canons of form.*

It may appear superfluous to mention that autoplastic representation does not represent the only form of sculptural activity of those blind from birth. For when they copy a model, or when they work according to the rules of systematic and "optomorphic" tuition in modelling, or when they are guided by their own impulse towards an approximation to visual principles of form, they produce plastic works which are free from any autoplastic tendency.

3. Sculptural Achievements of those who Became Blind Later in Life

We get a very different picture when we contrast the plastic works of those who have become blind at a later period of life or have some vision remaining with the works of others who were born blind or became blind at a very early age.

All the experiences which a seeing child gets and develops, which the eye conveys to the sense of touch during the most important years of development, the sphere also of dreams (governed as it is by visual impressions), and lastly the vast system of associations which develops through the inter-connection of visual and haptic experiences—all these ideas and concepts remain operative to a certain extent after the loss of vision. Even though the varied phenomena of visual reality tend gradually to fade away in the blind, and though with the passing of the years it becomes more and more difficult to reactivate the visual memories, the blind man will nevertheless not entirely lose contact with the visual world, owing to the fact that his tactile experiences are based on visual impressions.

Every teacher of the blind knows from his own experience how much more easily the teaching of modelling is achieved with those who have become blind at a later period of life or who have retained some vestiges of vision than with persons born blind; he also knows how the former make much more rapid progress than the latter. Even during the preliminary exercises after the object lessons the pupils of the former group, given the same degree of intelligence, are in a much better position as a result of their visual experiences. They distinguish themselves not only

technically, but also in creative activity. This is not surprising in view of the fact that those who have become blind at a later stage of life have at their disposal tactile experiences acquired by visual means as opposed to the limited and defective experience of those born blind.

We want to demonstrate with a number of sculptural works the difference between the achievements of workers blind from birth and those of workers who have become blind at a later stage of life.

Fig. 57.—A Couple.
(By a boy born blind.)

First of all it is interesting to note that among pupils born blind by far the best plastic creations are those by two pupils, one of whom retained vestiges of vision during the whole period of puberty, while the other, a girl, undoubtedly the most gifted of the blind pupils—had never entirely lost the response to light with the right eye. These two cases are remarkable because they show that even minute vestiges of vision may enable the blind to create lifelike sculptures, such as could never be produced by those completely blind from birth.

By contrasting two sets of sculptures we may make clear the difference between the two groups in the establishment of proportions and in expressiveness. The first work (Fig. 49) was done by a completely blind pupil, the other by a girl who became blind at the age of seven.

The plastic works of pupils who have lost their vision at a later age are so distinctly superior to those of the pupils born blind, both from a technical and from an artistic point of view, that we

need not supplement the illustrations with further explanations. We draw the reader's attention to a mask, modelled by a pupil who went blind as a child (Fig. 51), and to the group of figures in Fig. 58.

The staff of the psychological laboratory of Amsterdam have recently examined pupils born blind as well as pupils who became blind later, for their ability to reproduce objects. Both groups were from the Institute for the Blind at Bussum in Holland. Marked differences between the two groups were found

Fig. 58.—Chatting in the Bar.
(By a girl blinded at seven.)

in both perception and reproductive ability. As those born blind are guided more by the structure—*i.e.*, by the separate parts and their structural relations—than by the total appearance of the model, their sculptures give somewhat the impression of piecemeal work, and do not show any formal connection between the separate parts. As those in this group of blind persons are not able to integrate the separate haptic processes into a unity, their sculptures lack the totality of form which we encounter in those who have lost their sight at a later period of life. Certain details, frequently unimportant from an integrative point of view, are very prominent, while other features which are relevant from the point of view of the general impression are neglected. They are

not aiming at copying the model as it appears in its entirety, but rather at bringing out the details. Those born blind do not at all realise what is really important for reproduction; they want to convey the content and not the form. I will give two examples only.

The pupils were told to copy the schematic model of a bear. In both photos the figure on the left gives the model to be copied; the first two figures on the right give the work of two pupils who had become blind at a later age, and the other two the work of two pupils born blind.

FIG. 59.—Model and Copies.
(By two subjects who had gone blind.)

FIG. 60.—Model and Copies.
(By two boys born blind.)

Further support for our view that the combined visual and haptic experiences of the seeing period are of decisive importance for the plastic abilities of the blind may be found in the fact that all the blind sculptors known in literature and discovered by me belong to the group of " late-blind ". With one very doubtful exception, not one of them was deprived of vision before the end of adolescence—that is, before the twentieth year. This fact and its converse—the fact that those blind from birth have never produced any plastic work of æsthetic value—leaves no doubt whatever as to the importance of visual impressions as the basis of tactile experience.

4. The Sculptural Process in Modelling Blindfold

The clumsy plastic works of pupils blind from birth have shown us that without the help of vision or of visual memories and visualised tactile experiences the development of creative activity is confined within narrow limits. Although the blind are able to improve their manual dexterity and learn to execute certain schematic forms with great accuracy, their imitative and productive ability remain extremely reduced. Even in handicrafts the working hand is *the tool of the eye.* It is the eye which sets the haptic sense its tasks and directs it. Training under constant visual control and the numerous associative connections between visual and tactile perception and the ability resulting from this to transfer visual impression to the haptic sphere—all these factors help to develop dexterity and to raise achievements above the primitive level.

The fact that untrained sighted children working blindfold produce far better work at modelling than trained blind children may be looked upon as the best evidence of the outstanding importance of visual function. This view is further supported by the technically remarkable achievements of blind sculptors who, before becoming completely blind, have trained themselves systematically in modelling with their eyes closed.

I started from the assumption that the importance of vision in modelling would only be fully realised when a sighted artist copied a model with vision completely excluded. Such an experiment may also be instructive from other points of view. We shall realise how the artist suddenly loses his dexterity, and how his artistic personality recedes to the background, as soon as the eye is put out of action.

The blind sculptor, it is true, may not simply be identified with the artist who works blindfold, but we shall find so many similarities in the reproductive and creative activity of both of them that we shall feel justified in discussing both cases from one and the same point of view.

A talented young sculptress agreed to copy a bust in the original size in clay, blindfold. The work proceeded as follows:

After a quite schematic shaping of the clay she started with the modelling by proceeding piecemeal from part to part. Every phase of the work was accurately and repeatedly checked on the

original. At first the artist modelled with the right hand only, using the left as a check. Later on, when she had become more conversant with the original, she modelled with both hands. This led to definite difficulties which made her say: "One ought really to have three hands, one of which could always remain in touch with the model."

After the provisional modelling of some separate parts, 1 to 2 centimetres in size, the sculptress began to copy parts in greater detail. In doing so she constantly checked the immediate surroundings of the area she was working at. This method of modelling might best be compared with the technique of mosaic workers, who in following with the model insert the different bits of stone and marble one after another, paying constant attention to the outlines without bothering much about the total picture. The work of someone concerned with reproductive modelling does not proceed by such minute steps as in mosaic work, but fundamentally it is similar to it.

It was further realised that the tactile movements required in modelling corresponded exactly to those which the seeing and the blind perform in the act of haptic perception and recognition. This shows that there is no difference between the tactile movements used in perceiving, on the one hand, and in copying or modelling on the other—a very important fact from the point of view of a general theory of Haptics. For this fact points clearly to the actively creative and dynamic nature of the haptic sense in all its functions—perceiving, formative, and cognitive.

Moreover, the sculptress could not rely on her tactile sense of distance and proportion. Like many blind sculptors, she had repeatedly to make use of calipers. It seems impossible to construct a human body haptically in correct proportions without calipers or other measuring instruments, among which of course the hand in its metrical capacity must also be reckoned. Owing to the absence of actual perception, one is dependent on measuring. The sculptress repeatedly measured in the original those parts of the face in particular which are important from the point of view of haptic recognition, such as the nose, forehead, chin, and mouth, the measurements being transferred to the copy. The modelling of the mouth gave rise to special difficulties; she was very keen on rendering the "smiling" mouth, the expressive centre of the face, in as lifelike a manner as possible. The parts surrounding the mouth were

also very accurately copied and constantly checked. The greatest length of time was devoted to these parts of the face, but she did not pay much attention to the eyes. These appeared to her perfectly bare of expression, " blind ", just as they are for our blind subjects. She kept on saying, " The eyes are hopeless, I cannot make anything of them ". During the last half-hour, however, she tried to copy the eyes somewhat more accurately. She took accurate measurements, but without any success. After many attempts she gave up comparing and started simply to copy " eyes ", as eyes usually are (symbolic representation). She became aware of the fact that the expression of the eyes could not be grasped by haptic means and could therefore not be rendered.

After two days of very hard work extending over four periods of three-quarters of an hour each the sculptress came to the conclusion that she could not improve further on her work. She felt as if she had reached the limit of what could be attained. In fact during the last half-hour she merely checked the parts which she had modelled. So it became clear that up to the end she had not realised which characteristics were actually relevant from the point of view of the general impression. Quite irrelevant details were very accurately examined in the original and were compared with the copy, but important parts were entirely neglected. Up to the last moment she was busy with details, and it was very surprising to see that she never felt the face of the original and of the copy in a synthetic way. This is in perfect harmony with her own experience, for she stated that she could not get a total impression either of the original or the reproduction she had made herself, and so she did not wish to feel the sculpture integratively.

We now removed the bandage from her eyes and presented the copy to her visually. Her surprise was considerable. Her work had no resemblance to the idea she had gained from the model—definite evidence of the dissimilarity of visual and haptic impressions. But the most striking refutation of the assumption that there is a far-reaching concordance between visual and haptic impressions presented itself later. For when we disclosed the model, the artist recognised it as a bust which had been in her studio! One has to realise the importance of the fact that after feeling a bust hundreds of times this sculptress was not able to identify it, even although she had repeatedly used it as a model

for her studies in drawing. This fact is not only a stringent proof of the dissimilarity of visual and haptic impressions; it also shows very definitely that haptic impressions can be transposed only to a very limited extent into visual terms. Our artist gained a clear visual impression of the bust she had handled.

It should be pointed out that all that has been said about the sculptural process of this sculptress when making a copy applies generally to the creative activity of sighted sculptors working on haptic lines and of sculptors who have become blind at a later age. We shall have opportunity to show this in the following results.

In order to obtain a record of the method of modelling, we took photographs of the work after every half-hour.

By comparing the different photos with the original, we realised that the sculptress had actually performed the essential part of her task within the first half-hour. No great changes are seen in the following stages. There is a definite likeness between the copy and the original, both in the front view and in profile. As to details, the forehead, nose, and chin show a fairly good likeness, whilst the skull and the cheeks are less satisfactory. The general profile has wrong proportions. The expression of the mouth is not rendered satisfactorily, although some indications of it are to be found. The sculptress interpreted the wrinkles round the mouth as the expression of laughing, and modelled the copy accordingly. The eyes are bare of expression and blind.

The most striking conclusion which we draw from this experiment, and which seems to be important also for the problem of the sculptural activity of the blind, is that in spite of her tactile experiences based on visual impressions, and in spite of her visual memories being intimately associated with her haptic impressions, the sculptress was not able to render the characteristic features and the expression of the person represented in the model. She could not, in fact, succeed, *because these features cannot be perceived by haptic means at all*.

In order to be able to make a true copy of something, one must first perceive it accurately. As the haptic sense in itself is so very limited in the perception of form, it seems from the very beginning hopeless to reproduce a figure corresponding to the visual image by means of haptic impressions. Moreover, on account of the very limited direct haptic impressions of proportion, the parts

FIG. 61.—The Course of the Work of a Blindfolded Sculptress (Stages 1–5).

of the copied model are rarely set into correct proportion to the whole. It is true that the blind may make use of measuring instruments, even though they are not able to check the correctness of the proportions between the measured and estimated parts, for this is only possible by direct visual comparison of the two objects. We have had an opportunity of realising how difficult it is even for the sighted to reproduce the simplest proportions by haptic means; we can therefore imagine what a task it must be to reproduce correctly a system of proportions, like a face, by means of haptic impressions, or even by measuring instruments.

The limited possibility of perceiving forms and proportions by means of the sense of touch accounts for the fact that the individual features of a plastic work cannot be recognised or produced by haptic means. The individuality of a work of art cannot be comprehended through fragments, and the schematic picture is too poor in details to be an adequate substitute for the original. Fundamentally an artistic reproduction can only be achieved if the work is performed with constant reference to the original as a total entity and to the artistic purpose. This condition is not fulfilled in the blind nor in the sighted when they are working on haptic lines.

From the results of this experiment we might be inclined to draw the conclusion that the difficulties which arise in copying plastic works should become even more marked in spontaneous sculptural activity. This, however, would be an erroneous conclusion.

Copying and spontaneous work are quite different matters. What applies to the one need not apply to the other. What has been said of the work of copying may at most be applied to portraits, provided that one aims at life-like representation. But apart from such naturalistic portrait studies, and as far as concerns spontaneous modelling, it is possible that blindfold sighted subjects might attain more satisfactory results than at copying the works of other artists. It might even be possible that the artist's procedure becomes a different one under such conditions. This is all the more likely as in this case the sculptor is not bound by the perceiving and transposing functions, but may in his work make free use of all his creative energy and his wealth of visual and haptic experience.

In order to answer this question, we asked our sculptress to

perform any kind of plastic work blindfold. She decided to do a cat. The progress of the work was registered by means of a ciné-camera. The pictures given (Figs. 62–70) are cuttings from the film.

The sculptress started by shaping the clay so as to give a rough outline of the object she intended to represent.

Then she began to construct the figure by joining the separate parts, thus working in quite a different manner from that of a seeing artist, who, after designing a rough and schematic sketch, works the total form out of it. That is to say, before the general features of the animal were available the sculptress started to execute the separate parts which were important anatomically without paying much attention to the total impression. Thus the principle of piecemeal structuring is seen to be operative right from the beginning, as opposed to the integrative formative principle of the seeing artist.

The establishment of the proportions of the parts to each other caused her considerable difficulties. Although the task in itself was not a difficult one, it was not possible to obtain a well-proportioned whole figure by comparison of the proportions between the parts.

After fifteen minutes of very intensive work—a period during which the sculptress modelled quickly and straightforwardly—we had a short pause. She resumed her work after the pause and began to model the head. After quite a short time she realised that this method of working would not lead her very far. She therefore changed her method and worked according to the familiar anatomical structure of the parts she wanted to model. At this stage our sculptress also made use of her hand and fingers to check the proportions and the symmetry.

The work was again interrupted after a further ten minutes.

After a second rest-period the sculptress became depressed by a feeling of not being able to advance, and worked in a somewhat apathetic manner. She did not entertain much hope of being able to improve on her work. She told us repeatedly that she could not get a coherent picture of the animal she was modelling. Nevertheless she went on with her work and devoted most of her efforts to correcting the attitude of the body, and the relative proportions of the parts; but she did not succeed in her attempts. She became more and more unsteady. The longer

FIG. 62.

FIG. 63.

FIG. 64.

FIG. 65.

FIG. 66.

FIG. 67.

FIG. 68.

FIG. 69.

FIG. 70.

she worked the more the figure lost its originality. It became more and more unnatural and schematic. At this stage the sculptress began to stress the anatomical proportions and to accentuate certain details which actually prevented the creation of a unified figure.

The work was stopped after thirty-five minutes, especially as the sculptress was convinced that the figure had become worse instead of better as compared with the first sketch.

Finally, it should be mentioned that the sculptress was very surprised when she was shown the figure. She had had quite a different idea of it.

Fig. 69 shows us the surprise of the sculptress and Fig. 70 her satisfaction over the fact that she had after all done better than she expected.

Apart from this sculptress I have also experimented with a sculptor, a friend of mine. As his attitude and way of working were very similar to what we have just described, I need not discuss them.

I have further examined the process of sculpturing in an artist who became blind at a later period of life. For this investigation I chose the blind sculptor Masuelli. I shall give a detailed account of his technique in Chapter III of Part B. For the time being it need only be said that the whole process of modelling corresponded broadly with that observed in sculptors who worked blindfold. In the case of Masuelli also the very first sketch determined the eventual outcome. Just as our sculptors who worked blindfold reached a sort of critical stage after about twenty minutes, and broke off after thirty to forty minutes, our blind sculptor too reached the critical point after a comparatively short time (fifty to sixty minutes), and stopped completely after a further sixty minutes with the feeling that he could not improve on the work. The similarity goes even farther. Both built up the figure out of separate parts; neither of them was able to gain a total impression of the work; in each case chance played an important part. They both had to struggle with problems of symmetry and proportion; they were both without a definite starting point, and therefore liable to become lost; they were both unable to improve on their work by means of correction or finishing touches. The blind as compared with the sighted artist who works blindfold are in a better position, due to their training and to the experience

which they have gained in the course of their sculptural activities, and they make use of it in the experiment.

The experiments performed with all three sculptors have led to very important results in regard to the problems of general and formal haptics.

The most important fact emerging from our studies is that all the tendencies and principles which are at work in the process of haptic perception are fully operative in the field both of reproductive and creative haptic work. The stereoplastic principle operates here just as it did in haptic apprehension. The plasticity of the object becomes even more manifest in the process of haptic creation than in mere conception. The principle of successive progress as well as the kinematic principle is inherently connected with sculptural activity. The metric principle manifests itself in the fact that the main proportions of the plastic work are checked and the symmetry of the two halves of the face controlled by measuring the distance between the ears and the eyes. The schematising tendency becomes very marked in the æsthetic experience of the modellers as well as in their work. The person who works on haptic lines strives just as little after individualisation as the person who perceives haptically. The tendency towards transposition and the urge towards adapting the haptic form to the usual concept manifest themselves again and again. In creative activity the principle of structural construction, the elements of which are only secondarily checked by means of structural analysis, corresponds to the structural analysis which is instrumental in the process of haptic perception. The principle of constructive synthesis is realised in the fact that the separate parts become fused into an architectonic arrangement which is determined by the structure of the whole object. Lastly, the autonomous formative tendency of creative activity manifests itself most clearly in the fact that the sculptor builds up his first sketch—the original and expressionistic formulation of his haptic conception—out of purely haptic and kinematic forms irrespective of visual concepts.

This close relationship between haptic perception and haptic creation is a strong argument in favour of the assumption that *the above tendencies and principles are unreservedly valid in the whole field of Haptics.*

III

BLIND SCULPTORS OF THE PAST AND PRESENT

1. Introduction

From the results of our investigations reported in the preceding chapters one would anticipate with some justification that blind sculptors are lacking in artistic creativeness. A clarification of this question appeared to me to be so important both from the point of view of Haptics and of general æsthetics that I decided to investigate the problem of the blind sculptor—a problem which had hitherto been completely neglected—and to lift the veil that had so far obscured the question.

The literature refers only to isolated cases of blind persons engaged in sculptural work. I was only able to find four names—viz., the Tyrolese wood-carver Kleinhans, the sculptor of animals, Vidal, the modeller Moudrý, and the old Italian, Gonnelli, known as the " blind man of Gambassi ". Through further enquiries I came to hear of four more living sculptors: the German, J. Schmitt, the Frenchman, G. Scapini, and the Italians, F. Bausola and E. Masuelli, all of whom had lost their sight in the first World War. Further enquiries would certainly lead to the discovery of other blind sculptors.

The fact that not the slightest attempt has hitherto been made to investigate these few problematic cases is characteristic of the limited interest which has been shown in these important cases. One may well understand and excuse the attitude of the art historians, since the achievements of blind sculptors are rather irrelevant from an artistic point of view. Psychologists of the blind, however, who deal in detail with the sculptural activity, the object lessons, and the æsthetic feelings aroused in the blind by the contact with plastic works of art, cannot make such an excuse. I find it rather surprising that the authors who are specialists in the field of the activities of the blind do not, so far as one may judge from their publications, actually know the works of the sculptors they mention, either in the original or from

photographic reproductions. In the available literature I did not find a single picture, except for a portrait study, which is erroneously ascribed to the artist Kleinhans, and gives no evidence of the talent of the sculptor. We must therefore assume that the authors had no adequate notion of the abilities of blind sculptors, otherwise one could hardly understand the far too benevolent judgments which they passed on the works of young blind sculptors.

In order to fill this gap in the psychology of the blind, I set myself the task of collecting reliable data on talented sculptors, dead or living.

I met with a good deal of confusion. Many works had erroneously been attributed to blind sculptors, others were found never to have existed at all; a great number of once-existing sculptures had got lost, others could only be traced with great difficulty. The works had to be subjected to a strict criticism as to style, and the peculiarities of local conditions and the relation between style and local tradition had to be taken into special consideration.

2. Types of Blind Sculptors

So far as my own investigations are concerned, the blind sculptors with whom I am going to deal represent from a theoretical point of view the most important types of blind modellers, (1) those blind from birth—*i.e.*, the blind without any visual memories; (2) those who had lost their sight at a very early age; and (3) those who became blind at a later stage of life, whether they received their training before or after becoming blind.

Kleinhans (1774–1853), who became blind at the age of four, may, with some reservations, be looked upon as a representative of the first group. According to contemporary reports the whole of his artistic activity, including his training, took place during the period of complete blindness. Should Kleinhans actually have been completely blind—a fact which cannot now be definitely ascertained—his case would be absolutely unique. A similar case has never been heard of either before or since. This fact alone justifies a detailed description of his life and work.

The second type is represented by Moudrý (1865–1910), Scapini (born 1893), and Masuelli (born 1899), who started their creative activities many years after the loss of vision. These cases have this in common with Kleinhans, that they started sculp-

turing in the condition of blindness, so that right from the beginning they worked without visual control. Compared with Kleinhans, who is alleged to have been born blind, these sculptors were in a more favourable position, because they were all able to take with them into blindness stable visual concepts and a well-developed system of interconnected optical and haptic perceptions.

The third type is represented by Gonnelli (1603–1664), Bausola (born 1893), Vidal (1831–1881), and Schmitt (born 1891). They all lost their sight at a later period of life, at a time when they had already learnt or practised their art. They were in the fortunate position of having been trained while they could see; they were well equipped not only with visual images and visual-haptic associations and fusions, but also with a rich technical and artistic knowledge, and they had therefore no very great difficulty in carrying on their sculptural activities.

The fact that we find so very few professional sculptors among many thousands of educable blind definitely shows that sculpturing and interest for plastic art do not easily develop on the basis of the isolated function of the haptic sense. Otherwise it would be difficult to understand why the artistically gifted blind hardly ever choose a profession connected with plastic activity—*e.g.*, pottery—in spite of the fact that in the institutes for the blind modelling is taught during almost the whole of the curriculum. Differences in respect to talent cannot be looked upon as the decisive factor, for we cannot assume that among those who have become blind at a later period of life, and who constitute the great majority of the blind, artistic talent should occur to a lesser extent than in people who can see. If therefore the blind do not take to sculpturing as a profession, if they do not even go in for modelling as a pastime, the difficulties must actually be associated with those impediments which are due to the exclusion of the visual sense.

We are now going to investigate the sculptural activities of blind sculptors on the basis of biographical data and their creative achievements. In order to do so it is necessary to draw a line between art and technique, between the genuine and the spurious, between invention and imitation; this will give us an empirical basis for answering the questions set by the artistic activity of blind sculptors.

3. The Tyrolese Sculptor of Crucifixes, Jacob Bartholomew Kleinhans

(a) *Biographical*

Kleinhans, the sculptor of crucifixes, seems to occupy an honourable place among Tyrolese artists. Even now his name is as well known in his native country as if he were an artist still living. He was born at Nauders, in the Upper Valley of the Inn, on the 24th of September, 1774; he died there of old age on the 9th of July, 1853. Of the few documents dealing with him I shall mention only the one reliable report on his origin, his family, and his not very eventful life. This is the communication of the lawyer Joseph Rungger of Nauders. Rungger, a contemporary and compatriot of Kleinhans, must have written his report before 1803, for his communication is reprinted verbatim in the *Tiroler Merkwürdigkeiten und Geschichten*, Vienna, 1803.[1] The data contained in this report extend only to the twenty-sixth or twenty-seventh year of the life of the blind sculptor. We get some further information on his life from a brief communication in the *Kais. Königl. priviligierten Boten von und für Tirol und Vorarlberg*, dated 1823.

If we attempt to reconstruct the life of the Tyrolese artist from the reports of his contemporaries we find the following:

J. B. Kleinhans, the son of a peasant, lost his sight at the age of four years as a consequence of small-pox. Of his thirteen brothers and sisters, seven died from this disease. At the age of seven he became an apprentice to the cabinet-maker Johann Prugg of Nauders, who taught the blind boy wood-carving. Under Prugg's tuition he gradually performed "fairly good pieces of work". At the age of twelve or thirteen, Kleinhans tried to carve a crucifix for the first time. "He took another crucifix as a model, felt it until he had gained a clear idea of it, and finally shaped out of a piece of wood the image of our Lord on the Cross. Considering that this was his first attempt, he did it so well that everybody was surprised at the achievement of a completely blind boy." This success encouraged him shortly to join a sculptor at Fendels near Ried in the Upper Valley of the Inn, in order to get further training in this art. At the age of twenty-

[1] Manuscript in the *Landesmuseum Ferdinandeum* at Innsbruck (Dip. No. 1104, pp. 422–424).

FIG. 71.—Jacob Bartholomew Kleinhans, the Blind Tyrolese Sculptor.

two Kleinhans went to Fügen in the Valley of the Ziller to work under the sculptor Franz Nissl (born 1751), who was very famous throughout the country for his altar-pieces, bas-reliefs, and statues. Kleinhans, however, stayed but a few weeks with Nissl. "He learnt so much from the Master that he was able to make better use of the tools and to give his figures happier proportions." Then he returned to his native village, where he diligently carried out orders given him by ecclesiastical and private people.

Our Lord on the Cross was practically the only subject of his sculptural activities. The constant, at times exclusive, occupation with the image of our Lord enhanced his religious feelings to such an extent that he felt compelled to contribute in other ways to the glorification of God. At the age of thirty-six he starts learning to play the organ, in 1811 he is even for some time organist at the pilgrim chapel at Kaltenbrunnen.

Being a good Tyrolese and a loyal subject of the Habsburg dynasty, he considered the year 1815 to be the most important in his life; for in this year he was granted the privilege of being received by the Emperor and of showing him the wood-carved portrait he is said to have made from a child bust of the monarch.[1]

Kleinhans' fame spread quickly beyond the borders of his native country. For quite a time his crucifixes were in great demand. When, however, the demand for his crucifixes gradually declined, Kleinhans left his native village and travelled to different places. After his peregrinations he always returned to his native village, where he died at the age of seventy-nine. A good portrait by Franz Stecher, who is said to be a nephew of the sculptor, in the Ferdinandeum at Innsbruck shows the blind master at his work (Fig. 71).

According to the *Allgemeines Lexikon der bildenden Künste*, Kleinhans produced over 300 crucifixes. This figure appears to me to be grossly exaggerated. At any rate, in spite of all efforts, I was unable to find more than a very small number of his works in the district where Kleinhans worked. Even the works referred to in the *Allgemeines Lexikon* are open to some doubt. In enumerating the

[1] The report by Hörmann (*Oesterr. Alpenpost*, Vol. 5), according to which he met the Emperor Franz I at Nauders at the coach stage, where the Emperor is said to have allowed him to feel his face to enable him to make a bust-portrait, seems to belong to the realm of anecdote. It is most unlikely that the enthusiasm for art of a Habsburg should have gone so far.

works of the master, Thieme-Becker's *Allgemeines Lexikon* mentions only the bust of St. Charles Borromaeus for the prince-bishop of Brixen, that of Saint John of Nepomuk near the Upper Sill bridge at Innsbruck-Wilten, a further Nepomuk bust on the main road near Latsch in Vintschgau, a bust of David in the possession of the bishop of Chur, a bust of St. Francis in the Ambras Collection in Vienna, the bust of St. Erasmus at Maria Einsiedel, and lastly the crucifix and the statue of the Virgin in the church of Nauders. I doubt whether all those works have actually existed; the authorities I approached did not know anything about most of the works mentioned—*e.g.*, the episcopal Court at Chur did not know anything of a statue of David; even the name of Kleinhans was unknown to them. Even at Nauders nobody knew of a statue of the Virgin; neither in the parish church nor in any private house was such a statue to be found. The mention of a statue of St. Francis in Vienna must be based on a mistake, for the Ambras Collection of the "Kunsthistorisches Museum" in Vienna includes no work whatever of Kleinhans. In one document I found a mention of the altar of the parish church of Silz; it was found that this was due to a confusion of names, for the altar was not a work of Kleinhans, but of a wood-carver Kleinheinz of Silz.

On the other hand, there are in the Cistercian convent at Stams in the Upper Valley of the Inn some works of Kleinhans, which I have not found mentioned anywhere—namely, a crucifix and a St. Sebastian, a large crucifix in the vestry of the church at Nauders, which is exhibited during Lent, a small crucifix belonging to the peasant Kuppelwieser (House No. 55), a second crucifix in the Post Hotel, and, lastly, the statue of the Tyrolese Saint Notburga belonging to the peasant Josef Kleinhans, a relative of the blind artist.

The question arises whether the works which I could not trace are lost or whether they never existed? That is a question which cannot be answered. The art of wood-carving was so widespread in the Tyrol in the eighteenth and nineteenth centuries, the number of skilled masters and famous workshops was so great, and the tradition of the form of representation and the technical execution was so firmly established, that the names of the artists can no longer be ascertained.

(b) *Problems of Method*

Kleinhans' sculptural achievements gave me a great surprise, because they appear to support a view diametrically opposed to my own, and seem to prove the fundamental possibility of artistic creations by people born blind.

The first question we have therefore to ask is how to reconcile with the results we get from subjects born blind the fact that a man who was completely blind from birth produced work in every respect like sculpture achieved by sighted artists.

Even a superficial glance at the illustrations ought to convince us that the reports that Kleinhans was born blind belong to the realm of historical errors. The works cannot be copies, for by now we know too well from our experiences with blind and sighted artists that the blind are unable to produce copies of such expressiveness as is shown in the sculptures of Kleinhans. On the other hand, the fact that his works do not show any " autoplastic " features, which are so characteristic of modellers born blind, and that they are entirely determined by visual principles of form, are incompatible with the view that they should be free creations by one blind from birth, both from the point of view of technique and expressiveness as well as of artistic value. We come to the same conclusion if we assume that Kleinhans, although not born blind, lost his sight in his earlier childhood. Such an assumption is not very much more helpful, for a child who becomes blind at the age of four is practically comparable to a congenitally blind child, and in this case, too, we should be dealing with an artist who actually had no idea whatever of the visual world. How could he in spite of this achieve sculptures similar, both from the point of view of character and execution, to those of artists who could see?

The first question must therefore be answered in the negative.

The second question with which we are faced is the following: Was Kleinhans completely blind when he created his sculptures, or was his vision only reduced?

In view of the fact that the acuity of his vision cannot be ascertained from any contemporary reports, there remains only the alternative of analysing Kleinhans' works from the point of view of artistic value, stylistic standards, and technical skill, in order to decide whether they can possibly be looked upon as the free

creations of a talented man, who became blind after he had grown up. If, by comparing the works of the blind sculptor with similar sculptures by contemporary sighted wood-carvers, we should reach the conclusion that there is *no* marked difference between the works of the blind sculptor and those of his contemporaries, we should have to decide between two alternatives: either to assume that Kleinhans was *not completely* blind when he produced his works—*i.e.*, that he only became completely blind after his creative period—or to doubt his authorship in the majority of the works ascribed to him. By such a comparison we are, of course, only able to elucidate the individual problem of Kleinhans.

Fig. 72.—Kleinhans: The Head of a Man.

(c) *Works*

We shall now subject the works attributed to Kleinhans to a critical examination in regard to style; as a result of this we shall come to the conclusion that the majority of his works, and especially the outstanding ones, could not have been created by a blind man.

As we are unable to date the works accurately we shall discuss the most important ones in order of artistic value.

The head of a man in the Ferdinandeum at Innsbruck might be dated near the beginning of Kleinhans' sculptural activity.

The work is completely devoid of artistic value; even from a technical point of view it is very primitive. The face is a type completely lacking in expression and beauty. As in most of Kleinhans' primitive works, we notice a certain amount of asymmetry. We ought not to consider the asymmetry of the two halves of the face as a stringent evidence of the blindness of the sculptor. Although the asymmetry is definitely connected with the limited perceptive function of the haptic sense, it would only be conclusive evidence of the sculptor's blindness if this feature could be observed in all the works of the sculptor. This is not the case. Nevertheless there is no reason why the figure should

not be looked upon as the creation of a blind sculptor. However that may be, the question is rather irrelevant in view of the poorness of the sculpture itself.

The small bust of the Madonna may be a work of Kleinhans. More than any other work it may be looked upon as a good

FIG. 73.—Kleinhans: Madonna.

genuine piece of work by a blind modeller or copied from an eighteenth-century representation of the Virgin. Similar representations of the Holy Virgin dating from the baroque period—with that typical attitude and the beautifully curved folds of the garment—are very frequently met in the Tyrol.

The blind master was attracted by the fold of the garment, which appears to be moved by the wind, and by its spiral ending; this detail seems to be a specially attractive technical task, for it

recurs in several sculptures by Kleinhans. The bust is asymmetrical, the two halves of the face differ from one another, the proportions are incorrect, the eyes are placed aslant; the forms are lacking in detail and superficial, the whole work is performed in a "typifying" manner without any individual features. The face is devoid of genuine expression, and appears rigid in the original. Even from a technical point of view the work is rather poor.

Fig. 74.—Kleinhans: St. Sebastian.

The holy Sebastian of the Cistercian convent of Stams gives the impression of having originated from the workshop of a woodworker, a craftsman but not conversant with sculpturing, who in his hours of leisure creates works for his home or his church.

As regards both the expression and the technical execution, this figure shows a striking likeness to the awkward and stiff but sometimes very expressive representations of saints from the hand of rural painters. It is merely through the colouring of the eyes and eyebrows that the face obtains a certain expression, although mostly that of surprise. Without the crude primitive colouring the figure would be even more stiff and lifeless.

The bust of Andreas Hofer (Fig. 75) is a better piece of work from the point of view of technique; from an artistic point of view, however, it is not really what one could call a mature work. The figure is completely rigid, bare of expression and of life. The head is certainly made after a model, but the body probably from imagination or from another statue, for there is no organic relationship between head and body. Looked upon as a portrait, the sculpture cannot be considered to be

a success. Although the sculptor tried to represent characteristic features—such as the pug nose, the bushy eyebrows, the prominent cheek-bones and the long bones—very accurately, he did not succeed in giving the general character of Hofer. His Hofer is a weak and passive simpleton, whilst other portraits represent Hofer as a very strong, deliberate, and intelligent person.

Fig. 75.—Kleinhans: Bust of Andreas Hofer.

In analysing portraits produced by blind sculptors we shall again and again have to stress this important point: they may be able to render the likeness more or less satisfactorily, as this may well be done by palpation of individual features and typical traits, but they are unable to give the true character which remains hidden behind the palpated mask. This can apparently only be achieved by apprehending the face in its totality. But that is just what is lacking.

It is very difficult to tell whether the portrait of Hofer could have been done by a completely blind person. The accurate execution of the details does not point to the hand of a blind man.

With an unbiased approach to these works one cannot ascribe to any of these statues genuine artistic value. Some are clumsy sculptures with many deficiencies, some are fairly good but stereotyped works. Although they do not necessarily spring from a blind artist, they might, except perhaps for the bust of Hofer, be ascribed to a gifted modeller who became blind at a later stage of his life.

Fig. 76.—Kleinhans: Emperor Francis I.

The portrait of the Emperor Francis I—a work of artistic value—might represent the transition from the above-mentioned artistically negligible works to those of genuine artistic importance.

Other pictorial and sculptural representations of the Emperor show us a head with smooth, harmonious features of a coldly aristocratic but well-balanced character. With Kleinhans the features are harder, the smooth face is more deeply furrowed, the nose, mouth, and chin are more pronounced. The likeness to

other portraits of the emperors is not so much based on the individual as on the typical family likeness of the Habsburgs. I am referring to the long, oval shape of the head, to the abnormally high forehead, the smooth, narrow cheeks, and the peculiar proportions of the nose, mouth, and chin. The coarser and more vigorous, though partly exaggerated, features of the portrait of the Emperor might perhaps be explained on the basis of the nature of tactile perception; this explanation is, however, by no means convincing. There is no stringent argument for ascribing the bust of the Emperor to a blind artist. No art expert and nobody conversant with the art of the blind would, on seeing the original bust, take it for the work of a blind sculptor, if only because of the delicate and accurate technical execution and the anatomical correctness. Should the bust actually be the work of the blind Kleinhans, I do not believe that it was achieved without the help of others who could see.

The beautiful crucifix in the church at Nauders must now be mentioned.

This work does not represent the suffering Saviour, but the Saviour quiet after death and reconciled with the whole world, not the pain-afflicted Son of God, but Christ having peacefully passed over from life to death. The technical execution of the body is partly rough and partly finished, as, for example, the arms and the hands. The poorest parts are the legs. Their form, proportion, and their details show the technique of a poorly trained wood-carver. But in spite of its condition and all the deficiencies, especially with regard to proportions, we must look upon this work as one of the outstanding creations of the Tyrolese art of wood-carving. This is the work in which Kleinhans, the unpretentious and genuine artist, is at his best. The way in which the forms of the body are treated, the exaggerated accentuation of individual parts, the stiffness of the attitude, the marked asymmetry, and the wrong proportions do not destroy the impression of a harmonious structure or of genuine religious feeling. If Kleinhans had been completely blind, as we are told, this work would have to be looked upon as the climax of his creativeness and his technical skill. It must, however, be admitted that here, too, the expression of the face and the general impression are considerably impaired by over-painting.

St. Norburga kneeling in front of a crucifix is a charming,

FIG. 77.—Kleinhans: Crucifix at Nauders.

idyllic piece of work. The face of the holy maid worshipping Jesus is lovely and full of expression. The statue is noble in its simplicity and serenity. This effect is enhanced by the peasant costume with its many folds. Seen from a certain distance the little scene represents a pictorial entity; looked at from near at hand it shows numerous technical and artistic deficiencies, common to many works of peasant art.

Although the two last-mentioned works show definite signs of genuine art, it would nevertheless be possible, although not very probable, to ascribe them to a talented sculptor who became blind at a later stage of his life. Artistic value is here blended with primitive execution and primitive expression. The rather clumsy hand of the artist, the uncertain execution, the neglect of details, the clear dependence on earlier designs, the way in which certain parts of symbolical importance are over-stressed (one of the feet in the crucifix), the incorrect proportions, but at the same time the genuine piety which permeates the work, give us some idea of the artistic personality of the blind sculptor. We cannot decide whether the sculptures were performed without any help from assistants with sight. This is a question which cannot be answered with absolute certainty in regard to any blind sculptor, but it cannot be ruled out in any particular case.

The second group of works attributed to Kleinhans are of quite a different order. It includes first of all St. Borromaeus kneeling in front of a crucifix at Brixen (Bressanone).

From the point of view of execution the work is a masterpiece; it is extremely well modelled and finely executed technically. It represents an individualised portrait. Although the work corresponds to other works of the artist in a few special features, I have great doubts as to whether it is actually a work of Kleinhans. I do not want to deny that Kleinhans participated in the work; he may have done the first sketch of the body and the general outlines, he may have had his share in executing some parts, but the essentially artistic features of the composition and the execution, like the harmonious delineation of the figure and some other details, such as the balance of the body, which is attained by means of the resting legs, or the undulations of the garment, cannot possibly be the work of a blind sculptor. Even in technical details there are many points which cannot be accounted for, such as the lace on the edge of the ecclesiastical garment. Such

laces can only be produced by the constant control of the eye; the slight depressions, curves, and holes cannot be perceived haptically even by the most highly developed organ; they can only be cut out of the material with help of the eye working with greatest accuracy. The whole aspect of the statue of St. Borromaeus con-

FIG. 78.—Kleinhans: St. Borromaeus at Brixen.

veys the impression of being an original work; it is outstanding not only in originality and artistic representation, but also in the accuracy and elegance of the modelling.

However talented one may consider Kleinhans to have been, we can under no circumstances, on the basis of the experience we have gained in the psychology of the blind, attribute to a completely blind sculptor the bust of St. Borromaeus in its existing finished form.

Let us now turn to the representations of Christ.

The picture by Stecher in the Ferdinandeum at Innsbruck shows the aged Kleinhans at work (Fig. 71). We see the blind master working on a crucifix; the first shape of the face of the Saviour is just becoming visible as it is being carved out of the rough wood. The master's attitude is free and easy. He carves without any model for constant reference by measuring and handling, for he has done so many crucifixes during his life that he knows the proportions by heart. We know of quite a number of crucifixes by Kleinhans. I feel, however, entitled to assume that he made them in a few different sizes only. This was very useful from his point of view, for, being without visual control, he had to adhere to certain proportions with which he had become conversant by haptic means and by measurements. This assumption is based on the fact that the two crucifixes in the Ferdinandeum correspond with one other almost to a millimetre. I give the exact measurements in the following table:

	Crucifix I.	Crucifix II.
	in centimetres.	
Length of the whole body	81–82	81–82
,, of the head from the crown to the chin	8·2	9
,, of the nose	2·9	2·8
,, of the neck	3·6	3·5
,, from the base of the neck to the scar	17	17·5
,, from the scar to the knee	23	24
,, from the knee to the toes	29	28
,, of the arms	32	30
Width of the face from ear to ear	11	11
,, of the body round the chest	38·5	38·5
,, of the body round the hips	32·5	32·5
,, of the posterior part measured from the veil	23	23

In order to avoid any misunderstanding from the start, I must mention that I do not look upon the congruence of the proportions as evidence of Kleinhans having performed these works in the state of blindness; I only want to point out that we are here dealing with a model frequently repeated in size and proportions—that is, with a model which a blind sculptor might well be able to execute in its *primary* shape, though he had to leave to sighted colleagues the execution of the details.

The reproductions show clearly that we are actually dealing with very remarkable works. They would all do credit to any talented wood-carver of the Tyrolese school.

Fig. 79.—Kleinhans: Crucifix I.

Crucifix I in the Ferdinandeum is very well modelled. The original might be dated from the period of the master—*i.e.*, from the beginning of the nineteenth century. This crucifix is presumably a specimen from the collections of representations of Christ, which were carved in the district of Nauders according

to a certain pattern. The face is not quite symmetrical, although the proportions are correct. The left side of the face is better modelled than the right side. The body of the Saviour is well pro-

Fig. 80.—Kleinhans: Crucifix II, at Brixen.

portioned, too. On the thorax we find waves, elevations, and depressions, which appear to lie on the threshold of what can be perceived haptically. The whole figure is very plastic. We cannot say for certain how far the blind sculptor himself or other persons have worked or improved on it. It is, for instance, impossible to

attribute to Kleinhans the fine execution of the crown of thorns. There are, however, other parts also which cannot be the work of a blind sculptor working on purely haptic lines—*e.g.*, the tongue, which is correctly modelled. Its length amounts to 1·5 cm.; it can only just be seen, but not in its whole length. I cannot conceive how a blind man could possibly have carved this detail.

The crucifix at Brixen is a much more mature work from both the artistic and the technical point of view. The drawn-in abdomen, the bone structure, the legs and the arms are very finely executed. Although it appears to be at rest, the statue is full of life and motion. Such a representation cannot be achieved by means of piecemeal handling and execution. The gradual transitions of the surfaces, the softness of the flesh, the hardness of the bones, the tenseness of the muscles, the structure of the eye-sockets and the forehead create an effect of which those who have become blind in early childhood can have no notion. Such subtle physiognomic features, the whole scope and relevance of which can only be grasped by sighted human beings, cannot possibly be perceived and certainly not created by means of intellectual work, or by the handling of the inanimate material.

The Crucifix I of the Ferdinandeum at Innsbruck is, according to the still legible inscription, the first work, or perhaps the first crucifix, by Kleinhans. That is certainly not correct. A comparison with the above crucifix makes it clear that—provided the statue is a work of Kleinhans—we are dealing with a much later work. Among the Tyrolese crucifixes known to me it is certainly one of the most important, even if it should become clear that it is a copy from an older crucifix by a good master. The original might belong to late Austrian baroque art—*i.e.*, it may be an eighteenth-century work.

Among the known carved Tyrolese crucifixes there are few heads with such outstanding power of expression as this one shows. Pain and imminent death are expressed in the attitude of the head, in the features of the face, in the heavily breathing lips. The eyes are not so deeply set as in schematic representations; they are nevertheless more impressive and well-marked. Every single part of the face takes part in the fate of the soul. The body, too, is modelled in a masterly way. Although the subject is a well-known one and the composition is most simple, the figure impresses one by its subtlety and suppleness. From the toes to the hair, all the parts

are in motion, the lines and planes rise and fall in constant change. The whole figure shows features which cannot possibly be perceived by *haptic*, but only by *visual* means. The work is characterised not by sharp contours or by symmetrical alignment or

Fig. 81.—Kleinhans: Head of Crucifix I, at Innsbruck.

balance of the individual parts, but by subtle transitions, by effects of light and shade and by the overlapping of the planes. There is not one rigid surface; the whole figure is made up of various areas of *light and shade*. What strikes one in this work is not the haptic, but the *visual* element, not the plastic, but the *pictorial* element. In particular, the expression of the Saviour tormented to death is an *essentially visual one*. An artist who has never observed a suffering face, who has never seen despair and grief

reflected in the eyes, cannot create such a work, whatever his knowledge, skill, and intuition.

Perhaps a still more compelling argument in favour of the assumption that the blind Kleinhans did not create this work or the two crucifixes mentioned above, is the following.

The last work which a blind sculptor might succeed in copying, still less creating, is a work in the *baroque style*. This style, which relinquishes all claims to restful harmony, symmetry, and poise, and has an eminently pictorial character, *is sharply opposed to the haptic function*. Our haptic sense is unable to follow the whimsical design of the baroque style; it aims at architectural elements and at fully developed and defined static forms. The haptic sense lacks the ability of " supplementation ", and the representative principle of the baroque style must therefore remain alien to it, since that style makes outstanding demands on fantasy and on the psychological elaboration of elements which are not available to sensory perception. The expressionistic tendency of baroque art also stands in contradiction to the haptic function. Baroque art is devoted to the artistic representation of the transient. It aims at fixing one episode in the stream of living events. It may therefore set itself the task of expressing passion, violent emotions—in one word, the dramatic element—even in cases when this is bound to conflict with the laws of haptic composition. This sphere of exaggerated emotions is beyond the ability of even the most skilful blind sculptor. He is faced with an insuperable task where clear plastic forms no longer exist; for the tactile organ is confronted with a world which, although it is *palpable*, remains *incomprehensible*.

The functional difference between the organs of touch and vision in the perception of form is perhaps best brought out by Wölfflin's antithesis of classicism and baroque. " There (in classicism) are only definite, ' palpable ' works, here (in baroque art) all is transition and change; there shaping of the real, the permanent form, here the appearance of constant change; the representation is based on effects which no longer exist for the hand but only for the eye." [1]

Should any one succeed in proving convincingly that the baroque crucifix ascribed to the blind Kleinhans is actually an independent creation of the blind master, this would lead to con-

[1] H. Wölfflin, *Kunstgesch. Grundbegriffe*, Munich, 1920, p. 59.

clusions which would be incompatible with our experience of normal and blind people. For these conclusions would actually mean that the haptic world is congruent with the visual world to a far greater extent than we are justified in assuming on the basis of immediate experience. If it were therefore possible to establish beyond any doubt the authorship of the artist Kleinhans, whether he was born blind or lost his sight at an early age, we should be led to the conclusion that the haptic sense possesses the same claim as the visual sense to perceive reality and represent it artistically, as it is open to us.

(d) *The Kleinhans Problem*

Kleinhans was no doubt a highly talented artist. He learnt his craft with unflinching energy and diligence, and was at great pains to create works which would establish his position as an artist. Kleinhans had to overcome many difficulties and was partly successful in doing so, but he was unable to overcome one of them—namely, his blindness—and could not therefore master anything lying beyond the limits of the tactile sense. For that he needed originality and native inventiveness, technically perfect execution, and mastery of the pictorial and expressive creation of form free from control by any assisting hand.

I see three possible avenues of approach to the Kleinhans problem.

The first starts from the statement that Kleinhans spent his whole life from early childhood in *complete blindness*. By working on this assumption, which tallies with contemporary reports, we are unable to ascribe the vast majority of works to the wood-carver Kleinhans. In this case the best sculptures, such as the statue of St. Borromaeus and the crucifixes of Brixen and Innsbruck, are definitely not his creations, but the same would apply to the other sculptures, except perhaps for the first two unimportant ones.

The second possible explanation starts from the assumption that Kleinhans *only lost his vision in his youth*, and so had been able to become conversant with the art of sculpture perceptually and technically whilst he was yet able to see. This assumption gains in probability in view of the fact that the majority of blind sculptors known to us fall into this category. Taking this view we can ascribe to a sculptor who became blind at a later age the first

group of sculptural works, with the qualification, however, which we mentioned in analysing the individual pieces. But, even so, the question as to how the blind sculptor was able to endow some of his works with genuinely artistic value remains unanswered.

In this respect we might first mention the fact that during his whole life Kleinhans, except for a few copied busts and schematic statues of saints, confined himself exclusively to the representation of the suffering Saviour, and, secondly, that all his representations of Christ conform to a general pattern, which was represented by innumerable examples in the Tyrol; this gave Kleinhans opportunity of checking his own creations over and over again. Lastly, the art of wood-carving was so widespread in the Tyrol in Kleinhans' lifetime that the approach to that activity was rendered quite easy to him. The Tyrol is the home of wood-carving, and where folk-art played such an important part and where the native crafts exerted such a deep influence, not even the eyes of the blind could resist it. In such an atmosphere an artistically gifted and clever man was easily able, even after the loss of his sight, to express his inner world in some way or another and to make use of the art of wood-carving as a means of expression. These conditions help us to understand how a talented boy in the small mountain village of Nauders might take to wood-carving whilst he was learning carpentry, and how the lad, in spite of having lost his sight, could attain a remarkable standing. But they do not make it clear how Kleinhans could have created such sculptures as the works of the second group, the execution of which required visual perception and visual control.

The last explanation, through which the whole Kleinhans problem might find a really satisfactory solution, would be to assume that Kleinhans *did not actually lose his vision completely*, that he retained some vision, at least to such an extent as to be able to distinguish forms at a near distance. This assumption becomes more probable if we remember how inaccurately the term " blind " is commonly used.

How many conditions are spoken of as of blindness! Very few people know, for instance, that only a small minority of the pupils of institutions for the blind and of the workers in workshops for the blind are completely sightless. In every institution for the blind there can be found a whole series of degrees of blindness, ranging from the completely blind to the so-called half blind.

There are actually very few completely blind people; even in cases in which there are only vestiges of the eyeballs, we quite often find response to light and ability to distinguish light from dark. From a practical point of view, however, one is to a certain extent justified in calling all persons " blind " who have become unfit to work through their badly reduced vision, irrespective of whether they show sufficient sensitivity to light. Even from the ophthalmologist's point of view the term " blindness " does not necessarily mean total loss of vision. According to a common classification of blindness, an eye which is not able to count the fingers of a hand at a distance of one-third of a metre is termed " blind ". Another classification even speaks of the fourth degree of blindness in cases where there is an impaired acuity of vision and sensitivity to light, such as make it impossible for them to take part in school education for sighted children, though enabling the patients to perceive small objects. The comparative rareness of genuine amaurosis would therefore support the third hypothesis according to which Kleinhans' vision was not yet completely extinguished when he performed his best works.

On the assumption, therefore, that Kleinhans was completely blind in one eye only, while in the other he had not lost the ability to perceive dimensions and shapes in the " near-space ", it might be possible that all the works ascribed to him were actually his creations. Considerable impairment of acuity of vision, concentric narrowing of the field, colour blindness, etc., do not interfere with the perception of architectonic structure and of the proportions of objects and, what is most important, do not abolish the æsthetic pleasure in nature and objects of art. In that case some slight remnant of impaired vision would have spared the artist the loss of the most valuable means of perception, which were of the utmost importance for his activity as an artist. It is impossible to ascertain now whether Kleinhans was completely blind or not. We must necessarily decide in favour of one of the hypotheses; that, however, implies that we must draw the conclusions following from that hypothesis.

The first hypothesis, according to which Kleinhans lost his sight in early childhood and created all his sculptural works in a condition of complete blindness, is only supported by the contemporary reports, the vagueness of which we have already mentioned. Adopting this hypothesis we are compelled to deny him

the authorship of all artistically notable works which are attributed to him. Even the busts of Andreas Hofer and of the Virgin, even more so the portrait of the Emperor Francis, and the crucifix in the parish church of Nauders could only have been executed with constant and close assistance from workers who could see. For we must realise that in this case Kleinhans would be the *only instance* of one who, after becoming blind in early childhood, was, without having the slightest notion of the visual world and relying entirely on his haptic experiences, irresistibly attracted to sculptural work and created over a period of many years a number of works satisfying all the criteria of " visual art ".

The assumption that Kleinhans became blind at a later age is far more probable. In that case, however, we have to exclude from his total performance the best works attributed to him. His fame would not be destroyed, even if he could no longer be reckoned among the more outstanding Tyrolese wood-carvers. He would still have reached a height that can only be attained quite exceptionally by the blind.

The last assumption—that Kleinhans retained traces of vision—would solve the whole problem entirely. In this case we would be able to ascribe to him all the above-mentioned works and to understand without any difficulty the artistic development which expresses itself in Kleinhans' works. If therefore we want to attribute to the sculptor Kleinhans all these productions without confining ourselves to a few sculptures, we have only the one possibility of placing Kleinhans in that group of the blind who have traces of vision left.

It is difficult to decide which of these hypotheses carries most probability. I personally am in favour of the last assumption.

4. Vidal, the Animal Sculptor

Louis Vidal, called Vidal-Navatel, was born at Nîmes in 1831. His parents were poor people. The first reports state that his native town, by making him a modest annual grant, enabled young Vidal to go to Paris to be trained in fine arts in the studio of a master. From the readiness of the Town Council of Nîmes to give him such a grant we may infer that Vidal must have shown remarkable signs of artistic talent in early youth.[1]

[1] My account of Vidal's life is based on the reports of his artistically minded contemporary, Camille Leymarie, *Quelques notes sur Vidal, le sculpteur aveugle*. Réunion

In Paris, Vidal became a pupil of the animal-sculptor, Barye, who was already a well-known artist. At that time numerous young artists, attracted by the famous nature-minded master, gathered around Barye. Young Vidal soon distinguished himself among his pupils. Fired by his enthusiasm, and strongly inspired by Barye, the young artist gained, in a few years' time, a skill which ranked him among the best animal-sculptors of his day.

When he was twenty-two the catastrophe befell him. An illness caused the loss of his eyesight. Fortunately an improvement soon occurred; he regained a certain degree of vision and resumed work with passionate eagerness. In this state of " demi-vision ", still hoping for a complete restitution of his eyesight, Vidal worked on courageously; he gradually grew accustomed to dim vision, and even achieved some pieces of work on *purely haptic lines*, in order to spare his eyes, which grew tired easily. He learned to model without having to make use of his eyes; he trained himself in sculptural technique to such an extent as to be able to produce certain constantly recurring forms without visual control.

It is not surprising that the creative activity of a blind artist aroused not only the interest of the public, but also the scepticism of certain people. When Vidal, after having gone completely blind, carried on his artistic work and exhibited new sculptures to the public, the rumour spread that he did not execute his works without the help of others. A committee was appointed to investigate the matter. The committee called on Vidal in his studio, where they made sure that the blind artist was quite well able to model and to carry out in a technically perfect way the tasks set to him, without anybody's help.

Nothing could discourage Vidal; he went on working with unremitting diligence, and made an intense study of the animal world, which he effectively made use of in his compositions. Leymarie, who was personally acquainted with Vidal and who often had the opportunity of observing him at work, defends him. He finds it unfair to doubt the original authorship of Vidal's works and to prove, if that were possible, that Vidal had not been without help

des Sociétés des Beaux-Arts des Départements, XXVII Session, 1893, Paris. Ministère de l'Instruction Publique et des Beaux-Arts.

There is another essay on Vidal to be found in *The Art Journal* (1879); E. Ch. Guilbeau, the blind teacher at the Institution Nationale des Aveugles in Paris, has further communicated some facts on Vidal in the journal for the blind, " Le Valentin Haüy ", and in the *Bulletin Mensuel de l'Association V. Haüy*. All of these, including Leymarie's essay, are unfortunately not illustrated.

from someone. He even finds it perfectly natural for the blind sculptor to accept the ready assistance of others in view of the fact that, in spite of excellent artistic qualities, he lacks abilities essential for the practice of his art. I should like to quote literally what Leymarie writes in this respect: " On comprend que, même avec d'excellents conseils, Vidal ne pouvait pas enlever par lui-même au morceau auquel il venait de travailler cette sécheresse qui en rendait l'aspect déplaisant; par contre, une main habile arrivait

Fig. 82.—Vidal: Lioness at Nantes.

bien vite à donner au modèle la souplesse de la vie. L'intervention de cette main était indispensable à l'aveugle, et c'eût été cruauté que de la refuser; lui même ne pouvait pas avoir cette cruauté: aussi peut-on croire ce que quelques artistes racontent—sans malveillance d'ailleurs—au sujet de son ancient condisciple d'atelier, non sans quelque talent, qui, pendant de longues années, apporte à notre artiste un concours certainement indispensable, même en admettant—et pourquoi ne pas l'admettre?—qu'il ne dépâssat pas les limites permises " (p. 160).

Vidal actually found this aid in the person of young Barye, the son of his former teacher.

Even after he had become blind, Vidal was able to attract, by his technically accurate animal sculptures, the attention of large

circles. Many of his works were purchased by the State, others by the French aristocracy.[1]

At first sight the case of the blind French sculptor seems to have but a remote bearing on my problem; but on closer consideration it deserves special attention from a theoretical point of view. Looked at from this angle, the case appears as follows:

A young artist, highly talented and, in a period of naturalistic art, specially trained in animal sculpture, gradually loses his sight. In his misfortune he yet has the good luck to be able to work for six whole years—while his eyesight is gradually failing—as it were blindfold, though under constant visual control. He makes full use of this time to prepare and readjust in every detail his working methods to the imminent state of total blindness. The condition of " demi-vision " enabled him to form a widespread system of associations between visual and haptic perceptions and to develop his manual skill; he managed by long training to reinforce and preserve the experience gained previously. Nevertheless, in the course of time his abilities declined with the fading of his visual memories, although he always clung to the type of animals best known to him, and to the previously adopted naturalistic representation, a style which does not tax too highly the artist's original creative activity. His technical skill was the last to decline. After the total loss of his sight he went on working for twenty years and produced fairly good works, though aided by a young colleague whose share in the works cannot be ascertained. I consider it impossible that Vidal should have modelled

[1] The best known of his works are:

Recumbent Panther (Salon 1855) in the Museum of Orléans;
Roaring Lion (Salon 1855);
Lioness (Salon 1859) in the Museum of Nantes;
Recumbent Hind (Salon 1859), formerly owned by Prince Napoleon;
Goat Suckling her Kid (Salon 1861);
Bull (Salon 1863) in the Museum of Nîmes;
Dying Stag (Salon 1863), property of the State;
Cow suckling her Calf (Salon 1864);
Royal Tiger (Salon 1867);
Buck (Salon 1870), property of the State;
Lion, bas-relief (Salon 1870) in the Museum of Montpellier;
Great Lion of Senegal (Salon 1875);
Algerian Gazelle (Salon 1879);
African Gazelle (Salon 1880);
Cob, English Horse (Salon 1882), Vidal's last exhibited work.

The City of Paris purchased a group by Vidal now in Montholon Square. The Museums of Bordeaux, Nantes, and Clamecy, and the Valentin Haüy Blind Museum, in Paris, own sculptures by Vidal.

T

the above animal sculptures without any assistance. Such simple and clear plastic composition, such harmony and such perfect proportions, such careful execution cannot have been achieved by a blind artist, however highly talented he may have been. These works have either been created during the period of his eye trouble, or, should it be proved that they were achieved during total blindness, they can only have been made with the active assistance of his sculptor friend.

According to his contemporaries, Vidal's sculptural activity gradually lost markedly in artistic value. He was no longer possessed of the true unlimited artistic vision, constantly renewed and reinforced in the course of creative work. He had lost real command over his work, for he was not able—even Leymarie writes to that effect—to get a correct idea of the general effect (*effets d'ensemble*). *Blind* Vidal became the imitator of *the seeing Vidal of the past*, a copyist who had lost the creative faculty rooted in true experience and original sensations, and who tried to conceal the barrenness of his imagination under the cover of his still surviving technical skill.

Vidal represents the type of sculptor who lost the power of sight at a later age, who trained himself systematically in view of his imminent blindness, and adhered to his original range of subjects, in keeping with his previously established mode of expression. In other words, he went on repeating himself without any attempt at seeking new ways of expression essentially connected with the state of blindness.

5. Jacob Schmitt, the Naturalistic Sculptor

(a) *Sculptural Activity before and after the Onset of Blindness*

Jacob Schmitt was born at Mainz in 1891. As a young man he was trained as a silversmith. After four years of apprenticeship he worked for three years as an assistant, and then he attended courses at the School of Arts and Crafts at Mainz for a further year, in order to get further experience in engraving, chasing, and modelling.

In 1914 Schmitt joined the German army and went to the front, where in December he lost both eyes through a gunshot wound in the head. In October 1915 Schmitt entered the sculpture class of a school for arts and crafts.

Schmitt had first to copy the figures after handling them; he then had to reproduce them from memory. This method led to very good results, for the pupil acquired the ability to work without any model—a fact which subsequently was of great help to him in his sculptural activities.

After this training, Schmitt tried to work on the lines of fantasy, first under the personal supervision of his teacher, but later on independently.

(b) *The Method of Naturalism*

It was an entirely new task which confronted Schmitt when he decided to do figures after a model. The fundamental difference in the working method between seeing and blind sculptors in every stage of their work cannot be demonstrated better than by such a task.

The seeing sculptor asks his model to take up the attitude in which he wants to represent him. Once the desired attitude is found, the body is modelled on the basis of the immediate view of it. In representing the facial expression, the artist is not so much guided by the character and expression of the model; artistic intuition and fantasy remain the chief factors.

With a blind sculptor who adopts a naturalistic view of things, the work proceeds on entirely different lines. If he does not feel able to project his inner visions into the work, there remains no alternative but to copy the model as accurately as possible, though he may, of course, allow himself some liberties. What compels him to work on these lines is his limited ability to check the results of his work and to fill up gaps.

Faced with the model, he examined not only the attitude but also the plastic configuration of the individual parts of the body by feeling them accurately and copying them. That accounts for the amount of labour, concentration, and time Schmitt had to spend in completing any work. He spent over a hundred hours on a small figure of a reclining woman, and six weeks on his over-life-size head of St. Paul.

As the blind sculptor is in most cases not able to ascertain by means of his haptic functions whether the model has actually assumed the attitude which he meant him to assume, he will frequently be compelled to place *himself* in that attitude—*i.e.*, to become his own model. He therefore sets himself into the desired

attitude, studies accurately his own posture, and—this is the most significant part—measures exactly the most important parts of his body by projecting them, as Schmitt used to do, on a horizontal plane situated between his feet. In order to achieve this, Schmitt hung a plummet to the different parts of his body so as to be able to project them on to that plane. Further measurements may be taken by a yardstick or a tape-measure. With the help of such measurements, the blind worker obtains accurate figures about the most important points of his body and their relationship to one another; these figures are used for the *structural composition* of the body. Schmitt describes this as follows: "I project the spatial position of the parts of the body on to the base, and ascertain their relationship to the two fixed points (the feet). I then measure the vertical distance between these projected points and the basis. Once I have got these units, I can calculate them for any desired proportion."

FIG. 83.—Schmitt: St. Francis.

The sculptor working on naturalistic lines *constructs* his work as an architect builds a house. The haptic impressions by no means play the important part that is usually attributed to them. The work is a strictly constructive one, based on measurement and calculation. The proportions, too, are not obtained by way of the senses. On the contrary, they are calculated and the dimensions are laid on by means of the blind man's yardstick. Gradually

norms of measurement develop; they make the work easier and practically mechanise it. In his works, Schmitt always starts from an " ideal proportion " which he adopts from a textbook on the practice of modelling. Thus he found that the head must be one-eighth, the face one-tenth, the hand one-tenth of the total length of the body, and so on. Divisions by 2, 4, 8, 10 provide further criteria for the proportioning of the body. He studied all this on his own body, or on the body of the model; he copied every position, every expression, by imitating and feeling it. In modelling his crucifix he even went so far as to erect a provisional cross and to imitate the attitude of Christ on the cross, in order to study every detail. A few positions, which he could not make out on himself, he studied on a friend whom he fixed to the cross.

The relationship of his plastic concepts to the actual sculptural representation is, as with all blind workers, a very loose one. He admits himself that he is never sure whether his " concepts " correspond to reality; he lacks " a touch-stone " for them. He remarks that he will have to expect a very great surprise should he ever be able to see his own works in a life after death. In the case of Schmitt, therefore, the discrepancy between visual conceptions and haptic impressions expresses itself not only in his creations, but also in the immediate personal experience. This fact must be connected with the gradual subsidence of his visual concepts. He says himself that all his previous memories are fading away. When I explained to him my views on his development as an artist, and when I mentioned that I had the impression that he tended more and more to naturalism, and that his last works lacked all personal artistic style and idealisation, he remarked quite correctly that if he abandoned the naturalistic mode of expression he would be completely lost in darkness by being deprived of his most important working standards.

(c) *Theory and Experience*

The reader will be impressed by the fact that Schmitt's statements and experiences correspond surprisingly well with my views; he might easily imagine, when hearing him and reading my theoretical discussions, that he was influenced by my views, or that my views on the plastic activity of the blind were based on what I learnt from him. Neither of these assumptions is in accordance with the facts. Everything he told me was the spon-

taneous expression of his views. He is the living evidence of my theory: all the assumptions which I had made in analysing the works of blind sculptors were confirmed by Schmitt's works and statements. He admitted that his visual concepts were inaccurate and in the process of fading away; he further admitted that he was unable to gain a general impression of, or to pass æsthetic judgments on, his own creations or those of others, and further that, both in the act of perceiving and in the creative process, he built up objects out of separate perceptions one after another. He even remarked that the image he got was mosaic-like, and that the impression of homogeneity and totality was merely the result of a constructive activity. He also told me about the unusual difficulties he had to overcome when modelling, and gave me an insight into his peculiar technique, which is entirely unlike that adopted by a sighted artist. We realise how little intuition and how much intellectual work he has to make use of in order to endow a figure, if only to a limited extent, with the forms and proportions and expressions with which a seeing sculptor is able to endow it.

Fig. 84.—Schmitt: Eve.

I believe that every sculptor who becomes blind at a later period in life must necessarily go through the same stages of development as Schmitt, provided he aims at lifelike representation, and is neither able nor willing to free himself in his sculptural work from the art of sighted artists, and that he intends to work for sighted people. The more the visual memories and the visual-haptic experiences fade away, the more will such blind sculptors be guided by accurate copying of nature and by fixed standards of proportion. The basic tendency to naturalism must necessarily quite destroy the artistic qualities.

The works of Schmitt confirm our views. His first creations (during and after his training at the School of Arts in Frankfurt) still show a vivid, spontaneous, and moderate realism. Some excellent works date from that period: The Child with the Duck (1920), The Laughing Child (1918), St. Francis (1924), The Two

Warriors (1926). Adam and Eve (1930), The Saviour on the Cross (1935), as well as one of his last pieces, The Head of St. Paul, are executed in an over-realistic manner, and therefore lack artistic integrity.

More recently Schmitt modelled some designs which attracted my special attention. They represent male figures engaged in brisk

Fig. 85.—Schmitt: The Bomb-thrower.

movements. These designs cannot be denied expressiveness and artistic value. We must mention "The Bomb-thrower", for instance, a figure which conveys vividly the state of excitement, the vigour, and the intentness of the movement. This figure is expressive, both in silhouette and in the round. Provided Schmitt intends to confine himself to such *expressionistic* sketches, we may hope that his sculptural development will take place on truly artistic lines.

Schmitt was not able to enlighten us about his æsthetic values. From what he told me, I am inclined to believe that he is primarily guided by other than æsthetic standards. By circuitous paths he

reaches verdicts about values, which refer to nothing but the correctness of the proportions and to the use or neglect of the norms he has established for himself. "The details only mean something concrete to me—although only to a certain extent," he says, and adds at the same time: "For, as to the whole, it is the product of fantasy, although built up out of concrete details." "I should be completely helpless without a synthetic construction. It is only by means of constructive fantasy that I am at all able to judge a work of art."

We see that with Schmitt—and, with very few exceptions, this is likely to apply to all blind sculptors—the principles and tendencies of creative work conform to those of haptic perception. He creates his figures just as he builds up his perceptions. The hand gradually loses its creative power, and retains chiefly its instrumental function.

6. Masuelli, the Artist

(a) *First Works*

I must admit that before becoming acquainted with the works of Masuelli I was convinced that a completely blind man, even if he had been a sculptor before the onset of blindness, could not expect to show genuine artistic creativeness, and definitely not any development as an artist. Provided the sculptor is technically skilful and is satisfied with repeating his previous subjects in his former style (as is the case with Vidal), or if he is at great pains to construct his figures by every means at his disposal, as we have seen with Schmitt, works which are satisfactory from a technical point of view may occasionally be produced, but not works of artistic value and individual character. I had the impression that we had to expect a gradual decline rather than development in blind sculptors.

The works of Masuelli, however, made me revise my views on the ability of blind sculptors to express themselves artistically. The fact that this represents so far a unique case makes it our duty to study carefully Masuelli's sculptural activities.

Ernesto Masuelli was born at Nice in 1899. He started drawing at an early age—first, as a child, human figures, and, later, caricatures. He never received any tuition in drawing. During the war Masuelli lost his sight through a shell-splinter. After becoming blind he entered the Civil Service.

It was only in 1932, fourteen years after he became blind, that Masuelli decided to work in plastic crafts. This was due to pure chance. In order to occupy his children he did plasticine figures with them. At this game he produced a small figure of an animal which, though technically imperfect, was considered to be rather striking. The favourable opinion of his friends encouraged him to start modelling. He began working without the assistance of any teacher. He studied the human form and proportions on his own body and on some good plaster-of-paris casts; he gained his knowledge of the skeleton and the muscles from a textbook of anatomy. Masuelli very soon overcame the technical difficulties, but it took him several years of intense work before he was able to copy the symmetrical structure of the body correctly and without assistance.

Fig. 86.—Ernesto Masuelli.

As contrasted with other sculptors who were blinded in the war, Masuelli worked without models or an original. It is true that during the first period of his sculptural activity he tried to copy some models, but he was not successful. He finds copying and modelling from originals very tedious and uninteresting. He told me that in doing so his inner energy feels considerably inhibited. He avoids portraits, which he considers to be outside the scope of the artistic activity of a blind man. Masuelli very soon realised how difficult it is to gain an impression of a face by feeling it, and how much more difficult it is to represent expressions adequately by plastic means. Whenever he wants to judge the facial expression of a sculpture, he relies on the same clues as all his fellow sufferers. This accounts for the fact that he does not feel any urge towards handling the plastic works of great masters. He says himself that they do not inspire his work and that they do not arouse in him any æsthetic sensations.

During the first years Masuelli did a few portraits. One of his little daughter, which shows no likeness to the original, one of his wife, which shows a melancholic and indifferent expression not in keeping with her character, and a rather good portrait of himself.

At the time of my last but one stay in Rome Masuelli was just then working on a statue of Mussolini. Here he adopted quite different methods from those used previously. Having found that his works are far better if he feels the face for a short while only, just to gain a general impression, and having also realised that it is useful not to start on his work until some time has elapsed, Masuelli handled a bust of his patron for about five minutes and did not start modelling till some time later. He expected this short period of orientation to be sufficient to convey to him an idea of the proportions and the general form of the head, which was all he wanted to know. The result was a bust whose character certainly showed a likeness to Mussolini without being a realistic portrait. In this case, therefore, Masuelli, with proper insight, gave up the attempt at naturalistic reproduction, and adopted an expressionistic mode of representation. Expressionism enables him to overlook details, to neglect the exact proportions, and to confine himself to a few particularly characteristic features, as in a caricature.

Fig. 87.—Masuelli: Self Portrait.

I give in Figs. 87–91 some illustrations of works by Masuelli dating from the first period of his sculptural activity.

These are examples of expressionistic representation. We might also mention the figure in the nude Abbandono (Fig. 91).

Nobody is likely to deny the artistic value of these works, and hardly anybody would ascribe these figures, which conform so well to our æsthetic feelings, to a blind artist. Even the errors in

FIG. 88.—Masuelli: Raffiche.

FIG. 89.—Masuelli: Mother Love.

FIG. 90.—Masuelli: Palpiti.

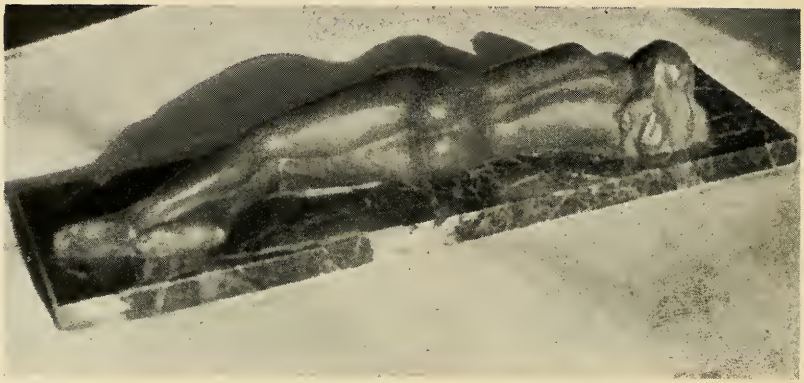


FIG. 91.—Masuelli: Abbandono.

FIG. 92.—Masuelli: Nude Study.

proportion or the roughness of the execution cannot be deduced from the nature of haptic perception.

We are therefore faced with the question, how such achievements can possibly be reconciled with the fact of blindness. This question becomes even more urgent in relation to Masuelli's later works—*e.g.*, the study in the nude (Fig. 92), and the charming figure of a girl (Fig. 93). The proportions and the correlation of the parts, the attitude of the body, the expression of the face, and especially the symmetry of the two halves of the body and the face, suggest a sculptor who knows how to embrace the total impression in an artistic entity. These are definitely features hitherto found only in sculptural works of sighted artists.

How are we to account for such an art which is apparently so strongly influenced by visual elements and by visual perception? How to account for such harmony, order, and form, for such poise, for a world reflecting visual reality in the works of a blind man?

In order to understand Masuelli's mode of sculptural expression and to ascertain the source of his creative activity we have to study his personality and his technique.

(b) *The Importance of Vision in the Creative Process*

I have seldom met anybody who bore his bodily and spiritual misfortune with so much grace as Masuelli. In his presence we are completely free of that kind of sympathy which we usually feel when facing people with an organic defect. Masuelli's attitude shows such assurance and such human dignity that we do not for a moment feel our superiority of sight. Even his external appearance is quite different from what we are accustomed to meet in blind persons. His features are attractive and full of life; he holds himself straight; his gait is full of grace; he moves surprisingly freely in his own house, runs up and down stairs like a boy. Whenever he wants to be led he leans slightly against the other person or touches his arm almost imperceptibly.

In spite of the fact that he has organised his new life so admirably all his psychological experience is intimately connected with his previous *visual life*. He devotes all his energy and intellect to the task of maintaining this contact. The tendency to cling to the contents of a vanished world of perception—an attitude also encountered in musicians who have become deaf—prevents his

FIG. 93.—Masuelli: Girl.

spatial concepts, which he gained by visual means, from fusing with the haptic impressions, as is the case with the majority of the blind. It is to the vivid contact with the world of sight that he owes the ability to model without having first handled the original; that also may be the reason why *motion*, as it manifests itself in *visual forms*, plays such a great part in his sculptures. Owing to this "visual-motor" attitude, Masuelli avoids the greatest danger that threatens the blind sculptor—the danger of destroying the unity of the work and its æsthetic effect through a too-natural reproduction of details. He himself is not aware of this; he rather believes in having fundamentally rebuilt his new life on the basis of the new situation. He asserts that he has no visual conception of his works either before or after their execution. That may be so, but I am inclined to assume that with him the *visual sphere* remains operative within the haptic one; the visual sphere, in this context, meaning not so much memories of the visible world but rather the essence of previous visual experiences and the residual traces of such experiences. The continuity between his seeing and his blind life has never been destroyed. His dreams, his hallucinations, his memories, and not least his sculptural achievements, are evidence of it. He says himself that dreams play a great part in his life. He dreams a lot, and his dreams are always of a visual nature. This fact shows very clearly how he wishes in his new life to prevent the fading away of the visual world. The intensity of this wish may be further seen in his memories of his childhood, his home, his family. He is able to describe everything accurately and in great detail, his description extending even to the colours and showing such vividness as can only be accounted for on the basis of memories full of visual elements. This view is further supported by the occasional hallucination which he believes to have a decisive influence on his work.

The persisting influence of the visual world shows itself clearly in his method of working, and above all in the integrative character of his works. The fact that after a short period of training he succeeded in creating works full of æsthetic qualities without relapsing into the typical errors of the blind—the piecemeal construction of the whole out of individual parts, the disturbing asymmetry, the lack of expression, the rigidity—indicates the persistence of a world of forms rescued from his seeing past. His

methods are therefore not those of a blind man, but rather those of a seeing artist, who does not start work with fixed conceptions and intentions, but rather lets the form emerge during his work.

At the time of our interview Masuelli told me that he was not interested in the form, but only in the expression, the " rappresentazione della idea "; that he was not attracted by the æsthetic pleasure, least of all by its sensual element, but by the ideal element, the " espressivo spirituale ". His works show that he actually succeeds in representing the intended expression adequately. He represents expressions in a manner absolutely unequivocal to us as seeing persons; we are never doubtful as to what he means to express. That is the only thing in our judgment which pleases and interests Masuelli, not whether or not we like his work. We meet here the fundamental difference between a person born blind and one who has become blind at a later stage of life. The forms of expression of the blind-born pupils of the Viennese Institution for the Blind are ambiguous; they impress us as being creations from a strange, unintelligible world. A layman may not guess that he is dealing with the works of blind people, but he feels that they belong to a world which, in form and content, strikes him as strange and inaccessible. With Masuelli's works—and this applies to a certain extent to all sculptors who have become blind at a later period of life—we remain in our own visual and æsthetic world.

Masuelli's expressionistic mode of representation is characterised by the fact that with him the modes of expression are not determined, as in the case of the pupils of the Institute of the Blind, by his own bodily feelings, by the so-called autoplastic tendencies, but by the *formal principles* originating in the world of visual perceptions. It is true that the free sculptural activity of Masuelli, carried out without any model or pattern, requires the autoplastic tendency; but he does not let this tendency take its free, unrestrained course—as is the case with blind pupils—rather does he master it, and allow it to become operative only within the limits of formative production. This resistance, which leads to a state of equilibrium between the purely autoplastic and the artistic representation, is partly due to Masuelli's genuinely artistic personality, partly to the help he gets of the visual sphere, which does not become operative in blind-born pupils.

The fact that Masuelli stresses the factor of expression so strongly

may partly be due to his personality; on the whole, however, it is probably connected with his blindness. Asked why he works, he replies: " For my own sake, because I feel the urge to express myself plastically." He is right in saying so. He needs his art, because his memories and dream-visions are indistinct and immaterial, and by shaping the material artistically he gains possession, so to speak, of the phenomena of the visual world. And that is what he clings to, what he insists on, because he wants to maintain the connection with the visible world. He is interested in the physical world which once meant so much to him; he loves, understands, and feels it, and devotes himself to the task of connecting this beloved world with his new turned-in world. On the whole, a blind man gifted with a sensitive mind and having to live this introverted life, is likely to be more susceptible than one with sight to the spiritual energies which endow the world of phenomena with life and motion and permeate the physical form. The very fact that his eye is not able to deduce the form from the objects, and that it is merely his hand which shapes the material into a living, expressive shape, enables him to feel to an otherwise unknown extent that the external world is dead and devoid of expression unless it is permeated by spiritual forces, and that it is only through our spirit that it gains life and shape. This shaping, this revival and spiritualisation of the amorphous clay by means of the idea and the hand, is above all what fascinates Masuelli; even before he became blind his interest centred on the expression, and his caricatures are striking evidence of this.

(c) *His Modelling Technique*

We have so far shown how the former visual world exerted its influence on Masuelli's sculptural activity by stimulation of the visual sphere, which had not been extinguished through his blindness. In doing so we have, however, not yet solved the problem of Masuelli's artistic work. We have now to study his technique and the conditions under which he worked.

Whenever we examine Masuelli's works carefully, we feel distinctly that in the majority of cases they reflect in their form, symmetry, and technique, the essence of *the visual, and not of the haptic world* of objects and forms. When we are faced with the graceful elegance of the finished works and their harmonious clarity, we feel unable to reconcile these creations with the fact

that they are the works of a blind artist. However strong the influence may be which the co-operation of the visual sphere and the results of experience and training exert, we should at least expect to find that the limited synthetic function of perception and the even more limited checking ability of the blind should, to some extent, manifest themselves in his figures. That, however, is hardly noticeable in any of his sculptures. One could hardly imagine, for example, that the upright female figure, or the charming face of the Holy Virgin, could have been achieved without visual control. But the fact that, contrary to all our expectations, an artist who became blind at a later age should be able to create figures which are equal to works by seeing artists, under the influence of the visual-haptic experiences which he gained *prior* to his blindness and after intensive study and training, points to the influence of certain elements which have hitherto escaped our attention. For the production of such sculptures which satisfy us fully in respect both of technique and artistic quality can hardly be understood on the basis of the limited ability of the blind to transpose and to check. We have to clear up that discrepancy before being able to give a definite judgment on Masuelli's art.

To that effect I deemed it necessary to proceed on empirical lines and to follow Masuelli's working technique carefully from beginning to end. I hoped thereby to get some insight into his methods and to find out how the design comes into being, the stages through which the work proceeds, and at what stage Masuelli considers his work to be completed. This was the reason which made me ask an Italian colleague to follow accurately from beginning to end the process of modelling as adopted by Masuelli.

The task consisted of modelling a bust from imagination without any model. Our experiment took the following course.

The first stage lasted seven minutes. During this time Masuelli worked very quickly with both hands. First he kneaded the clay; then with steady movements he designed the general scheme of the bust, and with his thumb he gave the face its first shape. After modelling the head for a while, Masuelli suddenly turned the bust round, thus standing behind the model, and in this position started to work on the face with both hands. From time to time he put his right hand on the back of the head, in order to have a definite point of orientation, and modelled the face with

the left hand alone. He then checked the work by drawing the left hand lightly over the profile of the figure, and both thumbs over the nose and mouth.

Masuelli then started to model the representative details. He successively felt the forehead, the nose, and the chin with both hands, presumably in order to ascertain the slope of the different parts of the front of the bust. Only then did he make the first measurement on the bust, by taking the distance between the latter and the back of the neck with his thumb and third finger.

After working intensely for one hour, Masuelli concentrated his whole attention on the mouth, the lips, and the sides of the nose. He worked out the details by means of a small wooden instrument, the action of which he checked by means of his left hand. He soon changed his position and went behind the bust, where, supporting his hands on both thumbs, he worked on the nose and mouth by means of his third and fourth fingers. He then returned to his original position and modelled the chin with both hands.

After an interval of half an hour Masuelli resumed his work. As he was not satisfied with his achievement, he tried to improve on the mouth, which is asymmetrical, and to check the eye-sockets and the lips. The work proceeded slowly. Masuelli sat down and worked on for a little while. After a further ten minutes he got up and declared the experiment to be finished.

The figure was practically completed after one hour's work, the style, the artistic form, and the expression then being clearly visible.

The further work consisted merely in the execution of details and correction, which, however, did not add to the æsthetic value of the sculpture. A number of people who saw the photos are inclined to assert that after one and a half hour's work the bust had lost rather than gained in character and spontaneity. This is in perfect agreement with what we have seen with sculptors working blindfold. Their works, too, became less original and less expressive after a comparatively short time. We remember that the sculptors themselves stated that they were at the end of their efforts, that they did not believe that longer work would improve on the sculpture; they were convinced that the creative energy became less with increasing time. Masuelli himself, however, did not make any such statements to that effect —at least, not in the course of this experiment—but the fact that, after three-quarters of an hour, he began to work remarkably

slowly, and that he stopped work with a feeling of dissatisfaction and ill-temper, suggests similar difficulties and inhibitions.

It seemed to me that these similarities between normal sculptors working on purely haptic lines and sculptors who had become blind at a later stage in life might furnish an explanation of the problem of Masuelli.

With Masuelli the artistic creativeness is centred on the sketch and on the first stages of the sculpture. All that the blind sculptor is able to attain by imagination, experience, and training is actually included in the very first form of the work. When he wishes to proceed beyond the sketch-like stage that carries in it the true essence of his art, he runs the risk of falling into a dilemma. It is easy to understand that he does not stop at that stage. For even if he felt, with correct intuition, that there was no possibility of improving on the work, he would hardly be able to resist the urge to carry on and complete the work like any other artist. He cannot be satisfied with a mere sketch, not even with an expressionistic representation; he is therefore tempted to produce something which is actually beyond the means of a blind artist—namely, a sculpture perfectly conforming to the principles of visual æsthetics. By cutting short the creative activity at the point at which the autonomous haptic act of modelling and creating actually comes to an end, he would create works which, though they might appear sketchy to people with sight, are full of expression and original conception. But if he goes beyond that stage, and enters the phase of supplementing and constructive correction, the work, although it might gain in technical perfection, would lose in artistic value. The rational and constructive element would take the place of vivid spontaneity.

Applying these views to an appreciation of Masuelli's works, we feel compelled to assume that his finished works could not have been created without the co-operation of others who could see. One might imagine that he allowed himself to be guided by critical remarks of persons assisting him. That participation may not extend very far, but nevertheless it is strong enough to impair the originality of the work, and to lead to a work that is not actually the production of a blind sculptor, and does not really represent his sculptural achievement. One might, however, contend that seeing sculptors, too, meet with the criticisms of their friends and relatives, and that they occasionally amend their

works according to such criticisms, in which case nobody would be ready to assert that the work was created under the influence of a third person, and did not constitute an original work of the artist. That is actually quite correct when we are dealing with a sculptor who can see. He discusses the suggestions of the third person, and only when he is convinced of the justice of the objections will he alter his work according to his own artistic concepts. He is, moreover, in a position to come to the same opinion without the criticism of others. This does not apply to blind sculptors. They are mostly not able to convince themselves of the correctness of objections and suggestions and to check the observations; they have to follow them "blindly" so far as they consider the verdict of their seeing friends as binding. Even their own corrections are not judged by themselves, but again by those who can see, just as if a musician who had become deaf a long time before were to alter his compositions because his critics remarked that they did not sound well. The piece of music might thereby gain in artistic value, but it would hardly be an original work any longer. The works of a gifted blind sculptor are under similar conditions even more likely to lose their originality because the foreign influence robs the work of its haptic—*i.e.*, of its original character.

Fig. 94.

At the time I believed that my views and suspicions had been confirmed by a strange coincidence. For I was struck by the fact that the last reproduction of a feminine bust modelled by Masuelli differed very markedly from a photograph which had been taken a few days after the experiment mentioned; during those days Masuelli had continued working on the bust in the absence of my colleague (Fig. 94). I could not help feeling that the per-

fect symmetry of both halves of the face, and the suppression of the differences between them, the finely executed symmetrical shaping of the nose, and the small and elegant, instead of long and asymmetrical, mouth, were the result of advice given by someone who could see. Many unevennesses, even certain errors of balance and proportion, might have been corrected by the artist himself, because of his training and constant experience. I felt, however, that the final stage had been achieved under the influence of persons who could see. At the time that was the only explanation I could find for the optomorphic features of the figure. I told Mrs. Masuelli of my suspicions and urged her to tell me how far she assisted her husband at his work. She confirmed those suspicions by writing to me as follows:

" Before my husband finishes one of his works he wishes me to look at it very attentively. He is not able to judge it alone and by touch only. The tactile sense is such an inaccurate organ, one cannot entirely rely on it. I often detect minor inaccuracies or asymmetries, and point these out to him so that he can correct them. The asymmetry is usually not related to the proportions—these are nearly always correct. In most cases it is a question of the height of the orbits and of the mouth. On the photograph of the ' Madonna ' one sees," she went on, " that the face is quite symmetrical, so it was from the very beginning, only a slight correction was required at the left corner of the mouth, which my husband altered according to my advice. All the other parts of this figure—the head, shoulder, arms—were perfectly symmetrical and correctly placed; I could therefore only approve of all of them. . . . Anyhow, I am convinced that your theory is quite correct in that my husband also considers it necessary to have his works judged by people who use their eyes before he gives them the final touch or has them reproduced." [1]

The problem of Masuelli appeared to me so important for the psychology of the blind in general that I decided, in spite of this report, to watch his sculptural activities in Rome personally.

So I asked Masuelli to model a figure in my presence. On the 22nd of May, 1938, he started working entirely from imagination on a head of a young girl, and completed it on the 30th of May.

[1] " . . . che anche mio marito ritiene necessario far giudicare dall' occhio le sue figure prima di potarle a complimento e prima di farle formare." (From a letter dated 27th April, 1937.)

During that period I had ample opportunity to follow all the stages of his sculptural activity from beginning to end. The whole work took him eighteen hours. It would certainly be interesting to give a detailed account of the process of work in all its stages. I shall, however, confine myself to recording those observations which are especially characteristic of Masuelli's way of modelling. First I should like to point out some general facts.

It can, I believe, be ruled out entirely that Masuelli has a clear visual conception of the figure he wants to model; he himself denies it categorically. He speaks only of a " vague conception ", which probably consists essentially of elements of knowledge and of tactile-motor memories. On the whole, he does not make any definite plans for its final execution when starting his work; he rather relies on chance—*i.e.*, on the intentions of the modelling hand. In this special case, however, he started with the intention to model the head of a woman, but without feeling bound by that plan. It would, moreover, be very unlikely that, after a blindness of eighteen years, there should still emerge such clear visual concepts as to serve as the model for a plastic work. In this connection we are not even taking into consideration the variability and lability of the visual concepts in general, nor the autonomy of the modelling hand, which are neither likely nor able to adhere to such a model. On the whole it would be a mistake to imagine that the modelling activity of those who have become blind at a later stage in life, or even of seeing people, is guided by visual concepts. The visual elements are to a certain extent operative in their sculptural work, but only in so far as *they supplement and modify the haptic impressions.*

The importance of *measuring* became very clear in Masuelli's modelling technique. He has at his disposal schedules of proportions for the length-to-width of the face and length-to-width of the head, and also for the length of the forehead, nose, and chin, etc., all of which he gained through feeling his own body and from the study of anatomical models and casts. He imposes the main proportions right from the beginning on to the first sketch and checks and amends them constantly during the whole period of working. After every step Masuelli checks the proportions of the parts to each other. To him the continuous haptic control has the same significance as the constantly available visual image to a sighted person. The measurements are taken by

means of the fingers of both hands, and (exceptionally) by means of a piece of string.

Apart from the proportions, Masuelli attaches the greatest importance to *symmetry*. He attains symmetry of the face in the first instance by working simultaneously with both hands on both sides of the face. The bi-manual work in itself doubtless leads to symmetrical composition; but what is symmetrical from the point of view of haptics need not be symmetrical from a visual point of view. If we observe visually a symmetrical movement performed by both hands, we are surprised to see how strongly the kinæsthetic impression of symmetry differs from the visual one. The reason for the asymmetry observed when modelling without being able to see is obvious. Whenever the symmetrical formation of a body is checked bi-manually, the perception becomes distributed to two sensory organs which are to a considerable extent independent of one another and therefore do not function absolutely alike. The impression of symmetry does not, as in the visual sphere, arise in a simultaneous and homogeneous manner, but partly by way of comparison—*i.e.*, on the basis of the identity or otherwise of two impressions.

In order to make up for the difference of the two hands in sensitivity and haptic sense, Masuelli adopted the method of working on the face alternately from the front and from the back, so that each hand is given the opportunity of working on both sides of the face. The use of the fingers as calipers represents a remarkably clever method of measuring and checking symmetry. By means of this method, the congruence of the two eye-sockets, for example, is checked by performing circular movements over the eyes with the first and middle fingers of both hands whilst the thumbs rest on the chin. Larger surfaces are felt and checked by means of the palms.

Masuelli aims at perfect symmetry. He is guided by the requirement of having equal conditions on both sides and making one side of the body congruent to the other. This accounts for the fact that Masuelli takes so long to finish the eyebrows and the line of the nose which joins them. For this line constitutes the middle line of the face on the basis of which the lateral parts have to be shaped symmetrically.

I was surprised to find how well Masuelli succeeded in shaping the face symmetrically. His achievement shows that our haptic

sense is able not only to perceive but also to produce accurate symmetry. In this connection we need not stress the fact that Masuelli occasionally wishes to have an opinion from people who can see about the symmetry of the two halves of the face or of two corresponding parts of the body, especially since these opinions do not influence him decisively. For even if no asymmetry in the structure of the face or of the body is pointed out, Masuelli continues his checking and controlling. He tries to eliminate any roughness, any asymmetrical feature, if only for the reason that on account of lack of visual control he is unable to judge how far even small incongruities may impair the visual impression of the whole work. While it is very easy for us who can see to notice any difference between subjective wishes and objective demands, this is not so with the blind. They are only satisfied when what is objectively given is congruent with what is objectively demanded, and it is that tendency which leads them to the rigid observance of symmetry.

With regard to special features of Masuelli's technique, the following may be noted. As opposed to other blind sculptors, Masuelli does not construct the bust out of parts, but tries, in a manner similar to that of artists with sight, to start from a simultaneous whole, though the term " simultaneous whole " actually means the parts which can be felt and embraced by two hands (fingers and palms). The details are only started on when the bust has obtained its first form. Even the comparatively independent parts are never modelled in themselves as such, but always in relation to others. While, for example, Masuelli is shaping the nose, he never ceases to feel the eyebrows, the eyes, and the forehead. In modelling the separate parts he is guided by basic stereometric and linear forms, as, for example, the sphere for the skull, the tetrahedron for the nose, the hemisphere for the eye-socket, the semi-circle for the eyebrows. It is out of these basic forms that he creates the bust with subtle plastic ability.

Masuelli works very carefully. He does not take any new step or make the slightest alteration before being convinced of its necessity. The alterations he makes are always slight ones. The modelling amounts more to a process of smoothing out than to one of creating a form out of an amorphous mass. He might be said to work on *subtractive* and not on additive lines, for he does

not actually add new material to the mass of clay; rather does he remove from it the unnecessary and superfluous parts.

The actual forming of the face and its parts is done by means of handling, with gliding and smoothing movements of the fingers and the palm. The same applies to the modelling of the body. In modelling heads he concentrates intensely on the plastic representation of the eyebrows, the nose, the forehead, and the chin. He devotes the greatest care to the correct proportions and to the detailed modelling of the individual parts, by which he apparently wants to stress the continuity of the physical mass. It is through the joining of these lines that the connection between the upper and lower part of the face is achieved. Masuelli devotes very little attention to the back of the head, the hair, the ears, and the mouth. These parts were completely neglected during the first days of work. At first sight, it appears surprising how little attention Masuelli devotes to the mouth, to which we ascribe such a great importance in expression. If, however, we feel the face, we understand why he is not more interested in that region. For the mouth plays an unimportant part from the point of view of Haptics. It is rather a disturbing element from the point of view of modelling, because it interrupts the haptically homogeneous lower part of the face extending from the nose to the chin. From a visual point of view, the nose constitutes the transition from forehead to mouth; from the point of view of the artist working on haptic lines, it is the transition from forehead to chin. We have further to realize that in the process of haptic perception, the mouth has little expressive importance.

Finally, I should like to give a series of photographs showing the way the work actually proceeds. Figs. 95–100 show five stages of Masuelli's modelling technique.

Photo No. 1 was taken forty-five minutes after Masuelli started to work. The fundamental scheme of the bust is already clear. No. 2 was taken on the next day, fifteen minutes after the new start. No. 3 shows the progress made during the second day. No. 4 gives the result of the third day, after about three and a half hours of intense work. The face already shows its charming expression, the eyes, the nose, the forehead, and chin have reached their final shape. In its unfinished form the bust was so charming and full of expression that I suggested to Masuelli that he should stop there. Of course he did not accept this suggestion of mine,

Masuelli's Modelling Technique in five stages. (Figs. 95–100.)

Fig. 95 (No. 1).

Fig. 96 (No. 2).

Fig. 97 (No. 3).

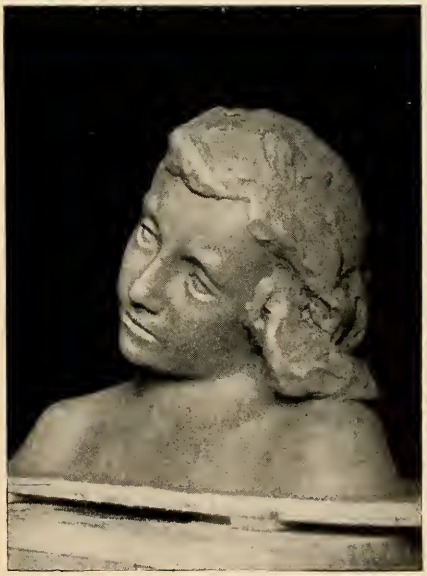


Fig. 98 (No. 4).

chiefly because the symmetry between the right and left sides of the face had not yet been achieved. By the end of the fifth day the eyes were already modelled, but not yet completed in detail. Nor was the neck quite finished. The hair was dealt with in an impressionistic fashion, and Masuelli left it at that. The mouth still remained in the provisional stage. Figs. 99 and 100 give two different aspects of the work as completed on the seventh day.

Fig. 99 (No. 5).

Fig. 100 (No. 6).

From an æsthetic point of view the work allows of different opinions. It may be looked upon as the expression of genuine artistic imagination, of the artist's true creative ability, or merely as the expression of formative activity ruled by æsthetic principles. But it is undeniable that we are dealing with a work which is inspired by an artistic idea and created by artistic means. The bust is not a naturalistic copy of a real handled object, but the free creation of a true artist, the realisation of an artistic idea.

Nobody can deny that this work, like many other sculptures by Masuelli, represents an object worthy of æsthetic contemplation, although it lacks originality and technical perfection. The figure is not bound within the limits of the merely sensual sphere, and extends into that world of ideals where objects are endowed with

æsthetic value by means of their specifically artistic effect. There is no doubt that the pleasure conveyed by this sculpture is based on the *æsthetic value* of the bust, and not on our admiration of the sculptural achievements of a blind artist. It is the *work* itself, and not the *personality* of its creator, that determines our æsthetic attitude.

One might imagine that on account of the lack of visual control the work might be looked upon as the result of mere chance. But to ascribe to chance everything that was not completely intended would amount to assuming that every work of art is stamped with the character of haphazardness, and that its very essence lies in the sphere of chance. No artist starts his work by fixing every detail right from the beginning; in the course of the execution of his original idea many unforeseen external and internal elements become operative which, in connection with the primary conception, constitute what is usually described as autonomous creative power. There is no doubt that there, too, some part has to be ascribed to mere chance. The blind sculptor is even more subject to this element of chance than is the artist with sight; he is likely to be more easily influenced by the free creative activity of the hand, which is not bound by conceptions of form. These considerations, however, do not play any part in the æsthetic appreciation of works in which nothing but the final stage of creative activity—*i.e.*, the completed work—is under discussion. The work constitutes the only reliable basis for the appreciation and valuation of the creative activity of an artist. From this point of view, Masuelli's work is truly an artistic achievement.

7. Reports on Some Other Blind Sculptors

The four cases with which we have dealt in full detail represent the most interesting cases among blind sculptors, both from the point of view of sculptural achievements and from a psychological point of view. Except for the problematical case of Kleinhans, who cannot be reckoned among the blind sculptors if one wants to ascribe to him the whole " Kleinhans-Œuvre ", the remaining three have in common, that they all lost their sight at a comparatively late stage of life, and that they all had practised sculpture before they became blind. They have therefore not only known the visual world and its variety of forms from their own experience, but before going blind have also become conversant

with the formal aspect of art which, although it is related to natural (visible) beauty, develops on independent lines. They have actually experienced the mysterious essence of the work of art and the plastic beauty of the body. These experiences could not remain without effect; they permeated their ideas, determined their intentions, and influenced the form and technique of their creative activity. One of them (Vidal) was not able to get beyond his technique; the second (Schmitt) tried to transgress the boundaries of his means of expression; in contrast to these, Masuelli attained the level of a more mature and conscious art. These facts are accounted for by the personalities and aims of the sculptors and not by their blindness.

I should like to report on a few more cases which have come to my knowledge. Although the sculptural activity of these blind artists does not contribute very much more to our knowledge, it seems to be quite interesting in that it gives further support to our theoretical views.

1. Giovanni Gonnelli, "il Cieco da Gambassi"

According to Baldinucci,[1] Giovanni Fr. Gonnelli, known as the blind man of Gambassi, was born at Gambassi (Valdelsa) in 1603.[2] He left his native town as a young boy and went to Florence to study the fine arts. There he belonged to the circle of the pupils of Pietro Tacca. As a follower of the Duke of Mantua, Gonnelli suffered ill-treatment during the siege of the town in 1630. This led to eye trouble culminating in blindness (1632). He left Florence and went home, where he spent ten long and painful years, until he eventually decided to resume his artistic activities, in order to make his life more bearable. According to contemporary reports, Gonnelli soon attracted general attention by a terracotta copy of a marble bust of Cosimo Medici the First. The blind sculptor is said to have achieved this copy by means of bi-manual handling and the use of calipers. He returned to Florence, where he studied at the Academy of Fine Arts. Later he followed the call of the Grand Duke Ferdinand II and of the Pope Urban VIII, and moved to Rome, where he died in 1664, aged sixty-one.

The life of this once-famous artist has been the object of com-

[1] F. Baldinucci, *Notizie de Professori del Disegno*, Florence, 1702.

[2] In the *Enzykl. Handb. des Blindenwesens*, edited by Mell, Gonnelli appears under the name of Johannes Cambassius. The date of his birth (1622) and his birthplace (Bologna) are quoted incorrectly.

paratively extensive study; in spite of this we are by no means fully conversant with his sculptural activity. We owe the oldest reports on him to the well-known Florentine biographer, Filippo Baldinucci, a contemporary and a personal friend of the artist. His notes are still looked upon as the chief source for Gonnelli's biography. A few dates are also given by Soprani, who lived a little later.[1] Among modern authors, del Rosso,[2] Ghilardi,[3] Supino,[4] Schubring,[5] and von Fabriczy[6] have dealt with Gonnelli's works.

In regard to the question of the works to be attributed to him, no definite judgment has yet been reached. According to Thieme-Becker[7] Gonnelli's authorship of the following works cannot be doubted:

Pietà, with seven life-size figures (painted), at San Croce, Borgo di Collo; Birth of Christ, with the Figures of the Annunciation and scenes of the life of Mary (relief in clay) in Santa Maria Assunta, Casola d'Elsa; San Stefano in San Stefano, Florence; Pietà, with five life-size figures (painted relief in clay) at Bernardino all' Osservanza, near Siena; Pietà, with Magdalena and John, as well as the Ascension and the Pentecostal Miracle (clay) in S. Vivaldo; and, last, San Sebastian in the Museo Nazionale, Florence.

The following busts have also been attributed to Gonnelli: Ferdinand II and the members of his family, and a portrait of Pope Urban VIII in the Palazzo Barberini in Rome; also the relief, "Doubting Thomas". Opinion on the reliefs in the Franciscan Convent at San Vivaldo, which are considered to be the most remarkable creations of the master, is very divergent. Ghilardi believes that at least some of the reliefs and figures are the work of the blind sculptor. He bases this opinion on the fact that one in possession of the family of the Marchese Maccarani was the first design of the Madonna dello Spasimo in San Vivaldo. Fabriczy is inclined to attribute to Gonnelli all of the seven groups;

[1] Soprani, *Vite*, 1674, p. 331.
[2] P. M. del Rosso, *Il Cieco da Gambassi*, Florence, 1880.
[3] P. F. Ghilardi, *San Vivaldo in Toscana*, Florence, 1895.
[4] J. B. Supino, "Le opere del Cieco da Gambassi a San Vivaldo," *Miscellanea storica da Valdelsa*, XIII, 1905.
[5] P. Schubring, *Lucca della Robbia und seine Familie*, Leipzig, 1905.
[6] C. v. Fabriczy, Discussion in *Repertorium für Kunstgeschichte*, XXX, 1907; also his critical catalogue of Tuscan statues in wood and clay up to the beginning of the Cinquecento, *Jahrbuch d. Preuss. Kunstsammlungen*, XXX, 1909.
[7] Thieme-Becker, *Allg. Lexikon der Bildenden Künste*, XIV, p. 370.

Supino, on the other hand, believes that of these reliefs only the very best—but definitely including the Madonna dello Spasimo—are Gonnelli's creations.

Without being an art historian, one must realise that the artist who created the group in the Doubting Thomas cannot possibly have also created the Madonna dello Spasimo. Both of them are beautiful, grand compositions with vivid figures, but dating from different periods of Italian art. Whatever groups one may attribute to Gonnelli, it will have to be admitted that the creator

Fig. 101.—Gonnelli: Doubting Thomas.

of these works must have been an important artistic personality. We are now faced with the psychological problem: Is it possible that those works are the creations of a completely blind artist? Is it possible to reconcile the artistic and technical qualities of those works—irrespective of which of them are attributed to Gonnelli—with the perceiving and creating function of the haptic sense, even though one attributes a considerable part to residual visual-haptic experiences. As far as I know this problem has first been tackled from the art-historian's point of view by the Bolognese art historian, Supino, who, when discussing the Scenes of the Passion in San Vivaldo, draws our attention to the deficiencies which are supposed to characterise the technique of a blind artist. His arguments are untenable, his observations by no means

convincing. Supino has never seen the work of a blind artist; he is therefore not able to judge works in relation to the psychology of the blind.

Fig. 102.—Gonnelli: Madonna dello Spasimo.

The not very impressive bust of Pope Urban VIII, and the self-portrait in the Castle at Gambassi, now in the possession of the family of the Marchese Maccarani, might perhaps be looked upon as the work of a blind artist. The portrait of the Pope, however, is a copy from a marble bust, and so cannot provide any clue to the talent of the " blind " artist. Judging from the photograph,

the self-portrait is a very mediocre work; its technical and artistic deficiencies might rather suggest a poorly gifted sculptor than a technically clever blind modeller.

In view of the fact that opinions differ so widely on these very mediocre sculptures, it appears strange to attribute to Gonnelli the masterful reliefs in San Vivaldo. It is not our task to ascertain which sculptures can be attributed to this particular sculptor, Gonnelli, but merely to decide whether the outstanding works, such as the sculptures in San Vivaldo and in Siena, are the creation of a *blind* Gonnelli. I deny that possibility, and base my attitude on the following arguments.

(1) Nobody has yet been able to prove satisfactorily that Gonnelli became *completely* blind through the injury or illness affecting his eyes. The author in the *Allgemeines Künstler-Lexikon* actually says: "When we hear that after becoming blind he took the courses at the Academy in Florence, and that in 1637 he was able to attach a legible signature to documents, we are entitled to some doubt as to the nature of his illness; possibly complete blindness did not set in for many years." Judging from the very clear signature on the document which dealt with his becoming a citizen of Volterra, we may assume that Gonnelli was quite able to see as late as seven years after his injury—*i.e.*, in his thirty-fourth year: he was therefore in a position to work as a seeing artist for a period of at least fourteen years. It is not even likely that Gonnelli had lost his sight completely as early as that. He may have had a serious disturbance of vision, which impaired his work considerably, but did not make him give up his artistic activities.

The surname "Cieco" does not signify much. All we have said about the term "blind" in dealing with Kleinhans applies *a fortiori* to Gonnelli. Every nation, and especially the Italian nation, is very ready to add nicknames to a person's own name. Not only do beggars of all kinds readily adopt the name "Il Cieco"; people with impaired eyesight are also sometimes called blind, or treated as such. One therefore ought not to be misled by such surnames; we should especially avoid giving the word in its extreme meaning. Remarks like, "Please speak a bit louder to him; he is quite deaf," or "He is so blind that he cannot see his hand in front of his face," show clearly the wide scope of the words "blind" and "deaf".

(2) The small number of his works (hardly more than ten

acknowledged works after forty years of artistic activity) is strongly in favour of the assumption that he gave up sculpturing many years before his death, presumably when his eyesight became completely extinguished, or when his vision became too bad to allow him to carry on with his work.

(3) Assuming that the poor portrait of Pope Urban and the doubtful self-portrait were creations of the *blind* Gonnelli—a possibility which cannot be excluded—the large reliefs in S. Vivaldo and Siena and the statues of S. Stefano and S. Sebastiano cannot possibly be attributed to the *blind* Gonnelli. They would have to be the works either of another artist or of Gonnelli whilst he was yet *seeing*.

(4) As regards the dates of the works, there are only two possibilities: all the more remarkable works were created either *before* or *after* the artist became completely blind, as they are practically all of the same quality both from the artistic and from the technical aspect. The former hypothesis would involve believing that Gonnelli after becoming blind did not produce any remarkable works; the latter would amount to assuming that Gonnelli did not achieve anything remarkable before he became blind, and that the whole of his artistic development and activity took place during the period of blindness. It need hardly be said that such an assumption is incompatible with all findings, reports, and other considerations.

(5) The most important and striking argument, however, is that the condition of complete blindness rules out fundamentally the composition and execution of *works in relief*.

Whenever a blind person models, or when an artist who has become blind attempts to carry on with his sculptural activities, he will have to accommodate himself to the function and the productive power of the haptic sense. He will therefore only consider tasks which are within the scope of haptic perception, and produce or copy figures which stand free in space and are open to handling from all sides. *A relief presentation is beyond the scope of a blind sculptor.* Among the forms of plastic representation, the relief picture is really open to visual perception only; the reason is to be found in facts about the general physiology of the senses, and especially the fact that haptic perception makes the subject only to a very limited extent able to fill gaps and to create illusions.

By thus stating that representation by means of relief pictures is incompatible with the essence of the haptic function, I believe I have proved the assertion that Gonnelli cannot have produced his most important works, the reliefs, while he was blind. It is obvious that this view applies not only to Gonnelli but to all blind sculptors, so far as they want to work in relief. Our view is further supported by the analysis of the works themselves. For it is quite impossible that a blind sculptor—even if he has retained the most vivid recollection of other works or of his own—should have created such mature compositions of human incidents, such perfectly balanced figures, such a functional clarity of the attitude and position of the individual figure, such pictorial overlapping in a solid form, and, last but not least, should have been able to express artistically such a wide range of emotions. Should a blind sculptor ever succeed in creating such works as the Pietà and the Madonna dello Spasimo, should blindness be compatible with such a vivid sense of form, of plastic expression of the emotions, and of artistic realisation of ideas, then indeed the gulf between the art of those who have sight and that of the blind would once for all cease to exist, and Michelangelo might have been able to create his Moses, and Verocchio his Colleoni if they both had been blind.

Summing up, we reach the following conclusions. Gonnelli, the so-called blind artist of Gambassi, must have created his works, except for a few unauthenticated sculptures, while he could see. His entire output has no connection whatever with blindness. He may have become blind at some period of his life; in this case his artistic activity must have taken place before he lost eyesight completely. The *blind* sculptor of Gambassi is, therefore, not identical with the *artist* Gonnelli.

2. Hubert Moudrý

The reports on Hubert Moudrý are very scanty. We know that he was born at Zittau (Moravia) in 1865; that he developed a cataract in 1900 and underwent an unsuccessful operation; finally, that he died there in 1920. From his autobiography we hear that he attended the German secondary school at Olmütz, and that he obtained a position as a civil servant in 1886; he had, however, to abandon his post in 1900 on account of impending blindness. Soon after he entered the Institute for the Blind in

Prague and stayed there for about one year. He learnt Braille, and started his first hesitating attempts at modelling without any assistance. In August 1902 he first exhibited some of his works and obtained a prize as a self-taught artist. He describes his method of working in a report,[1] where he writes: "I do not make use of any tools, but shape everything, even the most complicated things, freely by hand. Vases and other vessels are executed in a piecemeal manner; the same applies to larger figures, all of which are modelled as hollow objects. I indent the bark, and also the notches in leaves, with my nails; I impress the ribs of leaves with my fingers; roses and other complicated flowers are shaped petal by petal. I even model the heads and faces of human and animal figures with my fingers only. I had to pick up all the necessary knacks and technical routine by much practice. In spite of this, however, it sometimes happens even now that I do not succeed with a work, and have to repeat it three times before it is satisfactory. It is quite obvious that I am better at ceramics than at figures, because the latter are in themselves by far more difficult, and because I have no special aids at my disposal for executing them—which, I admit, applies to ceramics too."

FIG. 103.—Moudrý: Elephant Hunt.

Moudrý's works represent typical productions of an artist who became blind at a later stage of life, and who, by means of his visual and haptic experiences, was able to endow his works with a certain amount of differentiation and objective accuracy. A striking feature of all his figure works is the naïvely primitive and simple mode of representation. The proportions and the attitudes

[1] H. Moudrý, "Wie ich als Blinder Modelleur wurde," *Z. f. d. österreichische Blindenwesen*, I, 1914, p. 45.

of his figures are mostly incorrect; the bodies are definitely lacking in life and motion. There is a striking likeness of all his figures to one another. There is no real expression on the faces, just as there is no real composition in the groups. All his works show this incoherent, unintegrated structure and are devoid of any artistic unity.

I do not see in Moudrý's works any feature that requires further comment. When I was a child I knew an old gentleman who used to entertain the children at supper by modelling under the table little figures of animals out of bread crumbs. In the course of years he had attained such skill as to be able to conjure up a little Zoo on the rim of his plate. The children admired him greatly. Our friend, however, was no more an artist than was Moudrý. Both of them had merely learnt to create skilfully, out of soft material and without visual aid, a number of ornaments and little figures.

Moudrý's works do not convey any artistic ideas, nor are they true reproductions of nature. Moudrý's skill is akin to the naïve plastic art of peasants, or even more to the modelling achievements of a confectioner; it does not, therefore, fall within the scope of our problem.

3. Georges Scapini

Georges Scapini was born on the 4th of October, 1893, the son of a French manufacturer. His father died when he was six years old, and he was educated by his mother and grandmother. He visited the secondary school—École des Roches—at Dreux, and later the Collège de Normandie. He matriculated at Paris in 1912 and passed his B.A. In the same year he was called to the colours. At the outbreak of war, at the age of twenty, he was sent to the front. During the first year of the war, in 1915, he lost both eyes in action, and became completely blind. Scapini only gradually resigned himself to his fate. He reluctantly learned typewriting, Braille reading, and writing. Life itself eventually led him to the solution which his wounded self-confidence had not been able to show him. He decided to live his life as a blind man and to devote his energies to the great community of the war-blind of his country. With this aim in view he started to study law. He passed his examinations and became a solicitor in Paris. In 1923 he became chairman of the " Union of

the War-Blind," and, as one of the most radical champions of the cause of the war invalids and fighting men, he was elected deputy of the 17th Arrondissement of Paris.[1]

The idea of working as a sculptor did not occur to him before 1929, fourteen years after he became blind. He explained to me

FIG. 104.—Scapini: Self-portrait.

that what made him start sculpturing was not a creative impulse, but the desire to convince himself of the accuracy and reliability of his haptic perceptions (" de vérifier d'une manière matérielle l'exactitude des mes sensations ").

To my mind, however, his sculptural activity is rooted in his personality and character. Scapini is an energetic person with strong will-power and self-confidence. He wants to show to himself and to his fellow-sufferers that the means of expression

[1] G. Scapini, *L'Apprentissage de la nuit.* Paris, 1929.

available to a blind man are not at all as restricted as one is usually inclined to assume, and that the gap between the sighted and the blind is not so wide that it cannot be bridged by will-power and ability. To his mind the humility of the blind, their silent resignation, is not justified; it needs only strength of character and courage, self-confidence, and the urge for creative activity to gain admission to the spheres which one assumed to be barred to the blind. One of these spheres of activity is the projection of the spirit into matter.

In his portraits Scapini endeavours to strike off the character of the person he is modelling; in doing so he does not aim at an accurate reproduction of the form and features. That is his intention anyway. How far he is actually able to fulfil his aim in his works is, of course, a question which can only be answered by comparing his portraits with the model. Scapini is doubtless able to impart likeness to his portraits, but not character. He states that he has still some vivid visual images which help him to conceive and execute his ideas. It is difficult to say how far that is correct, but there can be no doubt that the influence of visual memories contributes to the quality of his achievements.

Artists who have seen sculptures by Scapini and have watched him at work admit that he shows some artistic talent. On the other hand, they say that his works lack that very quality which can only be obtained with the help of the seeing eye—that is the true artistic quality. Thus it is Scapini's fate, his *blindness* and not his art, that really makes him an interesting personality.

4. Filippo Bausola

Bausola belongs to the group of blind sculptors who had already worked as artists before they became blind.

He was born in Ovada in 1893. He started working as a sculptor in his early youth under the supervision of his father. The Great War ended this activity; he lost his sight by a gunshot wound through the skull in 1917. After a period of helplessness and indecision he made up his mind to resume his sculptural activities on the basis of what he had learnt in his youth. He felt encouraged by the successes of his famous compatriot, Gonnelli, and started modelling without any aid.

Bausola made portraits and reliefs for war memorials. One of the reliefs, representing Christ blessing the soldiers returning from

the war, is in the vault of the Casa Madre dei Mutilati, in Rome. Another relief in marble, " La difesa della vittoria ", was made in honour of the victorious soldiers. It may be seen on the front of the Casa di lavoro dei Ciechi di Guerra in Rome.

Bausola's works show clearly what a technically gifted blind sculptor, who is not aware of the limitations of his own ability

Fig. 105.—Bausola: Delacroix, Blinded in the War.

and of those of the blind in general, may achieve. Prior to his becoming blind, Bausola seems to have been a skilled modeller rather than a genuine artist. Among the works of his known to me, the only interesting one appears to be the life-size crucifix in the parish church of his native town, Ovada. It is full of expression and is a work of sound, if primitive, originality. I believe that Bausola, just as Schmitt, would be able to perform much better artistically if he had correct ideas about the true nature of haptic representation and the limitations of his own abilities.

IV

THE FUNDAMENTAL PROBLEM OF ARTISTIC CREATIVENESS IN THE BLIND

1. The Characteristic Features of Works by Blind Sculptors

We have by now become acquainted with the factual data concerning the achievements of blind sculptors. By subjecting these cases, very interesting in themselves, to a critical survey, we were led to the conclusion that the statements about the extraordinary achievements of blind sculptors are definitely exaggerated; to a great extent they are based on quite unreliable reports and ill-founded artistic criticism. Take the legendary personality of a Gonnelli—all that remains is a talented sculptor who gave up his artistic activity when he became blind; in Moudrý's case it was evident that he only performed a type of handicraft such as those who can see also can perform blindfold very skilfully after some training. Even Scapini's achievements are on a level that may be reached without considerable artistic talent. The same applies to Bausola, who, in spite of technical skill, never reached a really artistic level. There remain, therefore, only four sculptors whose works deserve our attention: Kleinhans, Vidal, Schmitt, and Masuelli.

In the case of Kleinhans, we expressed our doubts as to whether he was actually born blind, and tried to show that the really remarkable works attributed to him cannot be the creation of one who had been blind from his early youth. The variety of form, which reveals itself in these works, can only originate from the visual impressions and conceptions of an artist. From what sources could a blind person, who has never seen the world with all its wealth of forms and colour, derive those manifold experiences? He can never create new forms of expression, for that presupposes a rich and variable phenomenal world, free fantasy arising from symbolic comprehension of nature. This comprehension of nature endows the sighted with that æsthetically

founded insight which is the basis of all artistic creation. It is only the symbolic and creative conception of given reality—in our case, the visual world—which enables the artist to translate the spiritual content into the supranatural, non-material sphere of art. The man born blind apprehends nature in only one manifestation; the strongest ties bind him to the material sphere; no one born blind is able to become aware of the diversity of nature and to apprehend all the rich and various appearances of objects.

The appreciation of nature by means of the artistically gifted eye, the reduction of physical forms to visual values, the creative conception of new forms—all these are functions which are beyond the abilities of those who are blind from birth or have become blind at an early age. Whoever created the works attributed to Kleinhans cannot have been born blind.

Vidal's activities do not require any special comment. He was a technically and artistically well-trained sculptor before he became blind. In his blindness he adhered to the traditional subjects and forms of artistic naturalism and to the same schematic types for the artistic representation of animals. It was therefore not very difficult for him, after he went blind, to carry on his sculptural activity without introducing new problems and without altering his style. Nineteenth-century naturalism aimed at a correct reproduction of the model when representing animals. It is therefore by no means difficult to understand that an artist working on naturalistic lines and with fixed canons carried on his somewhat mechanical work after becoming blind. Vidal's art did definitely not become deeper; on the contrary, it gradually lost all vivacity and originality; ultimately all that remained were the stereotyped forms deprived of ideal content.

Schmitt's achievements are remarkable. He represents the type of blind sculptor who by technical skill and diligent training attained a remarkable standing. In the first period of his activity his works show some artistic qualities. The works, however, vary considerably in artistic value; they lack homogeneity and certainly an individual style. Just as in Vidal's case, Schmitt's art deteriorates with the fading away of the visual memories. The original creative power becomes replaced by technical skill and routine. The more he loses contact with the images of the visual world, the more the constructive rational work replaces spontaneous insight and artistic principles. Only

the brain and the fingers are at work, intuition and fantasy no longer.

Masuelli seems to be the only one whose work is based on artistic vision. He represents an example of how a completely blind, artistically gifted man, aiming passionately at expressing himself in plastic terms but aware of the limitations set to his activities, can create works which stand far above the crude or naturalistic achievements of other blind sculptors. Masuelli's works are the only ones which show a further development of the artistic personality during the period of blindness as well as a personal outlook on aims and work.

We have now to answer the following questions: first, what means have blind sculptors at their disposal, and, secondly, how it is possible for them to achieve works of artistic value in spite of their blindness.

2. Creative Activity in General and the Significance of Tactile Experiences

To my mind the difficulties connected with the first problem are not related to the blindness as such, but rather to an incorrect conception of artistic work in general.

Sculptural art, like every kind of pictorial art, is an artistic manifestation of our visual sense. Visual images stimulate the birth of artistic ideas; they direct the formative activity and engender the pleasure derived from a work of art. The plastic arts are ruled by visual forms and visual laws and by æsthetic principles derived from the sphere of visual perception.

These facts led to the erroneous conclusion that every sculptural work required distinct visual perceptions or even visions, and that the work was a sort of copy or resurrection of these visionary images. This conception became more convincing when our attention was drawn to the fact that the blind were not really interested in sculptural art, and that they rarely showed the desire to work as sculptors. It is easy to show that this "visual" theory represents a very one-sided and narrow-minded view. I should only like to stress the following points.

Both in music and poetry the whole creative art is carried out in one and the same sphere; in music in the acoustic-musical sphere, in literature in the sphere of speech and ideas. The composer remains entirely in the ideational sphere of *music—i.e.*, in the

world of acoustic concepts. It is neither through the writing down nor through the performing that the work is created; not even in those cases in which the composition only achieves its ultimate form in the process of copying or playing it. For even in this case the work of modifying and supplementing lies in the acoustic sphere.

We find similar conditions in the realm of *poetry*. The poem originates and becomes shaped in the poet's imagination, and the idea must find its verbal expression before it can be put to paper. The writing itself is just as irrelevant and inadequate as the scoring. It is only when the writing is understood, when the reader obtains a vivid impression of the spiritual content and artistic form, that the essence of the work is really comprehended.

We meet with completely different conditions when we turn to the arts of representation, especially *sculpture*.

The processes which take place in the mind of the artist, even his visions, are by no means the actual work, although they may be the origin of the work and may determine its direction or even its artistic value. Had it been possible to fix Michelangelo's idea, or even his visualised conception, in a visual image when he started his " Moses " this would certainly not have represented his statue of Moses as we find it in San Pietro in Vincoli. In the realm of sculpture the work is created when the idea becomes *realised* and gains a spatial, objective, structural form.

It is not until the idea, the artist's vision, becomes embodied in a spatial design that the work becomes manifest. The formal idea, springing from and emerging out of the spirit of man, has first to gain concrete form by means of man's hand. In this connection realisation is not identical with reproduction of what hovers, vision-like, before the artist's mind; it is rather the process of shaping a more or less labile and unfinished experience of form, which needs the actual process of creation to become crystallised.

We do not wish to deny that occasionally a sculpture may appear to the inner eye of the sculptor in a complete perceptible shape before it is actually executed. Such cases, however, are likely to be exceptions, or to belong to the illusions of artists, who are inclined to believe that they actually see vividly with their inner eye the work they are about to execute. On the whole we are justified in assuming that the creative process, not only with respect to the material but also to the ideal content, actually

takes place during the sculptural activity and not before it. In this process vision is operative not only by means of manifest visual data, such as impressions, ideas, and memories, but also by means of the latent influence that it exercises on tactile experience, which is controlled and developed by the function of sight. An artist who has become blind at a later age, also has at his disposal these visual-haptic experiences, which must be looked upon as an integral unity both from a phenomenological and from an operative point of view. For a considerable time after the onset of blindness his knowledge of the world of objects, and therefore his perceptions and ideas of form, remain determined by these tactile experiences gained before the loss of sight and blended with the content of visual perceptions.

In cases of acquired blindness, the decisive question is not really the extent to which the sculptors have retained their visual memories, and how far their work is based on visual conceptions (which of course may be of some importance), but rather the extent to which they dispose of tactile experiences which, before the onset of blindness, developed in intimate connection with visual experiences and have now become transferred from the extinct visual to the haptic world; and ultimately the extent to which blind artists are able to make use of these tactile experiences in the creative process.

In order to understand the artistic achievements of the blind, one has to start from the fact that the person who has become blind at a later age retains much more and has lost much less than is usually assumed. One need only think of the innumerable movements and functions of the hand, as performed in everyday life in a routine manner without the co-operation of vision and in professional work and at games; all these movements were once initiated and developed under constant visual control. How much and how valuable will be the tactile experience which the blind sculptor will carry over into his obscured world depends on the time of the onset of blindness, and on his vitality, intelligence, dexterity, skill, and the nature of his previous work.

That these tactile experiences may very well enable a person to do valuable work is shown by the figures which a sculptress and my daughter Judith achieved blindfold on the basis of previous sculptural and ceramic experience but without any previous training in blindfold work.

Simple objects and animal figures may be modelled on purely haptic lines with so much feeling for form, and so accurately, that nobody would imagine that they had been executed without the help of vision. These achievements of subjects who can see and are without previous training are the best evidence for the activity of tactile experiences being permeated with visual experiences. It cannot be assumed that such deeply rooted, habitual, and almost mechanised tactile movements become completely lost during blindness, especially since they are constantly renewed and occasionally improved on in everyday life and in the course of work. The works of talented blind sculptors, especially those of Masuelli, show that these tactile experiences may even lead to the production of genuinely artistic forms. The more the tactile experiences, modified by vision, are made use of for expressing artistic aims, the more resistance will the visual element offer to the destructive influence of blindness. Although the visual element no longer receives any stimuli from the external world, it still remains operative and takes part in the artistic production.

We must not forget *measuring* as one of the means at the disposal of blind artists. We have seen how accurately measuring by means of the fingers is instrumental in achieving correct proportions and symmetry. In this connection, however, we have stressed that measuring is of real importance only in the initial stages, chiefly during the geometrical construction of the body, while it exerts hardly any influence on the development of the artistic forms and on the actualising of the artistic idea.

Adequate *training* is a further necessary condition for the creative activity of the blind; it must, however, be understood in a wider sense than usual. For in this connection training does not mean a mechanical, fixative procedure, but rather hard learning undertaken by the intellect, the imagination, and the power of self-criticism. Great mental energy is indeed required to make up to some extent for the limited scope of the sensory impressions.

Lastly, we must not forget to take into consideration the importance of the *hand* as a tool in the process of modelling. *It is not the eye but the hand which models* by means of its formative activity. It is therefore a totally erroneous, and at the same time dangerous theory which denies the hand all form-creating function. In order to emphasise effectively the superior position and dominance

of the Optics of Form, it may of course appear justified to contrast the morphological trend of Optics with the constructive trend of Haptics. In doing so, however, one is obliged to make the necessary qualifications by emphasising the creative, formative energy of the hand. By omitting to do that one remains incapable of understanding either the plastic achievements of the blind or the entire sculptural work of sighted artists.

3. The Expressive Content

With the loss of the visual world, the inner world of the blind gains in importance. The contact with the objective world becomes looser, the blind turn toward their inner life. Whenever the blind feel the urge to give artistic expression to their moods, visions, and ideas, they are faced with three possible approaches, those of poetry, music, and plastic representation. If on the ground of a specific talent the blind choose the plastic approach, they will confine themselves, shut off as they are from the world of coloured forms, to human figures, because the form of the human body is best known to them, and because in the absence of a visible world, they are only able to perceive variations of expression through their own body. This accounts for the fact that they try to represent in human figures all that satisfies their feelings, moods, and urges. This tendency is by no means characteristic of the blind only. From prehistoric times to our own day the representation of human bodies and human states of mind has remained the main theme of representational art. What is characteristic for the plastic work of the blind is that they remain confined to this *one* field, and that they are so strongly tied to their *own* inner life,[1] in so far as they do not aim at naturalistic representation or at copying and re-modelling known models, or, alternatively, model only as a pastime.

The question which faces us in that connection is how a blind person, deprived of the co-operation and control of the visual sense, should nevertheless be able to express plastically the inter-play of inner forces as they express themselves in bodily attitudes.

We need not stress the point that, as regards the emergence and development of our expressive movements, seeing plays a far

[1] This accounts for the fact that artistically gifted blind sculptors are instinctively reluctant to model portraits.

smaller part than is generally assumed. Have we really learnt our expressive movements, imitative or pantomimical, before the looking-glass? Or have we ever felt the urge to check these movements visually? On the contrary, as soon as we observe ourselves in the mirror, we look such a funny childish sight that we have not the slightest desire to see it recorded for eternity. Or does the actor go to the mirror when he wants to represent a certain expression? By doing so he would run the risk of putting on a distorted expression instead of creating an inwardly well-founded one. The same thing happens when one wants to draw a certain expression on paper without being oneself in that particular mood.

That presumably is the origin of the exaggerated grimacing facial expressions found in older works on physiognomy, and also of the plastics of the insane sculptor Messerschmidt, which give the impression of being physiognomic studies.[1] The same applies to the tragi-comic photographs of popular actors in the parts of Othello and Siegfried.

Nor is one justified in attributing to imitation the emergence of expressive movements. We know that the infant does not learn laughing and crying from his mother and that he does not copy his first primary facial expressions from the sight of those around him. These expressive movements have their foundation in the human constitution, and their release does not depend on the influence of adequate stimuli. Once they have become habitual, they may come into being whenever the subject tries to place himself in the psychological situation of another person. Constitutional readiness, intuition, and habit are the most important pre-requisites of differentiated expressive movements, as of all other attitudes, in as far as they do not occur spontaneously as a reaction to certain psycho-physiological conditions.[2]

[1] E. Kris, "Die Charakterköpfe des Franz Xaver Messerschmidt," *Jahrb. d. kunsthist. Sammlungen in Wien, Neue Folge*, VI, 169 ff.

[2] In the absence of these conditions no "imitation" comes into being. It is in vain that we perform movements in front of dogs or cats if those movements, although within their constitutional range, are not adapted to their life habits. The same applies when the dancing master demonstrates certain steps to the clumsy novice and asks him to copy them. The poor fellow will with an effort be able to copy the dance figure piecemeal; he will jump about valiantly, but that is not real dancing. Then suddenly he grasps the whole thing and gets it right. We find the same thing in the most varied physical activities, in riding, swimming, rowing, ski-ing, etc. Even the psychological sphere provides us with analogies. The child who is transferred to foreign surroundings takes on the language of his surroundings without any difficulty, and quickly masters the accent, melody, and rhythm of the foreign language—all this

When an artist, be he sighted or blind, intends to embody an expression of human emotions in a plastic form, he does not in most cases need to study the special physical attitude on a model and copy it, or place himself in the desired attitude. All he need do is imagine himself being emotionally affected in that way—*i.e.*, to experience in himself the physical correlate of that particular emotion. What he thus personally experiences is a psycho-physiological state of tension, out of which the artistic intention seems to draw its material and content. When the artist wishes to represent plastically an attitude or the physical expression of an emotional state, he need not proceed by way of a vivid inner image; his own state of motion and emotion may well serve as the starting point for the creative conception. In that respect it may well be said that in many cases the sculptor forms himself in his figures by working on " autoplastic " lines. By means of his artistic hand he represents himself in the attitude which he would take up if he were actually in the throes of the emotion which he wants to represent. From that point of view every work of art that is conceived as the result of inner passion and emotion is " expressionistic ".

The artist is not tied to that state of mind; he need not fall back on it during the creative act. For once the artist has succeeded in identifying himself with his " part ", he regains his individual freedom. Just as in the dance and in dramatic art, he need no longer remain conscious of his movements and attitudes and control himself constantly—for all takes its spontaneous course in accordance with the unity of the embodied idea. Whenever the artist wants to work by æsthetic principles, it is even necessary for him to emancipate himself from the primary emotional state. It is only when the actor succeeds in identifying himself with Hamlet's personality, and adapting his whole attitude accordingly, that he succeeds in creating a unified and psychologically correct rôle. On the other hand, he will not be able to achieve a unified creation of form unless he shows an ability to emancipate himself during the formative process from the underlying bodily sensations and tensions.

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being due to his great and uninhibited talent for adaptability and intuition. We grown-up people are in that respect far inferior to the child, especially when we want to reproduce the special phonetical character of a language.

4. "Æsthetic" Quality and the Problem of Artistic Creation in Blind Artists

We have come to realise the means by which blind sculptors attain the realisation of their artistic aims. But that does not answer the question how it is possible for the works of blind sculptors to satisfy our æsthetic standards which are based on our visual sense. The sighted are inclined to consider this problem insoluble, or else they do not believe in the facts. They cannot imagine how the hand could achieve something which in their opinion necessarily requires the function of the eye. Such an assumption has proved incorrect in view of the artistic activity of the blind. We have seen from all the facts concerning the sculptural activity of skilful blind modellers that the function of the organ of vision is not a necessary pre-requisite for plastic activity. All the blind sculptors mentioned in this book demonstrate that persons devoid of visual impressions and proper visual images are quite able to create an integrated idea of bodily forms, to bring planes and lines into a formal unity, and to represent in their plastic works the vital spiritual elements of an æsthetic object. Although original artistic intuitions but rarely find expression in these sculptures, and although the personal note becomes lost in the majority of cases, still it cannot be doubted that they express, as regards form and content, the universal human factor in a remarkable manner.

The loss of the sense of vision does not render the practice of plastic art impossible. But for finding æsthetic pleasure in works of art, and for the creation of new forms, sight is essential.

Such knowledge provides us with an approach to the solution of the problem facing us. We have seen with gifted sculptors, especially Masuelli, that they start their modelling activities by establishing the correct proportions and dimensions of the body, and are therein guided by certain general norms which they have studied on themselves and on classical models, and which they have incorporated in their tactile-motor memory. That they are mostly guided by the classical ideal of beauty is easily understood, for it is clear that the exactness of the image, the relatively minor degree of individualisation, the symmetrical structure, and the moderate naturalism which characterise ancient art and the art of Renaissance, as contrasted with the freedom, unrestraint, and

arbitrariness of other styles, are able to provide them with fixed norms. They look upon the æsthetic norm originating in classical art as binding, and they adhere to the proportions and forms that are easy to grasp by means of the tactile sense. The principles of Greek plastic art and of the sculpture of the Renaissance, and of the period of " classicism ", arouse in our æsthetic feelings, based on visual perception, the impression of unity, serenity, formal integration, and harmony. So works in which these formal principles are expressed are bound to arouse æsthetic pleasure, irrespective of whether they have been created by blind or seeing artists.

By emphasising the importance of formal principles based on visual art, we are in a position to overcome the conflict which arises between the ability to create works of art and the inability to appreciate such artistic productions æsthetically. We have learnt that blind sculptors, when handling works of art, refuse to speak of æsthetic pleasure, or even use the term " beautiful " in regard to their own creations. It may, however, be observed that they are by no means indifferent when faced with their own works or the works of other artists; they appreciate one work more than another. What are their judgments based on? Without doubt, on the standards of form which they have derived from their models, created as they are according to strict canons. Everything which conforms to them is looked upon by them as being correct or good; everything which deviates from them, as incorrect or bad. In view of the fact that with some of them, especially with Masuelli, the classical principles of form are valid without restriction and that they do not know of any major antithesis between good and beautiful, and that correctness and beauty are practically identical, the conflict between creating and evaluating resolves itself into nothing.

We are not justified in identifying evaluation and the æsthetic judgment with actual experience. This again raises the question whether the factors which cause the pleasure experienced by the blind are not, after all, derived from the æsthetic sphere. According to our view, as discussed above, on the basis of which we denied the ability of the blind to experience æsthetic pleasure, their verdicts were assumed not to be founded on æsthetic experiences. But as order, structure, symmetry, clarity, and homogeneity are endowed with a certain emotional value, whose sources are not

necessarily entirely different from those arousing æsthetic pleasure, we are faced with the question of whether, after all, something akin to an æsthetic content is not experienced in haptic perception and in the estimation of works of art. If one agrees with Geiger, who considers the important point in the æsthetic effect to be the fact " that the influence involves a deeper stratum, the subject himself, his existence, his substance, his reality ", and who states that during the æsthetic experience " the Ego becomes grasped in its reality, becomes uprooted and shattered ",[1] one is not justified in assuming the existence of an æsthetic experience in the blind. Nor is one justified in such an assumption if one looks upon the spontaneous and integrating intuition as the real foundation of æsthetic experience. When the blind person in the act of handling objects of art turns to his inner being, when he listens to his inner emotions, he will hear no echo. If, on the other hand, he concentrates on the object, he will not be able to experience æsthetic pleasure and to apprehend the artistic content of the work. Neither in the vital psychological nor in the æsthetic sphere does he become conscious of emotion; it is only the fulfilment of known formal criteria and the technical execution which will determine the attitude and the judgment of the blind.

The fact that a blind man lets himself be guided by certain formal principles sanctioned by taste can only prove that his plastic achievements do not show deviations from poise and harmony or any mistakes of proportion; it does not, however, account for formal beauty, grace, vividness, and inner movement.

Opponents of such a view might ask: whence should a blind person acquire the sense for beauty of form, the ability to express attitude and movement, in a word, the very features which cause the sculpture to be looked upon as a work of art? We must not forget, however, that the same question may just as well be asked about sculptors who can see. They, too, will never reach the heights of genuine art so long as all they can achieve is to work, with suitable tools, according to given principles. Under these conditions the sculptor with sight will produce works just as schematic, lifeless, and devoid of any artistic quality as the blind sculptor would do. In order to reach the real level of art which lies beyond and above the realm of technical skill, in order to

[1] M. Geiger, *Zugänge zur Ästhetik*, p. 85.

achieve increasingly wide freedom from the objective spatial forms, *genuine artistic talent* is needed. And that talent is not bound to the *eye*, but to the *spirit*, to the artistic attitude and comprehension, to devotion and creative energy.[1] If, therefore, a blind person is artistically gifted, if he is aware of the limitations imposed on him by his blindness in regard to the possibilities of representation, if he is able to embody in his creations the universally valid artistic norms, the road to artistic production is open to him. And as the basic conditions for plastic representation are fundamentally the same in the case of the blind and the sighted, it will depend on the human and artistic personality of the blind sculptor to what extent he will be able to master the difficulties inherent in his blindness. We cannot tell how far a gifted sculptor may develop; the example of Masuelli shows us that the possibilities of such development are anyway far greater than we had so far suspected.

The approach to artistic production is, however, by no means identical with the attainment of full artistic achievement. It is not so much the lack of ability to represent artistically, but the impossibility of the highest development, that distinguishes the blind from the seeing sculptor.

The blind artist will never be able to reach the same heights as the seeing one; all his energy and talent will not help him to attain the highest spheres; they will remain closed to him. He will never create new forms or open up new approaches or exert any marked influence on artistic trends. For that, seeing, *artistic seeing*, is indispensable; for only vision is capable of raising the sensory impression into the sphere of æsthetic contemplation. Whatever part we may attribute to the mind and the artistic attitude, vision cannot be eliminated from the creative process without giving rise to a considerable loss of æsthetic value; for naturally occurring combinations and variations, which, as natural objects, are neither beautiful nor the contrary, can only stimulate artistic imagination through the sense of vision. Even in the process of plastic creation, the constantly changing form of the work gives rise to new ideas which, in turn, influence visual

[1] In connection with a discussion of the theories of art of H. v. Marées, C. Fiedler, and A. Hildebrand, Benedetto Croce remarks that " the sense of touch is just as insufficient in respect to art as the eye alone; for art is not sensory perception, but spiritual insight and activity." (*Kleine Schriften zur Ästhetik*, II, p. 193, Tübingen, 1929.)

fantasy and thereby help creative activity on in its way. An intuitive mind, creative activity, artistic vision, and the forming hand are the basic pre-requisites of artistic creation in the plastic arts. Of these factors vision may be in abeyance in exceptional cases, provided it is replaced by a system of visually modified tactile experiences and other energies of the mind and the will. But the loss of the creative function of the eye can never be fully made up.

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The facts which we have presented for the first time in this book deserve the full attention of the psychologists and teachers of the blind. Our arguments will enable them to revise their views, both positively and negatively. Positively, by their realising how much farther the scope of the representational function of the haptic sense extends than one had felt justified in assuming from the very clumsy plastic achievements of blind pupils; negatively, by their becoming conversant with the fact that, in the absence of the sense of vision, even a strong artistic talent will rarely (and even then to a very limited extent) endow creative work with artistic character and life.

The theoretician of æsthetics, too, will find cause to revise his views on the relationship between art and æsthetics. For the artistic production of blind sculptors demonstrates very clearly the difference between artistic creation and artistic pleasure; it shows plainly that artistic creation is only partly determined by the æsthetic experience. Predominant is the urge of the artist to realise his intuition by adherence to certain formal principles. The very creations of blind sculptors teach us that in the creative urge formative energy and the principles of formative activity play as big a part as æsthetic intuition and æsthetic judgment.

The art historian, on the other hand, will find confirmation of the fundamental differences between classical and free expressive art in the fact that blind sculptors are guided by the formal principles of classic art whenever they want to endow their creations with an artistic value beyond mere self-expression. This attitude is accounted for by the fact that in classical art reason plays just as important a part as imagination, and is therefore in a position to replace to a certain extent deficiencies of intuitive energy.

If we have thus succeeded in bridging the gap between the art of the blind and the art of those who can see, the artistic creativeness of the blind can be derived from the same psychological and æsthetic foundations as the art of normal individuals. Thus the inner unity of artistic creation is preserved.

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