77. *Part Similarity*

The dimensions [p]of the sensation qualities of a sense modality, namely quality solid, [76] (e.g., color solid, tone scale), intensity scale, and sensory field (e.g., visual field, tactile field) are not recognizable on the basis of the relation of part identity[p] (i.e., they are not constructable from the [c]part identity[c]). These orders rest upon [p]proximity relations[p], and the latter are not derived from [p]part identity[p]: [p]two color sensations of almost identical hues have, relative to part identity, the same relation to one another as two entirely different color sensations, nay, even as a color sensation and a tone sensation[p]. Thus, even if we had already introduced [p]part identity[p] as a basic relation, we would still have either to introduce [p]the approximate agreement of two elementary experiences relative to some characteristic of two constituents[p], itself as a basic relation, or else we would have to introduce another basic relation, from which this relation is derivable. We call this relation "part similarity", and, for the purposes of its logistic manipulation, we assign to its extension the symbol Ps. [p]Two elementary experiences *x* and *y* are called "part similar" if and only if an experience constituent (e.g., a sensation) *a* of

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75 das Gebiet der Gefühle
76 Qualitätskörper

x and an experience constituent *b* of *y* agree, either approximately or completely, in their characteristics (quality in the narrower sense, intensity, local sign)ᵖ.

By the expression "ᵖsimilarityᵖ", in contrast to "ᵖpart similarityᵖ", we here mean the corresponding relation between ᵖqualities of sensationsᵖ (even though this word has generally a wider meaning). To this relation, we assign the logistic extension symbol Sim. We say, for example, that ᵖtwo color sensations *a* and *b* are similarᵖ (*a* Sim *b*), ᵖif they agree approximately or completely in hue, saturation, brightness, (or hue, white content, black content) and location sign (i.e., place in the visual field); two elementary experiences *x* and *y* in which similar color sensations *a* and *b* occur are, then, part similarp (x Ps y). (For the relation between ᵖqualities of sensationsᵖ which corresponds to ᵖpart identityᵖ, we do not need a new term nor a special sign, since this relation is identity itself). We want to take the relation extension Sim and thus also Ps as reflexive so that "every elementary experience is said to be part similar both to itself and to those elementary experiences with which it is part identical, and every sensation quality is similar to itself.

78. *Recollection of Similarity as Basic Relation* [77]

We could use ᶜpart similarityᶜ as basic relation, but, instead, we shall rather take one of its constituent relations [78] from which it is easily derivable. This constituent relation is also epistemically more fundamental. ᵖIf it is recognized that two elementary experiences *x* and *y* are part similar, then a memory image of the earlier of the two, of say, *x*, must have been compared with ᵖ. This ᵖprocess of recollectionᵖ is not symmetrical; the occurrence of *x* is different from that of *y*. Thus, the ᵖresult of this cognitionᵖ is more precisely represented through an asymmetrical relation than through the symmetrical relation extension of ᶜpart similarityᶜ. We shall introduce this asymmetrical relation as basic relation; we call it ᶜrecollection of similarityᶜ and assign it the symbol Rs. "*x* Rs *y*" or "ᶜrecollection of similarity holds between *x* and *y*ᶜ" means: "ᵖ*x* and *y* are elementary experiences which are recognized as part similar through the comparison of a memory image of *x* with *y*ᵖ". We can express this more briefly as "ᵖthe elementary experiences *x* and *y* are connected through recollection of similarityᵖ". (By "ᵖrecollectionᵖ" we do not here mean only the ᵖreproduction of an already faded experienceᵖ, but also the

77 Grundbeziehung
78 Teilrelation

[p]retention of a just preceding experience, for example, a perception, which has not yet vanished but still has vivid after effects[p].)

From the indicated meanings of [p]part similarity and recollection of similarity[p], the following [p]derivation of part similarity from recollectionof similarity[p] results: [c]two elementary experiences *x* and *y* are called part similar (Ps) if the relation of recollection of similarity (Rs) holds either between *x* and *y* or between *y* and *x*[c]. ("Derivation" means construction without strict form. The construction of [c]part similarity[c] within the constructional system, which corresponds to this derivation, is carried out in § 110.)

Thus, while Ps can be derived from Rs, the opposite is not possible. If the difference in direction is once blotted out through a symmetrical relation, then it cannot be reintroduced by constructional methods. The difference in direction is important for the construction of time order; we shall later on derive time order from Rs without having to introduce a new basic relation. This is the main reason why we chose Rs and not Ps as basic relation.

79. *The Possibility of Further Derivations*

(In the following, we shall use the p- and c-symbols for psychological and constructional language only in special cases.)

In order to determine whether we have to introduce any basic relations other than recollection of similarity, we have to investigate the possibilities of further derivations from Rs and Ps. As we have mentioned earlier, it is not possible to derive part similarity (Ps) from part identity (Pi). However, the opposite derivation of Pi from Ps is possible, so that Pi does not have to be introduced as a basic relation.

For the derivation of Pi from Ps, the following simple method seems to present itself. We shall see that it is not successful. Two sensation qualities, *a*, *b*, are identical if and only if *a* is similar (Sim) to the same sensation qualities as is *b*. Sim and identity are relations which bold between sensation qualities; between elementary experiences, we have the corresponding relations 'Ps and Pi, respectively. Thus, one could think (that part identity Pi should be defined in such a way that it holds between two elementary experiences *x* and *y* if and only if *x* stands in the relation Ps to the same elementary experiences as *y*. However, this definition would be inappropriate. For, it should after all hold, for example, that *x* Pi *y*, if in the elementary experiences *x* and *y* the same hue is found at the same place of the visual field. However, in this case, the indicated

definition will fail most of the time. If, for example, *x* has another hue *a* at a different place of the visual field and *y* does not have a hue which is similar to *a*, then *x* is part similar to all elementary experiences in which a similar hue is in the place of *a*; but this does not hold for *y*. Thus, our tentatively formulated definition is here not fulfilled.

This attempted derivation shows the following: given a relation between elementary experiences which depends (as Pi and Ps) upon certain constituents of elementary experiences; if we want to ascertain whether such a relation holds, we shall have to consider upon which constituent it depends that the relation holds in a particular case. It is very easy to make mistakes in the various constructions of the lower levels if no proper attention is paid to this point. In this connection, it must also be noted that Pi is not transitive, as is usually the case with relations of identity or agreement (§ 11). The agreement of two elementary experiences in a definite constituent is indeed transitive, but not Pi as agreement in any constituent (cf. the nontransitivity of color kinship in the example of § 70).

The desired derivation of Pi from Ps cannot be carried out immediately. Rather, with the aid of the procedure of quasi analysis, we must derive from Ps first the "similarity circles" and then the "quality classes". From these we can then easily obtain Pi.

80. *Similarity Circles*

Let us apply to Ps the procedure of quasi analysis of the second type, which we discussed earlier (§ 72), i.e., quasi analysis on the basis of a part similarity relation (extension). We thereby determine the similarity circles based on Ps; from now on, let us call these simply *similarity circles* without any qualifying phrase, since similarity circles based on other relations will occur only rarely. Thus, by "ᶜsimilarity circlesᶜ", we understand those classes of elementary experiences which have the following two properties: any two elementary experiences of such a class are part similar to one another (Ps); if an elementary experience is part similar to all elementary experiences of such a class, then it belongs itself to that class. (The construction of similarity circles within the construction system is carried out according to this definition in §111.) The second step of quasi analysis based on Ps will determine quasi constituents which we shall call quality classes (§81).

In order to understand the significance of the derived ᶜsimilarity circles and quality classesᶜ relative to the ᵖconstituents of experiencesᵖ let us introduce a spatial symbolization of elementary experiences and their

constituents, which we shall initially take to be sense impressions. Let us represent the sensation qualities through points; proximity of two points in space is to represent the relation of similarity (Sim) between the qualities in question. Thus, we obtain a connected spatial array as a spatial representation for each sense modality. The tone sensations, since in them we differentiate pitch and loudness, form a two-dimensional array. Visual sensations do not form a three-dimensional array; this would merely correspond to the customary color solid, where the three dimensions, hue, saturation, and brightness, or hue, white content, and black content, are represented; rather, they form a five-dimensional array, since the location signs—which themselves form a two-dimensional manifold—also count as characteristics. Since a five-dimensional order is unintuitive, let us imagine a two-dimensional order, which depends upon the relations of the location signs (i.e., upon the order of the visual field); and let us furthermore imagine a set of three-dimensional color solids, one of which corresponds to each place of that two-dimensional order. Every point of the above-mentioned order represents a sensation quality (in the widest sense, cf. §§ 76, 85); we correlate to it those elementary experiences in which the sensation quality in question occurs. Since, in an elementary experience, several qualities occur at the same time, every elementary experience is correlated to various quality points, within different sense modalities as well as within the same sense modality. Let us now consider a sense modality whose spatial representation is to have the dimension number *n*. Within this sense modality, we find *n*-dimensional spheres, whose diameters correspond to the largest distance that allows two sensation qualities to be still similar (Sim) at that place of the sense modality. Through comparison with the example of § 72, whose "color spheres" correspond to these *n*-dimensional quality spheres, we recognize easily that a similarity circle is the class of those elementary experiences which are assigned to the points of such an n-dimensional quality sphere. These similarity circles do not exclude one another, but frequently show a partial overlap. Here, we have to distinguish two different types of overlap, which we could perhaps describe as "essential" and "accidental". If two similarity circles correspond to two partially overlapping quality spheres, which then of course belong to the same sense modality, then the similarity circles show a corresponding overlap; this we call essential overlap. On the other hand, if two similarity circles correspond to mutually exclusive quality spheres, then they can nevertheless have elementary experiences in common, since each elementary experience corresponds to various quality points.

This "accidental" overlap can even occur between similarity circles of different sense modalities.

81. *The Quality Classes*

We can also envisage the just-mentioned overlapping of similarity circles as mutual dissections. Since the quality points are the largest parts which remain undivided in the mutual overlapping of quality spheres, the classes of elementary experiences which correspond to these points are the largest subclasses of the similarity circles, which remain always undivided through essential overlappings. Now each such class of elementary experiences which correspond to one point can be isolated through such dissections of overlapping.[79] For, for any two different quality points, one can always find a third one such that it is similar (Sim) to one but not to the other (i.e., one can thus always find a similarity circle which includes the elementary experiences of the one, but not of the other).

In addition, we have to consider the dissection through accidental overlapping of similarity circles. To gauge their effect, let us consider a concrete example.

> EXAMPLE. Let the classes *a*, *b*, be two similarity circles of the visual sense. Let us restrict ourselves only to two individual places of the visual field in order that we should not have to cope with a five-dimensional array, but only with three-dimensional arrays. The three-dimensional color solids which correspond to each of these visual field places we envisage, for simplicity's sake, not as continuous, but as discrete (i.e., as being composed of a finite number of discrete points). Let us refer to the color solids which correspond to the two visual field places as the first and the second color solid. Let the similarity circle *a* include all those elementary experiences which correspond to five definite points of the first color solid; these five points are then in proximity to one another in the color solid; assume that they lie within the range of the blue hues. In like fashion, let *b* be a similarity circle of five red hues of the second color solid. If, in an elementary experience, one of those blue hues is found in the first visual field place, then it will not ordinarily be the case that one of those red hues will be found at the second visual field place. Nevertheless, this can happen in certain cases, which, however, will form only a small fraction of all those cases in which the blue or else the red hues occur at their visual field place. This means that there may be some elementary experiences which belong to the similarity circle *a* as well as

79 Überdeckungszerscheidungen

> b; let us assume that they are the elementary experiences *x*, *y*, *z*. We are here concerned with an accidental overlap between *a* and *b*; it cannot be an essential overlap in this case, since a and b belong to different color solids and furthermore to different color ranges within the color solids. *x* corresponds to one of the five quality points of *a*; let us call the class of elementary experiences which correspond to this point *q*. Let *y* correspond to the same and *z* to a different point of *a*; thus *x* and *y* are elements of *q* but *z* is not. The class *q* represents a sensation quality of the visual sense namely, a certain blue hue at a certain visual field place, for this sensation quality is a common property of the elements of *q*. Classes of this kind we call quality classes.

We have seen previously that quality classes (i.e., the classes of elementary experiences which are assigned to a given quality point) are not divided by an essential overlapping of similarity circles. We have now shown that they may be divided through an accidental overlapping. However, in this case, the part which is split off is generally (i.e., a not inconsiderable fraction of the similarity circle or of one of its parts).

Since quality classes can be determined with the aid of essential overlappping of similarity circles and since these overlappings can be distinguished from accidental overlappings by the indicated characteristic, we now can provide a definition of quality classes. It contains two conditions the first corresponds to the fact that quality classes are not divided by essential overlappings of similarity circles (i.e., overlappings which cut off more than only very small parts); the second condition is that quality classes should be the largest possible classes with the indicated property. (If the definition did not contain the second condition then every subclass of a quality class would fulfill the definition.) The definition reads: a class *c* of elementary experience is called a ᶜ*quality class*ᶜ if *c* is totally contained in any similarity circle which contains a considerable part of *c* and if for every elementary experience *x* which does not

belong to *c* there exists (at least) one similarity circle which contains *c* but to which *x* does not belong. (Construction of quality classes in the constructional system, § 112.)

We have previously seen that the ᶜquality classesᶜ are constructional representations of ᵖsensation qualitiesᵖ (in the widest sense, including the emotion qualities, etc.). Thus, we shall sometimes call them, in brief, "qualities".

In constructing similarity circles and quality classes, we must pay especial attention to the fact that the construction does not have to reflect the actual process of cognition, but that it is only a rational reconstruction which must lead to the same result.

> We have mentioned here and earlier (§ 72) that the application of the method of quasi analysis leads to the desired result only if special "unfavorable conditions" do not obtain. These unfavorable conditions could consist, for example, in the fact that certain ᵖqualitiesᵖ always or frequently occur together with certain others. This would lead to irregularities in the derivation of "quality classes" and later on in the division into "sensory classes" and in the "Sim-order" within the sensory classes. However, a more detailed investigation, which we have to omit for lack of space, shows that these interferences in the concept formation through quasi analysis can occur only if circumstances are present under which the real process of cognition, namely, the intuitive quasi analysis which is carried out in real life, would also not lead to normal results.

82. *Does One Basic Relation Suffice?*

We have seen earlier that the assignment of two elementary experiences to the same quality point—in other words, their membership in the same quality class—means that they have an identical constituent (i.e., that they are part identical [§ 76]). Thus, we can easily derive part identity (Pi) from quality classes: two elementary experiences are called part identical (Pi) if there is a quality class to which both of them belong. (For the construction of Pi, see § 113.) If we had introduced Pi as a basic relation, then we would derive the quality classes through quasi analysis from Pi. Here we actually proceeded in the opposite direction. Since we have just derived the quality classes from the similarity circles, which in turn were derived from part similarity (Ps), the desired derivation of Pi from Ps has been accomplished. Thus, the relation Pi, which is important for further derivations, does not have to be introduced as a basic relation.

So far, we have derived two relations between elementary experiences, namely. Pi and Ps, from the basic relation Rs. Furthermore, two kinds of classes of elementary experiences, namely, the similarity circles and the quality classes, have been derived. The latter are especially important since they represent the first constituents of elementary experiences, namely, the qualities of sensory perceptions and emotions (and perhaps even of other lands, if there are such; cf. §85). Now we must derive a further division of these qualities into the various domains, for example, of sensation qualities and sense modalities. Furthermore, for the individual sense modalities we have to derive a separation of the qualitative order (in the narrow sense) from the order of the sensory field, upon which the spatial order rests. Then we shall have to derive this spatial order itself and a temporal order. With the aid of the qualitative, the spatial, and the temporal order, the world of physical objects is then to be constructed, and finally the further object domains, especially the heteropsychological and the cultural.

The derivations themselves are discussed in the following, the third chapter of this part, and are then given in Part IV in the outline of our constructional system. As far as the problem of basic relations is concerned, we must here anticipate a result of later discussions, namely, that, *even for the further derivations, no new basic relation seems to be required*. Our primary objective is the treatment of the logical, not the content problems of the constructional system; thus, the exposition of the constructional system which is given in the sequel is only an outline, whose main purpose is to show the practical applications of the various formal principles and of the entire constructional method in an example. It is for this reason that we cannot make a definite assertion, but only a conjecture, to the effect that *recollection of similarity* (Rs) *suffices as basic relation for a constructional system with autopsychological basis*. In any event, the investigations show that a very small number of basic relations suffices and that we require as basic relations only relation extensions of elementary experiences and no relation extensions on higher levels. (Cf. the theses in §156.)

83. *The Basic Relations as Categories* (May be omitted)

By categories are meant the forms of synthesis of the manifold of intuition [80] to the unity of the object. Now neither this explanation (which is not a definition) nor the various traditional tables of categories make it

80 Anschauung

sufficiently clear what is meant by "categories". Since the concepts in our constructional system are clearer than those of the traditional systems, we ask what is there in the constructional system as a system of the synthesis of objects which corresponds to the categories? In construction theory, the manifold of intuition is called "the given", "the basic elements". The synthesis of this manifold to the unity of an object is here called the construction of this object from the given. Thus, the forms of this synthesis would be the constructional forms, of which we have distinguished several (§26). One could perhaps mean by "category" our ascension forms. Then we could say that, in our constructional system, we have only two categories, namely, class and relation. But perhaps we are in better agreement with established usage (which is not very clear) if we call the basic relations categories. The following fact would seem to support this: in a certain sense, every statement about any object is, *materialiter*, a statement about the basic elements. But, *formaliter*, it is a statement about the basic relations. Also, the agreement is easy to see when we consider a constructional system where the analysis has not been carried as far as in the present attempt and where, therefore, a larger number of basic relations is introduced.

> In an earlier draft of the constructional system, the following five relations were proved to be sufficient basic relations (if we can speak of a proof in the sketchy exposition of that system): (central) part identity (somewhat narrower than Pi in the present system, § 76), (central) part similarity (somewhat narrower than Ps in the present system, cf. § 77), the serial relation of intensity scales (here constructed only after the visual things, §131), the recollection relation (somewhat more general than the basic relation Rs in the present system, § 78), proximity in the sensory field (more general than Proxpl for visual field places in the present system, §89). It must be noted that the recollection relation leads immediately to the construction of a (preliminary) time order (in a similar way, Er leads to Er_{po}, § 87), and proximity in the sensory field leads to the construction of a spatial order, namely, at first to the order within the sensory field which must already be called "spatial", later on to the proper spatial order of the physical world (like Proxpl in the present system, § 89).

One can see a certain similarity between the indicated five basic relations of the earlier draft and the categories which occur in some category systems, namely, identity, similarity, intensity, time, and space. Thus, we can envisage the problem of the basic relations in construction theory as the problem of categories.

We have advanced the conjecture (§ 82) that Rs suffices as a basic relation. It is, namely, the case that the five basic relations of the earlier draft can be, in part, derived from one another. Indeed, it appears that they can all be derived from a single one. As a statement about categories, this would have to be expressed in the following way: the five above-mentioned categorial forms are not the actual (fundamental) categories, but they are in part reducible to one another; *the number of (genuine) categories is very small; perhaps there is only a single category*.

CHAPTER
D

THE OBJECT FORMS

84. *Derivations as Preparation for Construction*

Of the four main problems of construction theory (§ 26), only the last one, namely, that of the object forms, remains to be treated. This problem, more than any of the others, is predominantly concerned with the material content of the constructional system. Since we are here mainly concerned with the clarification of the logico-methodological aspect of construction theory, we will not be able to find a ready solution for it at this time. To begin with, we shall investigate, for the most important objects of the lower constructional levels, how they are determined by the basic relation and the already derived objects and thus how they can be constructed from these. The constructions themselves of these and other objects will then be given in the next section, in the outline of the constructional system. Thus the derivations which we are about to give here are in preparation for the constructions themselves. These derivations concentrate mostly upon the material aspect of the problem, while the later constructions will have to show how these material relationships are to be fitted into the logical forms which are to be used in the formulation of the constructional system. Since we are concerned merely with an outline, this process of fitting the material into the logical

forms amounts to no more than an application, by way of example, of the methodological forms to those material relationships of the objects themselves. It is the methodological forms with which we are mostly concerned; we assert their validity and utility. On the other hand, the content which we use for our examples is not asserted to be conclusively established. Should the empirical sciences (for the lower constructional levels, this means especially the phenomenology of perception and psychology) come to the conclusion that the relations of objects are different from what we are here supposing, then these different relations must be expressed according to the same methodological principles in appropriate constructional forms. This means that we are here formulating basic relation(s) and object forms only with reservations. On the other hand, the formulation of the basic elements and especially of the system form and the ascension forms belongs to the thesis of our construction theory (cf. the theses in § 156).

Thus the following investigations serve, on the one hand, as a preparation for the following part, for the outline of the constructional system. On the other hand, they should contribute to the support of the conjecture advanced in the preceding section, namely, that a single basic relation suffices for the construction of all objects.

85. *The Sense Classes*

After the quality classes have been derived (§81), a relation of similarity (Sim) between them can be defined in a simple way. Two qualities are similar if, and only if, every elementary experience in which the first occurs is part similar to every elementary experience in which the second occurs. Thus, we define: two quality classes *a* and *b* are called *similar* (*a* Sim *b*) if every element of *a* is part similar (Ps) to every element of *b* (construction of Sim in the constructional system: § 114).

With the aid of the relation Sim, we can now proceed with a division into sense modalities. This division must be based upon qualities and not on elementary experiences, since any of the latter may belong to several sense modalities at the same time. Two qualities belong to the same sense modality, if and only if, there is a sequence of qualities between the two such that each quality in the sequence is similar to the next quality in the sequence. (For example, between any two tones, we can form such a chain of Sim pairs, but not between a tone and a fragrance.)

If we call a class which is formed by the qualities of one and the same

sense modality a *sense* class, then the sense classes are formed through quasi analysis on the basis of the relation of connectibility through such Sim-chains (construction of sense classes: § 115).

We shall find as ᶜsense classesᶜ not only the classes of visual qualities, auditory qualities, thermal qualities, etc., but also the emotions; this is due to the meaning of the basic relation Rs and to the reasons advanced in §76. If psychology were ever to demonstrate the existence of psychological entities other than sensations and emotions, entities which could not be reduced to either sensations or emotions, such as, for example, thoughts, volitions, or whatever, then the basic relation would also refer to the similarities between these entities; their ᵖqualitiesᵖ would be constructed as ᶜquality classesᶜ, and their domain or domains would be constructed as sense classes. Thus, no kind of psychological process lies outside the framework of constructable entities.

86. *The Characterization of the Visual Sense*

After the division of the qualities into sense classes has been derived, we can investigate the order of the qualities within each of these sense classes. Indeed, we can envisage Sim as the proximity relation which determines this order. If a proximity relation exists for a given domain, then the *dimension number* (Dn) of the domain is thereby determined (at the moment, we shall not concern ourselves with the definition). Thus every sense class has a certain Dn relative to Sim. We have mentioned above that the sense class of tone sensations has Dn 2, that of the visual sense, of color sensations, Dn5 (§ 80). For the senses of the skin, the location signs are orderable in two dimensions. Since their qualities are furthermore differentiable through intensity and perhaps also through a quality series, the Dn of each of them (tactile sense, sense of warmth, sense of cold, sense of pain) is 3 or 4. The Dn of the other senses, including the domain of the emotions, is for some of them 2, for others 3.

The most important factor in this connection is that the quality order of the visual sense has a Dn which is different from that of all other senses. Thus it is possible to characterize, construct, give a definite description of, this sense, which is more important for the construction of physical objects than any of the others. The constructional definition reads simply: that sense class, for which the order of qualities relative to Sim has the Dn5, is called the visual sense (construction: § 115).

It may seem paradoxical at first sight that we here give a "definition"

of the visual sense, indeed, a definition on the basis of such an inessential property as the Dn, which does not have the slightest connection with the special phenomenal peculiarity of the visual sense and its difference from all other sensations. Such an objection, whether it is stated or whether it is merely a subconscious sentiment, rests upon a confusion of the aim of a constructional definition with that of a conceptual definition in the ordinary sense. We have mentioned earlier (§§50,51) that we require of a constructional definition a regard only for logical, not for epistemic, value. For, a translation which is carried out with the aid of a constructional definition as translation rule has to guarantee nothing but the invariance of the truth value of the statements, and not also the invariance of the sense. If we assume that the psychological statement which we have used for our definition, namely, that the Dn of the similarity order for the visual sense, but for no other sense, is 5, then it is quite obvious in the present case that every statement about the visual sense remains true or false if, for the words "visual sense", we substitute "the sense whose similarity order has the Dn 5".

87. *The Temporal Order*

In our perception of physical things, we recognize not only properties in their qualitative and intensive differences, but also spatial and temporal relations. Let us first concern ourselves with the temporal relations. It is easy to see that the temporal determinations of the physical world go back to the recognition of the temporal relation between elementary experiences. The question now arises whether the temporal relation between elementary experiences must be introduced as a basic relation. It turns out, however, that it can be derived from recollection of similarity (Rs). After all, Rs includes a temporal relation: from *x* Rs *y*, one can conclude that *x* is temporally earlier than *y*. However, we cannot in this way decide for every pair of elementary experiences which of them is temporally earlier; we can make this decision only for part similar elementary experiences. But, because of the transitivity of the time relation, we can infer from such pairs the temporal order of many other pairs. For the construction of the temporal sequence, the recognition of the temporal relation of temporally near elementary experiences is especially important, and such temporally near elementary experiences are in many, perhaps in most, cases, part similar. For, if any sensation quality remains constant or varies continuously during a certain time interval, all temporally near elementary experiences in this time span are part similar to one another.

From the basic relation Rs, we cannot construct an uninterrupted temporal sequence. Nevertheless, we can construct a preliminary temporal order (about its construction, cf. § 120), which we shall have to supplement with the aid of the regularity of physical processes which cannot be done until after the construction of physical objects. Not only here, but also in the actual process of cognition, the time ordering of experiences which is based upon "time perception" is incomplete and becomes a completely ordered sequence only through inferences on the basis of known psychological and especially physical regularities.

88. *Derivation of Visual Field Places*

We have seen that the visual sense can be differentiated from the other senses without any new basic concept, solely through the dimension number 5 of the similarity order of its qualities. Although we have constructionally introduced this five-dimensional order, we did not thereby introduce the three-dimensional order of the color solid, nor the two-dimensional order of the visual field. The derivations which we have made so far do not enable us to differentiate the various dimensions. If, for example, two qualities, *a*, *b*, of the visual sense are similar (Sim) to one another in *color type* (i.e., in hue, saturation, and brightness) and if they also belong to two proximate visual field places, briefly, *places*, and if two other qualities *c*, *d*, are similar to one another by belonging to the same place and by agreeing approximately in color type, then both pairs are called, without distinction, "Sim-pairs", and cannot be distinguished on the basis of their behavior relative to Sim. We call two qualities (without reference to their color types) *place identical* if they agree in their location sign (i.e., if they belong to the same place); correspondingly, we call two qualities *color identical* (without reference to their place) if they agree in color type. Our task is now to derive one of these two relations, either place identity or color identity, from relations that have already been derived. The other one will easily result in either case from the first.

The *derivation of place identity* (Plid) is indeed possible. It rests mainly upon the circumstance that (different) place-identical qualities cannot appear simultaneously in the same elementary experience. This fact can be expressed through the already available derivations. For, in the language of construction theory, it corresponds to the fact that certain pairs of quality classes have no elementary experience as a common element, hence, that they are mutually exclusive quality classes (relation Excl). But Excl is only a necessary, not a sufficient, condition for

Plid. There may be pairs of visual qualities which belong to different places and which never happen to occur together in one experience. Thus we cannot simply define Plid through Excl. On the other hand, we can be sure that all Plid-pairs are found among the Excl-pairs. Thus, the task consists in sorting those unknown pairs out of the known pairs, but this is not immediately possible. However, the following method accomplishes our aim. If Plid had already been derived, we could define the (visual field) places as abstraction classes (§73) of Plid (i.e., as the largest possible classes of place identical qualities). If we form instead (through quasi analysis according to §71) the similarity circles of Excl,[81] then the desired place classes are either identical with them or subclasses of them.

> It might seem as though this would not help us at all, as though we had only exchanged the earlier difficulty of sorting out the correct Plid-pairs from the Excl pairs for the new difficulty of sorting out the desired place-classes from the similarity circles [81] of Excl. In reality, however, the conditions are here quite different. In the earlier case, we had no reason to suppose that the Excl-pairs were, for the most part, also Plid-pairs. On the other hand, the probability that those similarity circles [81] are very much more comprehensive than the place classes which are contained in them is considerably smaller for the following reason: in order to make an erroneous assignment through quasi analysis of an element to a place class, it does not suffice that this element should have the relation Excl to one or more elements of the place, but it would have to have this relation to all elements of the place; this follows from the definition of similarity circles.[81] Looked at from another point of view: there are two necessary conditions for an erroneous assignment of an element to a given place class, namely, first, that the visual field place in question should be unoccupied in at least one elementary experience and, secondly, that the element to be assigned, which actually belongs to a different place, should occur only in such experiences as leave that other place unoccupied. For, in all other cases, the relation Excl would not obtain.

Through a more detailed investigation, one can show the following: if unoccupied places do not occur too frequently, then the number of Excl-pairs may still be considerably larger than the number of Plid-pairs; nevertheless, the probability that the similarity circles [81] of Excl surpass the place classes considerably is relatively very small. Incidentally, one

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81 The first German edition reads "*Abstraktionsklassen*" at the indicated places. The change is due to Prof. Carnap; it follows Prof. Goodman's observation that, since excl. (*Fre*) is a nontransitive relation, there can be no abstraction class of Excl.

can see at once whether a similarity circle [81] is a proper place class by noticing that none of its elements belongs to another similarity circle.[81] Elements whose membership is doubtful betray themselves through repeated occurrence; one ought to make them the subject of a special investigation after the preliminary place classes have been constructed and have been brought into a proximity order. We cannot concern ourselves here with the relatively difficult procedure of this investigation (the determination of the similarity relations between certain quality classes of proximate places), but, through it, we could construct the definitive place classes. For our purposes, it is satisfactory to have shown the possibility of dividing the visual qualities into place classes through a simple procedure, even though this division holds only approximately (i.e., with the possible exception of individual visual qualities which cannot be assigned a place with this simple procedure [construction of place classes, § 117]).

89. *The Spatial Order of the Visual Field*

From the just-derived place classes, Plid is derivable, namely, as membership in the same place class (construction: § 117). The introduction of place classes, which represent the visual field places, does not in itself lead to the spatial ordering of the visual field; this results only from the relations between the places, which, however, can now easily be derived.

Two places are called proximate places (Proxpl), if a quality of one of them is similar to a quality of the other (construction § 117). (We do not say "all qualities" since it is not impossible that at a given place qualities of certain color types do not occur.) Proxpl is the fundamental relation for the spatial order of the visual field. Thus, for example, the statement that the visual field is two dimensional is a statement about a certain formal property of Proxpl. (Thus, it does not mean that the visual field is like a surface in the phenomenal sense.)

> REFERENCES. The literature does not seem to contain any attempts at the construction of the initial spatial order, that is, of the two-dimensional order of the visual field. The two systems which otherwise give the most detailed description of the individual constructions, namely, Ziehen [Erkth.] and Driesch [Ordnungsl.] skip over this construction even though it already requires a very considerable number of steps (even if

81 See proceeding note.

one does not take only one basic relation, but a special basic relation for spatial ordering; they also omit the construction of three-dimensional space from the two-dimensional visual field order, which has repeatedly been discussed by others (cf. the references in § 124).

90. *The Ordering of Colors*

For the ordering of colors, which we frequently represent graphically in the form of the color solid, we do not need any further basic relation. The color order can be derived from the place classes and the proximity relation (Proxpl). For any two different colors, *f*, *g*, there is at least one color which is similar to *f*, but not to *g*. From this it follows: if *s*, *t*, *u*, are three neighboring places and if the quality *a* belongs to *s*, and the quality *b* to *t*, and if *a* and *b* have a different color type (this word comprises the dimensions of hue, saturation, and brightness), then it is not the case that both of them are similar to the same qualities of *u*. On the other hand, if *a* and *b* are both similar to the same qualities of *u*, then *a* and *b* must have the same color type, and vice versa: if they have the same color type, then the similar qualities in *u* must also be of that color type. Thus, this behavior of *a* and *b* can be used for a definition of "color identity in proximate places". From this we can derive the relation of color identity for arbitrary places (Colid): it holds between qualities *a* and *b* if, between *a* and *b*, there exists a chain of qualities such that each has to the next the relation of "color identity in proximate places" (construction: § 118).

The colors (in the sense of color types) result now simply as abstraction classes of Colid (construction: § 118).

In analogy to the relation of proximate places, we define here as proximate colors (Proxcol) two colors *f* and *g* if they are of such a kind that a quality of *f* is similar to a quality of *g*. (Generally speaking to each quality of *f*, there will be at least one similar quality in *g*, and vice versa, namely, a quality that occurs in the same or in a proximate place; however, for reasons similar to those given in connection with Proxpl we do not want to found our definition upon this fact.) The ordering of colors which depends upon Proxcol, we call color solid. The three-dimensionality of the color solid can be expressed analogously to the two-dimensionality of the visual field as a formal property of Proxcol (construction: § 118).

91. *Objections to the Given Derivation of the Visual Field Order and the Color Order*

Through the indicated derivations, we have divided the five-dimensional similarity order (i.e., the order based on similarity [Sim]) of the visual qualities into the two-dimensional order of the (visual field) places and the three-dimensional order of the colors. This division was possible because of the fact that the two relations of place identity and color identity are formally different from one another in that various color-identical qualities can occur in the same elementary experience, but not different place-identical qualities. One could object to this that the difference between the relation of two different colors in the same place and the relation of two identical colors in different places is not a merely formal difference, but a difference in quality or essence. It could be argued that, if only one basic relation is introduced, one cannot do justice to this essential difference, and that it is thus necessary to use several basic relations, among which there would have to be represented a qualitative and a location relation. It is indeed the case that the question as to the number of necessary basic relations has not yet been conclusively resolved. But, even if we were to introduce further basic relations, the difference between place identity and color identity does not belong to the given, but would have to be derived, for it is not a difference between pairs of elementary experiences themselves, but between pairs of qualities; the qualities would still have to be derived (namely through quasi analysis), and the same would hold a fortiori for that difference. Admittedly, the difference would, in this case, go back to different relations between elementary experiences which would be immediately given as different. Suppose that the difference between the two orders, which we have established through formal properties of the respective relations, is instead traced back to a qualitative difference between color and location sign (for the "places" must depend upon "location signs" of some sort). It must then be pointed out that, even in this case, these two quality determinations, with whose intuitively comprehensible difference we are here concerned, have the same status. But their role, for the construction of knowledge,[82] is nevertheless altogether different. One of the two determinations, the location sign, serves as the foundation of the "principle of individuation". It determines a preliminary ordering of places, upon which the spatial ordering ultimately rests. That this func-

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82 Erkenntnisaufbau

tion can be fulfilled by only one of the determinations is due precisely to that formal property of place identity through which we have separated it from color identity, namely, that nonidentical, place-identical qualities cannot occur in the same experience. Thus the separation of the two orders which we have carried out rests upon a formal, but not at all inessential, difference, namely, upon the difference in those properties on which the roles of the two determinations for the recognition of reality are based, namely, the role of that which orders (location sign) and of that which is being ordered (colors). We shall later on examine further considerations which are connected with this difference and with its role as a principle of individuation (§ 158).

92. *Other Possibilities for a Derivation of the Visual Field*

The indicated method for the derivation of the order of the visual field places is not the only one which is possible. It could be argued that only one kind of construction could be the correct one, since only one of them can properly reflect (more precisely: rationally reconstruct) the process of cognition as it takes place in the normal individual under normal circumstances. The reason for the multiplicity of possibilities lies in the fact that the real process of cognition, which we shall call intuitive in contrast to the rational reconstruction, is overdetermined.[83] Hence, the possibility and necessity of a plurality of determinations each of which would be sufficient by itself.

In the above-stated method of derivation of the visual field (§89), we have used only the similarity of the location sign of proximate visual field places. It is possible that this factor, even though it is always present, is not fundamental as far as the psychology of cognition is concerned. It could be that, fundamentally, the location signs are not comparable and that they do not exhibit relations of similarity to one another. It could be the case that certain pairs of location signs are marked as similar pairs only through an association due to a change in color quality which results upon a small motion of the eyes. It could also be the case that, from the viewpoint of the psychology of cognition, we should think of the origin of the relations between visual field places in a different way, namely, as connected with the kinesthetic sensations of the eye muscles. A different constructional derivation of the visual field order could be based upon such an assumption.

Let us discuss a third possibility of the derivation of the visual field

83 überbestimmt

order because it raises a point which is of general importance. This derivation, compared to the previous ones, assumes a good deal less as given. We could take as given only what occurs in the visual focus and disregard all that is seen indirectly. However, in this case, we must assume as possible that two (or more) color types which have a common boundary (or meet in a point) can be sensed simultaneously in the visual focus, while we have previously claimed that to one place of the visual field there corresponds always only one color type. The colors which occur in this case form, to begin with, a one-dimensional order which is due to their temporal relations. We can easily arrive at higher orders, at a sort of visual field, by utilizing, in addition, the kinesthetic sensations of the eye movements. However, it is possible, even in this case, to do without the kinesthetic sensations, even though this makes the construction considerably more difficult. While we would then not have a visual field, the construction would lead to a two-dimensional order, just as in the derivations which we have discussed earlier. (We can easily convince ourselves of this fact if we think of the series of visual point sensations which we have when the eye is moved but the surroundings are unchanged.)

It is remarkable that in all cases (even though in different ways) there results at first a two-dimensional order, from which only later a three-dimensional order is constructed, namely, the order which we take to be the spatial order of physical reality. Once physical reality is fully constructed, we can go backward, interpreting the various two-dimensional orders and "explaining" their two-dimensionality from a certain property of physical reality which includes essentially certain physiological things and processes. We can then explain, from the two-dimensional order of the retinal organs, the fact that the visual field turns out to be two dimensional in the first type of derivation (i.e., on the basis of the local signs). For the construction with the aid of eye movements, the explanation goes back to the fact that the eye can be moved in two dimensions relative to the head. Finally, we have shown the possibility of a construction of the two-dimensional order of the visual field on the basis of visual point sensations, without any reference to sensations of eye movement. We have done this predominantly for the following reason: this third possibility, which leaves out of consideration the relations of location signs, shows that the actual reason for the two-dimensionality of the local order of the seen lies neither in the constitution of the retina nor in the nature of the eye movement; rather, the reason for this (always from the viewpoint of the completely constructed, three-dimensional,

physical world) lies in the fact that the light rays which fall upon one point form a bundle of rays of second degree and are therefore ordered two-dimensionally. On the other hand, the constitution of the visual organ, as far as the arrangement of the nerve endings and its type of mobility are concerned, can be considered of practical value in view of this fact, since it facilitates the recognition of the two-dimensional order, but it is not absolutely necessary for the construction of this order.

93. *The "Sensations" as Individual Constituents of Experiences*

Above, we have constructed quality classes as classes of elementary experiences which represent the constituents of elementary experiences as quasi constituents. If two elementary experiences belong to the same quality class, then we say that the two experiences agree in a certain constituent. If we wish to differentiate the two like constituents of the two elementary experiences, then it does not suffice just to characterize them as to quality, but we must, in addition, identify the elementary experience to which they belong. Only a constituent which is so characterized is an individual, strictly unique constituent in the proper sense. In contrast to a constituent which is characterized only as to its quality (i.e., only as to how it is represented in a quality class), we wish to call it a "sensation". Actually, we choose this word only for the sake of brevity (according to what has been said above [§§ 76, 85], it also refers to simple emotions). Consequently, we would have to define a sensation as an ordered pair consisting of an elementary experience and a quality class, to which the experience belongs. ([p]The quality is a constituent of the experience[p]; [c]the experience is an element of the quality[c].)

Simultaneity of constituents of experience relates to sensations: two sensations are called "simultaneous" if the elementary experiences (i.e., the referents of the pairs) are identical (construction of sensations and simultaneity: § 116).

REFERENCES. Sensations properly belong to the object domain of psychology; qualities, on the other hand, belong to the domain of phenomenology or the theory of objects [84]; there they are called "objects of sensation": Meinong [Gegenstandsth.] 512, [Stellung] 8 ff.

It must be noted that, in our constructional system, we do not construct the qualities from the sensations (perhaps as classes of sensations, as certain positivistic theories would have it), but, vice versa, the sensa-

84 Gegenstandstheorie

tions are constructed from the qualities. These qualities, of course, are then constructed from elementary experiences (thus fulfilling a general tenet of positivism). We mentioned, as one of our basic tenets, that the individual constituents of an elementary experience do not stand out in the individual experience, but are gained only through abstraction, namely, by placing the experience into orders which comprise other experiences also. It is a consequence of this that sensations are constructed from quality classes and not vice versa. *An individual experience, taken by itself, is unanalyzable. Experiences, taken as a manifold, can be compared and ordered, and only through their order result the (quasi) constituents of the individual experiences*.

94. *Prospect of Further Derivations*

We now have given derivations for the most important objects of the lower levels (i.e., we have determined how they may be constructed); thus we have determined their "object form". In doing so, we have used the relation extension of recollection of similarity as the only basic relation. Let us take a brief look at the derivation of some further objects, paying particular attention to whether new basic relations are required.

An especially important step in the constructional system is the construction of the three-dimensional spatial order, i.e., of visual space, from the two-dimensional order, namely, the visual field. Here are constructed, for the first time, things which belong to "reality" (in the sense of "outside world"). In the actual process of cognition, tactile and muscle sensations play an important role. However, the construction can be carried out with the aid of visual sensations alone. It will turn out that, for this construction, no new basic relation is required. We shall give a brief indication of this derivation to show that it can be carried out.

The visual sensations (as individual constituents of experiences) are arranged in a one-dimensional sequence (time sequence) of three-dimensional structures [85] (spaces) in a way that can be inferred from the temporal sequence of spatially ordered visual fields (of the individual experiences), where it is assumed that what is seen retains its characteristics of color, shape, and position, except where changes are either seen or inferred by analogy. We shall later on determine the construction of the space-time world more precisely (§§ 125-127). The "visual

85 Gefüge

things" result from certain characteristically coordinated "world lines" of this four-dimensional structure (§ 128).

It must be noted that, for the construction of visual things and of three-dimensional space, we need neither the senses other than the visual sense nor the components of the visual qualities (hue, saturation, brightness), which, after all, have not yet been distinguished from one another through the derivations which we have given so far. Although this circumstance does not result in an economy in basic relations, it makes possible a methodological simplification of construction.

In the actual process of cognition, the three-dimensional character of things seems to be immediately given, at least in the case of persons whose consciousness is fully developed. There are cases, however, where the spatial order is the result of an ordering activity; this shows that the construction is not a mere fiction, but a rational reconstruction of actual processes. In the case of spatial ordering, this can of course be shown only if special difficulties keep the synthesis in the actual process of cognition, which corresponds to the construction, from proceeding as quickly and unconsciously as is usually the case. This is, for example, the case in the orientation of blind persons (cf. the interesting remarks of Ahlmann [Opt. Vorst.]).

From the indicated constructions, we shall then proceed to further constructions. Among the visual things, "my body" stands out through certain characteristics (§ 129). With its aid, we can give individual definite descriptions of the most important other senses, having identified, up to this point, only the visual sense (§§ 129, 131). Furthermore, the various components of the qualities which are represented in the quality classes can then be derived (e.g., quality in the narrower sense, intensity, location sign). In this way, we shall finally construct all the psychological entities of the autopsychological domain—in the derivations which have been discussed or sketched so far, we have been concerned only with this domain, and not with the heteropsychological domain. We shall also be able to divide these autopsychological entities into main areas ("sense classes") and discern their components (§131 f.). The construction of the autopsychological domain does not require any further basic relations.

We have to construct, then, the "perceptual things" by an assignment of the qualities of the other senses to the visual things (§133 f.). We shall construct the "world of physics" with the aid of the "world of perception" (§ 136). In such a way, we can construct the entire domain of physical objects.

The possibility of the construction of the heteropsychological objects

follows from the earlier discussions concerning the reducibility of these objects to physical objects (§§57, 58); the possibility of the construction of cultural objects follows from the consideration concerning their reducibility to psychological objects (§§55, 56). Later on, we shall return to the construction of the heteropsychological objects (§ 140) and the construction of cultural objects (§ 150f.) without, however indicating their precise object forms. Nevertheless, it will become clear that, even for the construction of these object types, *no new basic relations are required*.

CHAPTER
E

FORMS OF REPRESENTATION FOR A CONSTRUCTIONAL SYSTEM

95. *The Four Languages*

It is useful to give several parallel forms of representation or "languages" for the constructional system, in order to facilitate its comprehension and examination. In representing the outline of our constructional system in the next part, we shall use four languages, which are different from one another, partly only in form, but partly also as concerns their sense. By difference in sense, we mean a difference in the ideas [86] which different persuasions may connect with the constructional formula of an object which is otherwise neutral as far as sense is concerned. Thus, it is a difference in sense (or epistemic value) where the logical value remains the same (§ 50).

The basic language of the constructional system is the symbolic language of logistics. It alone gives the proper and precise expression for the constructions; the other languages serve only as more comprehensible auxiliary languages. However, in the following outline, we shall give only the construction of the lower levels in this language. The reason for this does not lie in the fact that the objects of higher type offer particular difficulties of expression for this language, but in the fact that the problem

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86 Vorstellungen

of constructing the higher objects has itself not been solved with precision and that these constructions therefore can be given only in bold outline. As soon as the content of the construction of any object is precisely known, there are no difficulties in the way of a logistic formulation. This basic language of logistics we shall discuss in somewhat more detail in § 96, and we shall explain the most important symbols in § 97.

The other three languages offer nothing but translations from this basic language of logistics. To begin with, we shall give, after each constructional definition, a simple *paraphrase in word language* (cf. § 98). Then follows a translation into the *realistic language* customary in the empirical sciences. Its main purpose is to facilitate testing the correctness of the content of the construction (i.e., whether or not the constructional definition actually refers to the familiar object to which it purports to refer (§98)). Finally, we have used a *language of fictitious constructive operations*[87] in which the construction is envisaged as a rule for a constructive operation. Its main purpose is to facilitate the intuitive recognition of the formal correctness of the construction (i.e., the testing of whether each constructional definition is operative,[88] that is, not ambiguous, not empty, and purely extensional) (§§ 99, 101, 102).

REFERENCES. Gätschenberger [Symbola] gives an explicit discussion of the relation between different languages which deal with the same state of affairs. His considerations can be used to facilitate the understanding of the multilingual technique which we are using here. The basic language of our constructional system forms a sketch for a unifled language such as is demanded by Gätschenberger; it also has the algorithmic properties which Gätschenberger desires. However, we do not wish to make the claim that this sketch solves the problem of the unified language; rather, the problem is clarified as through an example, and the method for its solution is given.

96. *The Symbolic Language of Logistics*

The actual language of the constructional system is the symbolic language of logistics. The construction of the individual objects (of the lower levels), as well as some statements ("theorems") as examples, are given in "logistic formulation" (§46). There are two reasons for the application of this symbolic language. To begin with, a constructed object must clearly be distinguished from the corresponding object of

87 Sprache einer fiktiven Konstruktion
88 konstructiv

daily life or of science. We have already shown the necessity for this distinction in the preceding chapter and have occasionally tried to make it obvious through special auxiliary symbols (p-symbols, c-symbols [§ 75]). The application of the symbolism, however, is more important for the attainment of a second desideratum: we must demonstrate that all objects are reducible to the basic objects (i.e., that all sentences about further objects are transformable into sentences which contain only logical signs and signs for the basic objects). It is obvious that the value of a constructional system stands or falls with the purity of this reduction, just as the value of an axiomatic exposition of a theory depends upon the purity of the derivations of theorems from axioms. We can best insure the purity of this reduction through the application of an appropriate symbolism. An application of the word language, without special symbolism, would guarantee this purity only if there were a system of the concepts of logistics in the word language, especially of the theory of relations, which is the most important part of logistics as far as the constructional system is concerned. Such a word system is not available, and one may doubt whether it will ever be developed, since the advantages of the symbolic treatment are obvious to everyone who is concerned with the theory of relations. The advantages are the same that we find in mathematics when we use the symbolism rather than expressing all mathematical equations and operations in a word language.

However, the system of constructions must not only be "pure" (i.e., free of unnoticed conceptual elements), but also formally accurate. In order for a constructional definition to fulfill its object-constructing function, it must be neither ambiguous nor empty, that is, it must not designate more than one, but it must also designate at least one, object (in the most general sense, including the quasi objects, i.e., either an individual, or a class, or a relation extension). If we formulate the definition in the word language, then this requirement is very difficult to fulfill (as is the related desideratum of "operativeness" of the construction, § 102, which we shall introduce in connection with the language of constructive operations). On the other hand, this requirement is easily and almost automatically fulfilled when we apply an appropriate symbolism, for example, when we apply the logistic forms for the introduction of classes or relation extensions and for definite descriptions of individuals. It is a fact of logistics that these forms guarantee unequivocalness and logical existence, for they have been created with these desired properties in view.

97. *Explanation of Some Logistic Symbols*

Knowledge of logistics is not a precondition for an understanding of construction theory nor for an understanding of the outline of a constructional system which is given below, since all logistical formulas which are introduced at that place are translated into the word language. Nevertheless, let us here indicate the meaning of those logistical symbols which will be used later, to the extent to which they have not already been explained earlier.

REFERENCES. For a more detailed exposition of logistics, cf. Carnap [Logistik]. For further references, cf. § 3.

EXPLANATION OF LOGISTIC SYMBOLS

Constants: classes with lower case, relations with capital, initial letter.

Variables: classes: α, β, ... ; relations: P, Q, R, . .. ; in general: *x*, *y*, *z*.

Statements: ~ : negation; : implication; one or several dots: conjunction (also substitute for parentheses); == (or I): identity; $=_{df}$: definition symbol.

Propositional functions (§28): if f*x* is a propositional function, then (*x*) . f*x* means: "f*x* holds for every *x*", (*x*). f*x* means: "there is an *x* for which f*x* holds."

Classes (§ 33): $\alpha \cup \beta$: intersection; $\alpha \cup \beta$; union; $\alpha \subset \beta$: subsumption; α—β : remainder. α Ex β: “α and β have no element in common." $\exists!\alpha$: " α is not empty"; [*x*] or ι‘*x*: the class whose only element is *x*. If μ is a class of classes, then s‘μ. is the union of the μ-classes. Every class α has a cardinal number Nc'α (§ 40). The customary symbols are used for numbers, e.g., >, / (fraction sign).

Relations (§ 34, II): Let Q, R be relation extensions, $\cap$, $\cup$, $\subset$ mean the same as with the classes (we omit the dot for the sake of simplicity). $\vec{R}$ ‘*x*: the referents of *x* in R. R |`α: the relation which results from R if its converse domain is restricted to α; R |/`α: the relation which results from R if its field is restricted to α. α↑β: the relation which holds between every element of α and every element of β. *x*↓*y*: the relation whose only pair is *x*, *y*. as, sym, refl: the class, respectively, of asymmetrical, symmetrical, and transitive relations.

Quasi analysis (§§71, 73): Simil'R: the class of similarity circles based on R. Abstr'R: the class of abstraction classes based on R.
Topology: Dnp (*n*, α, *x*, U): α has, in element *x*, the dimension number *n*

relative to a neighborhood relation U. Vicin'Q: the neighborhood relation, which is determined by the (proximity) relation Q. n Dnhomvic Q: the field of Q has the homogenous dimension number *n* relative to Vicin'Q.

98. *Paraphrase in Word Language and Realistic Language*

For each symbolic construction formula, we shall give a paraphrase in words. However, this paraphrase is not to be envisaged as a strict formulation of the construction. Its purpose is to indicate the sense of the formula in a more understandable, if less precise, manner. On the other hand, the last two languages each give a new sense for each construction.

According to a symbolism which we used earlier (§75), the paraphrase in the word language should be enclosed in k-symbols, while the realistic language corresponds to the expressions which we have previously marked by p-symbols. For each construction, we shall indicate in realistic language the state of affairs on which it is based.

The introduction of a new symbol through a constructional definition has a certain economic value; namely, the constructed entity can from now on, in further statements and constructions, be designated with a simple symbol instead of the complex constructing expression. In addition, the constructed entity is to be envisaged as a rational reconstruction of an entity which has already been constructed in a partly intuitive, partly rational way in daily life or in the sciences; thus, the name this object bears in daily life guides the choice of the symbol. Hence, the definition contains, among other things, also an assertion, namely, that a certain familiar object, as far as its rational concept is concerned, can be derived from such and such basic concepts in such and such a way. It must be admitted that it is sometimes not easy to realize that a given constructed entity corresponds in fact to a certain familiar object. The schematic construction formulas seem at first strange, but it is also difficult to recognize in a map the schematic representation of a landscape. The recognition of this agreement is facilitated by the translation of the construction of an object into the realistic language, for this translation expresses the fact that the indicated object, and only this object, possesses certain properties as distinguishing characteristics.

99. *The Language of Fictitious Constructive Operations*

The individual constructions will be translated into a fourth language, into the language of fictitious constructive operations. Here, the con-

structional definitions are not envisaged as acts of naming (as in the first and second languages) or as descriptions of familiar objects (as in the third language), but as operating rules for a constructive procedure. We shall presently describe in some detail certain appropriate fictions; once these fictions are introduced, the constructions can be expressed, as it were, as palpable processes, and thus the translation into this language satisfies best the desire for intuitive obviousness. This obviousness not only facilitates understanding, but also has heuristic value. While the realistic translation, through the continued contact with the facts of science, regulates the constructions with respect to their content, the language of constructive operations has a regulating effect with respect to their form. It precludes an attempted construction, as it were, automatically during the preliminary considerations, if the new object does not have a purely formal connection with the already constructed objects; in such cases, an operative formulation of a construction is altogether impossible (i.e., we cannot give it the form of an operating rule for the formation of an inventory list).

Appropriate fictions are chosen by keeping in mind the purpose of the constructions as rational reconstructions of the recognition of objects. This reconstruction is to reflect the formal structure of the formation of objects. [89] Hence, we shall introduce, to begin with, the fiction of a temporal separation between the experience of the raw material of cognition and our acting upon this material. Thereafter, we introduce the fiction of the retainability of the given (§ 101). As an overriding fiction, we assume that we have the task of providing a given subject A with rules for step-by-step operations through which A can arrive at the construction of certain schemata ("inventory lists") which correspond to the individual objects that are to be constructed (§ 102). If a constructional definition can be translated into such an operating rule, then we can be certain that the construction is purely extensional, as construction theory requires of each construction.

In the sequel (§ § 100-102), we shall give a more detailed description of the presuppositions and the method of the language of constructive operations. It must be emphasized that *the constructional system itself has nothing to do with these fictions*; they are related only to the fourth language, whose purpose is purely didactic, namely, to provide illustrations.

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89 Gegenstandsbildung

100. *Construction as Rational Reconstruction*

The "given" is never found in consciousness as mere raw material, but always in more or less complicated connections and formations. The synthesis of cognition, i.e., the formation of entities, or representations of things and of "reality", from the given, does not, for the most part, take place according to a conscious procedure.

> EXAMPLE. In looking at a house, we perceive it immediately and intuitively as a corporeal object; we imagine its unperceived back side, its continued existence while we are not looking at it. We recognize the determinate, familiar house; yet most of the time no explicit mental deductions are carried out.

In science, too, synthesis, the formation of objects, and cognition take place, for the most part, intuitively and not in the rational form of logical deductions.

> EXAMPLE. In perception, the botanist forms the object of an individual plant as a physical object, without thereby engaging in any conscious thinking activity; most of the time, he recognizes intuitively this thing as a plant of such and such a species.

The fact that the synthesis of cognition, namely, the object formation and the recognition of, or classification into, species, takes place intuitively, has the advantage of ease, speed, and obviousness. But intuitive recognition (e.g., of a plant) can become useful for further scientific work only because it is possible to give, in addition, the indicators (of the particular species of plant), to compare them with the perception and thus to give a rational justification of intuition.

The constructional system is a rational reconstruction of the entire formation of reality, which, in cognition, is carried out for the most part intuitively. In reconstructing the recognition of the plant, the botanist has to ask himself what, in the actual act of recognition, was really perceived and what was apperceptive synthesis? [90] But these two components which are united in the result he can separate only through abstraction. Thus, in rational reconstruction, construction theory has to distinguish, by means of abstraction, between the purely given and the synthesis; this division must be made, not only for the individual case, but for the entire conscious process.

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90 Verarbeitung

101. *The Fiction Of the Separation and the Retainability of the Given*

The fourth language, namely, the language of "fictitious constructive operations", has the purpose of illustrating the constructions. In connection with it, we wish to make the assumption that a certain subject A is to be given operational rules as to how objects are to be formed from the given. Now we have just seen that it is necessary for construction theory to carry out in abstraction a separation between the purely given and the synthetic components (i.e., the constructional forms). In the present context, this is expressed as the fiction of the temporal separation of the given from the synthesis; during the first part of his life, A merely absorbs the given, without working upon it, and then, in the second part of his life, he synthesizes the retained material according to the rules which we have given him, without absorbing, during this part of his life, any more of the given. The only fictitious assumption concerning the experience (i.e., the contents of the first part of A's life) is the abstraction from all synthetic aspects. The further fictions are concerned only with the second part of his life. Here we ascribe certain abilities to A so that he is in a position to carry out this synthesis, and finally we also deny him certain bits of information so that the synthesis takes place only within the framework which is determined through the constructional method. We think of all synthetic elements, and thus of all thought processes, as separated from the experiences only for the purpose of this auxiliary language of fictitious construction. It is understood that, in construction proper, all content which occurs in experiences must be reflected in the constructions; thus, the acts of thought must also be constructed (cf. §85).

In order to be able to apply the indicated fictional separation, we have to assume a further fiction, namely, that the given which has been experienced is not forgotten, but that A retains it in his memory, or that he makes a protocol of it, since otherwise there would be no material to be synthesized in the second part of his life. This fiction of the retainability of the given deviates from reality in various ways. To begin with, in real life, many things are forgotten, and, furthermore, we do not generally retain in our memory the raw given, but high-level, synthesized elements,[91] for example, physical or heteropsychological objects.

In construction, it is not essential to reproduce the process of cognition

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91 Verarbeitetes hoher Stufe

in all its aspects. During the discussion of the problem of the basic relations, we have already explained that, of the many relations which hold between the experiences, we postulate only the smallest number necessary to be able, in principle, to construct reality from them. "In principle" means that we shall disregard the question whether the construction of an individual object requires much or only a little material. As it were, each construction must be understood in the following way: "This object can be constructed in such and such a way from the given, provided only that a sufficient supply of the given is available." In the language of constructive operations, this aspect of the construction is to be expressed through the fiction that A does not forget anything of the given.

There is another assumption which is connected with the fiction of the retainability of the given, namely, that each element of the given (each elementary experience) is identically retained, so that, during the synthesis, it can be utilized more than once and can be identified each time as identically the same. In our fiction, we could express this, for example, by saying that each individual elementary experience is provided with an arbitrary, but permanent, token, for example, an (arbitrary) number.

102. *The Fiction of the Basic Relation Lists*

We realized earlier (§75) that construction theory may assume, as its initial material for the constructional system, not a property description, but merely a pair list of the elementary experiences which is based on the basic relation of the constructional system. In the language of constructive operations, this assumption is expressed by saying that, of the elementary experiences which A has in the first part of his life, A may not retain or record the individual properties of these elementary experiences, but only the pair list based on the basic relations. This is to say, A may retain an inventory list of each basic relation as a list of the number pairs of those elementary experiences between which the basic relation in question holds; thus, in our constructional system, A may retain nothing but the pair list of the only basic relation Rs. Constructions of impermissible (namely, not purely "operative" or "extensional") form cannot be expressed as operational rules; herein lies the regulative value of the indicated fiction.

The constructional system is a rational reconstruction of a process of cognition whose results are already known. Consequently, we add to the fiction of this language of constructive operations the assumption that, even though A does not know all of reality, it is known to us, since we

have to give A his rules of procedure. It is only on the basis of this knowledge that we know which constructional steps are appropriate for each level and to which entity each of them leads, even though we do not know of what nature A's experiences are. Thus, for the purposes of this fiction, we assume that we know the sense [92] of the basic relation(s) so that, starting from it (them), we can lead A to the entities which we have in mind. On the other hand, we are not familiar with the basic relation list(s) of A. This fiction forces us to formulate constructions as operational rules independently from the individual subject. A, on the other hand, is familiar only with his relation list(s), but not with the sense of the basic relation(s).

The utility of the fictions which we have introduced has now become clear. They help us to maintain and examine the conceptual purity of the operational rules and thus of the constructional definitions. It is absolutely necessary that this purity be strictly maintained, either with the aid of such fictions or otherwise. Philosophical discussions which are somehow concerned with constructions frequently make the mistake of not restricting themselves to those data which may occur in the construction of an object.

Thus the translation of each construction into the language of constructive operations has the form of a rule. A uses this rule to produce, step by step, the inventory list of each constructed object, starting with his inventory list of the basic relation(s). If the object is constructed as a class, then the inventory list states the elements of the class; in the case of a relation extension, it states the member-pairs. A furnishes all constructed objects with individual, but arbitrary, tokens, for example, numbers, so that they may be mentioned in further lists. After the formation of each new inventory list, A is to produce supplemental entries.[93] That is to say, for each object, A produces, in addition to the inventory list, which is immediately given in its final version, also an object description, which is constantly enlarged through supplemental entries from later constructions. The supplemental entries of the inventory list of a class consist in attaching to the object description of each of its elements the information that this element belongs to this class. We have discussed examples of this in connection with quasi analysis, where certain classes were assigned to their elements as quasi constituents. The supplemental entries of the inventory list of a relation consist in the following: in the object descriptions of each of its members, it is noted

92 Beziehungssinn
93 Rückübertragung

to which other members it stands in this relation (extension) and which other members stand in this relation (extension) to it. Thus, the inventory list and object description of an object in the language of constructive operations correspond to what, in realistic language, is called definite description and characterization of an object. The definite description gives only necessary and sufficient characteristics for the determination that precisely this object is present. The characterization mentions all further known properties and relations of the object. The subsequent applications will clearly show how the inventory lists and object descriptions are to be formed (IV, A, § 108 ff. always under the heading "fictitious operation").

The question now arises whether it is always possible to translate a constructional definition into such an operating rule concerning the formation of an inventory list of a new object from the inventory lists of the basic relation(s) and the previously constructed objects. This requirement of operativeness of the constructions is easily fulfilled if the logistic language is used; the constructional definitions must have the form of extensional definitions. From the logical theory of extensions, it follows that the inventory list of a newly defined concept can be formed if this concept is defined as an extension (i.e., class or relation extension) and if the inventory lists of the other concepts which are mentioned in the definition are known. (About the concept of extension, cf. § 32; about the extensional method of construction, cf. §§43,45.)

103. *About the General Rules of Construction*
(§§103 to 105 may be omitted)

System form and object forms of the constructional system are empirically determined; i.e., these forms depend upon reality and the individual objects which are presupposed as empirically known. However, when we are confronted on a given level with a certain empirical situation, then we may proceed in such and such a way or ways and in no other way; this must depend upon certain formal properties in the actual process of cognition as well as in the corresponding constructional system which is its reconstruction. *Thus each constructional step can be envisaged as the application of a general formal rule to the empirical situation of the level in question*. By empirical situation, we mean the properties of the already constructed entities which, even though formal, are nevertheless given only empirically. For example, we find through empirical investigation whether a certain constructed relation is transi-

tive or not, etc., or whether or not two classes partially overlap, etc. The formal rule, however, is not itself empirical inasmuch as it represents an implication which holds, not only for a special level, but for each place of the constructional system.

These general rules could be called a priori rules, since the construction and cognition of the object is logically dependent upon them. However, we cannot become conscious of these rules except through abstraction from already formed or constructed experiences. Since the constructions of the individual objects are, for the most part, known with only very little precision, we are not in a position to carry out this abstraction (the constructional system which is sketched in the sequel gives the construction of individual objects only for the lower levels and, even in these cases, only in an experimental way, while the constructions of the higher levels are merely indicated). However, the rules are not to be designated as "a priori knowledge", for they do not represent knowledge, but postulations.[94] In the actual process of cognition, these postulations are carried out unconsciously. Even in scientific procedures, we are rarely conscious of them and they are rarely made explicit.

104. *Tentative Formulation of Some Construction Rules*

A system of general constructional rules (i.e., of rules which hold for any level) cannot yet be given for the reasons indicated above. Let us nevertheless attempt to formulate some such rules in order to show what is meant by "general rules" and what they would have to look like. These formulations have the character merely of a tentative example. (Concerning the terminology of the theory of relations, cf. §§ II, 34.)

> 1. If any relation [95] is given (no matter whether it is a basic relation or a constructed relation on any level), then its domain, its converse domain, and (if possible, i.e., if the relation is homogeneous) its field is constructed. (We shall later apply this rule in the construction of elex, § 109.)
>
> The purpose of rules 2 through 7 consists in making possible a quasi analysis according to rules 8 and 9; these rules form the complete disjunction of all cases of homogeneous relations. (For the application of quasi analysis, according to §71, symmetry and reflexivity of the relation are required; for the simplest form, according to § 73, we also require transitivity.)

94 Festsetzungen
95 "relation" for "Relation" throughout §104

2. If a homogeneous relation P is given which is neither symmetrical nor reflexive, we construct the relation Q as the union of P, its converse, and of P^0. Q is then symmetrical and reflexive, so that rule 7, 8, or 9 becomes applicable. (This rule is used in the construction of Ps, §110.)

3. If a nonsymmetrical, reflexive relation P is given, we construct Q as the union of P and its converse. In this case, Q is symmetrical and reflexive, so that rule 7, 8, or 9 becomes applicable.

4. If a symmetrical, nonreflexive, nontransitive relation P is given, whose chain (power relation) becomes trivial (i.e., holds for all pairs of its field), we construct Q as the union of P and P^0. In this case, Q is symmetrical, reflexive, and nontransitive, so that rule 7 or 8 becomes applicable.

5. If a symmetrical, nonreflexive, and nontransitive relation P is given, whose chain does not become trivial (cf. rule 4), we construct Q as the chain (including identity) of P. In this case, Q is symmetrical, reflexive, and transitive, so that rule 9 can be applied. (This rule is applied for Colid, §118.)

6. If a symmetrical, nonreflexive, transitive relation P is given, we construct Q as the union of P and P^0. In this case, Q is symmetrical, reflexive, and transitive, so that rule 9 can be applied.

7. If a symmetrical, reflexive, and nontransitive relation P is given, whose chain does not become trivial (cf. rule 4), we construct Q as the chain of P. In this case, Q is symmetrical, reflexive, and transitive, so that rule 9 can be applied. (This rule is applied in the construction of sense, § 115).

8. If a symmetrical, reflexive, and nontransitive relation Q is given whose chain becomes trivial (cf. rule 4), we apply quasi analysis (according to §71) to Q, i.e., we construct the class of similarity circles of Q (used for similcirc, §111; place, § 117).

9. If a symmetrical, reflexive, transitive relation Q is given, we apply quasi analysis (in the simplest form, according to §73) to Q, i.e., we construct the class of abstraction classes of Q (used for sense, analys1, color, §§ 115, 116, 118).

10. If the similarity circles of Q which result through quasi analysis according to rule 8 or 9 do not overlap or overlap only very little, then we consider them quasi constituents of their elements.

11. On the other hand, if the similarity circles of Q overlap to a considerable extent and in a systematic order, then we determine the quasi constituents by constructing the largest possible subclasses of the similarity circles of Q which (aside from small pieces) are not divided through the mutual dissections of the similarity circles of Q; cf. § 72 (used for qual, §112).

12. If, among the quasi constituents which are formed on the basis of

Q according to rule 10 or 11, there are pairs such that all elements of the referent stand in the relation Q to all elements of the relatum, then we construct the relation S which is determined through these pairs as the proximity relation between the quasi constituents (used for Sim, § 114).

13. On the basis of the relation S, which is constructed according to rule 12, we divide the quasi constituents into connected areas by constructing the abstraction classes of the S-chain (used for sense, § 115).

14. On the basis of S (according to rule 12), we determine the properties of order of the quasi constituents within each of the connected areas (according to rule 13), especially the dimension number.

15. If the order of one of the areas (according to rule 14) deviates in certain general properties (e.g., dimension number) from those of all other areas, then this area is marked out through a constructional definition (used for sight, § 115).

105. *The Problem of Deducing the Construction Rules*

Now the question arises whether the general construction rules, of which we have tentatively given a few examples, could perhaps all be derived from a supreme principle and what the nature of this principle could be. We can here only raise this question, not answer it, since we have not even formulated the general rules themselves. We cannot even assert with assurance the existence of such a supreme principle.

In a certain sense, the method for the determination of the principle of construction is analogous to the determination of the single world formula for the physical processes. In both cases, we must proceed inductively from experience. In our case, we must abstract from the individual constructive steps which are found in the constructional system general rules for such steps, for example, the rules of the indicated examples. Furthermore, we must attempt to condense groups of such rules into more general rules (for example, rules 2 through 7 of the above examples into a more general rule of roughly this form: a homogeneous relation is to be transformed in as simple a way as possible, so that quasi analysis becomes applicable to it), until a single, most general rule results. If, in physics, the world formula were already known, then all the individual natural laws could be derived deductively without reference to experience. In exactly the same way, all the general constructional rules could be deduced from the supreme principle of construction without reference to experience, i.e., without reference to any concrete construction within the constructional system. But here,

as there, the supreme principle is not known, but forms, for the time being, only a goal for research, a goal of which we do not even know whether it can be reached. In a deductive system of physics, we would identify the individual formally deduced laws and forms of invariants [96] with empirically known natural laws and object types, for example, chemical elements. In the same way, in a deductive constructional system, the particular, formally deduced entities would be identified with certain empirically known objects (things, properties, relations, events).

Even if the supreme principle of construction were already known, we still would have a further task, namely, to ascertain why it should be necessary, in view of the contribution of cognition to the larger context of life's purposes, that experiences are formed into objects in just the way expressed in the constructional system, in the general rules of construction and, most succinctly, in the supreme principle of construction. Given the present state of our knowledge, this teleological problem of the formation of knowledge can be attacked, not as a whole, but only in some of its details. Thus one could concern himself, for example, with the tendencies to reify [97] and attribute causal efficacy, which become noticeable at the higher levels of construction. At present, we shall deal no further with this problem.

Summary

III. THE FORMAL PROBLEMS OF THE CONSTRUCTIONAL SYSTEM (26-105)

A. The Ascension Forms (26-45)

Frequently, signs are introduced in order to make it possible to speak about objects of a certain type in an abbreviated way, where the sign in question does not designate an object (of that type). In such a case, one often speaks of the sign as if it designated an object of a new type, even though, strictly speaking, it designates nothing; if this is the case, we will say that the sign designates a *quasi object* ("quasi" relative to the object type given in the first place) (27). From a sentence, which is the sign of a proposition, we generate the sign of a *propositional function* by introducing variables, or blanks, in the place of partial signs; we can then substitute "arguments" in the "argument positions". Each propositional function represents a concept: if it has one argument position, it represents a property;

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96 Stabilitätsformen
97 Substantialisierung

if it has several, a relation (28). Upon substitution of a "permissible" argument, a (true or false) sentence is generated; if other substitutions are made, a meaningless sign is produced. If two objects are permissible arguments for one and the same argument position of any prepositional function, then they are called "isogenous", otherwise "allogeneous". The *object sphere* of an object is the class of all objects that are isogenous with it (29). An object type is called "pure" if all its objects are isogenous with one another. Most ordinary object types are impure: no logically unobjectionable concepts correspond to them. In ordinary language (even in science), almost every word designates several concepts from different spheres. The "confusion of spheres" creates many logical, and consequently also philosophical, perplexities (30, 31).

Propositional functions which are satisfied by the same arguments are called "universally equivalent" or "coextensive". To such functions are assigned identical "extension symbols". Such a symbol is said to designate the *extension* of a function. Hence extensions are quasi objects (32). The extension of a property is called a class, that of a relation, a relation extension. Thus class and relation extension are quasi objects (relative to the elements of the class and the terms of the relation extension, respectively) (33, 34). A concept *a* is *constructed* from *b*, *c* by producing its "constructional definition", i.e., by producing a translation rule which indicates for all cases how a propositional function about *a* can be transformed into a coextensive propositional function about *b*, *c*. If such a rule exists, then *a* is said to be reducible to *b*, *c* or to a "(logical) complex" of *b*, *c*. Hence, class and relation extension are complexes of their elements or members, respectively (35). An (extensive) whole is isogenous with its parts no matter whether it is a "true whole" ("organic whole", Gestalt) or a mere "collection". Since a class and its elements are allogeneous, it follows that it is not the whole, let alone the mere collection, of its elements; rather, it is a quasi object which serves to represent that which the elements have in common (36,37).

The simplest case of a constructional definition of *a* out of *b*, *c* consists in the indication of an expression in terms of *b*, *c* which is equivalent with *a*: explicit definition. If such a definition is impossible, then a rule must be given for the translation of entire sentence forms (propositional functions) in which *a* occurs into *b*, *c*: *definition in use* (both forms are called "explicit definitions in the wider sense" to distinguish them from implicit definitions) (38, 39). In the formulation of a constructional system we speak of ascending to a new level whenever an object allogeneous to the preceding objects is constructed. This can take place only through definitions in use. Through such a definition, an extension symbol, i.e., the sign of a class or relation extension, is introduced. *Hence class and relation extension are the ascension forms* of the constructional system (40). Through repeated and sometimes

intermixed application of the ascension forms we construct, within the constructional system, all objects out of the basic objects of the system; hence the unity of the object domain (due to the unity of the system) and, on the other hand, the plurality of (allogeneous) object types which follows from the multiplicity of construction forms (41). The relation being-holding obtains between each constructional level and the next higher one (42). Against the *extensional method* of construction theory (each concept is represented by an extension) the objection is raised that there may be statements about concepts which cannot be expressed with the aid of the extension symbol of the concept, namely, "intensional statements". The objection is overcome through the thesis of *extensionality*: there are no intensional, but only extensional, statements (i.e., statements that can be transformed into statements about extensions) (43, 45). This thesis is founded upon the distinction between "sign statements", "sense statements", and "nominatum statements"; it turns out that the extensional and the allegedly intensional propositions about a concept are not concerned with the same object (44).

B. *The System Forms (46-60)*

1. FORMAL INVESTIGATIONS (46-53)

The problem of the system form: how to formulate the constructional system so that all scientific objects find a place in it? (46). To solve this problem, the reducibility relations of the objects must be investigated. In the realistic, or matter of fact, language which is customary in the empirical sciences, "*a* is reducible to *b*, *c*" means the same as "for each state of affairs relative to *a* (*b*, *c*), a necessary and sufficient condition can be indicated which depends upon *b* and *c* alone" (47), or "there is an infallible and always present indicator which can be expressed through *b* and *c*". Since, in principle, science can produce such an indicator for every concept, it follows that all scientific objects are constructable (48, 49). The "constructional transformation", i.e., the transformation of a statement or propositional function with the aid of a constructional definition is a "logical translation", not a "translation of sense"; that is to say, it leaves the *logical value* unchanged (namely, the truth value of a proposition or the extension of a propositional function), but not always the *epistemic value* (50, 51).

2. MATERIAL INVESTIGATIONS (54-60)

An object *a* is called epistemically primary relative to *b* (where *b* is called epistemically secondary) if the recognition of *b* presupposes that of *a*. For our outline of the constructional system we wish to choose the *epistemic system form*: each object is constructed out of those other objects which are epistemically primary relative to it. Hence, in addition to their reducibility, the epistemic primacy of the object types must also be investigated (54). The cultural objects are not only reducible to, but are also recognized through, their manifestations and documentations. However, all docu-

mentations are reducible to manifestations; thus, all cultural objects can in the end be reduced to psychological ones and are epistemically secondary with respect to them (55, 56). All *physical* objects are (either directly or through the mediation of other physical objects) reducible to sensory qualities (of acts of perception). On the other hand, all psychological objects are reducible to physical objects (either through the psychophysical relation or through the expression relation) (57). Hence there are several possible system forms: the basis (the domain of the basic objects) is either physical or psychological. We must divide the psychological objects into two classes with respect to epistemic primacy: the *autopsychological* objects are epistemically primary relative to the physical objects, while the *heteropsychological* objects are secondary to them. Hence, in the epistemic system form, the most important object types occur in the following sequence: *autopsychological*, *physical*, *heteropsychological*, *and cultural objects* (58). There exists another system form with physical basis (materialistic system form) (59). The basis of the epistemic system form lies in the autopsychological domain; still another system form has a general-psychological basis (60).

C. *The Basis (61-83)*

1. THE BASIC ELEMENTS (61-74)

The basic objects from which all others are constructed are the *basic relations*; their members are called *basic elements* of the system (61). The epistemic system form, which we have chosen, has its basis in the autopsychological domain ("methodological solipsism") (64). However, the concept of the "self does not belong to the initially given (65). In spite of the autopsychological basis, cognition can achieve an intersubjective objective status (66). As basic elements within the autopsychological domain we must choose the *elementary experiences* (67), which are taken as unanalyzable units (68). Nevertheless, concept formation must arrive at the so-called constituents of experiences. The method required for this is *quasi analysis*. Essentially, it is a synthetic procedure clad in the language of analysis. It leads to structures which are substitutes for the constituents (there actually are no constituents), and which are therefore called *quasi constituents*. Quasi analysis consists in the following: the (unanalyzable) objects are placed in various kinship structures on the basis of a relation description; the various structures to which an object belongs are then its "quasi constituents" (69-71). Depending upon the formal properties of the relation on which it is based, quasi analysis takes different forms. The simplest form occurs in connection with transitive relations: *Principle of abstraction*. In this case the quasi constituents are called “abstraction classes” (72-74).

2. THE BASIC RELATIONS (75-83)

Two elementary experiences are called "part identical" if they agree in

one part, "part similar" if they approximately agree in one part. It must be presupposed that these two relations are recognizable in any perception (76,77). However, as basic relation we choose the asymmetrical relation, *recollection of similarity*, which corresponds to part similarity and contains in it the direction of time: this relation obtains between experiences *x* and *y* if *x* and *y* are recognized as part similar through a comparison of *y* with a memory image of *x*. From this basic relation, part similarity can be derived in a rather simple fashion (78). Through the application of quasi analysis to recollection of similarity, "similarity circles" can be derived (80), and "quality classes" can be derived from the similarity circles. The quality classes represent the sensory qualities (including emotions). Part identity is easily derived from the quality classes (81). A survey of further derivations leads to the supposition that *no other basic relation is required* (82). In a sense, the basic relations correspond to the "categories" of traditional philosophy (83).

D. *The Object Forms (84-94)*

The problem of object forms: in which form are the individual objects to be constructed? Object forms are here considered only by way of example; they do not properly belong to the thesis of construction theory, which concerns itself only with the choice of basis, system form and ascension forms (84). The objects of the lowest levels have already been mentioned and their derivability has been investigated; the following additional objects are derivable from them: the relation of similarity between quality classes; the sense classes as classes of qualities of the individual sense modalities (85); the definite description of the visual sense with the aid of its dimension number (66); the preliminary time order (87); the visual field places and their order in the visual field (88, 89); the colors and their order in the color solid (90-92). The constructional separation of the visual field order and the order of colors depends upon a formal difference between the two orders: it is impossible that in a single experience two different colors should appear at the same visual field place, but two visual field places can very well have the same color. Because of this formal difference, it is possible that the visual field order and the spatial order which results from it, but not the color order, can serve as the principle of individuation for reality (91). It is furthermore possible to derive the sensations in the sense of individual constituents of experiences (93). From the indicated objects it is possible to derive the other objects of the autopsychological domain, from these the physical, and then the heteropsychological and cultural objects (94).

E. *Forms of Representation for a Constructional System (93-105)*

The constructional system consists of a structure of definitional chains. The conceptual purity of this structure can best be safeguarded through the use

of a symbolism. Hence, in the structure which we have formulated as an example, the symbolism of logistics is used as basic language. Parallel translations into three other languages serve to further the ease of understanding (95). The logistic language is based on the system of Russell and Whitehead, since this is the only system which possesses a detailed theory of relations (96,97). The first translation is a paraphrase (of the individual constructional definitions and theorems) into ordinary word language; secondly, we give a translation into the realistic language, which describes the states of affairs at hand (98). The fourth language is the language of fictitious constructive operations: here each constructional definition is expressed as an operating rule in a constructive procedure (99). We imagine, in this case, that the "given" is presented in the form of a "list of the basic relations", i.e., a number-pair list of the basic relations; the operating rules lead from this list to further "inventory lists" for all objects (102). Hence, in this fiction, the contents of the given experiences is separated from their synthesis: we must make the additional fictitious assumption that the given can be indefinitely retained (101). The formulation of the constructional system does not attempt to represent the way in which the various experiential contents are experienced, but rather it is to be an account only of the logical relations which are contained in them; this is done through *a rational reconstruction* of the synthesis of the contents of experience, which in actual experience is for the most part intuitive (100). Once the individual objects are constructed, an additional (here unsolved) problem arises: the constructions should be recognized as special applications of general formal rules (103-105).

PART FOUR
OUTLINE OF A CONSTRUCTIONAL SYSTEM

CHAPTER
A

THE LOWER LEVELS:
AUTOPSYCHOLOGICAL OBJECTS

106. *About Form, Content, and Purpose of this Outline*

In the following, we shall give a tentative version of the lower levels of the constructional system (Chapter A); the higher levels, we shall merely suggest (Chapters B and C). By and large, Chapter A comprehends the autopsychological objects; Chapter B, the physical objects; and Chapter C, the heteropsychological and cultural objects.

The constructional forms which we shall apply correspond to the results of the preceding investigations (Part III); according to III, A, we use class and relation extension as ascension forms; according to III, B, we use a system form with autopsychological basis; according to III, C, 1, we use as basic elements the elementary experiences; and, according to III, C, 2, we use recollection of similarity as the only basic relation; the object forms of the lower levels correspond to the derivations in III, C, 2, and III, D.

The form of exposition results from what we have developed in the preceding chapter (III, E). In particular, each construction is at first given as a definition in the basic logistic language (under the heading "construction"); then follows the translation into the three auxiliary languages: paraphrase, realistic language, and language of fictitious

constructive operations (under the headings "paraphrase", "realistic state of affairs", "fictitious operations"); then follow statements about the constructed entities and explanations.

The statements or theorems of a constructional system are divided into two different types (the following are given as examples for theorems: Th. 1-6 in §§ 108, 110, 114, 117, 118). The first type of theorem can be deduced from the definitions alone (presupposing the axioms of logic, without which no deduction is possible at all). These we call *analytic* theorems. The second type of theorem, on the other hand, indicates the relations between constructed objects which can be ascertained only through experience. We call them *empirical* theorems. If an analytic theorem is transformed into a statement about the basic relation(s), a tautology results; if an emprical theorem is thus transformed, it indicates empirical, formal properties of the basic relation(s). Expressed in the realistic language, this means that the analytic theorems are tautological statements about concepts (these statements are not necessarily trivial, since the tautology may become apparent only after the transformation, as is the case with mathematical theorems); the empirical theorems express an empirically ascertained state of affairs.

> REFERENCES. In Kantian terminology, the analytic theorems are analytic judgments a priori; the empirical theorems are synthetic judgments a posteriori. It is the contention of construction theory that there are no such things as the "synthetic judgments a priori" which are essential for Kant's approach to epistemological problems.

As concerns the content of our constructional system, let us emphasize again that it is only a tentative example. The content depends upon the material findings of the empirical sciences; for the lower levels in particular, upon the findings of the phenomenology of perception, and psychology. The results of these sciences are themselves subject to debate; since a constructional system is merely the translation of such findings, its complete material correctness cannot be guaranteed. *The actual purpose of our exposition of construction theory is to pose the problem of a constructional system, and to carry out a logical investigation of the method which will lead to such a system; the formulation of the system is not itself part of the actual purpose*. We have nevertheless formulated some levels of the system and have indicated further levels. We have done this mostly to illustrate the problem, rather than to attempt a beginning of its solution.

107. *The Logical and Mathematical Objects*

Even before the introduction of the basic relation(s), we must construct the *logical objects*, or objects of pure logistics. Once the basic concepts of any object domain are introduced, e.g., the basic relation(s) of the constructional system, pure logistics is transformed into applied logistics; this holds in particular for the theory of relations. It is not necessary here to give an explicit account of the system of pure logistics.

> REFERENCES. A complete version of this system has been given by Russell and Whitehead [Princ. Math.], including the mathematical objects. Cf. the bibliography about logistics in § 3 and the explanation of logistic symbols in § 97.

The following basic concepts are required: incompatibility of two statements and validity of a propositional function for all arguments. Then the further connectives for two statements and negation are constructed as the first logical objects from the basic concepts; also, identity and existence. Then classes and relations extensions with their respective connectives are introduced, and finally all objects of the general theory of relations. (Cf. § 25 for the independence of logical objects from psychological and physical objects.)

Mathematics forms a branch of logistics (i.e., it does not require any new basic concepts). It is not necessary here to give an account of the formation of the system of mathematical objects; let us merely recall its main levels.

On the basis of the logical objects, we construct at first the arithmetical objects: cardinal numbers (cf. §40); then the general relation numbers [98] (or "structures," cf. §11), which are less frequently employed in mathematics; as a special type of the latter, we then construct the ordinal numbers. For each type of number, we construct its connectives; furthermore, the (general) series, the rational numbers, the real numbers, the vectors, etc.

Geometrical objects, too, are purely logical objects, i.e., they can be constructed within the system of logistics with the indicated basic concepts. By "geometry" we mean here purely mathematical, abstract geometry which is not concerned with space in the ordinary sense of the word, but concerned with certain multidimensional ordered structures which are also called "space", or, more precisely, "abstract space".

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98 Relationszahlen

Intuitive, phenomenally spatial objects form a special object domain; they belong to the real objects and can be constructed only later, after the introduction of the basic relation(s) of the constructional system (§ 125).

REFERENCES. The derivability of geometrical concepts from logistics has been demonstrated through the investigations of Pieri, Peano, Huntington, Russell, Veblen, and others. A comprehensive discussion with bibliography has been given by Couturat [Prinz.], Chapter VI. Cf. also the examples of geometrical systems in Camap [Logistik]. Volume IV of Whitehead and Russell's [Princ. Math.], which was to give a detailed statement of the derivation of geometry from logistics, has not yet appeared.

About the difference between the so-called "space" of the pure theory of relations and the actual space of intuition, see Carnap [Raum]. (See also the bibliography on the subject in [Raum], 78 ff.) Keyser [Math. Phil.] gives an explicit account of the logical sense of abstract geometry as a mere theory form (theory function, "doctrinal function"); cf. also Weyl [Handb.].

It is important to notice that the logical and mathematical objects are not actually objects in the sense of real objects (objects of the empirical sciences). Logic (including mathematics) consists solely of conventions concerning the use of symbols, and of tautologies on the basis of these conventions. Thus, the symbols of logic (and mathematics) do not designate objects, but merely serve as symbolic fixations of these conventions. Objects in the sense of real objects (including quasi objects) are only the basic relation(s) and the objects constructed there from. All signs which have a definite meaning are called constants and are thus distinguished from the variables (§28). The logical constants are signs for logical objects; the nonlogical constants are signs for real objects (concepts of an object domain).

108. *The Basic Relation* (Rs)

Basic relation: Rs

Paraphrase: Recollection of similarity (cf. § 78).

Realistic state of affairs: *x* and *y* are elementary experiences, where a recollected representation of *x* is compared with *y* and found to be part similar to it (i.e., *x* and *y* are found to agree approximately in a constituent, § 78).

Fictitious operation: The only material which A has for synthesis is

the *basic relation list*, the inventory list of Rs. This list contains pairs of terms of the relation extension, each argument designated by an arbitrary but determinate token (number), cf. § 102. This list is known only to A, not to us. On the other hand, only we, but not A, know the sense of the basic relation (as it has been given in §78). Without knowing this sense, A can ascertain, from his basic relation list (i.e., empirically), the theorem Th. 1 below; this theorem states that no pair occurs in both orders of members (*a*, *b* and *b*, *a*) in that list. For each of the arguments of the basic relation, A begins an object description. These descriptions will later on grow in content; for the time being, A merely uses his basic relation list to ascertain for each member to which member it stands in the basic relation and which members stand to it in that relation. This way of using the basic relations list for object descriptions corresponds to supplemental entries as they occur in connection with objects which are constructed later on.

Theorem: 1 $Rs \in \alpha s$ (empirical).

Paraphrase: Rs is asymmetrical.

109. *The Basic Elements* (elex)

Construction: $elex =_{df} C'Rs$

Paraphrase: The Rs-members are called *elementary experiences*.

Realistic state of affairs: The recollection of similarity holds between elementary experiences; thus, since they are arguments of the basic relation, they are the basic elements (§67).

Fictitious operation: A forms the inventory list of class elex as the number list of all members which occur in the basic relation list. The supplemental entries are here rather trivial, since A enters into the object description which he has previously started (§ 108) for each element the remark that it belongs to the class elex.

110. *Part Similarity* (Ps)

Construction: $Ps =_{df} Rs \cup \breve{R}s \cup Rs^0$

Paraphrase: Two elementary experiences *x* and *y* are called *part similar* if the relation Rs holds either between *x* and *y* or between *y* and *x* or if *x* and *y* are identical Rs members.

Realistic state of affairs: If a recollection of similarity holds between elementary experiences *x* and *y*, then a part of *x* is similar to a part of *y* and a part of *y* is similar to a part of *x* (cf. §§ 78, 77).

Fictitious operation: A forms an inventory list of the relation Ps by entering all pairs of the Rs list; furthermore, also the converse pairs (i.e., in addition to *a*, *b*, always also *b*, *a*) and finally all identity pairs of members of the list (*a*,*a*: *b*,*b*; etc.). In this case, the supplemental entries consist in the following: after having previously begun his object descriptions (§ 108), A now uses the Ps list to supplement them by noting in each object description of a member of Rs (i.e., an elementary experience) to which others it stands in the relation Ps.

While A ascertains the *empirical theorems* on the basis of his list, the *analytic theorems* follow from the definition, thus do not require any confirmation through the inventory list. For example, Th. 2 and Th. 3 follow directly from the construction of Ps.

Theorems: Th. 2. Ps $\in$ sym (analytic).
Th. 3. Ps $\in$ refl (analytic).
Paraphrases: Ps is symmetrical; Ps is reflexive.

111. *Similarity Circles* (similcirc)

Construction: similcirc $=_{Df}$ Sim'Ps
Paraphrase: The similarity circles based on Ps (which are formed through quasi analysis) are briefly called *similarity circles*.
Explanation: The indicated construction consists in the application of quasi analysis (§71) to Ps according to the derivation in § 80. According to Th. 1 and Th. 2, Ps has the properties required for this purpose, namely, symmetry and reflexivity.
Realistic state of affairs: Let us determine, in any quality domain, the largest possible class of qualities which are all in proximity of one another and thereafter the class of elementary experiences in which these qualities occur; then any two of these elementary experiences are part similar to one another, and no elementary experience outside of these is part similar to all of them (cf. § 80).
Fictitious operation: A is to compose the inventory list for all classes of elementary experiences which are similarity circles based on Ps. For this purpose, A determines at first all classes of part similar experiences; he starts with the unit classes of elementary experiences which belong to those classes because of the reflexivity of Ps. Then he forms the classes of two members by taking the pairs from the relation list of Ps; then he forms classes three of members, etc. Finally, he erases from his list all subclasses of other classes on the list. The remaining classes are the desired similarity circles. A now numbers the classes which he has found

in order to be able to mention them individually. (This numbering has nothing to do with the numbering of elementary experiences.) He then enters all these class numbers into the inventory list of the class "similcirc"; into the inventory list of each of the classes which he has found, he enters the numbers of the elementary experiences which belong to it. Supplemental entries of similarity circles: A enters into the object description of each elementary experience the similarity circles to which it belongs (he designates the similarity circles by the newly introduced numbers).

112. *Quality Classes* (qual)

Construction: qual $=_{Df}$ $\hat{a}$ $\{(\gamma) : \gamma \in \text{similcirc} . \text{Nc}'(a \cap \gamma) / \text{Nc}'a > ½ . \supset . a \subset \gamma :. (x) : x \sim \in a. \supset . (\exists \delta) . \delta \in \text{similcirc} . a \subset \delta . x \sim \varepsilon \delta\}$

Paraphrase: A class *k* of elementary experiences is called a *quality class* if *k* is totally contained in each similarity circle which contains at least half of it, and if for each elementary experience *x* which does not belong to *k*, there is a similarity circle in which *k* is contained, but to which *x* does not belong (according to the derivation in §81).

Realistic state of affairs: The classes of elementary experiences which have a certain constituent in common are the largest classes which remain undivided when the similarity circles are divided through mutual partial overlapping, except for the splitting off of insignificant parts (cf. §81).

(In translating the constructional language into the realistic language, we must observe the circumstance, which has been repeatedly mentioned, that a class does not consist of its elements [§ 37]. Thus, a quality class is not the whole or the collection of the individual experiences which belong to it, but it is a quasi object which represents that which its elements [i.e., the elementary experiences] have in common.)

Fictitious operation: For each pair of similarity circles which have a considerable part (at least half of one of them) in common, A forms the intersection and the two remainder classes. The resulting classes, if they have a considerable part in common with any other similarity circle, are again divided, etc., until classes are reached which are not divided through any similarity circles in the indicated way. These are the desired quality classes. After A has thus produced the inventory list for each quality class (i.e., a list of numbers of those elementary experiences which belong to the indicated class), he then numbers the quality classes which he has found, in an arbitrary way. We who know the sense of the

basic relation, and thus also the sense of the constructed entities, know that the quality classes are the individual visual qualities, tones, fragrances, etc., but we do not as yet have a way of telling A whether a given quality class that he has formed is a tone, let alone which definite tone it represents. Eventually, we must come to the point where we can give him such information even though we do not know his inventory lists. For this is precisely the central thesis of construction theory, that each object about which a meaningful scientific statement can be made can be constructed. In the constructional language, this thesis is confirmed by the fact that we can later on convey to A the above-mentioned identifications.

The *inventory list* of the class "qual" lists the individual numbers which have been given to the quality classes. A produces the *supplemental entries* on the basis of the inventory lists of the individual quality classes by entering into the object description of each elementary experience the quality classes to which it belongs.

113. *Part Identity* (Pi)

Construction: $\mathrm{Pi} =_{\mathrm{Df}} \in | \breve{} \, \mathrm{qual} | \breve{\in}$

Paraphrase: Two elementary experiences are called part identical if there is a quality class to which both belong.

Realistic state of affairs (trivial): If there exists a quality which occurs in each of two elements, then these two elements agree in a constituent (cf. §§ 76,82).

Fictitious operation: Translation into the language of constructive operations is here and in the sequel generally no longer necessary; the previously given examples should suffice. The method remains the same; we give A a rule, on the basis of which he produces the inventory list of the new object; then he carries out the supplemental entries for the preceding objects which participate in the new object, whereby the object descriptions are more and more enriched.

114. *Similarity Between Qualities* (Sim)

Construction: $\mathrm{Sim} =_{\mathrm{Df}} \hat{a}\hat{\beta} \; \{a, \beta \in \mathrm{qual} \,.\, a \uparrow \beta \subset \mathrm{Ps}\}$

Paraphrase: Two quality classes are called *similar* if each element of one of them is part similar to each element of the other.

Realistic state of affairs: It follows from the sense of part similarity that two qualities are similar to one another (i.e., that they are in quali-

tative proximity), if and only if each experience in which one of them occurs is part similar to each experience in which the other occurs (§§77, 85).

Fictitious construction: The supplemental entries of Sim are produced. This starts the object descriptions of the individual quality classes.

Theorem: Th. 4. Sim $\in$ sym $\cap$ refl (analytic).

Paraphrase: Sim is symmetrical and reflexive.

115. *Sense Classes and Visual Sense* (sense, sight)

Construction: sense $=_{df}$ Abstr'Sim_{po}

Paraphrase: The abstraction classes of the Sim-chain are called *sense classes*.

Explanation: The construction takes place through quasi analysis (simplest form, § 73). The Sim-chain is transitive; also, according to Th. 4, symmetrical and reflexive.

In § 119, we shall translate the definition of sense back into an expression using Rs; the derivation relation of sense is given in § 121.

Realistic state of affairs: Two qualities can be connected through a series of qualities, where one quality is always similar to the next, only if they belong to the same sense modality (§ 85).

Fictitious operation: Once A has formed the inventory list of the class sense, whose elements are the sense classes, we know that one of the sense classes is that of the visual qualities; one, of the fragrances, etc., and that there is also one for the emotions (cf. §§ 76, 85); we have no way of informing A which is which. On the other hand, A is not permitted to give us the inventory lists of these individual classes. Thus our fiction makes explicit the narrow boundaries within which we must solve the problem of identifying the individual sense modalities or at least of identifying the visual sense which is basic for the further constructions.

Construction: sight $=_{df}$ $\hat{a}$ { ($\exists\lambda$) . $\lambda \in$ sense . Dnp (5, λ, *a*, Vicin' Sim)}

Paraphrase: The class sight (the visual sense) includes all those quality classes in which one sense class has the dimension number 5 relative to Sim (more precisely, relative to the neighborhood relation which is determined by Sim; cf. Camap [Logistik] § 34b).

Realistic state of affairs: The visual field is a two-dimensional order of places such that a color of the three-dimensional color solid can be correlated to each of these places. The Sim-order of the other senses has a smaller dimension number (cf. § 86).

116. *Sensations* (sen) *and the Divisions of an Elementary Experience*

Construction: sen $=_{df} \hat{Q}$ {($\exists$ x, *a*) . *a* $\in$ qual . x $\in$ *a*. Q = *x* $\downarrow$ *a*}

Paraphrase: An (ordered) pair, consisting of an elementary experience and a quality class to which the experience belongs, is called a sensation. (Concerning this expression, cf. § 93.)

Realistic state of affairs: Cf. § 93.

Construction: Simul $=_{df}$ ($\breve{D}$ \ D) $|_{/}^{\backslash}$ sen

Paraphrase: Two sen-pairs with the same referent are called *simultaneous* sensations.

Realistic state of affairs: Two individual constituents of experiences ("sensations") are simultaneous if they are constituents of the same experience (cf. § 87).

Divisions: According to earlier considerations (§93), we have to distinguish between the *individual* and *general* constituents of experiences (sen as contrasted with qual). Let us designate a class which contains the constituents of an elementary experience as its "division class"; thus we have to distinguish two types of division classes which we designate by div_1 and div_2.

Construction: $Div_1 =_{df}$Abstr'Simul

Paraphrase: The abstraction classes on the basis of Simul are called "division classes of the first type". Thus, the class of sensations of an elementary experience is such a class.

Realistic state of affairs: The sensations (in the general sense of an individual constituent of an experience) which are simultaneous with a given sensation are sensations of the same experience.

Construction: $Div_2 =_{df}$ $\hat{\lambda}\hat{x}$ {x $\in$ elex. $\lambda = \hat{a}$ (*a* $\in$ qual . x $\in$ *a*)}

$div_2 =_{df}$ D'Div_2

Paraphrase: The class λ, of those quality classes to which the elementary experience *x* belongs is called the *division class of x of the second type* (λ == Div_2'x); such a class is called a division class of the second type.

117. *Visual Field Places and Visual Field* (place, Plid, Proxpl)

Construction: Excl $=_{df}$ (Ex U l) $|_{/}^{\backslash}$ Sight

place $=_{df}$ $\hat{\chi}$ { !χ: ($\exists$ λ) . λ $\in$ Simil'Excl . $\chi = \lambda$— s' (Simil'Excl — [λ])}

Paraphrases: Excl designates (only here, and only for the sake of abbreviation) the relation extension "exclusive or identical" between

quality classes of the visual field. A class of quality classes of the visual field is called a "visual field place" or, briefly, place, if it is not empty and if it includes those elements of a similarity circle λ, of Excl which belong only to λ but not to other similarity circles of Excl.
Realistic state of affairs: Cf. § 88. (The places which are here constructed do not necessarily amount to a complete disposition of the qualities of the visual sense. According to earlier considerations, it is possible that the places of some exceptional qualities remain undetermined.)
Construction: Plid $=_{df} \in |^{\backslash}$ place $| \breve{\in}$
Paraphrase: Quality classes of the visual sense are called place identical if they belong to the same place class.
Construction: Proxpl $=_{df} (\breve{\in} \mid \text{Sim} \mid \in) |_{/}^{\backslash}$ place
Paraphrase: Place classes are called proximate places if a quality class of one of them is similar to a quality class of the other.
Realistic state of affairs: Two visual qualities are similar to one another if and only if they belong to the same or to proximate visual field places (cf. § 89).
Remark: The Proxpl-*order* is the visual field.
Theorem: Th. 5. 2 Dnhomvic Proxpl (empirical).
Paraphrase: The order of the places on the basis of Proxpl (more precisely, on the basis of the neighborhood relation which is determined through Proxpl) has the homogenous dimension number 2; that is to say, *the visual field is two dimensional*.
Fictitious operation to Th. 5: On the basis of the inventory list of Proxpl which A has produced, he can determine the dimension number of the Proxpl-order (this possibility shows very clearly that the dimension number is not a spatial property, but a property which belongs solely to the theory of relations, and that it is defined in a purely extensional way). In this way, A finds empirically that this dimension number equals 2.

118. *Colors and Color Solid* (Colidprox, Colid, color, Proxcol)
Construction: Colidprox $=_{df} \hat{a}\hat{\beta}$ {(∃χ,λ,μ). χ Proxpl λ. χ Proxpl μ.
λ Proxpl μ. $a \in \chi . \beta \in \lambda . \mu \cap S\vec{i}\, m'\alpha = \mu \cap S\vec{i}\, m'\beta$ }
Colid $=_{df}$ Colidprox$_{po}$
Paraphrase: 1. Two quality classes, α,β (of the visual sense) stand to one another in the relation of color identity in proximate places (α Colidprox β), if the place of α and the place of β are proximate places and if there is a place μ which is proximate to α and to β such that

the quality classes of μ that are similar to those of α and its quality classes that are similar to those of β are the same. 2. The Colidprox-chain is called color identity (Colid).
Realistic state of affairs: Cf. § 90.
Construction: color $=_{df}$ Abstr'Colid
Proxcol $=_{df} (\breve{\in} | \mathrm{Sim} | \in) | ^{\prime}\backslash$ color
Paraphrase: 1. The abstraction classes of Colid are called "color classes" or, briefly, colors. 2. Two colors are called proximate colors if a quality class of one of them is similar to a quality class of the other.
Remarks: The construction of Proxcol is precisely analogous to that of Proxpl (§ 117). In general, there is a certain analogy between the division of visual quality classes into places and their division into colors, and hence a correlation between the class place and the class color, between Plid and Colid, between Proxpl and Proxcol. However, the construction formulas show an analogy only for the third of these pairs of correlations, but not for the first two. This has to do with the fact that the relation Plid is derived from the class place (§ 117), while, inversely, the class color has been derived from the relation Colid. This disanalogous behavior of the two orders in the formalism of the construction goes back to the fact that the spatial order is a principle of individuation, while the color ordering is not. Formally, this shows itself in the fact that, in an experience, two different qualities may well belong to the same color, but not to the same place. It may be recalled that it was this formal difference which allowed us to carry out the constructional separation of the two orders (cf. §§ 88,91).

The Proxcol-order is the color solid (cf. § 90).
Realistic states of affairs: Cf. § 90.
Theorem: Th. 6. 3Dnhomvic Proxcol (empirical).
Paraphrase: The order of the colors on the basis of Proxcol has the homogeneous dimension number 3; that is to say, *the color solid is three dimensional*.

119. *Example of a Retranslation of a Definition and a Statement*

Construction theory contains the thesis that each scientific concept is either a class or a relation extension, which can be expressed through the basic relation(s) alone. In order to make the sense of this thesis quite clear, let us consider as an example the concept of a sense class (sense). Let us form, for this concept, an expression which (aside from logical constants) contains only the symbol "Rs" of the basic relation. To begin

with, according to the constructional definition of sense (§ 115), we have the identity:

$$\text{sense} == \text{Abstr}'\text{Sim}_{po} \qquad (1)$$

Since every definition is a rule of replacement, which allows us to replace in any context the definiendum by the definiens, we can replace in (1) Sim by its definiens (§ 114). The result is:

$$\text{sense} = \text{Abstr}'(\hat{a}\hat{\beta}\ \{a,\beta \in \text{qual}.\ a \uparrow \beta \subset \text{Ps}\})_{po} \qquad (2)$$

Here we replace qual by its definiens and then similcirc and finally also Ps. The final result is:

$$\text{sense} = \text{Abstr}'\ (\hat{a}\hat{\beta}\ \{a,\beta \in \hat{\zeta}\ ((\gamma): \gamma \in \text{Simil}'\ (\text{Rs} \cup \breve{R}\text{s} \cup \text{Rs}^0).\text{Nc}'\ (\zeta \cap \gamma)/\text{Nc}' > ½.$$
$$\supset .\zeta \subset \gamma:.(x): x\sim\in\zeta.\supset (\exists\delta).\delta \in \text{Simil}'\ (\text{Rs} \cup \breve{R}\text{s} \cup \text{Rs}^0).a \subset \delta.\ x\sim\in\delta).a \uparrow \beta \subset \text{Rs} \cup \breve{R}\text{s} \cup \text{Rs}^0\ \})(3)$$

According to this expression, sense is identical (i.e., of the same logical value) with the expression which stands to the right of the identity sign. In this expression, Rs is the only nonlogical constant (the Greek letters and x are variables; the other symbols are logical constants).

A *second thesis* of construction theory asserts that *each scientific statement is, in the final analysis, a statement about the basic relation(s)*; more precisely, each statement can be transformed into another statement which (besides logical constants) contains only the basic relations), where the logical value (although not the epistemic value) is retained. Let us clarify this thesis with the example of Th. 6 of the three dimensionality of the color solid. With the aid of the constructional definition of Proxcol, Th. 6 can be transformed, through substitution, into the sentence:

$$3\ \text{Dnhomvic}\ (\breve{\in}|\text{Sim}|\in)\ |\rangle\ \text{color} \qquad (4)$$

Through step-by-step substitutions on the basis of the definitions of color, Colid, Colidprox, Proxpl, place, Excl, sight, sense, Sim, qual, similcirc, Ps, and a formal simplification we finally obtain from (4) the following form for Th. 6; in this form, "Rs" is the only nonlogical symbol (Q, *x*, and the Greek letters are variables; the other symbols are logical constants):

$$(\exists Q, \nu).\ 3\ \text{Dnhomvic}\ (\breve{\in}|Q|\in)\ |\rangle\ \text{Abstr}'\{\hat{a}\hat{\beta}\ ((\exists\chi,\lambda,\mu).\ \chi \breve{\in} |Q| \in\lambda.\ \chi \breve{\in} |Q| \in\mu.\ \lambda \breve{\in} |Q|$$
$$\in\mu.\ \chi,\lambda,\mu \in \hat{\xi}\ \{\exists\,!\,\xi: (\exists\rho).\rho\in \nu.\xi=\rho\ \text{---}\mathbf{s}'(\nu\text{---}[\rho])\}.a \in \chi.$$
$$\beta\in\lambda.\ \mu \cap \vec{Q}'a = \mu \cap \vec{Q}'\beta\ )\}_{po}.\nu=\text{Simil}'\ ((\text{Ex} \cup \mathbf{I})\ |\rangle\ \hat{a}\ \{(\exists\mu).\mu\in\text{Abstr}'Q_{po}.\text{Dnp}$$
$$(5,\mu,a,\text{Vicin}'\ Q)\}).Q= \hat{a}\hat{\beta}\ (a,\beta \in \hat{\zeta}\ \{(\gamma): \gamma \in \text{Simil}'(\text{Rs} \cup \breve{R}\text{s} \cup \text{Rs}^0).\text{Nc}'(\zeta \cap \gamma)/\text{Nc}'\ \zeta$$
$$> ½.\supset .\ \zeta\subset\gamma:.(x): x\sim\in\ \zeta.\ \supset .(\exists\delta).\delta\in\ \text{Simil}'(\text{Rs} \cup \breve{R}\text{s} \cup \text{Rs}^0).\ a\subset\delta.x\sim\in\delta\}.a\uparrow\beta \subset$$
$$\text{Rs} \cup \breve{R}\text{s} \cup \text{Rs}^0) \quad (5)$$

To facilitate understanding:

$$\nu = \text{Simil'Excl}, Q == \text{Sim}$$

We can see that the expression which uses only the basic relation is already very complicated, even for a statement on a relatively low level. This complication increases very considerably for the higher levels, so that finally a retranslation is practically out of the question. Perhaps this is one of the reasons that the thesis of the reducibility of all objects and statements to one or a few basic relations does not seem very plausible at first sight. The objection that the objects of cognition form an extremely rich manifold is perfectly justified. But it does not follow from this objection that it is impossible to found this manifold on a narrow basis, but only that the structure of the system must be sufficiently complicated in order to be able to represent that manifold through the multiplicity of constructional forms in spite of the simplicity of the building stones.

The above translations were meant only as illustrative examples. Precise form in every detail is here not of the essence. Thus, the subsequent considerations are independent of the assumed number (one) and kind (Rs) of the basic relations. The example which we have carried out above shows that the empirical statements concerning the three-dimensionality of the color solid can be formulated, with our choice of basis, as a statement about *a certain, purely formal, though very complicated, property of the basic relation* Rs. In the same way, *all empirical statements of science can be expressed as statements about purely formal properties of the basic relation(s)*. This holds generally, no matter which basic relations and no matter what constructional system may be chosen.

120. *The Preliminary Time Order*

Constructional remark: We can envisage Rs_{po} as relation (extension) of a preliminary time order, which is not yet without gaps and not yet in strict serial order. We shall not introduce a new symbol for this relation.
Paraphrase: An elementary experience is called *earlier in time* than another in the sense of the preliminary time order, if an Rs'chain exists between them.
Realistic state of affairs: Cf. § 87.
Remark: The relation of complete temporal order must be a sequential relation (i.e., not only, like Rs_{po}, transitive and irreflexive, hence assymmetrical, but also connected) (§11). Rs_{po} is not connected: there will be pairs of elementary experiences, between which no Rs-chain exists in

either direction. A complete temporal sequence can be constructed only later with the aid of the regularities of the processes of the outside world.

121. *The Derivation Relation* [99] *of an Object*

According to the central thesis of construction theory, it is in principle possible to fit each scientific object (or concept) into the constructional system. Now, every object of the constructional system can be represented by an expression which contains the basic relation as its only nonlogical constant (§ 119). We obtain the logical form of this expression by replacing the symbol "Rs" of the basic relation by a variable, for example, R. The relation of this expression to R, we call the *derivation relation* of the object in question, since it is also the relation which expresses how the object is derived from the basic relation.

If the object in question is constructed in the system as a class, for example, *c*, then there is an expression for *c* which contains only Rs. Let us abbreviate this expression as $\phi(Rs)$, so that $c = \phi(Rs)$; its logical form is then $\phi(R)$. The derivation relation of c is then the relation between $\phi(R)$ and R; hence (since $\phi(R)$ is a variable class): $\hat{a}\hat{R}\ \{a = \phi(R)\}$.

If the object has been constructed as a relation extension, for example, G, then there is an expression $\psi(Rs)$ such that $G = \psi(Rs)$. In this case, the derivation relation of G is: $\hat{Q}\hat{R}\ \{Q = \psi(R)\}$.

In both of the given expressions for the derivation relations, no non-logical constants occur. Hence, we see that the *derivation relation of any object is a purely logical constant*.

> EXAMPLE. For simplicity's sake, let us consider an object of a lower level, namely, the class of the sense modalities (sense, § 115). The expression for the class *sense*, which contains only Rs, has been given earlier (§119 [3]). From it results the following definition for the derivation relation of sense, which we designate by Der(sense).

$$\text{Der(sense)} =_{df} \hat{\lambda}\hat{R}\ \{\lambda = \text{Abstr'}\ (\hat{a}\hat{\beta}\ \{a,\beta \in \hat{\zeta}\ ((\gamma) : \gamma \in \text{Simil'}\ (\text{Rs} \cup \breve{R}\,\text{s} \cup \text{Rs}^0).$$
$$\text{Nc'}(\zeta \cap \gamma)/\text{Nc'}\ \zeta > \tfrac{1}{2}. \supset . \zeta \subset \gamma :. (x): x \sim\in \zeta. \supset .(\delta).\delta \in \text{Simil'}(\text{Rs} \cup \breve{R}\,\text{s} \cup \text{Rs}^0).$$
$$a \subset \delta.x \sim\in \delta\}.a\uparrow\beta \subset \text{Rs} \cup \breve{R}\,\text{s} \cup \text{Rs}^0\})_{po}\}$$

It is a familiar fact of the theory of axiomatics that an axiomatic system (for example, a geometric system) can initially be constructed as a purely logical system, which is subsequently transformed into an

99 Ableitungsrelation

empirical theory [100] (for example, a physical geometry) by replacing the primitive concepts of the axiomatic system with empirical concepts.[101] In precisely analogous fashion, the constructional system can initially be formulated as a purely logical system, where each construction is replaced by the corresponding derivation relation. Through the substitution of the empirical concept Rs (as the only basic concept of the system) in place of the variable R, this purely logical system can be transformed into the actual constructional system of all empirical concepts.

122. *The Stated Constructions are Merely Examples*

At this place, we shall cease to exhibit the constructions in their explicit form, namely, as constructional definitions in the language of logistics and (in part) translations into the other languages.

In concluding the first part of the constructional system, let it be emphasized again that the determination of the content of the stated constructions does not belong to the thesis of the present treatise. This thesis merely asserts the possibility, in general, of a constructional system and especially of a constructional system of the same form as we have used here; furthermore, the thesis asserts the applicability and fruitfulness of the indicated method. After the exhibition of the constructional system, we shall give a more precise statement of these assertions (§ 156). The only purpose of these constructions was to show the aim of construction theory more clearly and to illustrate the method. The detailed execution depends upon the results of the empirical sciences. If the assertions which lie at the basis of indicated constructions are not scientifically tenable, then we must replace them by those findings by which they are replaced in the sciences; these must then be formulated in the constructional language and must be fitted into the constructional system. None of this will in any way impair the possibility, in principle, of translating all scientific statements into statements within a constructional system.

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100 Realtheorie
101 Realbegriffe

CHAPTER
B

THE INTERMEDIATE LEVELS: PHYSICAL OBJECTS

123. *About the Formulation of the Further Constructional Levels*

The further constructional levels we shall put forth not in the strict symbolic form of logistics, but merely in a loose paraphrase. We shall also occasionally omit constructions if they easily result from the context; thus, we shall state only the most important steps.

The following constructions follow the route which was indicated in § 94. To begin with, we shall discuss the method of constructing three-dimensional, *physical space* (§ 124), and then we shall carry out this construction as well as the construction of the visual things which depend upon it (§§ 125-128). For the constructional system, the most important visual thing is *my body* (§ 129). It will help us to give definite descriptions of the various senses, so that with its aid we can supplement the domain of the autopsychological (§ § 130-132). Then we shall describe the construction of the *world of perception* (§ § 133-135) as well as the construction of the *world of physics* (§ 136), which is quite different from the former. Finally, we shall discuss some physical objects (persons, the expression relation; § 137 f.), which are required for the subsequent construction of the heteropsychological objects.

124. *Various Possibilities for the Construction of Physical Space*

The following constructional step, namely, the transition from the two-dimensional order of the visual field to the three-dimensional order of the space of visual things is one of the most important steps in the constructional system. Various attempts were made to solve the problem of executing this construction; we shall here mention the most important ones and shall give reasons why we deviate from them.

REFERENCES. The only older work which gives a detailed description of this problem is that of Kauffmann [Imman.] 9-31; it is not necessary to concern ourselves with it here. The first to make a more precise investigation concerning the derivation of the three-dimensional space order (the "ontogram") from the two-dimensional space order (the "phonogram") was Gerhards [Aussenwelthyp.]; he was also the first to employ mathematical techniques. Our derivation differs from that of Gerhards in the following way: we do not presuppose, and construct from individual aspects, an unchangeable outside world, but construct at once the entire four-dimensional space-time world which comprises all events.

Russell ([External W.], [Const. Matter], [Sense-Data]) constructs visual things as classes of their aspects, in fact, not merely as classes of the real, experienced aspects, but as classes of *possible aspects*. This method is tenable if, as with Russell, these aspects are taken as basic elements. We have begun our structure several levels further down; thus, in order to be able to follow the same route as Russell, we will first of all have to construct the aspects from our basic elements, namely, the elementary experiences. However, this is probably impossible for aspects which "have not been seen", or at least, it would offer very considerable difficulties. Hence, it is more advantageous for us to use a different method, namely, to construct the entire visual world at once, rather than the individual visual things. Russell's method has the advantage of greater logical simplicity. The advantage of our method lies, first of all, in the fact that we have used the autopsychological basis, which Russell himself considers a desirable goal (cf. § 64), secondly, in the circumstance that unperceived points and states of a thing are, in our system, not inferred, but constructed. This procedure, too, Russell considers desirable. (Cf. the motto preceding §1; §3; [Sense-Data] 157 f., 159). It must be admitted, however, that our kind of construction of physical points and of the physical space is by no means a fully satisfactory solution.

Reasons similar to those just mentioned have induced us to avoid

the procedure which Whitehead ([Space], [Nat. Knowledge], [Nature]) has followed. Whitehead constructs space and time only *after* the things, as the structure of the relations which become apparent in the behavior of things to one another. He emphasizes especially that we experience, not spatial or temporal points, but extensions; from these, we must construct the points according to the method of "extensive abstraction". Unquestionably, this procedure has great advantages in method and content; however, we cannot follow it since the problem of constructing the three-dimensional things or four-dimensional events from the position relations in the sensory field, especially the visual field, offer unsurmounted difficulties. (Whitehead fails to indicate a solution to this problem.)

For the indicated problem, cf. also the discussion of Poincaré ([Wiss.], [Wert], [Letzte Ged.]) about the three dimensionality of space; furthermore, cf. Becker ([Georn.] 446ff.) about the "constitutive steps of spatiality", following some of Husserl's ideas; also, the discussions of Carnap [Dreidimens.] and Jacoby [Ontol.] lOOff. (The last two hold that the increase of the dimension number from two to three in the constructional step under discussion has the purpose of permitting the construction of causal regularity.)

The indicated investigations are important, since they (in contrast to some other systems) recognize and discuss the problem of the transition of the two-dimensional to the three-dimensional order. However, they are all mistaken when they assume that the two dimensionality of the visual field order must be envisaged as given; this holds also for my own [Dreidimens.]. Construction theory has shown us that this two-dimensional order, just as the three-dimensional one, must be considered derived; thus, the problem of its construction is posed. An attempt at solving this problem has been discussed in § 89 and has been put forth as part of the constructional system in §117 (cf. also the other possibilities of a solution discussed in §92).

It is still a question whether it is appropriate, or perhaps even necessary, to construct visual space before the construction of the visual things and their physical space. Psychologically, the three-dimensional, metric, non-Euclidean (namely, spherical), visual space forms an intermediate step between the two-dimensional order of the visual field and the three-dimensional Euclidean order of the outside world. However, it is probably appropriate for the constructional system to omit this step. For the introduction of this step does not bring about a formal simplification of construction, and the objects which are found on this intermediate level cannot be described as "real". According to our earlier considerations, such a simplifying deviation from the psychological order of the process

of cognition is permissible for the constructional system (cf. § 100). (Gerhards and Russell [see above], in their construction of the three-dimensional space of visual things, likewise omit the intermediate level of visual space.)

125. *The Space-Time World*

The points of n-dimensional, real-number space, we call *world points*, they are n-tuples of numbers which serve as subjects [102] of the following assignment.[103]

To some world points, we shall assign colors (later on, also, quality classes or classes of quality classes from other sense modalities); that is to say, we shall establish a one-many relation between world points and colors such that requirements 1-12 (§ 126) are fulfilled as far as possible.

The dimension number n is not constructionally determined. We only lay down that n should be the smallest number for which the desired assignment can be carried out. From requirements 3 and 5, and the empirical theorem (Th. 5 (§ 117) about the two dimensionality of the visual field, it follows that: $n \geq 3$; hence the dimension number of space (n—1) is at least equal to 2. From the (in realistic language) disappearance and reappearance of things in the visual field, it follows that $n \geq 4$; hence, the dimension number of space is at least 3. Finally, it can be ascertained empirically that the construction can be executed for $n = 4$; hence, the dimension number of the order of world points is to be fixed at 4, that of space at 3.

The *n* numbers of each world point form an ordered set; they are called its coördinates; the first number is called its time coördinate; the other n — 1 numbers, its space coördinates. World points with the same time coördinates are called *simultaneous* (absolute time system). A class of world points which are all simultaneous with one another (i.e., a cross section where t is constant) is called a *space class*.

Assume that a Euclidean metric on the basis of a Pythagorean determination of distances holds in the n-dimensional number space. Let the expressions "straight line", "surface", "congruent", "angle", etc., be defined in the customary way through relations of numbers. We can then use the language of geometry since it is briefer and more intuitive. It must be noted, however, that what we have in mind are always arith-

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102 Unterlage
103 Zuschreibung

metical relations between numbers, namely, between the coördinates of the world points. For, space (not in the abstract-mathematical, but in the actual, phenomenal sense), spatial position, spatial configurations, have neither been introduced as basic entities, nor have they been defined; we are only just now constructing these objects. In the constructional system, the peculiar quality of spatiality, even though it is such an essential feature of our experience of the outside world, no more occurs as a quality than do the other qualities, namely, colors, tones, emotions, etc. For the constructional system concerns itself only with the structural and, in the case of space, only with the formal properties of this structure. In doing so, the constructional system does not lose a recognizable (that is, conceptually apprehensible) object, for, according to the thesis of construction theory, the nonstructural cannot become the object of a scientific statement. The space which we here construct, even though we treat it only structurally, must nevertheless be well distinguished from the so-called "space" of pure abstract geometry, which was constructed before the introduction of the basic relation (§ 107). We presuppose and apply this abstract space as already constructed in order to be able to construct now space in the actual sense of the word, namely, *physical space*. The former, strictly speaking unspatial, order [104] is called "space" (or "abstract space") only because of its applicability to physical space (cf. also § 25).

126. *The Assignment of Colors to World Points*

The assignment of colors to the world points and the subsequent constructions which are connected with this are carried out in such a way that the following desiderata are satisfied as far as possible. They cannot be precisely satisfied because of (in realistic language) hallucinations, disturbances of the eye and the intervening medium, deformations and disintegration of bodies, etc. In §127, we shall indicate in realistic language the empirical states of affairs on which these individual desiderata or rules of construction rest.

1. There is a series of prominent world points which we call the points of view.[105] They form a continuous curve in such a way that each of the n—1 space coordinates is a single-valued, continuous function of the time coördinate.

2. The straight lines which proceed from a given point of view and

104 Ordnungsgefüge
105 Ausblickpunkt

which form, with the negative direction of time, the angle γ, we call the *lines of view*.

3. γ is constant and is very nearly equal to a right angle. Thus, if a point of view has the time coordinate t_1, then we can take as its lines of view the straight lines of its space class (cross section $t = t_1$) which proceed from this point.

4. A one-to-one correspondence is established between elementary experiences and some of the points of view in such a way that an experience which is later in time (Rspo, cf. § 120) corresponds to a point of view with a larger time coordinate.

5. If possible, we assign to each visual sensation (§ 116) of an elementary experience a line of view of the corresponding point of view in such a way that (a) to sensations with proximate visual field places (Proxpl, § 117) we assign lines of view which form only a small angle with one another, and vice versa; and that (b) the pairs of lines of view which are assigned to the visual sensations of two definite places in different elementary experiences all form the same angle, and conversely.

6. The color of a visual sensation is assigned to a world point of the corresponding line of view. Points which are occupied in this way are called "world points seen from the given point of view" or, in short, seen color spots. For the choice of position of these points on their lines of view, cf. II.

7. Furthermore, taking into consideration the requirements 8-10, we shall assign one color each to certain other world points. These world points are called unseen color spots. Among the points of each of the bundles of lines of view (according to 3, this means with very near approximation: among the points of each of the space classes), they form at most a two-dimensional area, usually connected surfaces.

8. An unseen color spot may not be located on a line of view between a point of view and a seen color spot.

9. The assignment of colors to unseen color spots according to 7 is carried out in such a way that, as far as possible, each seen color spot belongs to a *world line*. A world line is a continuous curve or curve segment such that precisely one world point belongs to each value of the time coördinate within a given interval; the world point may be either a seen or an unseen color spot. Within the interval, each space coördinate of the segment is a single-valued, continuous function of the time coordinate.

10. According to 7, we have to assign a color to the unseen color spots. Taking into account the colors of seen color spots, we make a pre-

liminary choice of these colors in such a way that the color of the points of a world line, considered as a function of time, shows a rate of change which is as small as possible, i.e., if possible, remains constant.

11. Aside from the requirements of number 8, the following requirements determine the position of world lines, which in turn determine the choice of position of the seen as well as the unseen color spots (according to 6) which lie upon their lines of view:

a. The world lines should have as little curvature as possible;

b. The angles between world lines and the direction of time should be as small as possible;

c. Two world lines which run through one or more pairs of proximate seen color spots should, if possible, also be proximate elsewhere, especially in the time intervals;

d. A set of world lines which form a spatially connected parallel bundle during one or several time intervals should, if possible, do the same at other times especially in the intervals between these intervals.

12. We shall later on supplement and correct the assignment; cf. §135 (supplementation of partially observed things or events through analogy) and § 144 (utilization of the observations of others). Nevertheless, the above-indicated requirements should always be fulfilled to the largest possible extent.

127. *Formulation of the Above Points in Realistic Language*

To facilitate understanding, let us here indicate, in realistic language, the states of affairs which lie at the bottom of the indicated requirements which determine the assignment of colors to the world points.

1. The particular point in the interior of the head from which the world seems to be seen has as its world line a continuous curve in the space-time world. (The construction does not have to concern itself with binocular vision, since the determination of depth has a sufficient and more precise foundation elsewhere.)

2. The optical medium between the eye and the seen things can generally be considered homogeneous. Under this assumption, the light rays which impinge upon the eye form straight lines which enclose the angle arc tg c with the negative direction of time (*c* designates the speed of light).

3. The speed of light, c, is constant and very large. Thus, the light rays are very nearly the straight lines of a momentary space.

4. Each visual perception is based upon an act of seeing from one of the points of view.

5. a. Visual field places that lie next to one another always depict only points of the outside world whose lines of view form a small angle at the eye;

b. A given pair of visual field places always has the same visual angle.

6. We conclude, from a visual sensation, that a point of the outside world which lies on the corresponding line of view has the color of the visual sensation.

7. At any given time, there are many points of the outside world which have a color, but are not seen at that time. "These visible, but unseen (by me), world points are, for the most part, points on the surfaces of bodies.

8. A visible, colored point of the outside world which is not seen by me at a given time cannot at that time be located in front of a seen point.

9. We must assume, if there are no reasons to the contrary, that a point of the outside world which has once been seen existed previously and will exist afterward. Its locations form a continuous world line.

10. We shall assume, if there is no reason to the contrary, that each point of the outside world retains at the other times the same or as similar as possible a color as that with which it was seen at one time.

11. Assumptions concerning the motion of points, especially during times when they are not seen, are to be made according to the following rules:

a. Changes of velocity or direction of motion are not assumed to be larger than is required by the observation; thus, if there are no reasons to the contrary, we shall assume the inertial motion (constancy of direction and velocity);

b. Velocity is not assumed to be larger than is required by the observation; thus, if there are no reasons to the contrary, we shall assume rest;

c. If we once, or repeatedly, observe two points to be next to one another, we shall assume that they are next to one another also when they are not seen;

d. If observations show several points to move as a connected surface, then we assume the same behavior while no observations are being made.

12. Inferences from the observed to the unobserved are at first scarce, later on more abundant, for example, through re-cognition of a partially

seen thing (§ 135), through an inference On the basis of a natural law (§ 135), or with the aid of observations of others (§ 144).

128. *The Visual Things*

If, in a bundle of world lines which have been constructed according to the given requirements (§§ 126, 127), the proximity relations remain at least approximately the same during a protracted stretch (of time), then the class of the corresponding world points is called a *visual thing*. If, in addition to the proximity relations, the metric relations also remain constant, then the thing is called *rigid*. The intersection of a visual thing with a space-class is called a *state* of the thing. (It is possible that it might be more appropriate to construct first the states-of-things and only afterward the things as classes of corresponding "genidentical" states-of-things; we shall not, at this point, investigate this question.)

Two world points of the same world line, we call *genidentical*, likewise, two states of the same thing.

The class of world points of a thing which are seen from a given point of view is called the "seen part" of the thing in the elementary experience to which the point of view corresponds. Since a point of view and the points which are seen from it are very nearly simultaneous, we can, in first approximation, take the seen part of a thing as a subclass of a state of the thing.

The class of those visual sensations of an elementary experience which correspond to the seen points of a given thing are called the *aspect* of the thing in that experience. Accordingly, the "seen parts" of the thing, that is, roughly speaking, parts of states of the thing, corresponds to aspects of the thing.

REFERENCES. Concerning the concept of *genidentity* (this term stems from Lewin), cf. Lewin [Zeiti.], Russell [External W.] 108 ff. Cf. also § 159 below, especially with respect to the necessary distinction between genidentity and identity.

l29. *"MyBody"*

There is a certain visual thing B which fulfills the conditions listed below. These conditions and even an appropriate part of them form a constructional definite description of it; this visual thing is called *my body*.

1. Each state of B is very close to the corresponding point of view.
2. B, as all other visual things, forms an open surface when seen from

a point of view. However, in contrast to all other visual things, every total state of B also forms an open surface.

3. The world lines of B or connected areas of them are correlated with the qualities (or classes of qualities) of a certain sense class in such a way that, upon contact with the world line of another visual thing or of another part of B, another quality, called a tactile quality, occurs simultaneously in the experience in question; the so-constructed sense class is called the tactile sense.

4. In a similar way, certain motions of B are correlated with the qualities of another sense class; the sense class so described is called *kinesthetic sense*.

5. On the basis of B, it will later on be possible to give a constructional definition of the remaining sense classes (§ 131).

The given constructional determinations are founded upon the following empirical states of affairs (in realistic language):

1. My body is always in the vicinity of my eye.

2. The surface of a body can never all be seen at the same time; thus, any part of the surface of a body which is seen at one time can never be a closed surface. However, in the case of some bodies, the entire surface is visible; thus the visible surface is an open surface, since some parts of its surface, for example, the eye and the back, are not visible.

3. The places of the surface of my body correspond to the qualities (or location signs) of the tactile sense in such a way that we experience a tactile sensation of a certain quality if a corresponding part of the skin is touched by another body or by another part of my body.

4. The qualities of kinesthetic sensations correspond to certain types of motions of my body.

5. The other senses are connected in a definite way with certain parts of my body, namely, with the sense organs.

REFERENCES. Because of its special epistemological significance, the construction of "my body" has been investigated several times, for example, by Kauffmann[imman. 39-54, Ziehen [Erkth.] 58,277, 445 ff., Driesch [Ordnungsl.] 354 ff.

130. *The Tactile-Visual Things*

Earlier, we have assigned colors, i.e., classes of classes of visual qualities to some world points. We shall now do the same in a somewhat different

way with quality classes of the tactile sense, or rather, with classes of such classes, namely those which coincide in their location sign. Earlier, we discussed seen and unseen color spots; in like fashion, we now distinguish touch points. The position of the touched touch points can be determined more precisely than those of the seen color spots. For these touch points touch the corresponding part of my body; hence, if we assume the spatial position of my body as already determined, we do not have to determine any distance or dimension of depth in this case. In most cases, the touch points are also color spots, either seen or unseen. This allows us in many cases to determine more precisely the position of the world lines of the color spots. Sometimes the touch points are not color spots; in these cases, they determine new world lines. In some cases, it takes these world lines of mere touch points, together with the world lines of color spots, in order to form the closed surface of a tactile-visual thing. For example, this is the case for the most important tactile-visual thing, namely, for my body. A large part of the surface of my body consists of world lines to which no color spots, but only touch points, correspond. Thus, my body becomes a completely closed thing only by taking into account the qualities of the tactile sense.

REFERENCES. The problem of assigning tactile qualities to world points to which only visual qualities (colors) were originally assigned and, furthermore, the assignment of still other sensory qualities (§ 133) can also be formulated as the problem of the mutual correlation of the various "sense spaces". This problem is discussed by Poincaré [Wert], Schlick [Raum und Zeit] 95 ff. (Method of Coincidences) and Jacoby [Ontol.].

131. *Definite Description of the Remaining Senses*

After my body has been constructed as a complete thing, namely, as a tactile-visual thing, we can, if necessary, give definite descriptions of various of its parts according to their shape or mutual position, since all spatial shape and position relations can be expressed with the aid of the already constructed space coördinates. Thus, the sense organs, which, for subsequent constructions, are the most important parts of my body, can be constructionally described. The events taking place in these organs are correlated in a certain way with certain senses. This enables us to give definite descriptions of the individual senses. For example, after spatial determinations have enabled us to distinguish ear, nose, tongue, etc., from the other parts of the body, hearing, smelling, tasting, etc., can

be characterized, for example, by the fact that the quality classes of the sense classes do not, as a rule, occur if the corresponding organ is blocked off from its surroundings in a certain way.

In the case of the senses of pain, warmth, and cold, the organ, namely, the skin, coincides with that of the tactile sense of which we have given a definite description above (§ 129). The constructional definite description of these senses is possible in various ways, for example, through correlation with the stimuli in question. The qualities of the sense of pain frequently coincide with certain qualities of the tactile sense (namely, those of great intensity). The senses of warmth and cold, for example, are characterized by the fact that, under certain conditions, we frequently run through a sequence of qualities of one of them, and afterward through a sequence of qualities of the other; it is also true of them that most qualities of the one sense exclude most qualities of the other for the same part of the organ.

Thus, in one way or another, we will finally be able to distinguish, or construct, all the individual sense classes. As we have mentioned earlier (§§76, 85), we count among the sense classes also the domain of emotions. According to the explanation of the construction of sense classes which we have given above (§85), it also holds that, if there are psychological objects (for example, volitions) outside of, and irreducible to, sensations and emotions, then the various types of such entities each form one sense class. Definite descriptions of these further sense classes could be given by correlating them with other sense classes (it holds, for example, for volitions, if they exist as a special kind of entity, that they could be correlated with kinesthetic sensations), or by correlating them with processes of the body (for example, correlation between emotions and expressive motions).

After definite descriptions of the individual senses have been given, it is possible to construct the various components of the qualities which are represented in the quality classes. By a "component" we understand, for example, pitch of a tone, loudness of a tone, timbre; hue, saturation, brightness; generally: *quality* (*in the narrower sense*), with several of the senses also *intensity*, and, in the case of the senses of the skin, the *location sign*; further, the (three?) dimensions of emotions, etc. The construction of these components, as classes of quality classes of the sense modality in question, becomes possible usually through a correlation with those overt processes to which certain values or certain changes of the individual components frequently run parallel. Given the constructions which we have already stated, such overt processes can, to a large extent,

already be constructionally formulated; further possibilities arise after the construction of the perceptual things, which is given below (§ 134).

132. *The Domain of the Autopsychological*

Earlier, we divided the elementary experiences into individual constituents, namely sensations, and also into general constituents, namely qualities (§§ 93, 116). In the constructions given so far, these constituents have been divided into main areas (sense classes) and have been analyzed into components (especially qualities in the narrower sense, intensity, location sign). Within their main areas, they have been assigned a qualitative and in part also a spatial order. Initially, the elementary experiences were brought into a preliminary time order (Rs_{po}, § 120); then, with the aid of the time coördinate of the point of view in the visual world (§ 126), they were placed into a complete time sequence.

The thus-ordered elementary experiences themselves, their constituents and components, and the more complex entities which are to be constructed from these, form the domain of objects of which I am conscious, or *my consciousness*. This domain forms the foundation of the domain of the *autopsychological*. The latter results, if we introduce, in addition, the "unconscious" objects. The construction of unconscious objects on the basis of conscious objects is analogous to that of unseen color spots on the basis of seen color spots (§ 126). There we made a certain assignment to world points, i.e., to coördinate quadruples; here we make an assignment only to time points, i.e., to the individual values of the time coördinate. Through the earlier construction of the seen, namely, through the mediation of the points of view, elementary experiences are assigned to certain time points. Now we assign quality classes, as well as components of qualities and more complex structures formed from them, to intermediate time points as well, even though no point of view and no elementary experience corresponds to them. The methodological tenets of construction theory require that all of these "unconscious" entities should be constructed from previously constructed, i.e., "conscious" objects. It is possible, however, that the unconscious entities are formed from the constituents of experiences and their components in a different way from the conscious entities.

The construction of unconscious objects has the following purpose: with their aid we can construct the domain of autopsychological objects as a domain in which a more thoroughgoing regularity of events holds than in the subdomain of the conscious. The construction form has a

certain resemblance to that of the physical world, especially to the procedure of supplementation through analogy, which we shall discuss below (§135). In both cases, there are tendencies toward preserving state identity [106] and process identity [107] (thus, as it were, a psychological category of substance and a psychological category of causality). There is, however, a remarkable feature of the domain of psychological objects in which it differs from the physical world and especially the world of physical science: in the former case, thoroughgoing regularity can be obtained neither completely nor even in asymptotic approximation. Certain events (namely perceptions) occur always spontaneously and are never the result of preceding ones.

We cannot here give a detailed description of the constructional object forms. The construction (or cognitive synthesis) of the physical world is very nearly completed in prescientific thought. On the other hand, the construction of the autopsychological domain—setting aside certain insignificant beginnings—takes place only in science, indeed, in a science which stands in a very early state of development, namely psychology. Thus, it is understandable that the construction is far from complete. In this science, there is no unanimity concerning the principles which it is to follow. As concerns the majority of constructions, namely, the completion of the context through introduction of the unconscious, there is not even unanimity about the question of whether this supplementation is to be carried out at all, whether it is appropriate and permissible. The question of appropriateness must be decided by psychological research itself and will probably be decided in the near future. On the other hand, the much-debated question concerning the methodological (logical or epistemological) permissibility of the construction of the unconscious must, on the basis of construction theory, certainly be answered in the affirmative. For, the construction of the unconscious is completely analogous to the construction of unseen color spots from seen color spots; yet the permissibility of the latter construction is never denied or even questioned. Also, on the basis of this analogy, one can easily see that the construction of such supplemented domains, which contain among other things also objects which do not immediately occur in experiences, does not consist in anything but an appropriate reorganization of the objects which occur immediately. But perhaps the opposition to the concept of unconscious psychological events is directed less toward the postulation of such objects than against the assertion of their reality. However, even

106 Zustandsgleichheit
107 Ablaufsgleichheit

this objection cannot very well be maintained in view of the analogy with the unseen color spots and all the unperceived points of the perceptual world. (Later on, we shall concern ourselves more closely with the problem of reality, § 170 ff.)

We speak of "physical things" and their "states". In a similar way, it is customary to envisage the autopsychological entities which correspond to an individual time point—be it an elementary experience with its (quasi) constituents, or an experience supplemented by subconscious entities, or subconscious entities alone—as "states" of a persisting bearer, of a psychological thing, as it were. From the analogy of this cognitive synthesis to that of the physical things, it follows that this bearer, which we do not commonly call "psychological thing", but *the self or my mind*, must be constructed as *a class of autopsychological states*. It is of especial importance in this connection to keep in mind that a class is not the collection of its elements (§ 37), but a quasi object which allows us to make statements about that which the elements have in common. The obvious objection to this constructional definition is unfounded as long as we keep this in mind. The constructional definition is to reflect nothing but the structural, the ordered, in the self, which alone can be rationally apprehended. On the other hand, the question whether, at the bottom of all autopsychological objects, there lies the "self" as a final unresolvable unity, is not a question of order, but a question of essence; thus, to pose and answer this question is not the task of the constructional system, but of metaphysics (cf. §163).

133. *The Assignment of Other Sense Qualities*

So far, we have assigned only the qualities of the visual sense and of the tactile sense to certain world points (§§ 126, 130). Since individual descriptions of the remaining senses are now also available (§ 131), we can proceed to assign their qualities or classes of their qualities to world points. Taking into account the cognitive synthesis as it actually occurs, the constructional system will not undertake this assignment with all qualities, but only with those where the assignment can be carried out in an appropriate way. This means that, for example, the assignment to individual world points of a (visual) world line does not result in too many changes of the assigned qualities in the course of time. For example, for the qualities of the sense of taste, an assignment is possible; if we assign the quality "sweet" to a certain state of a certain piece of sugar, then the assignment to "tasted points" can be extended to "un-

tasted points" of the world lines (in analogy to the seen and unseen points, § 126). This procedure will not often lead to contradictions through the assignment of different taste qualities to points of the same world line. An assignment for the qualities of the olfactory sense is similarly successful. In the case of the auditory sense, the assignment is not quite so simple. If we have once heard a tone in a thing, then we cannot simply continue to assign this tone to it permanently, without arriving at frequent contradictions. The qualities of certain other senses, for example, the sense of balance, the kinesthetic sense, the sensations in organs, can be assigned to certain world lines or bundles of world lines, i.e., to visual things, only with great difficulty or perhaps not at all.

However, there is no clear boundary line between assignable and non-assignable sense qualities. Let us consider, for example, the emotions and perhaps also the volitions. (We consider the volitions as an independent quality domain, i.e., as a "sense" only for the sake of argument, without wishing to prejudge the necessity, or even possibility, of such a step; cf. § 85.) We do not frequently assign qualities of emotions or volitions as properties to things in the outside world. This is due to the scientific orientation of our thinking, which affects us in this way, even outside of science, in daily life. We must assume, however, that to decline this assignment is only the result of a process of abstraction and does not hold from the outset. In the uncritical conception of a child, the apple does not only taste "sourish", but also "delicious" or even "like more". This seems to mean that, not only a taste quality, but also an emotion quality and even a volition quality is assigned to it. In a similar way, a woods is "melancholy", a letter "painful", a dress "arrogant". (It must be carefully noted that these objects are not meant as subjects on the basis of empathy, but as objects with the properties in question.) It must be admitted that these assignments are completely justified, for, just as we may call sugar "sweet", since it produces a taste sensation of an appropriate quality, a melody may be called "gay", a letter "painful", an act "outrageous", since these objects produce the appropriate emotions. Furthermore, an apple looks "begging for a bite", a face looks "pushing for a punch", a noise is "to run away from", since these objects cause volitions of the appropriate kind. The assignment of qualities of emotion and volition is generally dropped as conceptual thinking develops. The reason for this perhaps does not lie so much in pronounced temporal variations of these qualities in the same thing—for these variations are here frequently less pronounced than they are, for example, with the sense of warmth, the sense of cold, and the olfactory sense,

rather, these assignments are given up because of contradictions which result later on (when the intersubjective world is constructed) between the assignments which are made by the various subjects. This would seem to justify the assumption that emotions (and volitions, if they are an independent domain) actually stand on the same level as sensations (in the narrower, customary sense). Nevertheless, they are not included among the qualities which are assigned to the outside world; they are envisaged as belonging in a certain way to the "inward" man. The only reason for this seems to be that these qualities, even if assigned to the same object, show a higher degree of variation between several subjects than the sensations in the narrower sense. However, the rejection of these qualities for the construction of perceptual things by no means holds throughout; above, we have mentioned the thinking of the child, and similar remarks can frequently be made about the world of poetry.

That we are here concerned only with differences in degree becomes obvious through the fact that, in the course of scientific development, the qualities of taste and of odor are eventually no longer assigned, and the same holds finally even for the qualities of the tactile and the visual sense. This rejection is a necessary consequence of the insight that the assignment, even of the qualities of these sense modalities varies from subject to subject and thus cannot be carried out in a unique and consistent way. In other words, the conceptual formation (and thus also the construction which follows it) of the perceptual world has only provisional validity. In the progress of knowledge (and of construction) it must give way to the strictly unambiguous but completely quality-free world of physics (cf. § 136.)

134. *Perceptual Things*

Almost without exception, it is points of the tactile-visual things to which the qualities of the remaining senses are assigned in the indicated way. After this assignment we call these things *perceptual things*. The entire space-tune world, with the assignment of sense qualities to the individual world points, we call the perceptual world.

Earlier we were able to use spatial relations of shape and position to furnish definite descriptions of the individual parts of my body, taken as visual things (§ 131); now we can produce such descriptions on a large scale for individual objects as kinds of objects taken as *perceptual* things. On this can then be based constructional definite descriptions of individual colors, individual odors, etc. (e.g., green as the color of foliage,

etc.). As we can see from etymological considerations, this construction is analogous to the actual formation of concepts and of words for the individual sensation qualities. The construction of the autopsychological domain is here supplemented by higher-level constructions. Such supplementations will occur in various other places as well, but we shall not pay any further attention to them.

135. *Completion of the Perceptual World through Analogy*

Assume that, for large parts of two space-time regions, the assignment of sense qualities is completely or very nearly identical, while the remaining area of one of the space-time regions shows assignments for points where no qualities of the sense in question are assigned to the corresponding points of the other area. In this case, we undertake analogous assignments in the latter area.

The remaining area may be part of the larger region in a temporal or in a spatial sense. Depending upon which of the two is the case, the application of the construction procedure of *assignment* by *analogy* would seem to be quite different in the two cases. In the first case, the import of the procedure can be intuitively formulated in the following way (in realistic language): if a temporally large part of a known process is repeated in equal or similar ways while it remains unobserved for the remainder of the time, then we assume (if there are no reasons to the contrary) that, during the time when no observations are made, the second process continues in a way analogous to the first, or, more briefly, the processes are subject to mutual analogy. In the second case, i.e., in the case of completion in a spatial direction, the import of the procedure can be formulated thus (in realistic language): if a spatial part of a previously perceived thing is perceived again in the same or in similar ways, while the remaining spatial area remains unobserved, then we assume (if there are no reasons to the contrary) that the unobserved spatial part contains part of a thing which is analogous to the corresponding part of the first thing; or, more briefly, the things are subject to mutual analogy.

Both ways of applying this procedure have occurred earlier when we were concerned with supplementing the seen color spots with unseen color spots so as to arrive at world lines (the first kind in § 126, rules 10, 11, c, d; the second kind in rule 11, c, d), similarly, in the supplementation of touched touch points through untouched touch points (§ 130).

In a sense, the first kind of application of the assignment by analogy can be envisaged as the application of a *postulate of causality*, the second as the application of a *postulate of substance*, or, to put it the other way around, *the two categories of causality and substance amount to the application of the same analogy construction to different coördinates*.

Even if we consider the color spots alone, the application of this procedure brings the assignments very considerably closer to completion. Further supplementations result from the mutual support of the various senses. Through such supplementations, new things and regularities become known, or old ones become better known; with the aid of this information, further supplementations become possible. Thus, we find mutual advancement between the recognition of general laws which hold for things and processes on one hand, and the supplementation of the assignment of qualities to points in the perceptual world on the other.

136. *The World of Physics*

The perceptual world is constructed through the assignment of sense qualities; from it we must distinguish the *world of physics*, where physical-state magnitudes [108] are assigned to the points of the four-dimensional number space. This construction has the purpose of formulating a domain which is determined through mathematically expressible laws. They are to be mathematically expressible in order to allow us to calculate certain elements from those other elements which determine them. Furthermore, the necessity of constructing the world of physics rests on the circumstance that only this world, but not the perceptual world (cf. §132, conclusion), can be made intersubjective in an unequivocal, consistent manner (§§ 146-149).

It is not antecedently obvious that physics, if it wants to establish a domain of thoroughgoing regularity, has to eliminate all qualities and replace them by numbers. The opposition (which Goethe, for example, maintained against Newton in the polemical part of his *Farbenlehre*) asserts that one has to remain within the domain of the sense qualities and that one must ascertain the regularities which hold between them. This would mean that we would have to find the regularities in the domain which we called the perceptual world. Of course, laws like the natural laws of physics do not hold in this domain. One can show, however, that there must be regularities of some sort if the construction of a world of physics, which is governed by regularities, is to be possible at

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108 physikalische Zustandsgrössen

all. However, the regularities within the perceptual world are of a much more complicated nature than the laws of physics. At the moment, we cannot concern ourselves with these problems. There is a much more simple way to arrive at a domain of thoroughgoing regularity and calculability, and that is to construct the world of physics as a pure world of numbers.

The indicated purpose of this construction does not unambiguously determine which physical-state magnitudes must be chosen for the construction of the world of physics; at least, this is not clear at the present state of physical knowledge. There are various choices. However, as far as empirical evidence is concerned, the various resulting systems of physics have the same value. It is probable that eventually a clear decision will be made (which will be based upon empirical evidence but which will be guided by methodological principles, for example, the principle of greatest possible simplicity).

The formulation of the laws of nature depends upon the choice of state magnitudes and upon the system of physics. Nevertheless, the kind and degree of determination which is provided through the natural laws is empirically fixed and does not depend upon the system. That is to say, the assignment of all state magnitudes to all world points is determined by the assignment of the state magnitudes to the points of a three-dimensional cross section at right angles to the first coördinate (which corresponds to time).

The construction of the physical world, aside from the regularity to which it is to lead, is essentially determined through a special relation which holds between it and the perceptual world; this relation we want to call *physicoqualitative* correlation. To begin with, the world points of physics are in a one-to-one correspondence to the world points of the perceptual world. (Nevertheless, the metric of the physical world can be different from that of the perceptual world; for example, it could be the Non-Euclidean metric which is required by the general theory of relativity.) Then there exists a one-many relation between the qualities and the state magnitudes in such a way that, if there is an assignment of physical-state magnitudes of any (purely numerical) structure to a physical [109] point in its neighborhood, then the quality which is correlated with this structure is always assigned to the correlated world point of the perceptual world or, at least, it can be assigned without contradiction. However, in the opposite direction, the correlation is not unique; the assignment of a quality to a world point in the perceptual world does not

109 physikalisch

determine which structure of state magnitudes is to be assigned to the neighborhood of the corresponding physical world point of the world of physics; the assignment of this quality merely determines a class to which this structure must belong. It is clear that the physico-qualitative correlation cannot be free from the imprecision which attaches to the perceptual world generally.

REFERENCES. Concerning the problem of deciding between the possible systems of physics, cf. Carnap [Aufg. d. Phys.]; this article also concerns itself in more detail with the physico-qualitative correlation. About kind and degree of determination of the world of physics, cf. Carnap [Dreidimens.]. That the world of physics is completely free from sense qualities is shown by Schlick [Raum and Zeit] 93 f. and Carnap [Phys. Begr.]; the latter also gives reasons for the transition from the qualitative perceptual world to the quantitative physical world (p.51ff.).

137. *Biological Objects; Man*

After the world of physics has been constructed, it is possible to give a definite description of each individual event and each thing that belongs to the world. This can be accomplished through indication of place and time or through the relation to other events and things or through properties based on the assignments. We have already assumed earlier that definite descriptions of the individual sense organs of my body are given (§131); it is now also possible to give a constructional definite description of all the other parts and events of my body; furthermore, all other individual physical things, their parts, and events in connection with them. Accordingly, these physical things can be placed into classes or into entire systems of classes of various levels according to the properties in which they agree. In this way we obtain, for example, the inorganic and organic substances, furthermore, the inorganic and organic individual objects as well as the entire system of organisms, of plants, and of animals, as well as the system of artifacts. In such a way, the entire domain of physical objects is constructable.

Organisms are characterized through special properties of the events which take place with them or through certain "faculties" which are to be constructed on the basis of these events, for example, metabolism, procreation, regulation, etc. It is not necessary at this point to discuss these identifying properties in more detail. The only important thing is that they are physical properties, i.e., properties which we can assume

to be constructed after the construction of the world of physics. The organisms with their essential properties and relations and events which are peculiar to organisms are called *biological objects*.

One can show empirically that "my body", a thing which we constructed at first as a visual thing (§ 129) and which we have then, through further assignments, placed in the perceptual world, belongs to the organisms. "The class of *men* is constructed as a class of the biological classification of organisms, to which my body belongs. A constructional definite description of this class is given by indicating the degree to which its elements are to agree with my body in size, figure, motions, and other events. Outside of the thing which is called "my body", there are "other men" (as physical things) who belong to this class. This class forms an object type which is of especial importance for the constructional system. Starting from it, we shall construct the heteropsychological domain f§ 140) and thus all higher obiects.

138. *The Expression Relation*

The construction of my body, its parts, its motions, and the other events which are connected with it, has already been discussed (§§129, 131, 137). It is relatively unimportant whether we here mean by "my body" the mere tactile-visual thing, to which we originally gave this name, or the corresponding physical thing, because the events which we need for further constructions can be satisfactorily identified through tactile and visual qualities.

For the subsequent construction of the heteropsychological (§ 140), the *expression relation* is of fundamental importance. As pointed out earlier (§ 19), by this is meant the relation between expressive motions, i.e., facial expressions, gestures, bodily motions, even organic processes, on the one hand, and the simultaneous psychological events which are "expressed" through them, on the other. This explanation is not meant to be the constructional definition of the expression relation, since it would clearly be circular. It is really meant to refer to already known facts in order to provide a clearer understanding of the word. The construction of the expression relation, on the other hand, consists in the following: to a class of autopsychological events which frequently occur simultaneously with certain recognizable physical events of my body, we correlate the class of these physical events as "expression".

The construction of the heteropsychological could also be based upon the *psychophysical relation* (§§19,21), instead of the expression rela-

tion, if only this relation were somewhat better known. In this case, the relation would have to be constructed in the following way: to a class of autopsychological events which frequently occur simultaneously with certain physical events of my central nervous system, the class of these physical events is "psychophysically" correlated.

CHAPTER
C

THE UPPER LEVELS: HETEROPSYCHOLOGICAL AND CULTURAL OBJECTS

139. *About the Presentation of Subsequent Constructional Levels*

For the subsequent levels of the constructional system, we cannot do more than give outlines showing the possibility of a construction of the object in question on the basis of preceding constructions.

To begin with, we shall construct the *heteropsychological objects* (§ 140) on the basis of "other persons", which are already constructed as physical things (§ 137), and with the aid of the expression relation (§ 138). Furthermore, certain events in the other persons are envisaged as "productions of signs". With their aid, we shall construct the *world of the other* (§§ 141-145). There exists a certain correspondence between the world which we have constructed up to this point, namely, "my world", and this "world of the other". Upon this correspondence the construction of the *intersubjective world* is based (§§ 146-149). Finally, it is possible, on the basis of the (auto- or hetero-) psychological objects, to construct the objects of the highest level, namely, the *cultural objects* (§ 150f.) and *values* (§ 152). After having discussed these constructions, we shall then consider the problem of the elimination of the basic relation(s) as the only remaining aspect of the constructional system that is not purely formal (§§ 153-155). Finally, we shall sum-

marize, in the form of theses, all those points which may be asserted after completion of the exposition of the constructional system (§ 156). These theses are thus different from the content of the system itself, which was to be no more than an example.

140. *The Domain of the Heleropsychological*

Earlier (§ 137), we have constructed "other persons" as those organisms which are similar to my body in certain ways. Thus, they have been constructed as physical things. Now we shall undertake the construction of the psychological aspects of other persons, namely, the *heteropsychological*. This construction consists in the following: on the basis of physical events in another person and with the aid of the expression relation, which has been constructed earlier (§138), we assign psychological events to this person. Aside from the expression relation, we shall also utilize the "production of signs", i.e., information that the other person gives me (§§ 141-144). Here we arrive at two very important points; the construction of the heteropsychological can be an assignment only to the body of the other, not to his mind, which, after all, cannot be constructed in any other way than through this assignment; thus, constructionally, the other mind does not even exist before this assignment is carried out. Secondly, the assigned psychological events are autopsychological events for the very same reason: the only psychological entities which have been constructed up to this point are autopsychological entities, and no other can be constructed prior to this assignment; there is no possibility of constructing non-autopsychological entities other than with the aid of precisely this assignment.

We shall supplement this assignment in order to obtain a more or less complete experience sequence of the other person by using two types of law, both of which are derived from elementary experiences, namely, state laws [110] (i.e., that constituents of elementary experiences of type *a* are generally simultaneous with others of type *b*) and process laws [111] (i.e., that experiences, or constituents of experiences or sequences of them, of type *a* are generally succeeded by others of type *b*). Thus, the entire *experience sequence of the other person consists of nothing but a rearrangement of my own experiences and their constituents*. It must be noted, however, that we can construct experiences for the other person which do not correspond to any of my own experiences, but the constitu-

110 Zustandsgesetze
111 Ablaufsgesetze

ents of such experiences of the other person must occur as constituents of my own experiences, for (in constructional language) there is nothing to be assigned except the elementary experiences and what is constructed from them, i.e., their quasi constituents (in the widest sense, including components, etc.); (in realistic language): as I observe expressive events in another person, I cannot infer from them something that is unknown to me in kind.

We have pointed out (§ 132) that my experiences or conscious events are supplemented through the insertion of unconscious events so as to form the complete autopsychological domain; this domain shows fairly extensive, though not altogether autonomous, regularity. In precisely analogous fashion, we now supplement the experience sequence or the consciousness of the other with unconscious events of the other so as to arrive at the complete domain of the psychological states of the other. In so doing we assume the same determining laws as in the supplementation which produced the autopsychological domain. The thus constructed "psychological states of the other", when taken as a class, may be called the *mind of the other* in analogy to "my mind". The general domain of the heteropsychological embraces all psychological events of all other persons who (i.e., whose bodies) occur as physical things in the already constructed world of physics.

From the indicated type of construction for the heteropsychological domain, it follows that there can be no heteropsychological phenomena without a body, for (in constructional language): the heteropsychological can be constructed only through the mediation of a body; in particular, of a body where certain events ("expressive events") occur which are similar to those of my body; (in realistic language): if heteropsychological objects were not connected with a body through which they expresses themselves, they would be in principle unrecognizable and thus could not become the objects of scientific statements. (We shall not here concern ourselves with the problem of telepathy; a closer investigation would show that even telepathic knowledge of the heteropsychological needs the mediation of a body.)

If we were to presuppose sufficient (but presently unavailable) knowledge of brain physiology (such that the correlation problem of the psychophysical relation would be solved, cf. §21), then the psychological states of another person could be more precisely and more completely constructed with the aid of the *psychophysical relation* than with the aid of the expression relation (together with the production of signs). If the brain events of the other person were completely constructed to

their last detail as parts of the world of physics, then it would be possible to construct from them, at the same time, the conscious as well as the unconscious; hence, the entire range of the psychological states of the other person. The just-indicated conclusions follow from this type of construction also.

REFERENCES. Considering its great importance for the construction of the knowable world, the problem of the construction of the heteropsychological is not very often posed as a problem; attempts at its solution are even more rare. Actually, we have to mention only the following: Kauffmann [Imman.] 106-121; Dingier [Naturphil.] 140ff.; Driesch [Ordnungsl.] 371 ff. (with bibliography); Ziehen [Erkth.] 277ff.; Becher [Geisteswiss.] 119ff., 285 ff.; Jacoby [Ontol.] 307 ff. In these and other investigations of this kind (with the exception of Kauffmann and Dingier), the heteropsychological is generally inferred, rather than constructed. This inference amounts to a violation of the construction principle of Russell (see the motto preceding § 1, and § 3). Russell himself does not apply his principle to this particular problem. For detailed discussions of the epistemological reducibility of the heteropsychological to the physical, see Carnap [Realismus].

About the reduction by *behaviorism*, not only of the heteropsychological, but of all psychological phenomena to physical phenomena, cf. § 59.

141. *The Production of Signs*

Other persons, considered as physical things, exhibit certain physical manifestations other than expressive events which are of especial importance for the increase of knowledge and hence for the completion of the constructional system. These are the sign-giving manifestations, especially spoken and written words; we call them *sign productions*. They make possible a broadening of the constructional system, an increase in the number of constructable objects of almost all kinds.

Earlier, we have discussed the *sign relation* and have emphasized its difference from the expression relation (§ 19). One of its partial relations is the relation between "*sign production*" and the *signified*. The construction of this relation is more difficult than any of the constructions which we have hitherto undertaken. One can of course produce rules for how the meaning of sounds of a foreign language can be inferred by a comparison of these sounds with processes in the speaker. However, it is not possible to formulate these rules in such a way that the first occurrence of a sound will always allow us to infer its meaning. One can only

indicate how one could make conjectures and how these conjectures, after the sounds have occurred a number of times, can be either rejected or better confirmed until they become certainties.

In order to arrive at a constructional definition of the relation of sign production, one would have to translate such rules (for the recognition of the meaning of a sign) into the constructional language. Consequently, this definition, too, would take on a very complicated form. To begin with, we would have to stipulate that a physical event in another person is considered a sign production if the following construction can be completely carried out for that event. An object is considered the designatum of a sign production of a certain person if there is a procedure which assigns the greatest weight to it in relation to that sign production. The meaning of the sign production is considered the more safely ascertained, the more the weight of the object in question surpasses the weight of the other objects for the same sign production. We can here only barely hint at the rules for the assignment of weights to the various objects for a given sign production.

> The rules would say, for example, that the weight which is assigned to a physical thing, relative to a sign production, rises if the thing is close to the body of the sign-giver at the time of the sign production; furthermore, if it stands in certain relations (namely, the stimulus relations) to the sense organs of the sign-giver, or else if it was in the proximity of the sign-giver or stood in the stimulus relation to his sense organs, not at the time of the sign production, but a short time before. Furthermore, the weight rises if the thing is in motion or if it changes its state of motion or if it undergoes a discontinuous process or if it contrasts very strongly in its physical properties with its surroundings, etc. Let this simple indication suffice to show that such rules are possible.

According to the indicated procedure, sign production is, to begin with, related to the physical. Unlike the sample rules, our rules must eventually assign weights, not only to physical bodies, but to physical objects of all kinds (events, states, properties, relations, etc.). Furthermore, and still relative to a given sign production, we shall use similar rules to assign weights to the psychological objects of the sign-giver; they are again objects of various kinds (experiences, constituents, components, etc.). Eventually, weights will also be assigned to the psychological objects of other persons, including the self. After we have later on carried out still higher-level constructions, the objects which we shall then introduce will also have weights assigned to them, according to the closer or more remote connection between the object in question and the sign-giver.

The most important assignment of weights to objects, albeit the most difficult one, arises when (in realistic language) a word is understood through its context. Relative to a given word, which occurs in a sentence, those objects are to be assigned increased weight, which stand in a close relation to the objects designated by the other words of the sentence (they could be of the same object type, they could be in spatial or temporal proximity, they could coincide in certain properties or be connected through a certain event, etc.). If the meaning of the other word has not been sufficiently ascertained, we must for each word take several objects into account, depending on their weight.

142. *Reports of Other Persons*

Taking into consideration other words for the interpretation of a given word is only the most primitive form of considering the context. A much more fruitful form follows from the circumstance that words form sentences and that sentences designate states of affairs. A sign production which forms an entire sentence, i.e., *which designates a state of affairs*, we call a *report*.[112] The *reporting relation* (between a report and its state of affairs) is to be constructed together with the sign production relation (between a word and the designated object), since the two constructions relate to, and support, one another. However, the *construction of the reporting relation* is still more complicated than the construction of the sign production relation for words, especially since the different possible sentence forms must be taken into consideration.

> EXAMPLE. In order to indicate the rough form of this construction, let us concern ourselves with a rather simple sentence form, namely, with sentences which consist of three words, which designate a referent, a relation and a relatum (example: "Karl hits Fritz"). In such a case, the constructional definition of the reporting relation would contain roughly the following elements: the meaning of a report is that particular state of affairs which has the greatest total weight relative to that report. The total weight is a function (perhaps the product) of individual weight factors of the state of affairs relative to the given report. For the determination of these factors, definite rules would have to be devised, which could be like or similar to the following: A state of affairs is related to two objects (in the example, Karl and Fritz) and a relation which holds between them (hitting). The first factor for the total weight of a given state of affairs relative to a given report is the weight of the first object of the state of affairs (to be determined according to the rules of § 141), relative to the first word of

112 Angabe

the report ("Karl"); the second factor is the weight of the relation of the state of affairs relative to the second word of the report ("hits"); the third factor is the weight of the third object of the state of affairs, relative to the third word of the report ("Fritz"). A fourth factor, which carries much more weight than the three just-mentioned ones, could perhaps be determined in the following way. It is largest when the state of affairs obtains (i.e., if the relation in question holds between the two objects; in the example, if Karl really hits Fritz); it is smaller when it is not known whether or not the state of affairs obtains; still smaller, if the state of affairs does not obtain, even though the first object belongs to the domain and the second to the converse domain of the relation; it is still smaller if only one of these two conditions is fulfilled and still smaller if both of them remain unfulfilled, but if the objects at least belong to the object type or at least to the sphere of the domain or the converse domain, etc.

The meaning of a report is secure to the extent to which the total weight of a state of affairs which is determined according to rules of the indicated kind surpasses the total weights of the remaining states of affairs. The more or less secure correlations which are thus established for the reporting relation can now in turn be used for the sign production relation for words, namely, for the three words of the report. Now, if we have secured a pair consisting of a report and a state of affairs which stand to one another in the reporting relation, then an object is assigned greater weight relative to a word if word and object occur in corresponding positions in the report and in the state of affairs, respectively. The weight factor which is thus assigned to an object is of especial importance for the determination of its weight. This is a reflection of the special value of the "context" for the determination of the meaning of a word.

143. *Intuitive Understanding and Functional Dependency*

We have said earlier (§ 100) that the construction does not represent the actual process of cognition in its concrete manifestations, but that it is intended to give a rational reconstruction of the formal structure of this process. This viewpoint allows and even requires deviations of the construction from the actual process of cognition. In the last-mentioned cases, namely, in the constructional utilization of expressive motions, of sign productions, and of reports, this deviation is especially great. A child, in learning to understand the meaning of spoken words and sentences, proceeds in an associative, intuitive fashion and not (or at least

only to a very inconsiderable degree) through ratiocination. To a still greater degree, the understanding of the expressive motions of another person is restricted to the intuitive procedure. It is somewhat different with a sentence. After we have already understood a sentence, we can still remember its individual parts and infer the meaning of the entire sentence from the meanings of the parts and thus provide a rational check for the intuitive understanding. On the other hand, after we have understood the facial expressions of another person, it is not possible in most cases to recollect precisely the individual expressions of the other; the impressions of purely physical events are quite fleeting, so that essentially there remains only the recollection of the apprehended meaning.

Now, there is a certain dependency between sign production and expressive motion, on the one hand, and the designated or expressed meaning, on the other; it is this dependency which is to be expressed in the construction. This dependency holds in every case, whether the understanding of an utterance is intuitive or rational. To begin with, the dependency consists in the fact that all apprehensions of heteropsychological phenomena depend upon the mediation of a sign production or an expressive motion. More than that, the entire nature of the apprehensible or the apprehended content is dependent upon the nature of the mediating utterance. In other words, the heteropsychological is (even intuitively) apprehensible only as the meaning of an utterance (of an expressive motion or a sign production). The meaning of an utterance is a unique function of the physical properties of the utterance ("function" in the mathematical, not in the psychological, sense). Since the construction states this function, the course of the process of cognition is not misrepresented by the construction (it is not falsely given out as a rational-discursive, rather than an intuitive process); the construction does not even contain a fiction to the effect that the process is rational rather than intuitive. (The latter is the case only in the language of fictitious constructive operations, which is added as an aid to understanding.) The construction itself does not indicate any process at all, but only the above-mentioned logical function.

These remarks hold, beyond the present problem, quite generally for all constructions. For the sake of brevity and intuitive obviousness, we have, in this chapter (IV, C), used the realistic language most of the time. Thus, the present context makes it especially important to note that the constructions themselves (which are not here given) have the neutral character of logical functions even with the objects which are presently under discussion.

REFERENCES. About the necessity Of giving an epistemological-logical "justification" or legitimization of the recognition of the heteropsychological, which in reality takes place through empathy or "apperceptive supplementation" (B. Erdmann), cf. Becher [Geisteswiss.] 285 ff. For a more detailed anaylsis of the sense of the epistemological reduction in general and especially of the reduction of the heteropsychological to the physical, see Carnap [Realismus].

144. *The Utilization of Reports of Other Persons*

In the process of cognition, and thus also in the constructional system, we make two different kinds of use of the reports of other persons. To begin with, a report (if it is reliable) informs me about a state of affairs, but, secondly, I also find out that this state of affairs is known to the other.

Let us consider, to begin with, the utilization of the content of reports. Before a report is utilized, its reliability must be tested. This is done, on the one hand, through a comparison with already more or less well-established states of affairs and relational laws between them and, on the other hand, by taking into consideration the trustworthiness of the author of the report, the criteria for which are discovered empirically and gradually. We shall not dwell upon the test of trustworthiness and shall presuppose that a selection of the reliable reports has already been made.

It is quite obvious that the utilization of the contents of reports makes for an extraordinary enrichment of the possibilities of construction. More precisely, the number of constructable objects in the various domains is increased many times. Only the domain of the autopsychological allows very little enlargement. Not so with the physical domain, and the construction of the domains of the heteropsychological and finally of the cultural rest almost entirely on the utilization of reports. There is no need to concern ourselves at this point with the details of this.

Let us again focus our attention on the fact that, *on no level* of the constructional system, hence not even through the utilization of the reports of other persons, is something fundamentally new introduced into the system, but that what we have here is only a reorganization (albeit a very complicated one) of the given elements. The new order which eventuates from this reorganization is not determined through something that lies outside of the given, but again only through the given itself or, more precisely, through the inventory of the basic relation(s). Thus, this utilization of reports does not lead us to abandon the auto-

psychological basis upon which the entire constructional system is founded. Nevertheless, we do not construct other persons as mere machines, but with all the contents of their experiences, to the extent to which they are (in realistic language) recognizable. After all, it was the thesis of construction theory that the constructional system, in spite of its autopsychological basis, would be in a position to express all legitimate statements, more precisely, all statements which can be considered valid in an empirical science or which can be posed as questions. (This does not include the statements of metaphysics.)

145. *The World of the Other*

The experiences of a given other person M (who has been constructed as a physical thing, according to §137) are constructed according to the last-described procedure, i.e., with the aid of the expression relation and the reporting relation. It is not possible to construct these experiences either as numerous or as variegated as my own experiences, the elementary experiences, are given to me. Nevertheless, in spite of this incompleteness, we can apply the same construction forms to them which we have applied to elementary experiences from the beginning of the constructional system. More precisely, the constructional steps which were carried out earlier with the basic relation Rs are now carrried out with the analogous relation Rs_M, which holds between M's experiences. Thus, we formulate new constructional definitions by transforming the already available constructional definitions through a substitution of Rs_M for Rs and through attaching an appropriate subscript (indicating M) to the defined symbols (e.g., $color_M$, $qual_M$, etc.). Thus, we construct "M's objects" which form "the world of M."

Even here we do not desert the autopsychological basis; all of "M's objects" are still objects of the one constructional system and thus go back ultimately to the basic object of that system, i.e., to a relation which holds between elementary experiences (my experiences!). However, there is a certain sense in which one can speak of the *constructional system* of M, by this is meant nothing but a certain *branch* of "the" (or "my") *constructional system* that branches off at a high level. The only reason why we can envisage this branch as a constructional system is that it mirrors the entire constructional system by virtue of a certain analogy. We call it the constructional system "of M" only because, within "the" (or "my") constructional system, it is constructed as having a certain connection with M's body.

146. *Intersubjective Correspondence*

From the indicated way of constructing the "world of M", it follows that, between this world and "my world", there exists a certain analogy; more precisely, the analogy holds between the constructional system as a whole (S) and the "constructional system of M" (S_M). It must be remembered, however, that S_M is only a partial system within S; the world of M is constructed within my world; it is not to be considered as formed by M, but as formed by me for M.

The analogy between S and S_M amounts to a very far-reaching, but not to a complete, agreement. To begin with, for almost every construction in S, there is a corresponding construction in S_M, which has an analogous definitional form and whose symbol is marked by an index M. Furthermore, corresponding assertions hold almost without exception for correspondingly constructed objects. This holds especially for the levels prior to the construction of the space-time world. Later on, however, in the construction of the physical and the heteropsychological domain, this simple agreement, which depends upon analogous construction, no longer holds; on the other hand, a new type of agreement occurs.

In §129, it was described how "my body" was constructed first as a visual thing and then as a physical thing, which may be designated by mb. In an analogous way, we construct in S_M an object mb_M, namely, the body of M. (Note the difference between the physical thing M and mb_M. The former is constructed with myself as the vantage point; the latter, by proceeding from M's experiences.) From the analogy in constructional form it follows that mb and mb_M agree in certain properties; for example, they are both physical things. On the other hand, they disagree in many other properties. For example, if M has another hair color than I have, then we obtain two different statements about mb and mbM, respectively.

For the remaining physical things within S, it also does not hold that they agree with the corresponding things in S_M (for the things which stand in certain spatial relations to my body do not as a rule stand in the same relations to M). But now we find an agreement of a new kind. A one-to-one correspondence holds between the spatiotemporal world of physics in S and that in S_M, in the following way: the spatiotemporal relations which hold for the physical world points in S_M also hold for the corresponding world points in S. The same is true for qualitative relations (i.e., relations which hold on the basis of assignment). For reasons

to be explained later, we wish to call this correspondence *intersubjective correspondence*. An object in S_M which corresponds by virtue of analogous construction to an object O of S, we have called O_M. Now we assign the symbol O_M to the object of S_M which intersubjectively corresponds to the object O. Two intersubjectively corresponding objects of S and S_M represent (in realistic language) "the same" object, once as it is recognized by me and the other time as it is (so far as I know) recognized by M.

EXAMPLE. The body of a third person N is not to be characterized in S_M by a construction analogous to that in S. (Thus, it should by no means be designated with N_M.) But (under favorable conditions) there is a physical thing in S_M which intersubjectively corresponds to N, hence which is to be designated by N^M. N^M then represents the person N as it is cognized by M. Within the world of physics of S_M, N^M may have an entirely different constructional definite description than N has in S; but both objects exhibit identical properties in the respective worlds of physics. In this case we also find a certain agreement relative to the constructional form in that N in S as well as N^M in S_M is constructed as "another person".

There are, in particular, two places where the constructional forms of intersubjectively corresponding objects in S and S_M deviate considerably from one another, mb (my body) and mb_M (my body from M's point of view) are indeed both physical things, but, unlike mb_M (body of M as it is seen by himself), mb_M does not have a construction form analogous to that of mb, for we construct mb in S as "my body", while mb_M is constructed in S_M in the form, "body of another person". The second deviation goes in the opposite direction: M (the body of M seen by me) and M^M (the body of M seen by himself) are indeed both physical things, but are constructed differently. There is no object in SM which would be constructed in analogy to M (hence, no object to be designated as M^M). (The construction form of mb_M is similar, but not precisely analogous to that of M.) While M in S is constructed as "body of another person", M^M in SM is constructed as "my body" ($M^M = mb_M$).

147. *Intersubjective Correspondence Holds for All Object Types*

Intersubjective correspondence holds not only between physical objects, but also between psychological ones. For the most part, heteropsychological objects correspond to other heteropsychological objects. In S, we assign to N, namely, the body of another person, certain heteropsycho-

logical objects: in S_M there is an object N^M, again the body of another person, which stands in intersubjective correspondence to N; certain heteropsychological objects are assigned to N^M, and these objects stand in intersubjective correspondence to the heteropsychological objects which were assigned to N in S. The psychological objects of N in S correspond to the psychological objects of N^M in S_M in their qualitative structure (provided only that both constructions can be, and are, carried out).

In the construction of the psychological, the greatest differences in the constructional forms for intersubjectively corresponding objects arise at two points which are connected with the two just-mentioned ones, namely, in the construction of the psychological objects which are assigned to mb and to M (i.e., my psychological events, states, etc., and the psychological events, states, etc., of M).

We said earlier that this intersubjective correspondence does not hold for the lower constructional levels, but only for the levels beginning with the construction of the space-time world, while for the lower levels we could only show constructional analogy. However, after the intersubjective correspondence, which was first introduced for the world of physics, has now been accomplished for the psychological world, it gives us a thoroughgoing correspondence of all objects of S and S_M. It must be noted, however, that the intersubjective correspondence does not hold on the lower levels between such objects of S as Rs, elex, qual, sense, sight, and the analogously constructed objects Rs_M, $elex_M$, etc., which relate to M and his experiences. Rather, this correspondence holds between Rs, elex, etc., and certain objects Rs^M, $elex^M$, etc.

> EXAMPLE. elex are the (i.e., "my") elementary experiences; $elex_M$ are the experiences of another person M; $elex^M$, on the other hand, are again my experiences, but in a way in which they are constructed in S_M, (in realistic language) as they are recognized by M. Of course, these, as all objects, are constructed in S (i.e., "by me"), for there are no other objects. S_M is, after all, a part of the system S. In realistic language: $elex^M$ are my experiences, not as I know them, but as they are known to the other person M on the basis of his observations and the reports which I make. More precisely, they represent my knowledge (gained through his reports and various inferences) of his awareness of my experiences. Thus, $elex^M$ represents what, to my knowledge, M knows about my experiences. Considerations precisely analogous to the correspondence of elex to $elex^M$ hold also for the other objects of the lower constructional levels.

The intersubjective correspondence between S and S_M cannot at once be obtained for all objects of the two systems, but only after certain supplementations have been carried out. For example, the world of physics of each of the two systems is always incomplete and the gaps do not generally occur at the same places. Thus, the one system will contain assignments to world points of physics where they are lacking in the other system or where the other system has different, incompatible assignments. (Contradictory assignments are relatively rare. Where they occur, special criteria, which we shall not here discuss, must bring about a decision which recognizes one of the two assignments as legitimate, while deleting the other.) If we have disagreement in assignments, it will in most cases be brought about by the fact that one system has an assignment where the other has a vacant place. In these cases, a corresponding, supplementary assignment will be made in the second system in conformity with the rules for supplementation which have been given above (§ 135). (In realistic language): initially, the corresponding objects of the two systems agree in their properties; where the agreement cannot be proved, it is introduced as an hypothesis. Once this has been done in all cases, intersubjective correspondence holds throughout the two systems.

> It has been stated that S_M is contained in S as a proper part of S, and it has also been said that the objects of both systems can be brought into a one-to-one correspondence (intersubjective correspondence). These two statements are not contradictory to one another, since neither of the two systems can be completed. The second statement means the following: for each object which is constructed in one of the systems, an intersubjectively corresponding object can be constructed in the other as soon as the latter is sufficiently enlarged.

148. *The Intersubjective World*

We have seen above that, as a rule, intersubjectively corresponding objects of S and S_M differ from one another in the way they are constructed, but that they agree in properties which do not depend on the particular form of construction; that is, that they agree in properties which could be called material [113] properties. The properties which are thus in agreement and the statements about such properties we wish to call *intersubjectively communicable* [114] (more precisely, "intersubjectively

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113 inhaltlich
114 übertragbar

communicable between S and S_M"). On the other hand, properties which belong to an object only in S or only in S_M, and the statements about such properties, we call *subjective in* S or *subjective in* SM, respectively. It is easy to see that the intersubjectively communicable statements include, for example, statements about the similarity of two qualities, furthermore, statements about color, size, odor, etc., of a given physical thing, also statements about the emotions of a given person at a given time, etc. Moreover, certain statements about constructional form are intersubjectively communicable, for example, statements concerning whether an object is to be constructed as a class or as a relation, and similar ones. However, most statements about the form of the construction of an object in S or in S_M must be described as subjective in S or in S_M, respectively. For example, this holds frequently for statements about the required order in the construction of certain objects, and for requisite supplementations (according to §126, rules 7, 10). It also holds if the construction of a certain physical object requires arguments by analogy (according to § 135), etc.

So far, we have considered only the intersubjective correspondence between the systems S and S_M, i.e., a one-to-one correspondence of the objects of my world and the objects of the world of a given other person M. Now, everything that has been said about person M also holds for the remaining "other persons," thus, for example, for N, P, etc. Hence, there is a one-to-one intersubjective correspondence between the systems S and S_N, also between the systems S and S_P, etc. What has been said about the correspondence between S and S_M also holds for these correspondences. Now, if a one-to-one correspondence holds between S_M and S and also between S and S_N, then there exists a one-to-one correspondence between S_M and S_N, which has the same properties as the former correspondences. Thus, there exists a general one-to-one correspondence between all such systems, that is, between all the worlds of all persons (i.e., normal persons known to me), including myself. Henceforth, we shall mean by *intersubjective correspondence* this general correspondence and no longer the correspondence between two given systems. Also, in an analogous way, we shall mean from now on by *intersubjectively communicable properties* and *intersubjectively communicable statements* such as continue to hold when their object is replaced by the intersubjectively corresponding object of any other system. The class of all objects of the various systems which intersubjectively correspond to a given object of any system, we call an *intersubjective object*. Furthermore, a property of such a class, which it possesses on

the basis of an intersubjectively communicable property of its elements, we call an *intersubjective property*; and a statement about an intersubjective property of an intersubjective object, we call an *intersubjective statement*.

EXAMPLES. If, e.g., the statement f(O) about object O of system S is intersubjectively communicable, then this means that the corresponding statements $f(O^M)$, $f(O^N)$ etc., whose subjects O^M, O^N of systems S^M, S^N intersubjectively correspond to O, also hold. This situation is most easily expressed through an appropriate statement about the class which comprises the objects O, O^M, O^N, etc. If we designate the intersubjective correspondence by Int, then this class is to be called $\vec{Int}$ ' O, but $\vec{Int}$ ' O^M or $\vec{Int}$ ' O^N will do as well. By definition, the new statement, say F ($\vec{Int}$ ' O), is an intersubjective statement that is derived from the intersubjectively communicable statements f(O), $f(O^M)$ etc. Classes of the indicated kind, for example, $\vec{Int}$ ' O ($\vec{Int}$ ' O^M and $\vec{Int}$ ' O^N are identical with it) will now be called intersubjective objects. If we start with another object, say P, then the class $\vec{Int}$ ' P of objects P, P^M, P^N, etc., is derived in the same way.

As we can easily see from the example, the intersubjective objects are the abstraction classes (§73) of intersubjective correspondence. The world of these objects we call the *intersubjective world*. The indicated (quasi-analytic) procedure of the construction of an intersubjective object on the basis of the intersubjectively corresponding objects of the individual systems, we call *intersubjectivizing*.

In contrast to other conceptions (for example, Christiansen [Kant-kritik]) in our system *intersubjectivizing is not based upon a fiction*. The constructional system confines itself to the reports of other persons for the construction, i.e., to begin with, for the constructional supplementation of the physical world, but then also for the construction of the heteropsychological. However, these constructions do not consist in a hypothetical inference or fictitious postulation of something that is not given, but they consist *merely in the reorganization of the given* (cf. § 140). The same holds for the construction of the intersubjective world. Within the constructional system, no metaphysical assertions are made concerning the objects which are thus constructed through reorganization.

149. *The Intersubjective World as the World of Science*

The intersubjective world (in the sense of the above-given construction) forms the actual object domain of science. But science contains not only intersubjective statements, but also nonintersubjective statements that correspond to intersubjective statements or can be transformed into intersubjective statements. This transformation is one of the tasks of science; science aims to produce a supply of exclusively intersubjective statements. This aim is rarely stated explicitly, since the transformation generally takes place in an almost imperceptible way: we generally use the same sign (word or special symbol) for different but intersubjectively corresponding objects and, in addition, we use this same sign also for the intersubjective object which corresponds to all of them (and which we have constructed as their class).

This feature of science does not radically exclude from the domain of science all statements which are not intersubjectively communicable, i.e., which are subjective. Such statements can be scientifically phrased through a reformulation which mentions the author in the statement.

It likewise holds for the objects to be constructed subsequently, especially for the cultural ones, that they have intersubjectively corresponding objects in the systems S_M, etc. Thus, even in their case, it is possible to derive intersubjective objects. In doing this, the procedure of intersubjectivizing remains always the same; thus, it is not necessary to consider it in any detail for the higher-level constructions which we shall indicate in the sequel.

150. *The Primary Cultural Objects*

Earlier, we have briefly characterized the cultural object type and have emphasized its independence from the physical and psychological object types (§ 23). For the construction of cultural objects, the manifestation relation (§ 24) is of especial and fundamental importance. This is because the primary cultural objects, i.e., those objects whose construction does not presuppose the construction of other cultural objects, are always constructed on the basis of their manifestations (cf. § 55 f.), i.e., on the basis of those psychological events in which they are actualized or become apparent. There is a certain analogy between the construction of the cultural objects on the basis of their manifestations and the construction of the physical things on the basis of the experiences in which they

are perceived. We cannot here give an explicit account of these constructions. The reason for this is that the psychology (or phenomenology) of the cognition of cultural objects has not been researched and systematically described to the same degree as the psychology of perception. Thus, we give only a few examples and indicate briefly how they could be generalized. These indications may suffice, since we are here mainly concerned with the *possibility of construction* of cultural objects from psychological objects and since we are less concerned with the question precisely what forms these constructions must take.

> EXAMPLE. The custom of greeting through the lifting of one's hat would perhaps have to be constructed in the following form: "The custom of "greeting through the lifting of one's hat" is present in a society (or in some other sociological grouping) at a certain time, if, among the members of this society at that time, there is present a psychological disposition of such a kind that, in situations of such and such a sort, a voluntary act of such and such a sort takes place."
>
> All primary cultural objects are to be constructed on the basis of their manifestation in the indicated fashion. It is the task of a logic of the cultural sciences to investigate which objects of the various cultural areas are to be constructed as *primary* cultural objects. A phenomenology of the cultural sciences would then have to investigate, for each primary cultural object, which psychological objects are its manifestations and hence must serve as a basis for its construction and how this construction is to be carried out.

151. *The Higher Cultural Objects*

The remaining cultural objects are constructed on the basis of the primary cultural objects, but psychological, and occasionally physical, objects are also used. In this case, even more than in the case of the primary cultural objects, construction theory has to await the investigations of the special sciences in order to be able to give correct, concrete examples of constructions. Thus, we confine ourselves to the indication of an example without being able to assert the correctness or appropriateness of precisely this constructional form.

> EXAMPLE. The object "state" [115] could perhaps be constructed in the following form: a relational structure of persons is called a "state" if it is characterized in such and such a way through its manifestations, namely, the psychological behavior of these persons and the dispositions

115 Staat

toward such behavior, especially the disposition, on the part of some persons, to act upon the volitions of others.

Sociological groups or organizations are, among others, the most important higher cultural objects. Such a structure (for example, a tribe, a family, a club, a state, etc.) must be constructed as a relation extension, not as a class, since the order of the members within the sociological group belongs to the character of the group. That it is not permissible to construct these groups as classes follows from the possibility that the members of two different groups are identical.

The other sociological groups must be constructed in a way which is similar to that which we indicated for the state. In this and other ways, we can then construct generally all higher cultural objects on the basis of the primary cultural objects and occasionally also on the basis of objects of other previously constructed types. Thus, we can construct, either as primary or as derived objects, the cultural objects of all cultural fields; hence, the entities, properties, relations, events, states, etc., of technology, of economics, of law, of politics, of language, of art, of science, of religion, etc. Finally, the division into, and the characterization of, the individual fields can be carried out through further constructions.

REFERENCES. There seem to be hardly any attempts at a genuine construction (i.e., a construction that goes back to the given) of cultural objects, either in the literature of epistemology, of the philosophy of history, of history, or of sociology. Even delineations of the last steps of such a construction, starting from the psychological domain, are relatively rare. It seems that the only investigations which we have to mention are those by Driesch [Ordnungsl.] 421 ff., Section E, The Order Forms of the Cultural; [Wirlichk.] 194: "Thus, an *individual state* is the mental behavior of a number of individual persons as it is guided by the contents of certain books."

Through the indicated way of constructing the cultural on the basis of the psychological, as it is also found in our example of the state, the impression could arise that the cultural objects are here unduly "psychologized". In order to overcome this objection, let us again emphasize that the construction of one object on the basis of certain other objects does not amount to saying that the object is similar to those other objects; on the contrary, if the construction leads to the formation of new logical levels (as it does in the case of the cultural objects, and especially the higher levels of cultural objects, where it is very marked), the thus-constructed objects have a different mode of being, or, more precisely,

they belong to a different object sphere (§§29, 41 f.). Thus, there is no psychologism in our way of constructing the cultural objects (cf. also §56).

On the other hand, let it be emphasized again that the assertion that cultural objects belong to a new object sphere is not to be understood in any metaphysical sense. It follows from the given definition of the concept of an object sphere that we have here nothing but a formal-logical delineation of objects against one another. According to the conceptions of construction theory, no relation between two object types other than the formal-logical relation which depends upon the constructional forms of the types can become the subject of a scientific statement.

152. *The Domain of Values*

So far, we have given or indicated the construction of the most important object types familiar in daily life and in science, to wit: the physical, the psychological, and the cultural. In conclusion, let us briefly indicate now the construction of the *values*, at least in their general methodological form. Here, even less than with other object types, can we expect final formulations, since the domain of values, as far as the character of its objects and their recognition is concerned, is to an especially high degree problematic and subject to controversy.

The construction of values does not continue from the already discussed levels of the cultural or the heteropsychological, but connects with an earlier stage of the constructional system. We have to distinguish several types of values, for example, the ethical, the aesthetic, the religious, the biological (in the widest sense, including technological and economic values, values of individual and social hygiene), and others. The construction of values from certain experiences, namely, value experiences, is in many ways analogous to the construction of physical things from "perceptual experiences" (more precisely, from sense qualities). Let it suffice here to indicate some examples of such experiences. For the construction of ethical values, for example, we must consider (among others) experiences of conscience, experiences of duty or of responsibility, etc. For aesthetic values, we take into account experiences of (aesthetic) pleasure or other attitudes in the appreciation of art, experiences of artistic creation, etc. The particular nature of the value experiences of the different value types is investigated by the phenomenology of values; we cannot here concern ourselves with the details of this issue. Once the phenomenological analysis is carried out, we can give

a constructional expression for the characteristic properties of the various value experiences with the aid of the autopsychological qualities and their components, which have been constructed earlier, especially the emotions and volitions (§ 131 f.). On the basis of those constructions, we can then form the construction of the various value types. This should not be considered a psychologizing of values, just as the construction of physical objects from sense qualities does not amount to a psychologizing of the physical. In realistic language, values themselves are not experiential or psychological, but exist independently of being experienced. They are merely recognized in the experiences (more precisely, in the value sensations [116] whose intentional objects they are). In like fashion, a physical thing is not psychological, but exists independently of perception and is merely recognized through a perception whose intentional object it is. On the other hand, construction theory does not speak this kind of realistic language, but is neutral toward the metaphysical component of realistic statements. However, construction theory provides a translation into constructional language of the indicated statement about the relation between values and value sensations. This translation is analogous to the translation of the statement concerning the relation between physical things and perceptions; that is to say, it emphasizes a purely logical relation, namely, that one object is determined through the nature of another.

This concludes the outline of the constructional system.

153. *The Problem of Eliminating the Basic Relations*
(§§ 153-155 maybe omitted.)

Every constructional system rests upon basic relations which are introduced as undefined basic concepts. Thus, all constructed objects are complexes (§ 36) of the basic relations. All statements which occur in the constructional system are statements about nothing but the basic relations. Formally, they initially contain indeed also other objects; however, through substitution of the constructional definitions of these objects, it is possible to transform them step by step in such a way that their external sentence form, too, finally contains only the symbols of the basic relations (and logical symbols). For the present constructional system, in whose outline only one basic relation (Rs) is used, this has been discussed in §119 in the example of theorem Th. 6 concerning the three-dimensionality of the color solid.

116 Wertgefühl

However, this characteristic of the statements of a constructional system is not in harmony with the earlier thesis that statements of science are purely structural statements or that, in principle, it is possible to transform them into such statements, and that in the progress of science they should be so transformed (§ 15 f.). A purely structural statement must contain only logical symbols; in it must occur no undefined basic concepts from any empirical domain. Thus, after the constructional system has carried the formalization of scientific statements to the point where they are merely statements about a few (perhaps only one) basic relations, the problem arises whether it is possible to complete this formalization by *eliminating from the statements of science these basic relations as the last, nonlogical objects*.

That this elimination is possible becomes obvious through the following consideration. Given a constructional system which proceeds from certain basic relations, there is a possibility that this system can also be formulated with a different set of basic relations. But then the construction of each object would have to be formulated in a different way. Assume that we were to try to transform the previous constructional definitions by simply substituting the new basic relations for the old ones; it would then indeed be possible for the lower levels that the thus-transformed definitions are not meaningless or empty. But for a reasonably high level, the probability of such an accident is extremely small. It is still less likely that the empirical statements of the constructional system about constructed objects would accidentally continue to hold even after the transformation. From this it follows that the original basic relations can be characterized by saying that the objects which are constructed from them in a certain way show a certain empirical behavior; definite descriptions of the basic relations could be formulated with reference to the behavior of objects on a sufficiently high level. Thus it follows that it is possible to define, through purely logical concepts, the basic relations which were originally introduced as undefined basic concepts.

154. *"Founded" Relation Extensions*

The task of eliminating the basic relations as the only nonlogical objects of the constructional system contains one more difficulty to which we have to pay some further attention. We had assumed that, after a replacement of one set of basic relations by another, the constructional formulas of the system would not remain applicable, and the empirical statements would cease to hold. However, our assumption is justified

only if the new relation extensions are not arbitrary, unconnected pair lists, but if we require of them that they correspond to some experienceable, "natural" relations (to give a preliminary, vague expression).

If no such requirement is made, then there are certainly other relation extensions for which all constructional formulas can be produced. However, in such a case, the construction leads to other entities than with the original relation extensions, but, for these other entities, the same empirical statements still hold as for the original ones (that is to say, the symbols for these statements are still the same, but they now mean something different). All we have to do is to carry out a one-to-one transformation of the set of basic elements into itself and determine as the new basic relations those relation extensions whose inventory is the transformed inventory of the original basic relations. In this case, the new relation extensions have the same structure as the original ones (they are "isomorphic", cf. § 11). From this it follows that, to each originally constructed object, there corresponds precisely one new one with the same formal properties. Thus all statements of the constructional system continue to hold, since they concern only formal properties. However, we can then not find any sense [117] for the new basic relations; they are lists of pairs of basic elements without any (experienceable) connection. It is even more difficult to find for the constructed objects any entities which are not in some way disjointed.

In contrast to relations of this sort, we wish to call relation extensions which correspond to experienceable, "natural" relations *founded relation extensions*. Thus, the various member pairs of founded relation extensions have something in common that can be experienced.

We have seen (§ 153) that the basic relations can be eliminated only by characterizing them through the behavior of sufficiently high-level objects which are constructed from them. If this characterization is to become a definite description, it must be limited to founded relation extensions. This establishes the importance of the concept of founded relation extensions for the constructional system, for, if we take into account all relation extensions (in the formal-logical sense of arbitrary,ordered couples), then the basic relations are not the only ones which satisfy the definite descriptions, but they are the only ones among the founded relation extensions. We shall use the example of our constructional system to carry out such a definite description (§ 155).

The given explanation of the concept of foundedness is not meant as a definition; it is merely to make comprehensible what is meant. The

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117 Beziehungssinn

concept of foundedness is *undefinable*. It cannot be derived from constructed concepts, since it is the most fundamental concept of the constructional system. It also can not be derived from the (customary) basic concepts of formal logic. On the other hand, it does not belong to any definite extralogical object domain, as all other nonlogical objects do. Our considerations concerning the characterization of the basic relations of a constructional system as founded relation extensions of a certain kind hold for every constructional system of any domain whatever. It is perhaps permissible, because of this generality, to envisage the concept of foundedness as a concept of logic and to introduce it, since it is undefinable, as a *basic concept* of logic. That this concept is concerned with the *application* to object domains is not a valid objection to introducing it as a basic concept of logic. The same is true for another basic concept of logic, namely, generality: "(x) fx" means that the propositional function of fx has the value true for every argument of an object domain in which it is meaningful. Logic is not really a domain at all, but contains those statements which (as tautologies) hold for the objects of any domain whatever. From this it follows that it must concern itself precisely with those concepts which are applicable to any domain whatever. And foundedness, after all, belongs to these concepts. In view of these reasons, let us introduce the class of *founded relation extensions* as a basic concept of logic (logistic symbol: *found*) without therefore considering the problem as already solved.

155. *Elimination of the Basic Relation Rs*

Let us use our constructional system as an example in order to show how the elimination of the basic relations and thus the final formalization of the constructional system can be carried out, if we make the just-mentioned assumption that *found* can be taken as a basic concept of logic. The undefined basic relation Rs, we define in the following way: Rs is the only founded relation extension from which we can construct in a given way a certain sufficiently high-level object, still to be chosen, which shows certain empirical characteristics.

We have to choose a sufficiently high-level empirical theorem about Rs. Let us abbreviate this theorem as Th(Rs). We envisage this theorem as generated from the propositional function Th(R) through introduction of the argument Rs. "Rs" is now definitely described as that particular founded relation which satisfies Th(R). Thus, we define:

$$\mathrm{Rs} =_{\mathrm{df}} \breve{\iota}' \{\mathrm{Found} \cap \hat{R}\,(\mathbf{L}(\mathrm{R}))\}$$

In order to show that this can be practically carried out, we choose as our empirical statement theorem Th. 6 concerning the three-dimensionality of the color solid (§118). We have shown earlier how this theorem can be expressed as a statement exclusively about Rs (§ 119 [5]). Considering the complicated nature of the statement about Rs, it is perhaps permissible to assume that it is of sufficiently high level. This statement is the value for Rs of a certain propositional function Th(R), which has the following form (abbreviated):

$$(\exists Q,\nu).3\ \text{Dnhomvic}(\breve{\in}|Q|\in)\ |_{/}^{\backslash}\ \text{Abstr}'\{\hat{a}\hat{\beta}\ (\exists\chi,\lambda,\mu)\ldots.$$
$$\ldots(\exists\delta).\delta\in\ \text{Simil}'(\text{Rs}\cup\breve{R}\,\text{s}\ \cup\text{Rs}^{0}).\ a\subset\delta.x\sim\in\delta\}.a\uparrow\beta\ \subset\ \text{Rs}\cup\breve{R}\,\text{s}\ \cup\text{Rs}^{0}))\}$$

We now define the *basic relation* Rs as the only founded relation which satisfies this prepositional function (abbreviated):

$$\text{Rs}=_{\text{df}}\breve{\iota}'\{\text{Found}\ \cap\ \hat{R}\ (\mathbf{L}(\text{R}))\}.\ (\exists\text{Q},\nu).3\ \text{Dnhomvic}\ldots$$
$$\ldots(\exists\delta).\delta\in\ \text{Simil}'(\text{Rs}\cup\breve{R}\,\text{s}\ \cup\text{Rs}^{0}).\ a\subset\delta.x\sim\in\delta\}.a\uparrow\beta\ \subset\ \text{Rs}\cup\breve{R}\,\text{s}\ \cup\text{Rs}^{0}))\}$$

This expression which defines Rs *no longer contains anything but logical symbols and variables*. Since all objects and statements of the constructional system can be expressed through Rs, *it is now possible to express all objects and statements of the constructional system in a purely logical way*. Thus our aim of the complete formalization of the constructional system is achieved. We have shown that (and, through the suggestions in the outline of the constructional system, also how) all objects of science can be envisaged as structural objects, and all statements of science can be envisaged as structural statements and can be transformed into structure sentences. We had to presuppose, however, that *found* is a logical concept; here lies an unresolved problem.

156. *Theses about the Constructional System*

In concluding the presentation of the constructional system, let us again emphasize what is important in this system outline and what is not. The primary purpose in the formation of a constructional system was to illustrate, by way of an example, the actual content of construction theory, namely, to formulate the problems of forming such a system. In order to fulfill this purpose, the outline had to be given with a certain amount of detail in spite of the shortcomings in its content. These shortcomings were not so much due to difficulties which arise from some of the unsolved logical problems; rather, they arose from difficulties and as yet unresolved problems in the individual empirical sciences.

A further purpose of the outline was to show that a constructional system of all scientific objects is, in principle, possible, no matter how the details of such a system would have to be formulated. We do not only wish to assert here that it is possible in general to erect some constructional system or another; rather, we wish to defend the thesis that it is possible (though perhaps not necessary in all points) to give the following properties to the constructional system, which are also found in the system which we have tentatively outlined:

A. Formal Theses

1. The basic elements are all of the same type.
2. The basic order is established through relation extensions (§75).
3. The basic relations are all of the same level.
4. All basic relations are first-level relation extensions (i.e., relation extensions of basic elements).
5. A small number of basic relations suffices.
6. (A conjecture): One basic relation suffices (§ 82).

B. Material Theses

7. The basic elements are experiences as unanalyzable units (§67f.).
8. "My" elementary experiences are the basic elements ("autopsychological basis" [§64]).
9. (A conjecture): Rs (recollection of similarity) can be taken as the only basic relation (§ 78).
10. The following objects occur in the indicated sequence: quality classes, sense classes, the visual sense, visual field places, colors (possibly before the visual field places), space and time order, the visual things, my body, the other autopsychological objects (possibly before the spatial order), physical objects, other persons, heteropsychological objects, cultural objects, objects of all kinds as intersubjective objects (§§112-151).
11. The construction of the world of physics consists in an assignment of numbers ("state magnitudes") to the elements (world points) of a four-dimensional number array (space-time system); the assignment is based upon the distribution of the quality classes (§§ 125-136).
12. The construction of heteropsychological objects rests upon the expression relation (including the reporting relation) or upon the psychophysical relation (§§ 140, 57 f.).

13. The construction of cultural objects rests upon the manifestation relation (§§ 55 f., 150).

Thesis 6, that only one basic relation is required, and, to a greater extent thesis 9, concerning the special nature of this basic relation, are expressly indicated as conjectures. We are considerably more certain that thesis 5 concerning the small number of basic relations is correct. All previous attempts at tables of categories or basic postulates, [118] from Aristotle to Driesch, appear to us, all of them, to be too rich (cf. § 83). The reason for this lies in the fact that the methodological tools which were used are unsatisfactory. Only the application of the logico-constructive method shows how in many cases which were considered irreducible a reduction and thus a construction is possible.

Summary

IV. OUTLINE OF A CONSTRUCTIONAL SYSTEM (106-156)

A. *The Lower Levels: Autopsychological Objects (106—122)*

The only purpose of this outline is to provide an example for the clarification of construction theory. The lower levels are to be given in somewhat greater detail, on the basis of the preceding formal and material investigations. In addition to the constructional definitions, we give some theorems as examples; these are either *analytic*, that is, deducible from the definitions, or *empirical*. Like all other scientific propositions, these theorems can be translated into propositions about the basic relation alone: an analytic theorem will then result in a tautology, an empirical theorem in a proposition about an empirical, formal property of the basic relation (106).

To begin with, the logical and mathematical concepts (the latter actually form a part of the former) must be defined. They presuppose only the fundamental logical concepts, not the basic relation; they are not concepts in the sense of empirical concepts (107). On the basis of the basic relation (recollection of similarity, 108), the constructions of the following concepts are given (the constructions correspond to the derivations in §§ 67-94 and are given in the previously indicated languages, §§95-102): the elementary experiences (109), part similarity (110), similarity circles (111), quality classes (112), part identity (113), similarity between qualities (114), sense classes, visual sense (115), the sensations, analysis of experiences into their individual and general constituents (116), visual field places and their order in the visual field (117), the colors and their order in the color solid (118), the preliminary time order (120).

The thesis that every scientific concept is either a class or a relation exten-

118 Grundsetzung

sion which can be expressed through the basic relation alone is clarified by taking the concept of the sense modalities as an example. The thesis that every scientific proposition can be transformed into a proposition about the basic relation alone is exemplified through the empirical proposition about the three-dimensionality of the color solid (119).

By the *derivation relation* of an object we understand a certain expression which indicates how the object is derived from the basic relation; it designates a purely logical concept. If we replace each construction by the corresponding derivation relation, we formulate the constructional system in the form of a purely logical system; by substituting the basic relation, this system is then transformed into the proper constructional system of all empirical concepts (121).

B. *The Intermediate Levels: Physical Objects (123-138)*

There are several ways of constructing three-dimensional space (to begin with visual things) from the two-dimensional order of the visual field (124). We choose that form which utilizes only the temporal sequence of the visual fields which occur in the experiences (we do not use kinesthetic sensations); the four-dimensional "visual world" results through the assignment of colors to the "world points" (125-127). Certain parts of this visual world are the "visual things" (128). One of these is especially important: *my body*, it has certain unique properties which allow a definite description of it (129). With its aid, definite descriptions of the other senses can be given (we include here the emotions [130, 131]). The experiences have now been analyzed into their qualitative constituents; the latter have been divided into sense modalities and components. With the aid of these entities, all conscious processes can be constructed. These are supplemented by the so-called unconscious processes in order to provide more thoroughgoing regularities. Conscious and unconscious processes together form the total domain of the *autopsychological*. The *self* is the class of autopsychological states (132).

From the visual world results the *perceptual world* of "perceptual things" through the assignment of the qualities of the remaining senses (133, 134). This assignment is supplemented by certain rules of analogy (which correspond to the categories of causality and substance [135]). The perceptual world stands in contrast to the *world of physics*, where we assign to the world points not qualities but numbers, namely, the values of physical state magnitudes. In the world of physics, strict laws hold which can be mathematically formulated, and it can be intersubjectivized in an unequivocal fashion; this constitutes an advantage over the perceptual world (136). It is possible, in the world of physics, to give definite descriptions of all physically differentiable processes and things, hence, for example, organisms, and among them especially *other persons*, and all other biological concepts (137). The expression relation and the psychophysical relation can be constructed with the aid of the processes of "my body" (138).

C. *The Upper Levels: Heteropsychological and Cultural Objects (139-156)*

The construction of the *heteropsychological* consists in the assignment of psychological events to the body of another person with the aid of the expression relation. Hence, from the viewpoint of construction theory, the heteropsychological consists in a reorganization of the autopsychological. If the psychophysical relation were better known, then we could use it instead of the expression relation for a more precise and complete construction of the heteropsychological. The heteropsychological, just as the autopsychological, is supplemented through the addition of the unconscious (140). For the construction of the heteropsychological, we must use—aside from the expression relation in the narrower sense—also "sign production", namely, the linguistic expressions of other persons. The relation of sign production is constructed in analogy to the learning of a foreign language without interpreter, initially for words (141), then for sentences: "reporting relation" (142). In the actual learning of a language, understanding is, for the most part, intuitive; in the construction, this intuition is rationally reconstructed (143). The reports of other persons are now used for further constructions: all object types are enriched, but nothing that is new in principle can be brought into the system. Utilizing the reports of others does not mean that the autopsychological basis has been abandoned; after all, the reports have been constructed on that basis (144).

From the constructed experiences of another person M we can construct the "world of M" in analogy to the construction of "my world" from "my experiences". We now find two relations between the objects of M and the objects of my world: 1. the relation of analogous construction, which must be taken into account especially on the lower levels (145) and 2. the *intersubjective correspondence* between empirically identical objects (e.g., between my Berlin and that of M [146]). This correspondence can now be used for the supplementation of each of the two systems (147). A class of intersubjectively corresponding objects, one of which is in my system and the remaining in the systems of the other persons is called an "intersubjective object" (e.g., the class of the objects "Berlin" in the various systems); they form the *intersubjective world* (148). It is the proper object domain of the sciences (149).

The primary *cultural objects* (i.e., those which do not presuppose any other cultural objects for their construction) are constructed on the basis of their manifestations, i.e., on the basis of psychological objects (150). With their aid we can then construct the other cultural objects, where the sociological objects must be constructed predominantly as relations. The construction of the cultural from the psychological does not amount to "psychologizing", for the cultural objects form new object spheres (151). With the domains of the autopsychological, the physical, the heteropsycho-

logical, and the cultural, the most important object types have been constructed. Values are mentioned as an example of a further object type. They are to be constructed on the basis of "value experiences" in analogy to the construction of the physical on the basis of sense qualities (152).

In principle, all statements of science are translatable into statements about the basic relation; can it, too, be eliminated so that all statements are pure structure statements (153)? It turns out that this is possible, but only if the concept of *a founded relation extension* is added to the fundamental concepts of logic. Founded relation-extensions are those which correspond to natural, experienceable relations. It remains problematic whether this addition is permissible (154). The elimination is clarified by means of an example (155).

The purpose of the indicated outline of a constructional system is merely to illustrate the theory. On the other hand, what is asserted as valid is stated in a few theses. The *formal* theses say the following: all basic elements are of the same level. The basic relations are on the first level; there is only a small number of them, perhaps only one. The *material* theses state: the basic elements are "my experiences" as unanalyzable units; it is possible that recollection of similarity suffices as basic relation; the following can be constructed in sequence: qualities, senses, visual sense, visual field, colors, space and time order, visual things, my body, the other autopsychological objects, the physical objects, among them other persons, heteropsychological and cultural objects, objects of all kinds as intersubjective objects. The construction of the world of physics is an array of numbers on the basis of the distribution of qualities; the construction of the heteropsychological is based on the expression and reporting relations or on the psychophysical relation; the construction of the cultural is based upon the manifestation relation (156).

PART FIVE

CLARIFICATION OF SOME PHILOSOPHICAL PROBLEMS ON THE BASIS OF CONSTRUCTION THEORY

157. *The Constructional System as the Basis of Philosophical Investigations*

After having given, in the previous section, an outline of the constructional system, we now want to show, by way of example, the value of such a system for the clarification of philosophical problems. The virtue of the constructional system in this connection does not lie in the presentation of materially new insights, which could then be used for the solution of those problems. What it achieves is actually only a uniform ordering of concepts which allows a *clearer formulation of the question for each problem and thus brings us closer to a solution*.

Since the given constructional system is only a preliminary outline, we do not wish to base the following considerations upon details of this system, but only upon its character as a whole. Hence, we presuppose the possibility of a unified system of concepts and the possibility of constructing this system from experiential relations as basic concepts in the following sequence: the autopsychological, the physical, the heteropsychological, the cultural. Thus we presuppose roughly what has been stated in the theses of § 156. The problems which we shall discuss are meant only as examples. In this book, the emphasis is put on construction theory itself, not upon its application; thus, we cannot give a detailed discussion of the individual problems. We must leave this for a separate discussion. It is still less feasible to give an exhaustive survey of all those problems which can be treated in connection with construction theory. We can here only suggest in what way construction theory sheds light upon various problem situations and what course a subsequent, detailed treatment would have to take.

To begin with, we shall briefly discuss some problems of essence,[119] among them the problems of identity, the self, dualism of the physical and the psychological, and causality (§§ 158-165). Furthermore, we shall consider the psychophysical problem (§§ 166-169) and the problem of reality (§§ 170-178); in both cases, we shall clearly distinguish the constructional aspect of the problem from its metaphysical aspect. Finally, we shall discuss the question of the limitation of (rational) knowledge and shall clarify the distinction between science and metaphysics (§§ 179-183).

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119 Wesensprobleme

CHAPTER
A

SOME PROBLEMS OF ESSENCE

158. *About the Difference between Individual and General Concepts*

Concepts are usually divided into individual concepts and general concepts; the concept Napoleon is an individual concept; the concept mammal, a general concept. From the standpoint of construction theory, this division is not justified, or, rather, it is ambiguous, since every concept, depending upon one's point of view, can be considered either an individual concept or a general concept. We have stated this earlier (§5) and have derived from it the justification for speaking of the object which corresponds to a given concept. Now that we know the constructional forms, in particular the ascension forms (III, A, especially § 40), we realize that, just as the general concepts, (almost) *all of the so-called individual concepts are classes or relation extensions*.

> EXAMPLE. Let us use for clarification the following descending sequence of objects (or concepts). The dog (species) is a class to which my dog Luchs belongs. Luchs is a class whose elements are the "states" of Luchs. An individual state of Luchs (as a perceptual thing) is a class whose elements are points of the perceptual world. One such point is a many-place relation extension whose terms are four numerical terms

(namely, the space-time coördinates) and one or more sense qualities; a sense quality is a class "of my experiences". The latter are here envisaged as basic elements.

In the ordinary view, some of the concepts in this example would have to be called individual and others general. But each of them (except for the last one) is constructed as a class or relation extension, and each of them is an element of the preceding class or a term of the preceding relation extension; thus, each of them is a generality [120] of other objects.

What is the reason that, in the ordinary view, e.g., the species dog and the sense quality brown are considered something general while the dog Luchs, and a given world point, and a given experience are considered something individual, and that frequently only the latter are called "objects", while the former are called "mere concepts"?

The investigation of this and similar examples shows, to begin with, that the so-called individual objects have in common that they are temporally determined, either as belonging to a given time point or a connected time stretch. Furthermore, there is always a definite space point or a connected spatial area to which they belong, if they can be spatially determined at all. On the other hand, the sense quality brown, for example, has many unconnected space-time areas assigned to it (namely, the areas of those space-time points in which this brown is experienced, i.e., to which it is assigned during the construction of the perceptual world).

However, there are orders (though not spatio-temporal orders) in which either points or connected areas are associated with so-called general concepts. For example, to brown—it is a precisely determined hue, etc.—there belongs a point of the color solid or, if we are concerned with brown in general, a connected part of the color solid. Similarly, the species dog is, as it were, assigned a point of the zoological solid (the system of animal species) and to the class of mammals there belongs a connected part of this solid.

Thus, the difference between individual and general objects (or concepts) rests upon the distinction between spatio-temporal and other orders. Usually, only objects which are individualized with respect to the first order are considered individuals. The problem of why this is so is thus reduced to the problem of finding out what distinguishes the orders of space and time from the others. We shall see later that these two orders are also fundamental for the characterization of real-typical [121]

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120 ein Allgemeines
121 wirklichkeitsartig

objects (§ 172 ff.). The distinction which we wish to discover goes back to a difference between two types of relation extensions which have quality classes as terms. We shall concern ourselves only with the visual sense, since it has more bearing on this issue than any of the others. We are then concerned with the difference between place identity and color identity of two quality classes of the visual sense. Upon the first of these relation extensions rests the construction of the spatial order; upon the second rests the qualitative order of the colors, the "color solid". We have seen earlier (§91) that there is a formal difference between the two relation extensions which stems from the fact that different place-identical quality classes can never belong to the same elementary experience, but that different color-identical ones can. This difference was required at that juncture to differentiate the two relation extensions and thus the two orders (visual field and color solid) and to construct each of them separately (§§ 88 ff.,117 f.). We also realized, at that time, that this difference does not only have formal-logical import; since the spatial order is derived precisely from place identity, spatial order could not fulfill its peculiar role in the synthesis of cognition [122] if it were not for this formal-logical property of place identity. This role of spatial order is to serve as the principle of individuation and also (according to the subsequent discussion, §172 ff.) as *principium realisationis*, namely, as the principle which allows us to posit something initially as real-typical, and eventually as real. We must add that similar considerations hold for temporal order, which is connected with spatial order in the construction of the physical world. The reason why temporal order can also play both of these roles, namely, that of a principle of individuation as well as that of a principle of concretion, is that temporal order also leads to a separation of the characteristics (particularly of the quality classes) of elementary experiences, since characteristics of non-identical experiences are held to be temporally different, and vice versa. In fact, temporal order can play these roles logically prior to spatial order.

The view of construction theory concerning the difference between individual and general objects can now be formulated as follows: There are two types of order—initially only for quality classes, but derivatively also for any objects whatever—which are differentiated by the fact that the relation extensions upon which they are based have a certain formal-logical distinction, which has to do with whether two quality classes can belong to the same elementary experience. The first kind comprises the

122 Erkenntnissynthese

orders which we called temporal and spatial; the second kind, all others. The formal-logical properties of the relation extensions which generate the first type of order make it possible to use these orders as principles of individuation and thus also as principles of concretion [123] (which presupposes individuation). Thus, there results an ascertainable, formal distinction between such objects which are assigned (either themselves or through the mediation of their elements) to points or a connected area of orders of the first kind and objects which do not have this property. The former, we call "objects of the first type"; and the latter, "objects of the second type". It turns out that, for an object of the second type, there is always an order of the second type (i.e., such an order can be constructed) such that the object corresponds to a point or a connected partial area of this order. Thus objects of the first and of the second types behave analogously relative to their respective orders. It is of course permissible to use the customary designations "individual" and "general" for the objects of the first and second types. However, these expressions should not be thought to refer to any but the indicated differentiating properties; it must be especially noted that the so-called individual objects are in no sense logically simpler or more uniform than the general objects.

159. *On Identity*

The problem of identity is connected with the just-discussed problem of the distinction between individual and general objects. For its clarification, it presupposes a solution of that problem, namely, a recognition of the logical import of that distinction.

The problem of identity arises only because it is not the case that each object has only one name (in the widest sense). Thus, basically, the problem is to determine when two or more different expressions designate the same object. That there are several different expressions for the same object is not just an empirical shortcoming of the system of expressions. Rather, a multiplicity of names is logically brought about by the fact that, for each object, we may have not only a *proper name* (more than one proper name is superfluous), but that we also have *definite descriptions*; in fact, always several of them (perhaps even arbitrarily many). We have explained earlier (§13) that a definite description consists in the following: an object is described through an indication of overlapping classes to which it belongs, or through relations to other

123 Wirklichkeitssetzung

objects, or through a purely structural description of its place in a relational structure. This description is carried to the point where it holds only for this object alone and for no other object. We have seen the fundamental importance of definite descriptions, especially for construction theory, since the constructional system consists of nothing but such descriptions in the form of constructional definitions. Moreover, definite descriptions play an important role in all other questions of epistemic and especially of scientific identification. The following are all definite descriptions which may occur in questions: "the father of Mr. A", "the birth day of Mr. A", "the species of this beetle", "the specific resistance of copper", etc. As an answer, we require other definite descriptions of the same objects, namely, names of persons, dates, numbers, etc. The questions have a point only because there are different descriptions of the same object, namely, the description in a question ("the birth date of Mr. A") and the description of the answer ("March 22, 1832"). Expressions designating the same object, we call synonymous. In this connection, we must pay attention to the distinction between nominatum and sense of an object sign; it corresponds to the distinction between logical and epistemic value of statements (§50). The expressions, "the birth date of Mr. A" and "March 22, 1832", have the same nominatum, for it is the same day which is designated by both of them. On the other hand, they have obviously different senses. This is shown by the fact that it is not trivial to claim that they are identical.

Substitutability is the criterion for an identical nominatum: two designations are said to be synonymous if each propositional function which is turned into a true sentence through the substitution of one of the designations does the same upon the substitution of the other. *This is the definition of logical identity*.

> EXAMPLE. The sentences, "Goethe died on March 22, 1832" and "Goethe died on the birthday of Mr. A" are both true. The same holds for all other sentences about this date. That one of these two sentences is important while the other one is not, is of no consequence in this context. All that matters for a criterion that two designations have the same nominatum, i.e., a criterion for "identity", is the truth value of the sentences involved.

Identity, in common usage and also in the usage of science, is not always taken in the strictest sense. Language often treats objects which are not identical in the strict, logical sense as identical; whether objects are envisaged as identical is frequently shown through the use of the

words "the same" or simply "this". Frequently, identity does not hold for the object which is ostensibly meant, but for its kind; in these cases, the object functions as a representative of its kind.

> EXAMPLES. The question, "Do you already have this book? This butterfly?" does not mean the indicated object itself, but the kind, as whose representative the object is taken. This improper identification can have various different aspects, as can be seen from the following four sentences: "The public transport system in A has the same trains as that in B." "Today, I came home on the same train as yesterday, namely, on the 6:12." "This is the same train that used to run on Route 10." "I was sitting in the train which you saw go by."

The indicated examples show that in some cases it is clear to what the identity is supposed to relate, i.e., as representatives of what kind the object is meant. For example, in the case of an animal or a plant, we mean, as a rule, the species. In different cases, depending on the context, an object is held to be the representative of entirely different classes. In these cases, the identity, which is ostensibly related to the object itself, holds only for one of these classes. This is the case in our example of the four sentences about the train. In order to be able, in these cases, to characterize the difference in the aspects of identification, we can use two different modes of approach or modes of expression. According to the first approach, we are, in these cases (for example, in the case of the four sentences), not concerned with identity, but with various other relations, which, however, are envisaged as identity (either linguistically or conceptually). According to the second approach, we are not here concerned with similarity (in this or that respect), but with identity in the strict sense, however, not with identity between the individual objects which occur here, but between objects on a higher level (classes or relation extensions), of which the objects are representatives.

> EXAMPLE. Let us apply the first mode of approach to the above example of the four sentences about the train. In this case, we say that the identity, which is expressed in the form of words, does not, strictly speaking, obtain between the objects, but that various other relations hold between them, namely, (a) similarity in construction and looks, (b) the identical time of day or the identical place in the time schedule, (c) "genidentity" (cf. § 128), i.e., association of various "thing-states" 124 with one object, (d) the intersubjective correspondence between thing-states (cf. § 146). On the other hand, under the second mode of approach, we take the trains to be representatives of objects of a

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124 Dingzustände

higher level; these higher-level objects, for which identity holds in the strict sense, are, in our four cases, (a) the manufacturing pattern, as a class of trains; (b) the arrangement to have a daily train at 6:12 P.M., as a class of train runs; (c) the physical thing "train" as the class of its states; (d) the intersubjective object "train" as the class of those objects which are in intersubjective correspondence (§ 148), that is to say, an individual train in the intersubjective sense. It can be seen that identity in the strict sense does not hold between the objects themselves, but only between the higher-level objects which they represent. This is quite obvious in the first three cases, namely, (a) manufacturing pattern, (b) the arrangement of which I make use on both days, and (c) the physical thing at different times. It is somewhat more difficult to recognize this in case (d), where identity holds only for the intersubjective object, which is constructed as a class, but not for the individual objects which are intersubjectively correlated to one another. I can here only refer back to the earlier presentation of intersubjectivization (§§ 146-149).

The above considerations show that, with every identity statement, we must pay careful attention to whether or not identity is meant in the strict sense. One may say that, in most cases of linguistic identity (that is to say, when words like "the same" or "this" are used or even if the same word is used several times), we are concerned with improper identity. In such cases (according to the second approach), the objects are taken as representatives of strictly identical objects of a higher level; (in the first approach): instead of with identity, we are here concerned with other equivalence relations (§ 11). Relations of this kind are especially likeness of any kind, meaning the agreement in any property whatever, genidentity (§ 128), and intersubjective correspondence (§ 146f.). The last two are frequently confused with (proper) identity; this is perhaps due to the fact that, so far, they have not received any name. In all cases where such relations hold, the higher-level object for which the identity holds is constructed from the nonidentical objects with the aid of the relation in question; it is only this construction which gives us the right to speak of identity in these cases.

REFERENCES. There are some essentially correct remarks about genidentity in the literature, in which this relation is falsely described as "identity"; these remarks receive their just recognition only after the two relations are clearly distinguished. Thus, for example, Cornelius' claim (opposed by Gomperz [Weltansch.] 163) that "identity" (where genidentity is meant) must be constructed from certain agreements between experiences is justified. Furthermore, Volkelt's critical remark against Avenarius [Gewissheit] 130, that "identity" (where, again, gen-

identity is meant) is not originally given and thus must not be considered "pure experience", is correct.

It is remarkable that occasionally the temporal sequence of concept formation is such that, first, a relation of the just-described sort is linguistically taken as identity, and that the higher-level object which justifies this usage is constructed only afterward. In fact, the higher-level object is constructed, as it were, precisely through this improper use of language. In this context, we must also mention the method of constructing an object on the basis of other objects by indicating under what conditions two of the latter objects are to be considered identical.

EXAMPLES. The construction of perceptual things which rests upon genidentity can, for example, take the following form: "A perceived thing *a* and a perceived thing *b* are the same thing if *a* and *b* fulfill such and such conditions (namely, the genidentity criteria)." Likewise, animal species (and, in an analogous way, plant species) are constructed in zoology by speaking of "the same" animal, if such and such criteria are fulfilled. The above-mentioned four cases, where we spoke of "the same" train, can also be used as examples in this connection. An important example is formed by the characterization of the different geometrical disciplines. According to F. Klein, they can be envisaged as the theories of those properties which remain invariant, relative to various types of transformation. Consequently, the concept formation, and thus the construction, of topology can be characterized by saying that geometrical entities are considered identical (e.g., two drawn figures are considered representations of "the same" state of affairs), if they are homomorphic; we have a corresponding case in projective geometry, if they are in projective relation; correspondingly, in a metric geometry, if they are similar; lastly, in a nonexistent discipline, which corresponds to topography but is purely geometrical, we would call two figures identical if they are congruent. (The designation, homomorphism, projective relation, similarity, and congruence, are generally applied only to entities of the same system, but not to two arbitrarily chosen figures; thus, we would have to say, more precisely: "if the figures are of such a nature that they would have the relation of homomorphism, etc., if they were brought into a system".)

160. *The Essence of the Psychological, Physical, and Cultural Object Types*

Let us again briefly summarize how the nature of the most important different object types and their distinctions can be characterized on the

basis of the constructional system. This is of fundamental importance for the problems which are to be considered subsequently. In order to omit unnecessary detail, we shall not, at this point, take into consideration the distinctions within the main object types. Thus, for each object type, we consider only the most important representative. Of the autopsychological object type, we consider the experiences, their individual constituents, and the qualities (of sense impressions, emotions, volitions, etc.). Of the physical object type, we consider the physical things. Of the heteropsychological objects, we consider again experiences, their individual constituents, and the qualities; of the cultural objects, we consider the primary cultural objects and general higher-level objects.

The constructional system shows that all objects can be constructed from "my elementary experiences" as basic elements. In other words (and this is what is meant by the expression "to construct"), all (scientific) statements can be transformed into statements about my experiences (more precisely, into statements about relations between my experiences) where the logical value is retained. Thus, each object which is not itself one of my experiences, is a quasi object; I use its name as a convenient abbreviation in order to speak about my experiences. In fact, within construction theory, and thus within rational science, its name is nothing but an abbreviation. Whether, in addition, it also designates something which "exists by itself" is a question of metaphysics which has no place in science (cf. §§ 161 and 176).

The *autopsychological objects* (that is to say, the most important ones which have been mentioned above) are in part my experiences themselves, in part classes of such experiences, which have been formed with the aid of the basic relation(s); in part, they are relation extensions of those experiences and these classes; thus, they are my experiences themselves and auxiliary expressions (quasi objects) of the next higher levels.

The *physical objects* are four-dimensional orders of qualities (or of numbers which represent the qualities); thus, they are classes of my experiences. The experiences are originally organized into classes and the latter into fourfold systems of sequences; certain subsystems of the latter are formed by the physical objects.

The heteropsychological objects consist of a new arrangement of the autopsychological objects in relation to certain physical objects (namely, my body and the bodies of other persons). Thus, they have in common with the physical objects that they are orders of autopsychological objects. However, the order of the autopsychological objects which leads to the physical objects (namely, the above-mentioned fourfold system of

sequences) is very different from the order of the autopsychological domain, while that particular order of autopsychological objects which results in the heteropsychological objects has considerable similarity with the order of the autopsychological objects themselves. This similarity, though, does not hold for proximity in individual cases (namely, in the time order), but it holds relative to the general laws of proximateness within an order [125] (that is to say, it holds for the psychological laws of a process in time).

The *cultural objects* are orders of heteropsychological (and, to a lesser degree, also of autopsychological) objects, which are usually found several levels higher up.

161. *Constructional and Metaphysical Essence*

The indicated answers to the quest after the nature of the various object types are frequently felt to be unsatisfactory. They would be considered unsatisfactory if the question were not concerned with constructional, but with metaphysical, essence. If we ask for the constructional essence of an object, we wish to know the constructional context of this object within the system, especially how this object can be derived from the basic objects. On the other hand, if someone asks for the metaphysical essence of an object, he wishes to know what the object in question is in itself. Such a question presupposes that the object does not only exist as a certain constructional form, but also as an "object-in-itself", and this characterizes the question as belonging to metaphysics. This is frequently overlooked, and thus this same question is sometimes posed in science, which is nonmetaphysical, and where such questions have neither justification nor meaning.

We must indicate still more precisely what is to be meant by the constructional essence of an object. In science, we can, strictly speaking, not speak about the essence of an object, not even about the constructional essence of an object, and thus we cannot raise any question concerning essence. An object has an essence, and an object name has a nominatum, only in a certain improper sense, and thus the question about the nominatum of a given object name is meaningful only in this improper sense. Strictly speaking, the question should not be phrased as "What is the nominatum of this object sign?", but "Which sentences in which this object sign can occur are true?" *We can make an unambiguous assessment only of the truth or falsity of a sentence, not of the nominatum*

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125 Ordnungsnachbarschaft

of a sign, not even of an object sign. Thus, the indication of the essence of an object or, what amounts to the same, the indication of the nominatum of the sign of an object, consists in an indication of the truth criteria for those sentences in which the sign of this object can occur. Such criteria can be formulated in various different ways; these various ways then indicate the respective character of the essence description in question. If the constructional essence of an object is to be indicated, the criterion consists in the construction formula of the object, which is a transformation rule that allows us to translate step by step every sentence in which the sign of the object occurs into sentences about objects on a lower constructional level and, finally, into a sentence about the basic relation (s) alone. Let us consider those pairs of experiences for which the basic relation(s) hold(s) and which occur in the inventory list of the basic relation(s) as an indication of the originally given states of affairs;[126] then a criterion of the just-indicated kind consists in a reduction of all sentences about the object whose constructional nature we wish to ascertain, to such sentences as can be shown to be true or false through the originally given states of affairs.

The earlier mentioned concept of an essential relation (§ 20), which plays a considerable role in discussions about problems of essence (especially in connection with the problems of causality and of psychophysical parallelism) is related to the notion of metaphysical essence. An essential relation cannot be given a place in the constructional system. Thus, statements about such relations cannot be brought into a verifiable form. Thus, science cannot ask questions concerning essential relations. Hence, this concept is shown to belong to metaphysics.

REFERENCES. Cf. Hertz [Einleitg.] 129 f., about the question concerning the "nature" of force or of electricity.

162. *About Mind-Body Dualism*

Are body and mind, the physical and the psychological, two different substances (or principles or object types or aspects) of the world, or is there only *one* substance (or object type, etc.)? (This problem of dualism must be clearly distinguished from the actual "psychophysical problem", namely, the problem of the mutual dependency relations between the physical and the psychological events, which shall be discussed in more detail in the sequel [§§ 166-169].) If we consider the indicated

126 Ur-Sachverhalte

question from the viewpoint of construction theory, then the argument for dualism would have to be phrased in roughly the following fashion. Even though construction theory places emphasis upon the fact that, in the formation of the constructional system, we proceed from a unified basis, it must nevertheless construct various object types, especially the physical and the psychological, in order to comprehend all objects of science within the system. From this it follows (and this is the argument for dualism) that, in spite of the unity of the basis, there are differences between the object types, and especially there is an important difference between the physical and the psychological. Against this, it must be said that construction theory speaks of "object types" or generally of constructed "objects" only to make a concession to the realistic mode of speech of the empirical sciences. Within the framework of construction theory it would be more fitting to speak of order forms and their types. When we are confronted with a monism-dualism problem within any domain whatever, we must always clearly distinguish whether the question concerns the unity or multiplicity of that which is to be ordered or of the order forms. Since there are in any case various different types of order form, in fact, an arbitrarily large number of them, the question is of import only relative to that which is to be ordered, i.e., relative to the basic elements. If the question is posed in this form, we must decide it, for the constructional system and thus for the monism-dualism problem of the physical and the psychological, in favor of monism; this results from the uniformity of the basic elements of the system.

> Let us illustrate this fact through an analogy. We observe the starred sky at night; neither the moon nor clouds are visible, only stars. We can undertake to distinguish and classic the stars; we notice various "object types" which are distinguished according to type of light, brightness, color. Hence, in this case, there are distinctions in that which is to be ordered. In contrast, let us now consider the (fictitious) case that only fixed stars Of equal brightness and color are visible. If we are now asked for the number of object types, we would have to answer that we notice objects of only one type. We would not become doubtful about the justification of this answer if somebody were to object: "No, there are quite a number of different object types which can be noticed: to begin with, the stars themselves; secondly, the distances between any two stars; third, the relations in size between any two distances; fourth, the triangles of any three stars; fifth, the overlapping relation between two triangles; etc.; these object types are, in fact, entirely different from one another: a distance is not a star; a relation between two distances is not

a distance; etc." Against this objection, we would reply that the enumerated different object types (except for the stars themselves) are not autonomous object types; they do not actually comprise objects, in the proper sense of the word, which can be coordinated with the stars, but only relations and relational structures among the stars. If we notice any stars at all, we always notice them at definite places and thus distances, figures, and relations are necessarily given at the same time. The question whether we notice one, two, or several types of object cannot refer to the number of ascertainable types of such order forms of the elements, for these order forms, as can be seen from the indicated five examples, are unlimited in number. Thus the question can concern only the elements themselves.

The analogy of the stars (that is to say, the second case with the propertyless stars which are connected only through relations) gives a good picture of the intention of construction theory: all objects of the empirical sciences (except for the elementary experiences themselves, which correspond to the stars) are constellations of stars, together with their relations and connections, which are formed from propertyless, but orderable, stars. The differences between the so-called object types, especially the difference between the physical and the psychological, merely indicate different types of constellation (or their connections) which are due to different modes of organization.

Let us now apply the insights which we have gained from the example to the monism-dualism problem; we see that the physical and the psychological must not be envisaged as two principles or aspects of the world. They are order forms of the one, unified domain of elements which are propertyless and merely connected through relations. There is an unlimited number of such order forms. If we were to claim that the difference between the physical and the psychological amounts to a difference between two substances or aspects of the world, then we should not stop with these two forms. In science, even today, there is already a considerable number of object types which have the same independence and thus the same claim to be considered essential aspects of the world. The old metaphysical problem of dualism is restricted to the physical and the psychological only because science recognized the independence of these two object types, more precisely, constructional forms, first. In the meantime, other object types (especially the cultural objects, the biological objects, and the values) have been recognized as independent, even though the equality of their status with that of the physical and the psychological objects is at the moment still debated (cf. also the ex-

amples of further object types in § 25). But even this enumeration of object types mentions too few, since each of them comprises objects on various constructional levels, as has been shown in the sketch of the constructional system. This aggregation is useful for a rough classification, but we must not overlook the fact that the objects on the different levels belong to different object spheres (§§41,29) and thus belong to logically totally separate and independent domains. Thus, in the final analysis, it turns out that dualism is an arbitrary restriction to two important, but not fundamentally preeminent object domains. As a thesis concerning the fundamental constitution of the world, it is certainly not tenable but has to give way to a pluralism which recognizes in the world an unlimited number of aspects or substances. But these would then merely be the unlimited number of possible forms of ordering the elements on the basis of their basic relation(s). The result remains the same; *in the world of cognizable objects, there are indeed* (as in any domain, if it can be ordered at all) *an unlimited number of order forms, but only one uniform type of element which is to be ordered*.

REFERENCES. In the opinion of Natorp, whose conception is related to ours, this rejection of psychophysical dualism goes back to Kant. Natorp says [Psychol.] 148, that, according to Kant, " "matter", namely, the sensations of the inner and outer sense, are one and the same and are distinguished only through the "form", i.e., their mode of ordering." Natorp gives some further historical remarks and systematic discussions concerning the problems just treated. Moreover, our position agrees with that of Russell [Mind], where a bibliography to this problem is found (p. 22ff.); he derives his position from William James and mentions especially the behaviorists. Another, but related, formulation is found in Ziehen ([Erkth.] 19 f., 43 ff. [Gegenw. Stand] 66ff. "Binomism"). Russell ([Mind] 287 ff.) speaks of the physical and the psychological as two types of regularities for the same elements. The formulation of Mach ([Anal.] 14, [Erk.] 18) that there are different directions of investigation relative to the same matter is likewise related to the given position.

163. *The Problem of the Self*

The "*self*" *is the class of elementary experiences*. It is frequently and justly emphasized that the self is not a bundle of representations, or experiences, but a unit. This is not in opposition to our thesis, for (as we have shown in § 37 and have emphasized repeatedly) a class is not a collection, or the sum, or a bundle of its elements, but a unified expression for that which the elements have in common.

The existence of the self is not an originally given fact.127 The *sum* does not follow from the *cogito*; it does not follow from "I experience" that "I am", but only that an experience is. The self does not belong to the expression of the basic experience at all, but is constructed only later, essentially for the purpose of delineation against the "others"; that is, only on a high constructional level, after the construction of the heteropsychological. Thus, a more fitting expression than "I experience" would be "experience" or, still better, "this experience". Thus, we ought to replace the Cartesian dictum by "this experience; therefore this experience is", and this is of course a mere tautology. The self does not belong to the original state of affairs (§65), as we have already indicated during the discussion of the autopsychological basis. Philosophical introspection [128] has led philosophers of various persuasions to the same result, namely, that the original processes of consciousness must not be envisaged as the activities of an acting subject, the "self".

REFERENCES. Not "I think", but "it thinks within me", says Russell [Mind] 18, and we would, just as Lichtenberg (according to Schlick [Erkenntnisl.] 147 f.) strike out the "within me". A similar denial of activity in the original state of affairs is found in Nietzsche [Wille] §§ 304, 309; Avenarius [Kritik]; Natorp [Psychol.] 41 ff.; Driesch [Ordnungsl.]; Schlick [Erkenntnisi.] 147 f. Cf. also the bibliography in § 65. Where the mistaken cleavage of the original state of affairs into self and object leads is shown in Nikolai Hartmann [Metaphysik] 38, 40, where a distinction is finally made, not only between two, but between four, layers, namely, subject, object, object image, and the trans-objective.

164. *The Nature of the Intention Relation*

The intention relation holds between a content-possessing psychological process and its content, for example, between my present representation of the cathedral of Cologne and this building as the content of my representation, or that which is "intended". Thus, the domain of the relation comprises the "intending" psychological processes, such as perceptions, representations, emotions (if they are related to something), etc., which are directed toward something. We leave open the debated question whether all psychological processes belong in this category; that is, whether they are all "intentional". Now, if the intention relation

127 Ur-Sachverhalt
128 Selbstbesinnung

holds, for example, between a given perceptual experience of a tree and the intended tree, then by the "intended tree" we mean initially the tree "that is represented in the perception"; thus, it could also be a tree in a dream or a hallucination. Now, whether it is such an unreal tree or whether there is a real tree that corresponds to the intended tree, is a secondary question which is of no concern for the immediate character of the experience.

Now, the customary conception of the intention relation holds that such intending psychological events refer, in a peculiar way, to something beyond themselves, namely, to their "intended" or "meant" object, which is different from them. It is consequently held that the relation is of a special sort and cannot be reduced to anything else. What is correct in this conception is only that the experience and its intended object are not identical. But the intention relation is not a relation of a unique kind which can be found nowhere but between a psychological entity and that which is represented in it. For, from the viewpoint of construction theory, the intended tree is a certain, already very complicated ordering of experiences, namely, of those experiences of which we say that the tree is their intended object; now, these experiences are units which cannot be analyzed, but can merely be brought into different orders, in this case, into an order which represents the intended tree. From this we can see the following: the intention relation holds generally between an experience and an order of experiences, if the following two conditions are fulfilled: first, the experience must belong to this order; second, this order must be one of those constructional forms in which real-typical objects are constructed. ("Real-typical" objects are those objects for which a distinction between real and nonreal is meaningful, even before this distinction has been made [§ 172]. This agrees with the fact that, so far as the intentional object is concerned, it is not yet necessary to decide the question of reality.)

The relation between an element and a relational structure of a certain sort in which it has a place is one of the most important relations of the applied theory of relations. The intention relation is nothing but a subclass of this relation, namely, the relation between an experience (or constituent of an experience) and an order which has a real-typical structure. Actually, there is no objection if such a relation is formulated as "reference to something outside itself", as long as it is made clear that the expression "outside" means that the intentional object is not identical with the experience or, more precisely, that the experience stands in a more comprehensive context.

EXAMPLES. Let us mention some examples of the indicated general relation in other areas; in these cases, we can also use the expression of "referring". A given plant refers to the botanical system of plants, a given hue to the color solid, a person refers to his family, his state, or his occupational hierarchy, etc.

The intention relation belongs to the same type as the relations in the indicated examples. Of course, if a tree occurs in one of our experiences, we are usually conscious that this tree is intended, while we do not, as a rule, think of the color solid whenever we are aware of a color. But this is only a difference in degree; consciousness of the tree can occasionally be lacking, although this is rarely the case in an adult person. However, if one says that it lies in the essence of an experience to refer intentionally to something, even if one is not in each experience conscious of its intended object, then it must be replied that, from the viewpoint of construction theory, this holds quite generally; it is essential to each object that it belongs to certain order contexts; otherwise, it could not even be constructed, that is, could not exist as an object of cognition.

REFERENCES. The traditional theory of intentionality stems from Brentano and has been continued by Husserl [Phanomenol.] 64 ff. Our position agrees essentially with that of Russell [Mind]. It is closely related to that of Jacoby ([Ontol.] 258 ff.), according to which we are here concerned with the overlapping of two systematic orders, namely, the system of consciousness and some other system, for example, the system of external reality. Jacoby puts justifiable emphasis on the fact that, through this insight, the "duplication of entities in the external world into appearance and the thing-in-itself" becomes superfluous and is disregarded (p. 257).

165. *The Nature of Causality*

There are certain laws in the perceptual world which supplement the construction of this domain to a considerable degree and without which the construction of a large part of this domain would not even be possible. These laws have the form of implications between assignments to pairs of places or place areas which have a certain relation to one another in the order of places. It will be recalled that events in the perceptual world are represented by four-dimensional areas of world points, to which (in part) qualities are assigned (cf. the construction of the perceptual world, §§ 125 f., 133f.). Hence, such a law has the following form: "If qualities are assigned to the world points of a

(four-dimensional) area in such and such a way, then qualities of such and such a kind are assigned, or must be assigned, to the world points of another area whose location stands in such and such a relation to the location of the first area." If the two areas which are thus connected through implication are simultaneous, we are concerned with a *state law*;[129] if they follow one another, with a *process law*.[130] If the two four-dimensional areas are in proximity, then we have a *proximity law*.[131] In the case of a state law, we have spatial proximity; in the case of a process law, temporal proximity. In this latter case (process law with temporal proximity), the law is called a *causal law*. Of the two four-dimensional areas which are in temporal proximity, i.e., which follow one another, and between which the dependency obtains, we call the earlier one the cause of the latter, while this latter area is called the *effect* of the former.

Thus, within science, causality means nothing but a functional dependency of a certain sort. We must emphasize this because time and again the opinion is advanced that, aside from the functional dependency between the two events, there must be a "real" relation or "essential relation", namely, such that the first event "produces", "generates", or "brings about", the second. It is strange that the opinion is still held, even by physicists and epistemologists, that science, in this case, physics, must not rest content with an investigation of those functional dependencies, but that it should ascertain, above all, the "real causes".

The error which lies in this opinion becomes even clearer if we consider, not the perceptual world, but the purely quantitative world of physics, with which physics is after all concerned. In the world of physics, one cannot even speak of events which stand to one another in the relation of cause and effect. The concepts "cause" and "effect" are meaningful only within the perceptual world; thus, they are infected with the imprecision which attaches to concept formations within this world. Actually, the process laws of the world of physics, i.e., the causal laws of physics, do not speak of a dependency between events, but of a dependency between a state and a certain limiting value relative to the assignment of state magnitudes[132] (namely, the temporal differential quotient of a state magnitude). It is only these causal laws, and not those of the perceptual world, which hold strictly and without exception. The causal laws in the perceptual world do not hold strictly, but only as

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129 Zustandsgesetz
130 Ablaufgesetz
131 Nachbarschaftsgesetz
132 Zustandsgrössen

qualified by the vague clause "if no other circumstance intervenes." Thus, if we speak of strict causal laws, we can mean only the physical laws. But in this case, there is nothing present which could be called "cause" and "effect" (for nobody will wish to call a momentary state a "cause", let alone a differential quotient, an "effect"). Moreover, what is meant here can certainly not be the essential relation called "bringing about". We have frequently mentioned the metaphysical, extrascientific character of essential relations. (Cf. also the general remarks concerning problems of essence at the end of § 169, which also apply to the problem of causality.)

REFERENCES. Since Hume, it has been said frequently and clearly that, within science, "real causation" must be denied. (Let me here only refer to Mach, Verworn [Kondit.], and Vaihinger [Als Ob].) Thus, an explicit clarification from the standpoint of construction theory seems superfluous; perhaps the clearest rebuttal was given by Russell in his lecture [Cause].

CHAPTER
B

THE PSYCHOPHYSICAL PROBLEM

166. *Formulation of the Problem*

In the present context, we do not mean by the psychophysical problem the question of whether to all psychological events there corresponds a simultaneous physiological event in the central nervous system (such that to similar psychological events there correspond similar physiological events). This is presupposed as an empirical hypothesis. Furthermore, we also do not mean the problem of ascertaining the types of individual brain events which correspond to the various sorts of psychological events. The solution of this "correlation problem" of the psychophysical relation (cf. §21) is a task of physiology. The philosophical problem presupposes the solution of this problem or at least presupposes that it is solvable. We are here concerned with the problem that we have designated earlier as the "essence problem" of the psychophysical relation (§ 22); we are here asking bow the parallelism of two such disparate sequences of events can be envisaged and explained. More recent philosophy of nature has again concerned itself with this ancient problem, and ever since it has been one of the most frequently treated and debated philosophical problems.

REFERENCES. Du Bois-Reymond [Grenzen] 33 ff., formulates the problem in the following way: "If we make this same assumption of

> astronomical knowledge for the brain of man ... then, relative to all material events which occur in it, our knowledge ... will be complete ...even those material events which are always, and hence probably necessarily, simultaneous with mental (in our language, "psychological") events, would be completely understood ... however, as concerns the mental events themselves, it appears that they would be just as incomprehensible as they are now, even if we presuppose astronomical knowledge of the mental organ . . .. What conceivable connection is there between certain motions of certain atoms in my brain, on one hand, and certain, for me given, not further definable, undeniable facts such as, "I feel pain", "I feel desire". . . . It is altogether and forever incomprehensible that it is not a matter of indifference to a collection of carbon, hydrogen, nitrogen, oxygen, etc., atoms how they are situated and how they move. . . . *There is no way of comprehending how consciousness can result from their interaction*." (Italics mine). We give the quotation in such detail since it shows, in exemplary fashion, how a problem can be clouded to the point of complete opaqueness, if a question is posed in the wrong way.
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> Of the extremely extensive literature concerning this problem, let me mention only the lucid discussions by Busse [Geist]; in the same book, Durr gives an extensive bibliography; furthermore, Erdmann [Leib].

167. *The Psychophysical Problem Does Not Originate from the Heteropsychological*

Let us, first of all, find out which state of affairs is here to be explained, and in what situation we meet with this state of affairs.

Let us (just as Du Bois-Reymond) presuppose knowledge of the brain events. We express this through the fiction that we are in the possession of a "brain mirror", i.e., of an apparatus which allows us to observe a living brain in detail.

To begin with, it could appear as if the state of affairs with which the psychophysical problem is concerned could be observed in the following way: we use the brain mirror to look at the brain events of a test person, and at the same time we listen to his reports about the events of which he is conscious; furthermore, we observe his expressive motions. But this cannot be the typical case of the observation of the state of affairs in question, for here we are not confronted with two parallel sequences of events in different domains, but with two parallel *physical* sequences of events, namely, the sequence of visual observations in the brain mirror and the sequence of auditory observations of the spoken words of the test person (perhaps combined with visual observations of

his expressive motions). Of course, we draw conclusions concerning the sequence of psychological events from the second sequence of physical events. But, what we observe are two physical sequences which show a certain complicated parallelism, but a parallelism which is in principle no more problematic than any other parallelism between physical processes. At any rate, this is not a situation in which the state of affairs in question is, as such, observed.

To facilitate understanding, we have represented the situation in realistic language. If we use constructional language, it is even more clearly evident that it is in principle impossible to observe the basic state of affairs of the psychophysical problem in another person. The two parallel sequences are constructed, on one hand, as a sequence of physical events in the body of another person, and, on the other hand, as a sequence of heteropsychological events which are constructionally assigned to this body. But the assignment of heteropsychological phenomena to the body of another person consists in assigning autopsychological events solely according to the physical behavior of this body. It is trivial and requires no further explanation that, in this case, we have a parallelism between the physical events of this body and the values which have been assigned. To pose the psychophysical problem from the vantage point of the heteropsychological would be very much like the following: somebody has accustomed himself to envisage an angry Zeus whenever he hears thunder. Eventually, he poses the question of how it could be explained that Zeus's anger and the thunder always occur simultaneously.

168. *The Basic Situation of the Psychophysical Problem*

Since the basic situation of the psychophysical problem has nothing to do with the heteropsychological, it must be related to the autopsychological. Therefore, in order to produce appropriate conditions, I have to observe my own brain through the brain mirror. In order to simplify the situation as much as possible, let us assume that auditory perceptions take place in such a way that they attract the main attention (while the visual observations through the brain mirror are only made on the side). The auditory perceptions could be produced by creating certain physical conditions, for example, by having a music box play a melody. But then we encounter a difficulty which corresponds precisely to the one discussed in connection with the heteropsychological experiment: I see brain events and I hear the tones of a music box; thus, we have again a purely physical parallelism. Thus, let us assume, instead, that I merely

vividly imagine the melody. Here, now, we have really the desired situation: in imagination, I hear a melody, or, better, the same melody over and over (psychological sequence), and at the same time, I observe in the brain mirror my brain events (physical sequence); the parallelism shows itself in the fact that the same brain event always occurs during the same phase of the melody.

Let us consider the just-described basic situation from the constructional point of view. We find that the following state of affairs obtains. There is a temporal sequence of elementary experiences. If we carry out a constructional analysis of these experiences into their constituents (more precisely, into their quasi constituents), it becomes evident that there is a parallelism between two sequences of constituents; in each experience of the sequence of experiences, there is one constituent from each of the two constituent sequences; two constituents which occur together once will occur together again if one or the other of them occurs. The occurrence of two sequences of constituents of experiences which are connected with one another in such a way, we wish to call generally *parallelism of constituents*. Such a parallelism can occur, as we shall see, between the most heterogeneous sequences of constituents. In the case of the basic situation here under discussion, the parallelism of the constituents has the peculiarity that the constituents of one of the sequences (visual perceptions) can be used for the construction of real physical objects, while the constituents of the other sequence (auditory representations) cannot be used in this way; rather, the latter can be of any arbitrary kind.

There are also parallelisms of a different sort. Parallelisms between two sequences of constituents, both of which can be used for the construction of physical objects, occur frequently.

> EXAMPLES. Parallelism between different sense modalities; (in physical-realistic language): when a body visibly vibrates in a certain way, it simultaneously emits a certain sound; when a body has a certain visual shape, then it has simultaneously an analogous tactile shape. Parallelism within the same sense modality is also frequent; if a body has the visual shape of a horse, then it has simultaneously one of the horse colors; if part of a body has the visual shape of a horse head, then the entire body has simultaneously the visual shape of a horse.

Furthermore, there are parallelisms between two sequences of constituents, neither of which can be used for the construction of real physical objects, but (either for the construction of unreal physical objects

or) only (as all sequences of constituents) for the construction of psychological objects.

> EXAMPLE. (In physical-realistic language): if I have the representation (not the perception) of the visual shape of a rose, then I have simultaneously the representation of the color and the fragrance of a rose; if I have the representation of the taste of an apple, then I simultaneously have a feeling of pleasure.

169. *Constructional and Metaphysical Problem*

The indicated parallelism, which takes place in the basic situation of the psychophysical problem, is distinguished from the other examples of parallelism only by the fact that one of the sequences of constituents can be used for the construction of physical objects, while the second sequence may be utilizable for the construction of physical objects, but does not have to be. From the viewpoint of construction theory, this is not an essential difference. The inherent nature of the given does not allow us to make essential distinctions between experiences or between constituents of experiences, especially not on the basis of the fact that constituents of one sort can be ordered in a certain way, while others can be ordered only in other ways. Thus, from the viewpoint of construction theory, the discernment of that basic situation does not offer anything new. *It is only another case of the frequently occurring parallelism of sequences of constituents*. It offers no more problems than this parallelism offers in general. Many more examples of such parallelisms could be mentioned, none of them any less problematic. The indicated cases, including the psychophysical situation, pose the problem: how can the occurrence of a parallelism of sequences of constituents be explained? For construction theory, and thus also *for* (*rational*) *science*, *the only thing to be done here is to ascertain what is the case*, namely, that it is not only the case that the given can be ordered in some way or another, but that it can be ordered to such an extent and in such a way that parallel sequences of this sort can be constructionally produced. *The quest for an explanation of these findings lies outside the range of science*; this shows itself already in the fact that this question cannot be expressed in concepts that can be constructed; for the concepts, "interpretation", "explanation", "basis", do not in this sense have any place in a constructional system of objects of cognition. (This holds for any such constructional system and not only for a constructional system of

our specific kind.) Rather, the quest for an explanation of that parallelism belongs within metaphysics.

> It is a familiar fact that metaphysics explains the parallelisms of the first kind through realistic or phenomenalistic postulations of physical things-in-themselves; it is one and the same thing which on one hand appears to me as the visual thing, apple, and on the other hand as the taste thing, apple. Parallelisms of the second kind can be explained through analogous postulations of psychological realities; it is one and the same psychological entity which is, on one hand, the representation of an apple and which carries with it, on the other hand, a certain emotional quality. Thus in both cases the metaphysical explanation makes use of a reification (positing as real) or a substantialization (in the sense of the category of substance). In a similar way, the parallelism of the third kind, the one that occurs in the psychophysical basic situation, can be explained through reification of things-in-themselves which have two different types of property.

To the extent to which it is necessary and possible for science, the psychophysical problem can be clarified in the indicated way on the basis of construction theory. The given suggestions must here suffice. Of course, this clarification does not go beyond the indicated state of affairs; but this does not mean that there is a gap in science: *a question which goes further cannot even be formulated within science* (i.e., formulated with scientific, that is to say, constructable, concepts, cf. § 180).

Aside from the psychophysical relation, we have noticed earlier certain other relations between different object types, each of which gives rise to a correlation problem as well as to an essence problem (§§20,21,24). In a manner similar to that used for the psychophysical problem, we could also show for these other problems that they can be posed in constructional language only as correlation problems. Their solutions, in these cases, are certain functional dependencies. On the other hand, if they are envisaged as essence problems, then they belong to the domain of metaphysics. This holds especially, for example, for the intention relation (cf. § 164), the causal relation (cf. § 165), and the manifestation and documentation relations among cultural objects.

> REFERENCES. It was especially Mach [Anal.] who emphasized that in science we can ask only for functional dependencies, not for "essential relations". At present, this view is frequently argued by thinkers he has influenced.
>
> Dingler [Naturphil.] 158 ff., also tries a solution to the psychophysical problem with the aid of the thought experiment, where the "brain mir-

ror" is used relative to one's own brain, but shortly before the nicely prepared solution, he goes astray: he believes that the simultaneity between the picture in the brain mirror and the corresponding conscious event cannot be established because of the loss of time in the transmission through the apparatus. However, this time difference is not essential for the problem; moreover, it does not occur if the phenomena in question are static or periodic.

CHAPTER
C

THE CONSTRUCTIONAL OR EMPIRICAL PROBLEM OF REALITY

170. *Real and Nonreal Physical Objects*

The only concept of reality which occurs in the empirical sciences we shall call the *empirical concept of reality*. It is this concept which distinguishes a geographically determined mountain from a legendary or dreamed mountain, and an experienced emotion from a simulated one. The question as to what is real, when it is formulated with the aid of constructable concepts, can only be concerned with this empirical reality it alone can be posed and treated within the constructional system hence, we speak here of the "constructional" or "empirical" problem of reality, in contrast to the "metaphysical" problem of reality which will be discussed in the sequel (§ 175 ff.), when we shall be concerned with a different, a "metaphysical", concept of reality. This latter concept occurs only in traditional philosophy, not in the empirical sciences.

To begin with, we consider the concept of (empirical) reality as relates to physical objects, in particular to the most important object namely, physical bodies. These bodies are called *real* if they are constructed as classes of physical [133] points which are located on connected bundles of world lines and are placed within the all-comprehending four-dimensional system of the space-time world of physics (§ 136). On the

other hand, things which, taken by themselves, have the same or a similar constitution as the real physical bodies, i.e., which are also four-dimensional orders of world points with physical [133] assignments, but which are not parts of the one, comprehensive, four-dimensional system of the world of physics, are called also "physical" since they have a similar constitution, but, since they do not belong to the total system, they are called *nonreal* physical things.

The construction of nonreal physical things can take place in various different ways. Generally speaking, the construction of physical things, including the real ones, leaves it initially open whether they are real or nonreal; this decision will be made only afterward depending on the possibility of placing them in the total system. This holds already for the world of perception, which is a preliminary to the world of physics.

> EXAMPLE. On the basis of a number of visual perceptions alone, we do not generally carry out an assignment to the world points of the four-dimensional system, according to the rules of § 126 ff.; rather, we establish initially a special, four-dimensional order of the colors in question which could represent a visual thing during a span of time. We must now test whether or not this visual thing can be placed in the system of the perceptual world according to the constructional forms of this system. If it can be so placed without producing a contradiction with the other constructions of perceptual things, where the assertions of other persons are frequently decisive factors, then it is legitimized as a *real* perceptual thing (i.e., initially, as a visual thing). If it cannot be so placed, then it is a *nonreal* perceptual thing.

In constructing a nonreal thing, we can decide, through a more detailed investigation, what kind of nonreal physical thing it is. If a visual thing (as in the indicated example) is constructed from visual perceptions, then it could perhaps be a *dream*, a *hallucination*, an *hypnotic suggestion*, etc. On the other hand, if the construction takes place on the basis of assertions of other persons (§ 144), then, depending upon the circumstances (i.e., the "intention" of the other), it could be a *lie*, a *piece of fiction*, an *error*, etc. (of another). However, construction can also form a physical thing in a free way, relying neither upon the experiences of the self nor upon the assertions of others. Here the object must be called an object of *one's own phantasy*, whose purpose could be (one's own) lie, invention, theoretical fiction, hypothetical assumption, or free play of phantasy.

133physikalisch

The given suggestions will suffice to make it clear that the *difference between reality and nonreality (dream, invention, etc.) retains its full meaning even in a constructional system which is based upon an autopsychological basis, and that this distinction in no way presupposes any transcendency*.

171. *Real and Nonreal Objects of Psychological and Cultural Type*

For object types other than physical objects, we must envisage the difference between real and nonreal objects in much the same way as for physical objects. An object is called "psychological" if it is constituted in such a way that, taken by itself and according to its internal structure, it has the constitution of events or states that are normally called auto-psychological, no matter whether this object is based on my own experiences, the assertions of others, or free stipulation. If, in addition, it can be placed within the connected and temporally ordered system of autopsychological objects, then it is called a *real autopsychological object*. If an object can be assigned to another person, who is a real physical object in the just-discussed sense, in accordance with the constructional forms appropriate to the heteropsychological (§ 140), then we call it a *real heteropsychological object*. If no placement is possible in either of these ways, then it is called a nonreal psychological object. We must here again distinguish, just as we did above, between a dream, a lie, etc.

For cultural objects, the distinction is logically even more simple (though empirically more difficult). An object which is constructed in such a way that, taken by itself, it has the constitution of those objects which we have called cultural, is in each case called a *cultural object*, whether it be real or not. It is called *real* if its manifestations belong to the real psychological objects; otherwise, it is called *nonreal*. The application of this criterion is simple in the case of those objects which are constructed as primary cultural objects. It becomes more complicated for the higher cultural objects, because, in these cases, we must consider the reality or nonreality of the primary cultural objects which lie at their basis. I do not wish to go into any more detail in this matter.

Through a comparison of these distinctions in the areas of the physical, the psychological, and the cultural, we find that, throughout, the following properties are used as indicators to distinguish the real from the nonreal.

1. *Every real object belongs to a comprehensive system which is governed by regularities*, that is to say, the physical objects belong to the

world of physics, the psychological objects to the psychological system of a subject, and the cultural objects belong to the cultural world.
2. *Every real object is either itself an intersubjective object or the immediate occasion for the construction of such an object*. The latter we can say of an object which belongs to the field [134] of intersubjective correspondence (§ 146f.).
3. *Every real object has a position in the temporal order*.

172. *The Concept of Real-Typical Objects*

More difficult than the just-discussed differentiation between real and nonreal objects is the distinction between objects which are either real or nonreal, on the one hand, and objects to which this distinction does not apply, on the other; the former we call *real-typical*.

> As we have seen above, the real and nonreal objects of an object domain agree in several properties; these, then, are the characteristic properties of the real-typical in the domain in question; we shall now consider them in more detail. For example, if a physical object has the properties common to real and nonreal physical objects, then it is a real-typical physical object. It may then happen that we recognize it as a real object or as a nonreal object, but it is also possible that this distinction has not yet been carried out or perhaps that it cannot be carried out on the basis of the available information. Nevertheless, we can know of it that it is real-typical.
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> REFERENCES. The concept of the real-typical is called by Christiansen [Kantkritik] "empirical objectivity". "What must be the nature of an object, that we may ask of it whether or not it is real?" In Christiansen's opinion, Kant actually means real-typical objects when he speaks of "objects". Meinong, in his theory of objects, calls the real-typical objects "real".

The concept of reality is not yet a scientifically determined concept. Its boundaries are not drawn according to uniform principles, but are in part merely traditional, i.e., objectively speaking, merely accidental (just like the historical boundaries of a state). But (in contrast to the boundaries of a state) these boundaries are not uniquely determined. In the following, we attempt a rough determination of the boundaries of the real-typical in the various domains. In doing so, we shall conform to linguistic usage as it obtains in science and after the clarifying influ-

134 Geltungsbereich

ence of scientific thinking also in daily life. But this use of language is frequently quite fluctuating.

In order to find, for a certain object domain, the boundary between real-typical objects and those that are not, let us, for the sake of simplicity, confine ourselves to the comprehensive system of those domains for which we have succeeded in distinguishing the real objects from the nonreal ones (§ 171): the world of physics (as a whole), the psychological world (as a whole), or the cultural world (as a whole). According to the indicated criteria of reality, the real-typical objects, if they occur within such a system, are real. Thus, if we limit ourselves to such a system, then the desired boundary of the real-typical coincides with the boundary of the real. It is permissible to make this restriction since the boundary of the real-typical, outside of such a system, is analogous to the boundary inside.

173. *The Boundary of the Real-Typical in the Physical Domain*

Let us, to begin with, find the boundary between the real-typical and the other objects for the physical object type. In doing so, we shall limit ourselves to the total system of the world of physics, within which the real-typical objects are the same as the real ones. The following discussion does not so much have the purpose of ascertaining the precise course of the boundary; rather, it is to show that this boundary is rather arbitrary and frequently vacillating.

To begin with, and according to general linguistic usage, physical bodies (which belong to the system) must be called real. From this it follows for our problem that the physical bodies, whether real or not, are real-typical. But, even here, doubts are possible in some cases (for example, in the case of a virtual optical picture). However, greater difficulties arise in another direction: we now have to ask which physical objects, other than bodies, may be called real. It is common linguistic usage to call the events in, and the states of, these bodies real. To a large extent, this holds also for the sensory-qualitative properties, although here we already find some deviation. However, for the wholes which are composed out of bodies, the differences in language use occur with more frequency; here we are concerned with those body-like objects which consist of bodies as their spatial parts, but which do not themselves have to be spatially connected (cf. § 36, about the concept of whole). If the individual bodies which form the whole are spatially close together, then we frequently call the whole real and sometimes even call it itself a

body (for example, a pile of sand, a forest). If the individual bodies are spatially farther separated from one another, then the whole is more likely to be called real, the more similar the individual bodies are to one another.

EXAMPLES. "My furniture", "the German coal reserves", will generally be admitted to be physical objects. On the other hand, there will already be doubts concerning an object such as "the present vegetation of central Europe" (meaning the whole, whose parts are the presently living, individual plants). The object, whose parts are certain trees, may or may not be called real, depending upon the characteristic properties of the trees: if the trees are close together, then the object is called a forest or a part of a forest, and there is hardly any doubt; if, on the other band, we are concerned with the oaks of Europe, or with all trees in Europe which are higher than twenty meters, or with the European trees the name of whose owners begins with an A, then it becomes more and more likely that the object is no longer considered real, but a more or less arbitrary "conceptual assemblage" without a "real" object which "lies at the bottom of it".

Classes of bodies (about the distinction between class and whole, cf. §37) are not as frequently considered real as wholes which consist of bodies. This is justified inasmuch as these classes are much more clearly distinguished from bodies, since they belong to another object sphere, while the whole belongs to the same object sphere as the bodies themselves. But, even here, the boundary does not take a simple and clear course. There are classes of bodies which are frequently considered real, namely, those whose characteristic property can be perceived through the senses or is in some other way considered easily recognizable and important. This coincides with what has been said above about properties, for a property of physical bodies is, as a rule, to be constructed as the class of those things which have this property.

EXAMPLE. Physical substances are frequently called real, for example, the substance gold as the class of all pieces of gold (in contradistinction to the corresponding whole which is the total amount of gold in the world).

Linguistic usage is even more vacillating in the case of relation extensions of physical bodies.

EXAMPLES. The relation extension which is characterized by one body pushing another is generally considered real. Occasionally, the spatial distance between two bodies is thought of as something real, but, sometimes, it is considered merely to hold for real bodies and to be

purely conceptual. This latter conception is even more marked in the case of the temporal distance between two body states and perhaps even more in the case of those relations between bodies which are based upon qualitative likeness or similarity.

Let us now proceed from classes to *classes of classes* and to *relations* [135] *between classes* and from relations [135] to *classes of relations* [135] and to *relations* [135] *between relations* [135], such objects are generally no longer called real. But there are exceptions even among these objects which are two (or more) levels higher than bodies; even here, there are certain objects which are occasionally considered real. This is an especially good indication of *the arbitrary and accidental boundary of the concept of the real-typical*. (Incidentally, on these levels, linguistic usage fluctuates even with respect to the expression "physical".)

EXAMPLE. The relation [135] between one generation of animals and their immediate offspring is a relation [135] between classes of physical bodies. One finds occasionally, though not generally, that this relation [135] of *parent generation* is considered real.

174. *The Boundary of the Real-Typical in the Psychological and the Cultural Domains*

In the domain of psychological objects, common usage draws the boundary of the real-typical in a somewhat less arbitrary way than in the case of the physical objects. Generally, only experiences and the individual constituents of experiences are considered real (or nonreal, as the case may be). To these are added unconscious constituents of experiences, if they are constructed as a supplementation of the conscious ones (§ 132). Occasionally, one of the senses of a certain person is considered as something real (for example, the visual sense of Mr. N); this is done less often with a given quality class (for example, a certain blue hue, not as it is perceived on a particular occasion, but generally). In the case of relation extensions of experiences or of constituents of experiences, the boundary shows considerable fluctuation, just as in the case of the physical.

In the domain of the cultural objects, we find the boundary in an even worse condition than in the preceding two cases. Here, it is not only the case that the boundary is frequently rather erratic from a given viewpoint, but it also shows great differences between different points of

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135 Relation

view. Oftentimes, reality is denied to the entire domain, as if all the cultural objects were only "conceptual assemblages". However, if some cultural objects are considered real, then the boundary can be drawn on very different levels and may frequently include only a part of the objects on certain levels. The domain of the cultural objects shows a very large number of levels; thus, here there are many more possibilities for varying the boundary. Linguistic usage actually expresses many of these possibilities and thus shows very little uniformity. This can be explained mainly through the fact that the domain of the cultural has been recognized and accepted as an independent object domain only very recently.

We have here considered the concept of the real-typical, not from a substantive or systematic point of view, but only relative to linguistic usage. Here we merely find a disjointed concept which is not clearly delineated. The boundaries of this concept are subject to a certain degree of arbitrariness. It is reasonable to assume that the variations which we find here are caused mainly by subjective dispositions relative to the experiences, and by variations in interest. The terminological situation which we have described shows that it is necessary to make a clear and uniform determination of this boundary; that is to say, to determine with which concepts the distinction between real and nonreal is to be made at all. The purpose of our discussion is, mainly, to show that we are here not concerned with a question of fact, but with (the lack of) a convention. Furthermore, the discussion has the purpose of showing the urgent need for such a convention.

CHAPTER
D

THE METAPHYSICAL PROBLEM OF REALITY

175. *Realism, Idealism, and Phenomenalism*

We now wish to deal with a problem of reality which is quite different from the one that we have discussed so far. We have determined what constructional (empirically ascertainable) conditions must be fulfilled in order for an object to be called real in the customary usage of the empirical sciences. In addition to this "constructional" or "empirical" problem of reality, the question may arise whether or not we must ascribe "reality" in a special sense to these empirically real objects. For this special sense, there are various formulations; most commonly, it is characterized as *independence from the cognizing consciousness*. Thus, we have to differentiate two different meanings of the word "reality". Wherever it is necessary, we shall indicate them by calling the one "empirical reality" and the other "metaphysical reality". Later on we shall give a justification for this second expression (§ 176).

EXAMPLES. The difference between the two meanings becomes clear through the following two questions: "Was the Trojan War a real event or merely an invention?" and "Are those objects which are not feigned or simulated, for example the perceived physical bodies, real, or are they merely contents of consciousness?" The first question is treated by

historical science; it is to be resolved with empirical and constructional methods, and hence there is no divergence of opinion among the adherents of the various philosophical schools. The second question is customarily transacted within the field of philosophy; it is answered in different ways by different schools; we shall see later that it is extra-constructional and hence extrascientific; it is metaphysical.

REFERENCES. We customarily use the expressions "actual" [136] and "real" [137] as synonymous. Külpe [Realis.] distinguishes the postulated, inferred (i.e., constructed) objects from the processes of consciousness. He calls the former "real", and the latter "actual"; but this seems a little too far removed from customary usage.

The second concept of reality (in the sense of independence from the cognizing subject) indicates the point where the schools of realism, idealism, and phenomenalism part company. These schools are distinguished from one another by the fact that they ascribe reality in the second sense to object domains of varying extent (within the field of the empirically real). *Realism* holds that the constructed physical and heteropsychological objects are real. Subjective *idealism* holds that the heteropsychological, but not the physical, objects are real. The more radical form of *solipsism* denies even the reality of heteropsychological objects. (Objective idealism ascribes reality to a superindividual, absolute subject, which is not constructed within our system; hence, we shall not consider this school in the present context.) *Phenomenalism* agrees with realism in maintaining that real entities exist outside of the domain of the autopsychological; on the other hand, it agrees with idealism in denying this reality to the physical; according to phenomenalism, reality must be ascribed to unrecognizable "things-in-themselves", whose appearances are the physical objects.

176. *The Metaphysical Concept of Reality*

The concept of reality (in the sense of independence from the cognizing consciousness) does not belong within (rational) science, but within metaphysics. This is now to be demonstrated. For this purpose, we investigate whether this concept can be constructed, i.e., whether it can be expressed through objects of the most important types which we have already considered, namely, the autopsychological, the physical, the heteropsychological, and the cultural. At first sight, it might appear as

136 wirklich
137 real

though this were possible. An object which I have recognized, that is, an object which has been constructed on the basis of my experience, will have to be called "independent of my consciousness" if its constitution does not depend upon my will, i.e., if an act of volition which aims at a change of the object does not result in such a change. But this does not agree with the concept of reality as it is meant by realism and idealism (the former ascribing it to, and the latter denying it of, physical bodies). For, according to the definition which we have just attempted, a physical body which I hold in my hand should not be called real, since (even in the opinion of the realists) it changes if I carry out an appropriate act of will; this would then be contradictory to the realistic position. On the other hand, this definition requires that any physical thing which lies outside of our technological reach, for example, a crater in the moon, should be acknowledged as real, since (even in the opinion of idealism) it does not change if I carry out an appropriate act of will; this then would be contradictory to the position of idealism.

One could try in various other ways to give a definition of reality (in the sense of independence of my consciousness) in such a way that the concept becomes constructable. However, one can show in each such case that the concept which is so defined does not agree with the concept as it is meant by realism as well as by idealism. It must be noted that this holds, not only of a constructional system which has the system form represented in our outline, but for any experiential constructional system, even for a system which does not proceed from an autopsychological basis, but from the experiences of all subjects or from the physical. *The (second) concept of reality cannot be constructed in an experiential constructional system; this characterizes it as a nonrational, metaphysical concept*.

REFERENCES. It seems that we agree with Russell [Scientif.] 120 ff. in the indicated conception that the concept of nonempirical reality cannot be constructed. However, this does not seem to be consistent with the fact that, in Russell, questions of the following kind are frequently posed, which (independently of how they are answered) imply a realistic persuasion: whether physical things exist when they are not observed; whether other persons exist; whether classes exist; etc. ([Scientif.] 123, [Mind] 308, [External W.] 126, [Sense-Data] 157 and elsewhere). Cf. also Weyl [Handb.] 89.

The indicated conception of the concept of reality is related to that of positivism, which goes back to Mach. Cf., for example, Ostwald [Naturphil.] 101 ff.; the concept of reality as it is defined there roughly

corresponds to the constructional concept of reality. The same holds for the concept of reality as it is defined by Bavink ([Ergebn.] 26, 187); thus, Bavink is right when he describes it as neutral relative to the realism problem.

The definition of the concept of a *thing-in-itself* goes back to the concept of reality (in the sense of independence from the cognizing subject). Thus, in our conception, this concept, too, must be placed *within metaphysics*, for metaphysics is the extrascientific domain of theoretical form (§ 182).

REFERENCES. If things-in-themselves are defined as real objects which are not given (as is done by Schlick [Erkenntnisl.] 179), then they must indeed be counted among the cognizable objects and thus must be placed within the domain of (rational) science and not within metaphysics; for then they coincide with the constructed real objects. However, it seems to us that this definition is not very practical, since it deviates altogether too much from customary usage (cf. Külpe [Realis.] II,213). The same holds also for the characterization of constructed real objects as transcendent ([Erkenntnisl.] 180). The essential limit of transcendence, according to customary usage, lies between the recognizable (in our language, constructable) objects and the nonrecognizable (not constructable) objects. If one wishes to emphasize, through a special expression, the limit between the given objects and those objects which are constructed but not given, then the term "transgression" ("transgredient" or transgressive objects) may serve for this purpose; this term has been introduced by Ziehen [Erkth.] 279; Ziehen justifiably makes a sharp distinction between this concept and the concept of transcendence.

177. *Construction Theory Contradicts Neither Realism, Idealism, nor Phenomenalism*

The following concerns objects which are empirically real (i.e., objects which are (in constructional language) placed in the total system of the object type in question; cf. §171; (in realistic language) objects which have been "recognized" or "determined" as "real"). Relative to these empirically real objects of the various object types, construction theory and realism agree in the following points: 1. Such objects can be clearly distinguished from unreal objects of the same object type (dreams, hallucinations, inventions, etc.). Only to the extent to which they can be clearly distinguished, are they used in the formation of the system of knowledge. 2. They can be intersubjectivized, i.e., in principle, they can

be placed in constructional systems which belong to other persons (§ 146ff.) and can be confirmed or corrected through the reports of other persons (§ 144); they are included in the system of knowledge only to the extent to which they can be intersubjectivized. 3. They are independent from being cognized in the sense that they exist also at times when they are not represented in my experiences or in the experiences of another. 4. They are independent of me, in the sense that a wish to change them does not result in a change of their characteristics unless a physical causal chain connects an appropriate motion of my body with the object in question. 5. They are governed by their own regularities which makes it occasionally possible to make predictions: if I put my body into an appropriate position, then an experience of a certain predictable kind takes place, whether I want it or not. However, there is agreement, not only in the points just mentioned, but in all points in which assertions are made at all by *both* theories. *Construction theory and realism do not contradict one another in any point*.

Construction theory and subjective idealism agree with one another in the claim that statements about objects of cognition can, in principle, all be transformed into statements about structural properties of the given (with retention of the logical value, cf. §50). Construction theory agrees with *solipsism* in the notion that the given consists of my experiences. Construction theory agrees with *transcendental idealism* in the conception that all objects of cognition are constructed (in idealistic language: "are created in thought"); in fact, the constructed objects are objects of conceptual knowledge only *qua* logical forms which are generated in a certain way. Ultimately, this holds also for the basic elements of the constructional system. Even though these basic elements are initially introduced as unanalyzable units, eventually, in the progress of construction, different properties are attributed to them, and they are analyzed into (quasi) constituents (§ 116). It is only through this procedure, that is, only as constructed objects, that they become objects of cognition in the proper sense of the word, in particular, objects of psychology. Here again we have the situation that there is agreement between idealism in its different varieties and construction theory in all points where assertions are made by both theories. *Construction theory and idealism* (objective, subjective, and solipsistic idealism) *do not contradict one another in any point*.

The same holds for phenomenalism. For, aside from asserting the existence of "things-in-themselves", it shows no deviation from construction theory, and construction theory neither affirms nor denies the exist-

ence of things in themselves. Here again, we find agreement in all points where both theories make assertions. *Construction theory and phenomenalism do not contradict one another at any point*.

178. *The Divergence Among the Three Schools Occurs Only Within the Field of Metaphysics*

It is not particularly surprising that none of the doctrines—realism, idealism (in its different varieties), and phenomenalism—show in themselves any contradiction to construction theory, yet contradict one another. For, the three schools do, after all, agree with one another and with construction theory in the following points: ultimately, all knowledge goes back to my experiences, which are related to one another, connected, and synthesized; thus, there is a logical progress which leads, first, to the various entities of my consciousness, then to the physical objects, furthermore, with the aid of the latter, to the phenomena of consciousness of other subjects, i.e., to the heteropsychological, and, through the mediation of the heteropsychological, to the cultural objects. *But this is the theory of knowledge in its entirety*. Whatever else construction theory states about the necessary or the useful forms and methods of construction belongs to the logical, but not to the epistemological, aspect of its task. The theory of knowledge does not reach beyond what has just been indicated. How cognition can proceed from one object to another, how, in what sequence, and in which form the levels of a system of cognition can be formulated,—all this is contained in the indicated material. The theory of knowledge cannot ask any further questions.

But where do the contradictory components of realism, idealism, and phenomenalism belong, if not to the theory of knowledge? The assertions of these doctrines which stand in contradiction to one another are all related to the second concept of reality (§ 175), and this concept, as we have already seen (§176), belongs to metaphysics. From this it follows: *the so-called epistemological Schools of realism, idealism, and phenomenalism agree within the field of epistemology. Construction theory represents the neutral foundation which they have in common. They diverge only in the field of metaphysics, that is to say (if they are meant to be epistemological schools of thought), only because of a transgression of their proper boundaries*.

It is occasionally said that there is a (usually tacit) realism at the bottom of the practical procedures of the empirical sciences, especially

of physics. However, we must here clearly distinguish between a certain kind of language usage and the assertion of a thesis. The realistic orientation of the physicist shows itself primarily in the use of realistic language; this is practical and justifiable (cf. § 52). On the other hand, realism, as an explicit thesis, goes beyond this and is not permissible; it must be corrected so as to become "objectivism": the regular connections (which in natural laws are formulated as implication statements) are objective and are independent of the will of the individual; on the other hand, the ascription of the property "real" to any substance (be it matter, energy, electromagnetic field, or whatever) cannot be derived from any experience and hence would be metaphysical.

REFERENCES. The above-indicated standpoint is closely related to what Gätschenberger, [Symbola] 452, says about the reconciliation between idealists and spiritualists on the one hand, and materialists on the other: "Materialism is a translation of spiritualism"; "All philosophers are correct, but they express themselves with varying degrees of ineptness, and they cannot help this, since they use the *available* language and consequently speak in a hundred sublanguages, instead of inventing one pasigraphy." This neutral language is the goal of construction theory.

Carnap [Realismus] contains detailed expositions of the difference between the empirical and the metaphysical concept of reality and more exact reasons why the realism debate should be banished from science and placed within metaphysics.

CHAPTER
E

AIMS AND LIMITS OF SCIENCE

179. *The Aims of Science*

We have repeatedly pointed out that the formation of the constructional system as a whole is the task of unified science, while construction theory is merely engaged in carrying out the appropriate logical investigations. By placing the objects of science in one unified constructional system, the different "sciences" are at the same time recognized as branches of the one science and are themselves brought into a system.

How should we determine the aim of unified science from the viewpoint of construction theory? The aim of science consists in finding and ordering the true statements about the objects of cognition (not all true statements, but a selection, made according to certain principles; we do not undertake to discuss the teleological problem of these principles at this point).

In order to be able to approach this aim, that is, in order to be able to make statements about objects at all) we must be able to construct these objects (for, otherwise, their names have no meaning). *Thus, the formation of the constructional system is the first aim of science*. It is the first aim, not in a temporal, but in a logical, sense. The historical development of science does not have to postpone the investigation of

an object until this object is placed within a constructional system. For objects on higher levels, especially for biological and cultural objects, science must not wait for this to take place, if it does not want to forego, for a long time, the development of these essential fields with their important practical applications. Rather, in the actual process of science, the objects are taken from the store of everyday knowledge and are gradually purified and rationalized, while the intuitive components in the determination of these objects are not eliminated, but are rationally justified (cf. § 100). Only when this has been successfully accomplished can the object be constructed, and only when it has been carried out, in addition, for all its constructional ancestors, can the constructional system be built up to the object in question. This is the procedure as it historically takes place in actual practice. From a logical point of view, however, statements which are made about an object become statements in the strictest scientific sense only after the object has been constructed, beginning from the basic objects. For, only the construction formula of the object—as a rule of translation of statements about it into statements about the basic objects, namely, about relations between elementary experiences—gives a verifiable meaning to such statements, for verification means testing on the basis of experiences.

The first aim, then, is the construction of objects; it is followed by a second aim, namely, the investigation of the nonconstructional properties and relations of the objects. The first aim is reached through convention; [138] the second, however, through experience. (In the view of construction theory, there are no other components in cognition than these two, the conventional and the empirical; thus, there is no synthetic a priori.) It has already been said that, in the actual process of science, these two aims are almost always connected with one another. Moreover, most of the time, it is not even possible to make a selection of those properties which are most useful for the constructional definition of an object until a large number of properties of this object are known. In analogy, the construction of an object corresponds to the indication of the geographical coördinates for a place on the surface of the earth. The place is uniquely determined through these coördinates; any question about the nature of this place (perhaps about the climate, nature of the soil, etc.) has now a definite meaning. To answer all these questions is then a further aim which can never be completed and which is to be approached through experience.

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138 Festsetzung

REFERENCES. In the opinion of the Marburg Neo-Kantian school (cf. Natorp [Grundlagen] 18ff.), the object is the eternal X, and its determination an aim that can never be accomplished. Against this, it must be pointed out that a finite number of characteristics suffices for the construction of the object, thus for its definite description within the field of objects in general. If such a definite description is given, then the object is no longer an X, but something that is uniquely determined, whose complete description, however, still remains a task that cannot be completed.

180. *About the Limitations of Scientific Knowledge*

Science, the system of conceptual knowledge, has no limits. But this does not mean that there is nothing outside of science and that it is all-inclusive. The total range of life has still many other dimensions outside of science, but, within its dimension, science meets no barrier. Let us consider an analogy: an infinite plane in space does not include the entire space, but it is nevertheless unlimited, without border, and is thus distinguished, for example, from a triangle within this plane. When we say that scientific knowledge is not limited, we mean: *there is no question whose answer is in principle unattainable by science*. Concerning the expression "in principle": if it is practically impossible to answer a question about a certain event, because the event is too far removed in either space or time, but if a question of a similar kind about a present event which is within reach can in fact be answered, then we call the question "practically unanswerable, but answerable in principle"; spatial and temporal remoteness, we call a "mere technical obstacle", not an "obstacle unsurmountable in principle". In like fashion, a question is said to be "answerable in principle" if it is not practically possible to answer it today, but if a state of technological resources (in the widest sense) can be envisaged which would make it possible to answer this question.

It is occasionally said that the answer to some questions cannot be conceptualized; that it cannot be formulated. But in such a case, the question itself could not have been formulated. In order to recognize this, let us investigate somewhat more closely what the answer to a question consists in. In the strictly logical sense, to pose a question is to give a statement together with the task of deciding whether this statement or its negation is true. A statement can only be given by producing: its symbol, namely, a sentence, which consists of words or other symbols. Now, it happens very frequently, especially in philosophy, that a

sequence of words is given which has the outward construction of a sentence and is therefore mistaken for one without being one. A string of words can fail to be a sentence in two ways: first, if it contains a word which has no meaning, or, second (and this is the more frequent case), if the individual words do indeed have meaning (i.e., if they can occur as parts of genuine, not merely apparent, sentences), but if this meaning does not fit with the context of the sentence. In a word language, it is very difficult to avoid such pseudo sentences, since, in order to recognize them, it is necessary to pay attention to the meaning of every individual word; on the other hand, in a logistic language, it is not necessary to consider the meaning, but only the "type" of the sign (which corresponds to the sphere of the object, § 29). Similarly, an ideal, logically unobjectionable, word language would require of us no more than to consider the grammatical word type and the inflection forms. The difficulty in recognizing pseudo sentences in natural language is connected with the problem of the "confusion of spheres" in the given word language which we have discussed earlier (§ 30); it is not possible for us here to concern ourselves with the particulars of this important logical problem.

Now, if it is the case that a genuine question is posed, what are the possibilities of giving an answer? In such a case, a statement is given; it is expressed through conceptual symbols [139] in formally permissible combination. Now, in principle, every legitimate concept of science has a definite place in the constructional system ("in principle", i.e., if not today, then at a conceivable state of development of scientific knowledge); otherwise, the concept cannot be acknowledged to be legitimate. Since we are here concerned only with answerability in principle, let us disregard the stage of scientific development as it happens to be, and let us assume that we have reached a stage where the concepts which occur in the statement in question have already been placed within the constructional system. We now replace the sign for each of these concepts as it occurs in the given sentence by the expression which defines it in its constructional definition, and we carry out, step by step, further substitutions of constructional definitions. We already know that, eventually, the sentence will have a form in which (outside of logical symbols) it contains only signs for basic relations. (This transformation has been discussed in §119 and has been illustrated in an example.) Thus, the sentence which was given when the question was posed has now been so transformed that it expresses a definite (formal and extensional)

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139 Begriffzeichen

state of affairs relative to the basic relation. In keeping with the tenets of construction theory, we presuppose that it is in principle possible to recognize whether or not a given basic relation holds between two given elementary experiences. Now, the state of affairs in question is composed of nothing but such individual relation extension statements, where the number of elements which are connected through the basic relation, namely, of elementary experiences, is finite. From this it follows that it is in principle possible to ascertain in a finite number of steps whether or not the state of affairs in question obtains and hence that the posed question can in principle be answered.

Now we see more clearly what it means to say that science has no "limiting points": *the truth or falsity of each statement which is formed from scientific concepts can in principle be ascertained*.

REFERENCES. Cf. the quotation from Wittgenstein in §183. The requirement that only such concept words [140] should be considered legitimate which are constructed, that is, which can be translated back into expressions about basic objects is related to the requirement which is posed by positivism and which has, for example, been formulated by Petzold [Positiv.] 7, in the following way: "If someone is unable to descend from the highest concepts at once to the last individual facts which fall under them, then he does not even possess these concepts." Similarly, Gätschenberger [Symbola].

In the thesis of the decidability of all questions, we agree with positivism as well as with idealism; cf. Becker [Geom.] 412: "According to the principle of transcendental idealism, a question which is in principle (in essence) undecidable does not have any meaning at all. No state of affairs corresponds to it, which could provide an answer for it. For there are no states of affairs which are in principle inaccessible to consciousness."

181. *Faith and Knowledge*

According to the above-indicated position, conceptual knowledge does not meet any limitations in its own field; nevertheless, it is an open question whether it is perhaps possible to gain insights in a manner which lies outside of conceptual knowledge and which is inaccessible to conceptual thinking. Such a possibility would lie, for example, in faith, perhaps on the basis of religious revelation, mystical absorption, or other types of vision (intuition).

Unquestionably, there are phenomena of faith, religious and other-

140 Begriffsworte

wise, and of intuition; they play an important role, not only for practical life, but also for cognition. Moreover, it can be admitted that, in these phenomena, somehow something is "grasped", but this figurative expression should not lead to the assumption that knowledge is gained through these phenomena. What is gained is a certain attitude, a certain psychological state, which, under certain circumstances, can indeed be favorable for obtaining certain insights. Knowledge, however, can be present only when we designate and formulate, when a statement is rendered in words or other signs. Admittedly, the above-mentioned states put us occasionally in a position of asserting a statement or ascertaining its truth. But it is only this articulable, hence conceptual, ascertainment [141] which is knowledge; it must be carefully distinguished from that state itself. This conception is closely connected with our conception of a concept. A concept is the meaning of a sign which may occur in sentences.

Thus, for example, faith in a certain revelation or in the assertions of a certain person can, through further investigation, lead to knowledge, for in this case, faith means the same as holding to be true. On the other hand, if by faith is meant the inner attitude of a person as something which cannot be conceptually formulated, then we are not even within the realm of theory, and the effect of this attitude cannot be called knowledge. It is similar with intuition. Either it has an articulable result—in this case, this result is put into conceptual form through this articulation and thus has been made subject to the laws of conceptual knowledge—or else something ineffable is meant—in such a case, intuition again cannot claim to be taken as knowledge. Still less can it be maintained that, in this way, questions can be solved which cannot be answered within science. For, we cannot speak of question and answer if we are concerned with the ineffable.

We do not here wish to make either a negative or a positive value judgment about faith and intuition (in the nonrational sense). They are areas of life just like poetry and love. Like these latter areas, they can of course become *objects* of science (for there is nothing which could not become an object of science), but, as far as their content is concerned, they are altogether different from science. Those nonrational areas, on the one hand, and science, on the other hand, can neither confirm nor disprove one another.

A justification of our use of language. Occasionally, it is objected that the word "knowledge" [142] should not be used only for conceptual knowledge, but should also include other things, for example, a non-

141 Feststellung
142 Erkenntnis

rational or an intuitive grasp of certain things. Against this objection, we wish to propose the following compromise, in order to reach an agreement about a reasonable delineation of the term "knowledge". Let us proceed from those phenomena which are held to fall within the field of "knowledge" by ourselves as well as by the objectors. Let us think of the field of knowledge as comprising, in addition, all those things which stand in the relation of dependency (either positive or negative, i.e., either confirmation or contradiction) to the contents of this common area. Furthermore, add to it all those things which stand in a relation of dependency to the contents of the area as it has thus been enlarged, etc. Let us be careful and choose as the common initial field only the field of empirical knowledge (for example, "The oak is a tree", "I have three apples"), and let us pose, for example, the question whether the contents of mathematics should be called knowledge. In this case, the suggested criterion would be applied in the following way. The arithmetical statement "3+2 = 5" contradicts the following statements which belong to the field of empirical knowledge (i.e., whose affirmation and negation are empirical cognitions): "I have three apples", "You have two apples", 'Together we have four apples". Thus the validity of these three statements is dependent upon the above-mentioned statement of arithmetic. Consequently, this statement belongs to the total field of knowledge (i.e., either its affirmation or its negation is a true statement; our criterion does not decide which of these two is the case, since we are not here concerned with the difference between true and false, but only with the question of what belongs to the field of knowledge). The criterion is fulfilled in a similar way) also, for all other statements of arithmetic, of analysis, and of geometry. Thus, the contents of mathematics belong to the field of knowledge; to the extent to which its validity is ascertained, it should, according to the proposed compromise, be called "knowledge". Thus, the entire area of rational science, of formal as well as of empirical science, should be called "knowledge".

Now, what about "nonrational knowledge", for example, the content of a mystical, ineffable view of God? It does not come into a relation with any knowledge within the limits that we have so far staked out; it can neither be confirmed nor disconfirmed by any of it; there is no road from the continent of rational knowledge to the island of intuition, while there is a road from the country of empirical knowledge to the country of formal knowledge, which thus show that they belong to the same continent. Thus it follows that, if our suggested compromise is accepted, then nonrational intuition and religious faith (to the extent to which they are not only a believing the truth of certain propositions, but are ineffable) cannot be called *knowledge*.

It should be favorable to the peaceful relations between the various spheres of life, if we do not designate two such heterogeneous spheres with the same name. It is only through this that contradiction and strife arise, which are not even possible as long as the complete heterogeneity is clearly seen and emphasized.

182. *Intuitive Metaphysics*

The decision of the main questions about metaphysics, namely, whether it is meaningful at all and has a right to exist and, if so, whether it is a science, apparently depends entirely on what is meant by "metaphysics". Nowadays, there is no unanimity whatever on this point. Some philosophers call metaphysics a such and such delineated area of (conceptual) science. In view of the fact that this word, through its historical past, contains for many a suggestion of the vague and speculative, it would be more appropriate not to call such areas of philosophy which are to be treated with strict scientific concepts "metaphysics". If what is in question is basic knowledge (in the sense of logical, experiential, constructional order), then the name "basic science" could be used. If we are concerned with the ultimate, most general knowledge, the name "cosmology" or a similar one could be employed.

Other philosophers use the name "metaphysics" for the result of a nonrational, purely intuitive process; this seems to be the more appropriate usage.

REFERENCES. In referring metaphysics to the area of the nonrational, we are in agreement with many metaphysicians. Cf., for example, Bergson ([Mefaphysik] 5): "That science which wants to get by without symbols." This means metaphysics does not wish to grasp its object by proceeding via concepts, which are symbols, but immediately through intuition. Schlick [Metaphysik] gives an especially clear account of the difference between metaphysics and knowledge.

If the name "metaphysics" is used in this sense, then it follows immediately that metaphysics is not a science (in our sense). If someone wishes to contradict this, he should be quite clear whether he opposes our delineation of the term "metaphysics" or (as Bergson) our delineation of the term "science". We are not as much concerned with the former as we are with the latter; if it were found desirable to call "metaphysics" what we have called "basic science" or "cosmology", we should be perfectly agreeable and consequently would have to call metaphysics, too, a science; on the other hand, a deviation from our restriction of the

meaning of the expressions "knowledge" and "science" to the field of the rational seems to us altogether inappropriate for the reasons given in § 181.

That intuitive metaphysics, too, uses words for its exposition should not lead to the opinion that it proceeds within the field of concepts and thus belongs to (rational) science. For, even though we may call conceptual only that which can be expressed through words or other signs, it does not follow that everything that employs words is conceptual. There are spheres of life other than conceptual knowledge in which words are used, for example, in the imposition of will from person to person, in art, in the area of myth, which stands between science and art (and to which intuitive metaphysics perhaps belongs), and in other areas. Words can be considered signs of concepts only if they are either defined or at least if they can be defined; more precisely, if they are placed within an experiential constructional system or at least if they can be so placed (cf. the quotation from Petzold in §180).

183. *Rationalism?*

The indicated position, namely, that (rational) science not only can deal with any objects, but that it also never comes to a limit, never meets with a question that cannot in principle be answered, is occasionally called "rationalism"; however, this expression is not justified. If we take the word in the sense of the old epistemological and theoretical opposition between rationalism and empiricism, then this expression should obviously not be used to indicate our position. Since, according to construction theory, each statement of science is at bottom a statement about relations that hold between elementary experiences, it follows that each substantive (i.e., not purely formal) insight goes back to experience. Thus, the designation "empiricism" is more justified. (That it is not a raw empiricism needs hardly to be emphasized in view of the importance which construction theory attaches to the form components of cognition.)

However, the word "rationalism" is nowadays, for the most part, and perhaps also in this case, used in its modern sense, namely, in opposition to irrationalism. But even in this sense we would not wish to have it applied to construction theory. After all, the word is meant, not so much, for those positions which, like ours, wish to give reason (i.e., to conceptualizing understanding) a leading role within the field of knowledge, but, rather, it is applied to those persuasions which wish to bestow such

position upon it with respect to *life* as a whole. But such a tendency is found neither in construction theory in general nor in the notion that conceptual knowledge is unlimited. The proud thesis that no question is in principle unsolvable for science agrees very well with the humble insight that, even after all questions have been answered, the problem which life poses for us has not yet been solved. The task of cognition is a definite, well-circumscribed, important task in life, and it can certainly be demanded that mankind should shape that aspect of life which can be shaped with the aid of knowledge by a determined application of this knowledge, that is, by using the methods of science. Even if modern movements frequently underestimate the importance of science for life, we do not wish to fall into the opposite error. Rather, we wish to admit clearly to ourselves, who are engaged in scientific work, that the mastery of life requires an effort of all our various powers; we should be wary of the shortsighted belief that the demands of life can all be met with the power of conceptual thinking alone.

To put it otherwise: for us there is no "*Ignorabimus*"; nevertheless, there are perhaps unsolvable riddles of life. This is not a contradiction. *Ignorabimus* would mean: there are questions to which it is in principle impossible to find answers. However, the "riddles of life" are not questions, but are practical situations. The "riddle of death" consists in the shock through the death of a fellow man or in the fear of one's own death. It has nothing to do with questions which can be asked about death, even if some men, deceiving themselves, occasionally believe that they have formulated this riddle by pronouncing such questions. In principle, these questions can be answered by biology (though presently only to a very small extent), but these answers are of no help to a grieved person, which shows that it is a self-deception to regard them as formulations of the riddle of death. Rather, the riddle consists in the task of "getting over" this life situation, of overcoming the shock, and perhaps even making it fruitful for one's later life. Our thesis that all questions can be answered has indeed a certain connection with this task of overcoming, but this connection is so remote that the thesis does not make any assertion as to whether or not it is in principle always possible to surmount such distress. We do not have to decide this here.

REFERENCES. Wittgenstein has clearly formulated the proud thesis of the omnipotence of rational science as well as the humble insight relative to its importance for practical life: "For an answer which cannot be expressed, the question too cannot be expressed. The riddle does not exist. If a question can be put at all, then it can also be an-

swered.... We feel that even if all possible scientific questions are answered, the problems of life still have not been touched at all. Of course there is then no question left, and just this is the answer." [Abhandig.] 262. Unfortunately, this treatise has remained almost unknown. In part, it is difficult to understand and has not been sufficiently clarified, but it is very valuable, both in its logical derivations and in the ethical attitude which it shows. Wittgenstein summarizes the import of his treatise in the following words: "What can be said at all, can be said clearly, and whereof one cannot speak, thereof one must be silent. " (p. 185).

Summary

V. CLARIFICATION OF SOME PHILOSOPHICAL PROBLEMS ON THE BASIS OF CONSTRUCTION THEORY (157-183)

We wish to discuss some examples in order to show that the ordering of concepts which construction theory achieves allows a more precise formulation of the problems (157).

A. *Some Problems of Essence (158-165)*

The investigation of the traditional distinction between *individual* and *general concepts* shows that these are not two essentially different kinds of entity. The so-called individual concepts, too, must be constructed as classes or relations. The only difference is that, to an individual concept, there corresponds a connected area in the space-time order, while for the general concepts we have such a correspondence only with respect to another (qualitative) order. From a logical point of view, the former are not simpler or more uniform than the latter (158).

Identity: two signs are "synonymous", mean "the same", if they are everywhere interchangeable. In common usage we frequently call objects "the same" even if they are not strictly identical. This improper identification is based upon a strict identity, not indeed of the objects in question, but of objects on a higher level (e.g., classes to which these objects belong); among the objects themselves there holds another relation, frequently that of genidentity or of equivalence relative to some order or to the intersubjective correlation (159).

What is the essence of the physical, the psychological, the cultural? The objects of these types are quasi objects, linguistic aids for the representation of certain relations among experiences (160). This is their constructional essence. The indication of the scientific or constructional essence of an object can only consist in the indication of criteria for the truth of those sentences in which the name of the object occurs. This can be done, for example, by

giving constructional chain definitions. Questions that go beyond this cannot be answered by using constructable concepts; they are concerned with the metaphysical essence of objects and lie outside of the framework of science (161).

The problem of mind-body dualism: are there two essentially different object types? Answer: the physical and the psychological are two different forms of order (analogy: stellar constellations) of the basic elements. There is only one kind of basic element, yet there are not only two, but very many, different ways of ordering them. This is no peculiarity of the empirical world, but holds analytically of any ordered domain (162).

The *self* is the class (not the collection) of the experiences (or autopsychological states). The self does not belong to the expression of the basic experience, but is constructed only on a very high level (163).

The *intention relation* between a psychological event and that which is meant by it is not a unique, irreducible relation; rather, it is a special case of the relation between an experience and a real-typical experiential structure which includes that experience (164).

In science, *causality* means nothing but functional dependency. Strictly speaking, it does not exist in the perceptual world, but only in the world of physics. The dependency holds between a state and a certain limiting value in the assignments of state magnitudes; hence, it does not hold between events. Thus, the concepts of "cause" and "effect", which have already lost their anthropomorphic sense of "bringing about" in the perceptual world, have no meaning at all in the world of physics (165).

B. *The Psychophysical Problem (166-169)*

The psychophysical problem of traditional philosophy asks for an explanation of *psychophysical parallelism* (166). This parallelism cannot, originally, relate to the heteropsychological (167), but can be empirically observed only as a parallelism between the sequence of autopsychological events and observed processes of my own brain. However, during this observation, the brain processes occur as the contents of my own experiences. Hence we are here not concerned with a parallelism of essentially different entities, but between sequences of constituents of experiences; such parallelisms occur frequently in other contexts too (168). In science we can only ascertain that there is such a parallelism. The interpretation of this fact belongs to metaphysics. In science we cannot even pose a question that expresses this metaphysical problem (169).

C. *The Constructional or Empirical Problem of Reality (170-174)*

We can use empirical criteria in order to differentiate between a "real" thing and a "nonreal" one, e.g., a merely imagined, invented or erroneously supposed entity: the "empirical" or "constructional" concept of reality. This concept of reality retains its validity even in a system with autopsychological basis (170). There is a distinction between real and nonreal not only in the

physical, but also in the psychological and cultural domains. The indicators of reality are the same in the various object domains, namely, participation in a comprehensive, law-governed system, and a position in the time order (171). Objects which are either real or nonreal we call real-typical; for all other objects, there is no sense to the question whether they are real or not (172). The boundary line of the real-typical as drawn by ordinary linguistic usage has an inconsistent, arbitrary, and wavering course (173, 174).

D. *The Metaphysical Problem of Reality (175-178)*

There is still another concept of reality, usually formulated as "independence from the cognizing consciousness". It is this concept which is meant by both realism and idealism when they affirm or deny the reality of the outside world (175). We call this concept of reality "metaphysical" since it cannot be defined through scientific, i.e., constructable concepts; the same holds for the concept of the "thing-in-itself" (176). Any question which is answered by construction theory as well as realism, idealism, and phenomenalism is answered uniformly (177). The divergences between the three schools occur only where they leave the domain of the constructable, that is, the domain of science; however, then we are no longer concerned with epistemology, but with metaphysics. The practical procedure of the empirical sciences is "realistic" only in language, not in the metaphysical sense. For the empirical sciences, realism in the proper sense is meaningless; it is to be replaced by an "objectivism" of lawlike regularities (178).

E. *Aims and Limits of Science (179-183)*

The aim of science consists in finding and ordering the true propositions. This is done, first, through the formulation of the constructional system—that is, the introduction of concepts—and, second, through the ascertainment of the empirical connections between these concepts (179). In science, there is no question that is unanswerable in principle. For, each question consists in putting forth a statement whose truth or falsity is to be ascertained. However, each statement can, in principle, be translated into a statement about the basic relation; and each such statement can in principle be verified through confrontation with the given (180). Faith and intuition in the nonrational (e.g., religious) sense have nothing to do with the distinction between true and false; they do not belong to the domain of theory and cognition (181). If, like many metaphysicians themselves, we mean by metaphysics not the doctrine of the logically most basic, or the highest, scientific insights (i.e., "basic science" or "cosmology"), but a domain of pure intuition, then metaphysics has nothing to do with science and the rational domain; between the two there can be neither confirmation nor contradiction (182). The indicated position is not that of rationalism, since it demands rationality only for science. For practical life the existence and importance of the remaining, nonrational spheres is acknowledged (183).

Bibliography and Index of Names
Index of Subjects
(THE LOGICAL STRUCTURE OF THE WORLD)

BIBLIOGRAPHY AND INDEX OF NAMES

The numbers after the names refer to sections. The expressions enclosed in brackets are the abbreviations under which the books are quoted in the text. (Where several editions are indicated, quotations are taken from those editions whose years appear without parentheses.)

(Suppl.) designates books which were subsequently added to this index and which are not discussed in the text.

Books which are especially suitable for the study of problems connected with construction theory, are designated in the following manner:

1. Suitable for the study of epistemological problems (e.g., analysis of reality, object types and their relations, the auto- and heteropsychological, relation between the physical and the psychological, etc.):
EI: Introductory EII: Advanced

2. Suitable for the study of logical problems (e.g., propositions, propositional functions; classes, relations, structures; definitions; extensionality; types):
LI: Introductory LII: Advanced

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ASTER, ERNST, v., 65
[Erkemitnisl.] *Prinzipien einer Erkenntnislehre*. Leipzig, 1913.
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CARNAP, RUDOLF,
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CASSIRER, ERNST, 12, 64, 75
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CHRISTIANSEN, BRODER, 148,172
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CLAUBERG and DUBISLAV, 3
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COUTURAT, LOUIS, 73,107
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DESCARTES, 163

DEWEY, JOHN, 59

DILTHEY, WILHELM, 12,23
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DINGLER, HUGO, 58, 64, 65, 140, 169
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DUBISLAV. See CLAUBERG

DU BOIS-REYMOND, EMIL, 166, 167
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DURR. See BUSSE

ERDMANN, BENNO, 143,166
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ERDMANN, K. O., 30
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FREYER, HANS, 12, 19, 56
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GOMPERZ, HEINRICH, 64, 65, 67, 159
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HAMILTON, WILLIAM, 67
HARTMANN, NICOLAI, 163
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HAUSDORFF, FELIX, 40
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HUNTINGTON, E. V., 107
HUSSERL, EDMUND, 3, 64, 65, 124, 164
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JAMES, WILLIAM, 162
KANT, I., 67, 106, 162, 172
KAUFFMANN, MAX, 124, 129, 140
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KEYSER, CASSIUS, J., 33, 107
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LEWIN, KURT, 128
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See also Wittgenstein
SCHELER, MAX, 58
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VEBLEN, O., 107
VERWORN, MAX, 165
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WATSON, JOHN B., 59
WERTHEIMER, MAX, 36,67
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WEYL, HERMANN, 38, 40, 62, 73, 107, 176
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WHITEHEAD, ALFRED NORTH, 3, 12, 13, 27, 30, 33, 35, 40, 43, 50, 73, 107,124
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WINDELBAND WILHELM, 12.

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WITTGENSTEIN, LUDWIG, 43, 180, 183

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WITTMANN, 65,67

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INDEX OF SUBJECTS

(The numbers refer to sections of Structure; important passages are indicated by italics.)
def. = definition (or clarification) of the expression
der. = derivation of the concept (cf. § 84)
constr. = construction of the expression
(E) = example
(R) = references

Abstraction, 67, 74; classes, def. 73, 88, 90, 97, 104, 148; principle of, 73 (R)
Aesthetic content, 55 (E)
Aesthetic value.
Agreement [*Übereinstimmung*] in a constituent. See Part identity; approximate. See Part similarity
Allogeneous. See Isogenous
Ambiguity [*Mehrdeutigkeit*], 30,96
Analysis, 67-70, 71, 74. See also Quasi analysis
Analytic statements (or theorems), def. 106, 110
Analytic judgments a priori. See Synthetic judgments
Answer. See Question
A priori, 103, 179. See also Synthetic judgments
Argument, argument position, def. 28, 29, 34
See Value Arithmetic objects, constr. 107
Arrow diagram, def. II, 12
Ascension form [*Stufenform*], 26 f., def. 40,68 f., 106
Aspect, 124, constr. 128
Assignment [*Zuschreibung*] to world points, 125, 126, 127, 130, 133 f., 135,165
Assignment of the heteropsychological, 140,167
Autonomous object type, 162
Autopsychological [*eigenpsychisch*], def. 58, 60-65, 94, 132, 138, 140, 160,

168, 171; basis (solipsistic), 60, 63, 64-66, 106, 124, 144 f., 170
Axiomatics, 2, 15, 121
Axioms of logic, 106

Basic concept [*Grundbegriff*], basic object (undefined) 1, 7, 36, 38, 41, 61, 75, 96, 107, 121, 179
Basic elements [*Grundelemente*], def. 2, 61, 65, 67 f., 74-76, 106, constr. 109, 177. See also Elementary experiences
Basic object. See Basic concept
Basic relation [*Grundrelation*], 61, 69, 75 f., 78, 82f., 91, 94, 102, 106, 108, 119, 121, 144 f., 153-155, 156, 161, 180. *See also* Recollection of similarity
Basic science [*Grundwissenschaft*], def. 182
Basic state of affairs [*Grundsachverhalt*], def. 48,49,53
Basis, def. 2, 26, 59 f., 61, 75. *See also* Autopsychological basis, Psychological basis. Physical basis, Cultural basis, Basic concept
Behaviorism, 59,140,162
Being and holding [*Seiendes-geltendes*], 42
Binocular vision, 127
Biological objects, 25, constr. 137, 179
Blind, 94
Body. See My body. Other persons
Brain, (central nervous system) 19, 21 f., 57 f., 138, 140, 166-168; mirror, 167 f.

Calculability [*Berechenbarkeit*] 136
Cardinal number, 37, def. 40 (E), 42, constr. 107
Causality, (cause-effect, natural law), 20 (E), 22, 47, 124, 136, 165, 178. See also Regularity; category of, 105, 132,135.
Chain (relational product), def. 34
Characteristics [Merkmale], 69,102
Class, 27, def. 33, 36, 37, 40-42, 48, 68, 70, 75, 97, 102, constr. 107, 121, 158, 173, 176; not the whole or collection of its elements, but that which the elements have in common, 33, 36, 37, 40, 42, 70 f., 76, 112, 132, 163, 173
Coextensive (universally equivalent), def. 32, 33-35, 40, 43, 45, 47 f.
Cognition, recognition, knowledge, cognize [*Erkenntnis, erkennen*], 15, 24, 49, 54, 64, 66, 76, 92, 94, 100, 105, 133, 143, 158, 178, 179 f., 181, 183
Collection (sum), def. 36, 40. *See also* Class, not the whole ...
Color (color sensation, color type), 76, 88 f., der. 90, 91, 115, constr. 118, 125-127, 134
Color identical. *See* Identity
Color solid [*Farbkorper*] (proximate colors), 77, 80 f., 88, der. 90,91,115, constr. 118,158,164
Color spots [Farbpunkte], Constr. 126, 130-135
Complex, logical, 4, 27, def. 36
Concept, 1, 2, 5, def. 28, 119, 158, 180-182. *See also* Object; general [*Allgemeinbegriff*], 5, 27, 158; individual [*individual-begriff*], 12,27,75, 158
Condition (necessary, sufficient), 47-49,53
Confusion of spheres, def. 30, 31, 180
Connected, def. 11
Conscious. See Unconscious; objects of which I am [*Eigenbewusstes*], constr. 132
Consciousness, processes of. *See* Experience
Consciousness, in general [*Bewusstsein Uberhaupt*], 66
Consistency, 15
Constant, def. 107. *See also* Logical constant. Extralogical constant
Constituent [*Bestandteil*]. See Analysis, Experience
Construction [*Konstitution*], to construct, def. 2, 5, def. 35, 38 f., 46, 49, 58, 74, 109-156,176
Construction principle (Russell), 1, 3, 140
Construction rule. See Rule
Construction theory, 1, 2, 26, 106, 156, 177 f., 183; theses of, 84, 112, 119, 121 f., 144, 153, 156
Constructional definition, 2, def. 35, 38 f., 40, 48-52, 95-105, 109, 119-122, 145, 153, 161, 180
Constructional language. See Language

Constructional level. See Level
Constructional system, def. 1, 2, 4, 8, 26, 46, 68, 82, 95 f., 103-105, 106, 119, 121 f., 144, 156, 179 f. See also System form; outline of a, 8, 106-152
Constructive operation [*Konstruktion*]. *See* Language of fictitious constructive operations, Rational reconstruction
Convention. See Postulation
Converse, 11, def. 34; domain, def. 34
Coördinates, def., constr. 125; as an analogy, 179
Correlation. See Relation extension, Psychophysical relation. Physical-qualitative correlation; problem, def. 20, 21, 24, 166, 169
Cosmology [*Weltlehre*], 182
Cultural basis, 59
Cultural [*Geistig*] (sociological, historical) objects, def. 23, 24, 55 f., 59 f., der. 94, 149, constr. 150 f., 160,171,174,179
Cultural sciences [*Geisteswissenschaften*] 12, 23 *f*., 49, 55 f., 150

Decidability [*Entscheidbarkeit*], 180
Deduction of construction rules, 105
Deduction of theorems, 106
Definite description, characterization [*Kenuzeichnung*] def. 13, 14 f., 50, 102,153-155,159,179
Definition, 24, 38 f., 51, 102, 119. *See also* Constructional definition. Explicit definition. Implicit definition; in use [*Gebrauchsdefinition*] def. 39, 40, 48
Derivation [*Ableitung*] 2, 84; relation of an object [*Ableitungsrelation eines Gegenstandes*], def. 121
Description [*Beschreibung*], 10. *See also* Relation description. Property description, Structural description. Object description. Definite description
Designation relation [*Zeichenbeziehung*], def. 19, 20 f., 141
Dialectics, 42,56
Dimension number, 80, 86, 92, 97, 104, 115, 117, 118, 124, 125, 155. *See also* Four-dimensional world. Color solid
Disposition (psychological), 24, 150
Division of an elementary experience, constr. 116
Documentation, documentation relation, def. 24,55 f.
Domain, def. 34
Dream, (hallucination, etc.), 164, 170, 177
Dualism (mind-body), 162

Egocentric [*ich-bezogen*], 65,163
Elementary experiences [*Elementarerlebnisse*], "my" experiences, 65, def. 67. 68, 69, 74-82, 93, 106, constr. 109. 126, 132, 140, 147, 163, 177 f.
Elements (of a class), def. 33. *See also* Basic elements
Elimination of an object symbol [*Elimminierung eines Gegenstandszeichens*], 38,50
Elimination of the basic relation, 153-155
Emotions [*Gefühle*] 76, 82, 85, constr. 131, 133
Empathy [*Einfühlung*]. See Intuition
Empirical, 15, 21 f., 103-106, 136, 155, 179,181
Empirical concept [*Realbegriff*], 121
Empirical science [*Realwissenschaft*], 12, 52, 59. 106, 122, 144, 156, 162, 170,178
Empirical statements, def. 106, 108, 119. *See also* Theorems
Empiricism, 183
Epistemic primacy [*Erkenntnismässige Primarität*], def. 54, 56, 58
Epistemic system form, 53, def. 54, 56, 58, 60, 64, 67, 156, 176
Epistemic value [*Erkenntniswert*], def. 50, 51, 75, 86, 95, 119, 159
Epistemology [*Erkenntnistheorie*], 52, 59,64,106,178
Epistemological subject, 64, 66
Equivalence [Gleichheit], def. 11, 73, 159. *See also* Part identity
Equivalent. *See* Coextensive
Essence [*Wesen*], constructional or empirical, 160, def. 161; metaphysical, 20,59, def. 161
Essence, problems of, def. 20, 21 f., 24, 132,158-166,169
Essential overlapping. See Overlapping
Essential relation, def. 20, 21, 161, 165, 169
Euclidean, non-Euclidean metric, 125, 136

Existence (logical), 96, constr. 107. *See also* Reality
Experience [*Erfahrung*]. *See* Empirical Experience [*Erlebnis*], 16, 64f., 163f., 174. *See also* Elementary experience
Experience, constituent of an [*Erlebnis-bestandteil*], 67, 68, 71, 74-77, 93, constr. 116, 140, 168, 174, 177
Experiences of other persons, constr. 140,145
Explicit definition, def. 35, 39
Expression relation [*Ausdruckbeziehung*] expressive motion [*Ausdrucksbewegung*] def. 19, 21, 52, 57 f., 131, constr. 138, 140, 143, 167
Extension, extensional, def. 32, 33 (R), 34, 40, 43, 45, 48, 50, 95, 99, 102
Extensionality, thesis of, def. 43, 45, 50
Extensional logic (intensional logic), 43
Extensive. See Whole
Extensive abstraction (Whitehead), 124
External world. *See* Perceptual world, World of physics
Extralogical constant, def. 107, 119, 121

Faith [*Glaube*], 181
False, 28, 161
Fiction, 27, 33 f., 99, 102, 148, 167, 170. *See also* Language of fictitious constructive operations
Field, def. 34
Form. *See* Object form, Ascension form, System form
Formal, llf., 16, 106, 119, 153-155
Form problems, 7, def. 26
Founded relation extension [*fundierte Relation*], def. 154, 155
Four-dimensional world. *See* Space-time world
Function, functional dependency [*Funktionale Abhängigkeit*], 143, 165, 169
Fundamental propositional function [*fundamentale Aussagefunktion*], def. 48

Genealogy of concepts, 1
Genidentical, def., constr. 128, 159
Geometry, 12, 107, 121, 158
Geometrical objects, constr. 107, 125
Gestalt (true whole, organic whole), 38 (R)
Gestalt theory, 36, 67, 71
Given [*das Gegebene*], 3, 64 f., 67, 75, 100 f., 144, 163, 169, 176 f.
Graphology, 19,21

Hallucination. See Dream
Hearing [*Gehor*], constr. 131, 133
Heteropsychological [*Frempsychisches*], 52, 57, def. 58, 63, def. 94, 138, constr. 140, 160, 167, 171, 175
History. *See* Cultural sciences, Cultural objects
Holding [*Gelten*] (as opposed to being), 42
Homogeneous relation, def. 34, 104

Idealism, 52, 75, def. 175, 176-178. 180. *See also* Language, idealistic
Identity, 15, 34, 44, 51 f., 101, constr. 107, 146, 159; between object and concept, 5; theory, 22; of nominatum, def. 159
Identical, color, def. 88, der. 90, 91, constr. 118,158
Identical, place (of visual qualities), def., der. 88 f., 91, constr. 117, 158
Implication, def. 32, 47, 165
Implicit definition, def. 15
Incompatibility of statements, 107
Incomplete symbols [Ungesättigte *Zeichen*], def. 27, 28, 33 (R), 36
Independent complex, def. 36, 37, 40
Independent, object type, 23, 25, 56, 162
Indicator [*Kennzeichen*], def. 49, 50-57, 100
Individual (general) constituent of an experience, def. 93, 94, constr. 116
Individual (general) state of affairs, 47
Individuation (principle of), 91, 118, 158
Ineffable, 180 f.
Intensional—extensional logic, 43
Intensional statement, def. 43
Intensity (of a sensation), 76 f., 86, 94, constr. 131
Intentional relation [*intentionale Beziehung*], 164
Interpretation of a finding [*Deutung eines Befundes*], 169
Intersection, def. 33
Intersubjective (object, world) inter-

subjectivizing, 2, 64, 66, 133, 136, def. 148, 149, 159, 171, 177
Intersubjective correlation [*intersubjektive Zuordnung*], def. 146, 147 f., 159
Intuition (intuitive, empathy), 21, 49, 54 f., 92, 100. 133, 143. 179, 181 f.
Inventory list [*Bestandliste*], 99, def. 102, 108-117. *See also* Pair list
Irrationalism, 183
Isogenous [*sphärenverwandt*], allogeneous [*sphärenfremd*], def. 29, 30 f., 37,75
Isomorphic, def. 11, 34

Judgment. See Synthetic
Justification. See Rational reconstruction

Kinesthetic sense, kinesthetic sensations, 92, 94, constr. 129, 131, 133

Language, 20, 65, 95, 134, 141, 159, 172-174, 178, 180; of geometry, 125; idealistic, 5, 177; constructional, 5, 47, 52 f., 75, 167, 169, 177; of fictitious constructive operations, 95, def. 99, 101 f., 106, 109-117: of logistics, 46, 95, 96, 102, 106, 109-122, 180; neutral, 5, 52 f., 178; psychological, 75; realistic, 5, 47, 52 *f.*, 95, 98, 102, 106, 109-120, 125, 127, 129, 135, 140, 143, 147, 152, 167, 177, 178; word [*wort-sprache*], 30, 46, 96, 180, 182; four languages of construction theory, def. 95, 96-98, 106, 108-122
Level [*Stufe*] (constructional level), 2, 40. def. 41, 42, 68, 74 f., 151
Life. See Practical life; riddles of, 183
Limits of science, 180, 183
Line of view [*Blicklinie*], def., constr. 126
Local sign [*Lokalzeichen*], 76 f., 80, 86, 88, 91 f., 94, 129, 130, constr. 131
Logic, 107,150
Logical constant, def. 107, 119, 153
Logical form, def. 46
Logical objects, 25, constr. 107, 121
Logical skeleton, def. 46
Logical translation, def. 51
Logical value, def. 50, 51, 75, 86, 95, 119,159
Logistics {Logistik}, 3 (R), II f., 43, 46; pure, applied, 107
Logistic rendition, def. 46, 96
Logistic symbols, 32-34, 76, 97

Manifestation, manifestation relation, def. 24, 55 f., 150, 171
Materialism, 59,178
Materialist basis. See Physical basis
Mathematics, 12, 16, 42, 106, 107, 181
Mathematical objects, 25, 35, constr. 107
Meaning, [*Bedeutung*], 19f., 27, 32, 141, 143, 180
Member, member pair [*Gliederpaar*] 11 f., def. 34,61
Memory. See Recollection
Men, constr. 137. *See also* Other persons
Metaphysics, 20, 22, 24, 52, 59 f., 132, 144, 160-162, 165, 169, 170 f., 176, def. 182. See also Essence, Reality
Mind of the other, constr. 140
Mind-body dualism, 162
Monism, 162
Motion, 127
Multiplicity of object types, 25, 41
My body, der. 94, constr. 129, 130, 137, 146
My mind. *See* Self
My consciousness [*Mein Bewusstsein*]. *See* Conscious, objects of which I am conscious
Mysticism, 181
Myth, 182

Natural law. *See* Causality
Natural sciences. See Physics, Empirical sciences
Nature- *See* Physical World, Perceptual World, Essence
Neighborhood relation [*Umgebungsrelation*], 97,115
Nominalism, 27
Nominatum, meaning, designate, [*Bedeutung*] [*bedeuten*], 19 f., 27, 32, 44, 141, 143, 159, 161, 180
Nominatum statement [*Bedeutungsaussage*], def. 44,45
Non-Euclidean. *See* Euclidean
Number, constr. 107. *See also* Cardinal number; space, 125, 136; pair list. *See* Pair list

Object [Gegenstand], def. 1, 5, 12, 19,

48f., 74f., 107, 119, 121, 155, 158, 159, 161, 177, 179; description [*Gegenstandsbeschreibung*], def. 102, 162, 108-114; form [*Gegenstandsform*], 26; name [*Gegenstandsname*], 39, 50, J59, 160, 161, 179; sphere [*Gegenstandssphaere*]. *See* Sphere; type [*Gegenstandsart*], 17, 25, 29, 31, 39, 151, 159, 160, 162
Objective, 2, 16, 66, 178
Objectivism, 178
Objects, theory of [*Gegenstandstheorie*], 93
Operative definition, [*Konstruktive Definition*], def. 95,96,102
Order forms, 162
Orderability of the given, 162, 169
Ordinal numbers, constr. 107
Organic whole. *See* Gestalt
Organism, constr. 137
Ostensive definition [*Aufweisung*], def. 13
Other persons, 65, constr. 137, 140, 145-148, 167,176
Overdetermined [*Überbestimmt.*], 92
Overlapping of similarity circles (essential and accidental), 80 f., 104, 112

Pair list, def. 12
Parallelism, psychophysical, 22. *See also* Psychophysical relation; constituents, def. 168,169
Paraphrase in word language, 95, def. 98, 106, 120, 123
Part. *See* Whole
Part identity, [*Teilgleichheit*], in general, 70-73, 76; between two experiences, def. 76, 77, 79, der. 82, constr. 113
Part similarity [*Teilähnlichkeit*], in general, 72, 77, 80; between two experiences, def. 77, der. 78, 79f., 87, constr. 110
Perception [*Wahrnehmung*], 57, 67 f., 164
Perceptual, thing, constr. 134, 159; world, constr. 133 f., 135 f., 165, 170. *See also* Visual world. Physics
Permissible arguments, def. 28, 29, 33
Persons. *See* Other persons
Phenomenalism, 169, def. 175, 177 f.
Phenomenology, 93, 106, 150, 152
Philosophical problems, 9, 17, 22, 157, 158-183,180
Physical [*physisch*], def. 15, 22, 57-60, 75f., 94, constr. 136. 137f., 160, 166-176, basis (materialist basis), 59, 62; thing (body), def. 94, 27*f*., 136 f., 170,173
Physical-qualitative correlation, def. 136
Physics, 16, 20, 136, 165, 178; world of [*physikalische Welt*], 133, constr. 136, 137, 140, 146 f., 165, 170, 173
Place. *See* Visual field. Identity
Pluralism, 162
Point of view, def., constr. 126
Positivism, 60, 74 f., 176, 180
Postulation, convention [*Festsetzung*], 103,107, 174,179
Power [*Potenz*] (power relation, power of a relation), def. 34, 104
Practical life, 179,181-183
Principle, supreme, of construction, def. 105
Principle of individuation. *See* Individuation
Process [*Vorgang*], physical, 94, 137, 165, 173; psychological. *See* Experience
Process law [*Ablaufgesetz*], 165
Proper name [*Eigenname*]. *See* Object name
Property [*Eigenschaft*], 10, def. 28, 33; description [*Eigenschaftsbeschreibung*], def. 10,69
Proposition, statement [both translations of *Aussage*], 2, 12, 13, 16, 27, 44 f., 52, 97, 107, 119, 153, 155, 161, 179, 180. *See also* Theorem, Sentence
Propositional function [*Aussage-funktion*], def. 28, 29, 32. 33 (R), 45, 48ff., 97, 107
Proximate colors. *See* Color solid.
Proximate places. *See* Visual field
Psychological, def. 18, 19-24, 55-58-60-64, 85, 150, 152, 160, 162, 164, 171, 174. *See also* Autopsychological, Heteropsychological; basis, 60, 63 f.
Psychologism, 151 f.
Psychology, 21, 52, 67, 74 f., 106, 132, 150,177
Psychophysical problem, def. 22, 166-169
Psychophysical relation [*psychophysische Beziehung*], parallelism, def. 19, 21 f., 57 (R), constr. 138, 140, 166

Pure (logically pure, impnre), 18, def. 29, 31
Purity of derivation, 96
Purpose. *See* Teleological problem
Causality
Qualitative-quantitative method, 136, 165
Quality (sensory quality, sensation quality), in the wider sense, 18, 25, 57, 76, 80, 125, 173; in the narrower sense (in contrast to intensity, local sign), 76f., 86, 94, constr. 131, 133-135
Quality class, 75, def. 76, der. 80 f., 82, 93, constr. 112, 131-135, 174
Quantitative. *See* Qualitative
Quasi analysis, 69, def. 71, 72-74, 76, 80 f., 85, 97, 104, 111, 115, 148
Quasi constituent [*Quasibestandteil*], def. 71, 72-74, 76, 80, 104, 140, 168, 177
Quasi object, def. 27, 32-42, 52, 107, 112,160
Question [*Frage, Fragesteltung*], 22, 159, 166, 169, 179, def. 180, 183

Rational, conceptual [*begrifflich*], 15, 22, 49, 177, 179-183. *See also* Intuition, Science
Rational reconstruction [*rationale Nachkonstruktion*] (rational justification), 49, 54, 81, 91 f., 98 f., 100, 102, 143, 179
Rationalism, 183
Real object, 121
Realism, 5, 52, 169, def. 175, 176-178. *See also* Language, realistic
Reality, empirical (constructional), 52 f., 64, 66, 158, 164, def. 170, 172-174, 175, 177; metaphysical, 52 f., def. 175 f., 177 f.; analysis of, 3
Real-typical, [*wirklichkeitsartig*] 158, 164, def. 172. 173 f.
Recollection [*Erinnerung*], 78, 101; of similarity [*Ähnlichkeitserinnerung*] def. 78, 106, 108. *See also* Basic relation
Reconstruction. *See* Rational reconstruction
Reducible, def. 2 and 35, 46, 47, 53*f*., 56-59,96,119
Referent, def. 34
Reflexive, def. 11
Regularity [*Gesetzmässigkeit*], 59, 132, 136, 140, 162, 165, 178. *See also*

Relation [*Beziehung*] 10, 11-24, def. 28, 34, 162. See also Relation-extension; description [*Bexiebungsbeschreibung*], description in extension, def. 10, 69-75, 102; number. *See* Structure
Relational structure, 7, 61, 164
Relation-extension [*Relation*] def. 34, 36, 40, 42, 48, 68, 75, 97, 102, 104, constr. 107, 121, 158, 173. *See also* Basic relation; description [*Relationsbeschreibung*]. *See* Relation description
Relations, theory of, 3, 11,12, 34, 96, 104,107
Relatum, def. 34
Religion, 181
Report, reporting relation [*Angabebeziehung*], def. 57, 140, constr. 142, 143, 144
Retainability of the given [*Festhaltbarkeit des Gegebenen*], 101
Revelation. *See* Faith
Rigid body, constr. 128
Rule, general rule of construction, def. 103,104 f.

Satisfy [*befriedigen*], def. 28, 32
Science, unified science, 2, 4, 16, 20, 22, 27, 52, 66, 149, 169, 176, def. 179, 180-183; aims of, 179, 183
Seen color spots, constr. 126, 127 f.
Self [*Ich*], 64, 65, constr. 132, 163. *See also* Autopsychological, Egocentric
Sensation [*Empfindung*], 67 f., 76, 80, der. 93, constr. 116; quality. *See* Quality
Sensationalism, 60
Sense [*Sinn*], def. 44, 51, 95, 159; statement, def. 44, 45; translation of, def. 51
Sense, of cold [Kältesinn], constr. 131; of pain, constr. 131; of smell, constr. 131, 133, 134: of taste, constr. 131, 133; of warmth, constr. 131; organs, 129, constr. 131, 137; qualities. *See* Quality; spaces, 130. *See also* Visual space

Senses, 76f., 80, der. 85 and 94, 86, constr. 115 and 131, 119, 121, 133, 135, 174. *See also* the individual senses. Visual sense, etc.; of the skin [*Hautsinne*], 86, constr. 131
Sensory field, 77. *See also* Visual field
Sentence [*Satz*] def. 27, 28, 44, 141, 142, 161, 180. *See also* Statement
Sequence [*Reihe*], def. 11, constr. 107, 120
Set, 37. *See also* Class
Sign, symbol [*Zeichen*], 27, 44, 181 f. *See also* Logistic symbols
Sign production by other persons, 140, constr. 141 f., 143
Sign statement, def. 44, 45
Similarity [Ähnlichkeit], in general, def. 11, 71; between qualities, def. 77, der. 85, 90, 91, constr. *See also* Part similarity. Recollection of similarity
Similarity circle [*Ähnlichkeitskreis*], general, def. 70, 71-73, 80, 97, 104; of experiences, def., der. 80, 81, constr. 1ll
Simplicity (principle of greatest simplicity), 136
Simultaneous, for sensations, der. 93, constr. 116; in the sense of physics, constr. 125
Sociological objects. *See* Cultural objects
Sociology. *See* Cultural sciences
Solipsism, methodological. *See* Autopsychological basis; metaphysical (so-called epistemological), 52, 64, def. 175,177
Space, Space order, 18, 25, 91 f., der. 94, 107, 118, 124, constr. 125, 158
Space class, def., constr. 125, 126
Space-time world, 124, constr. 125-127, 133, 134, 136, 170
Sphere (object sphere), 23, def. 29, 30-33, 151, 173, 180. *See also* Isogenous. Confusion of spheres
Spiritualism, 178
State [*Staat*] 151 (E) (R)
State [*Zustand*], physics, constr. 128, 173; psychology, constr. 132 and 140
State law, 165
State magnitudes, constr. 136, 165
State of affairs, fact [*Sachverhalt*], 47, 48 f., 75, 98, 106, 142, 167, 180
Statement, proposition [both translations of *Aussage*], 2, 12, 13, 16, 27, 44 f., 52, 97, 107, 119, 153. 155, 161,179, 180. *See also* Theorem, Sentence
Step. *See* Level
Structural definite description [*Strukturelle Kennzeichnung*], 14, def. 15, 16
Structure (Relation number), def. 11 and 34,12, constr. 107, 127; description, def. 11, 12, 15; statements, 16, 66,153,155,177
Subject, 64 f. *See* epistemological subject
Subjective, 2, 16, 66, 148
Substance (category of substance), 105, 132,135, 162, 169, 178
Substitutability, 159
Subsumption, def. 32, 43
Sum. *See* Collection
Supplemental entry [*Rückübertragung*], def. 102,109,114
Symbolic logic. *See* Logistics
Symbolism, 96
Symmetrical, def. 11
Synthesis, 68 f., 74, 83, 100
Synthetic judgments a priori (Kant), 106 (R), 179
System, of concepts. *See* Constructional system; of the sciences, 3, 179; form 26, def. 46, 53 f., 58-60, 65, 106, 122

Tactile sense [*Drucksinn*], constr. 129
Tactile-visual thing, constr. 130,133
Tautology, 50,106 f.
Teleological problem, 105,179
Telepathy, 140
Theorems of the constructional system, 106,108,110,114
Thing, 18. *See also* Physical thing (body)
Thing in itself [*Ding an sich*], 18, 164, 169,175,176 f.
Thinking, acts of thought, 85, 101
Thoughts. *See* Thinking
Three dimensional. *See* Dimension number, Color spots
Three-dimensionality of the color solid, 90, 115, 118 f., 155
Time, time order, 18, 78, der. 87, 94, constr. 120, 158, 171. *See also* Space-time world
Topology, 97,159

Touch points [*Tastpunkte*], constr. 130. *See also* Tactile-visual thing
Touch, sense of (tactile sensations), 94, constr. 129,130,133
Transcendent. *See* Thing in itself
Transcendental (idealism, subject), 66, 75,176 f., 180
Transformation of statements, 2, 16, 27, 32, 35, 38 f., 46 f., 50, 56 f., 86, 96, 106, 119, 122, 148, 161, *180*
Transitive, def. 11
Translation. *See* Transformation, Paraphrase in word language
Trivial, 50,106,159
True, truth, 28, 161, 179
Truth value, def. 43, 44, 50
Type, type theory, 29, 30 (R), 33, 180, *See also* Sphere, Isogenous

Unanalyzable unit [*Unzerlegbare Einheit*], 67, 68 f., 71, 74, 93, 164, 177
Unanswerable questions, 180 f., 183
Unconscious, conscious, 18, 64, constr. 132,140
Undefined. *See* Basic concept
Understanding [*Verstehen*]. *See* Intuition; of words and sentences, 141, 143
Unified science [*Gesamtwissenschaft*]. *See* Science
Union, def. 33
Unit, unanalyzable. *See* Unanalyzable unit
Unity of the object domain [*Einheit des Gegenstandsgebieles*], unity of science [*Einheit der Wissenschaft*], 4, 41,162
Unreal. *See* Reality, Empirical, Dream
Unseen [*Nichtgesehenes*], 124, constr. 126,127,176 f.

Value 59, constr. 152
Variable, def. 28, 39, 97, 107, 121
Verifiable, 161,179
Visual sense (visual sensations), 65, 80 f., der. 86, 90 f., 94, constr. 115, 117,126
Visual field (visual field place, proximate place), 76 f., 80 f., der. 88 f. and 92, 91-94, 115, constr. 117, 118, 124-127,158
Visual space, 124
Visual thing, der. 94, 124, constr. 128, 129, 133,170
Visual world, 124
Volition [Wollung], 85, constr. 131, 133, 176 f.

Will. *See* Volition
Withholding (of judgment) [*Enthaltung*] (methodological, phenomenological), 53,64
Whole [*Ganzes*] (extensive whole, composite part, consist of), 33, def. 36, 37,40,56,173
Words, 141-143. *See also* Language, Paraphrase in word language
World. *See* Visual world, Perceptual world. Physics
World line, 94 def., constr. 126, 127 f., 130,133,170
World of the other, constr. 145
World point, def., constr. 125, 126 f., 133,136,165,170