Some Remarks on the Typological Procedures in Social Research.

By
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Problems come up daily in empirical social research which the student attempts to solve with measures developed to answer the immediate need. After some time, a tradition of procedures accumulates; these procedures are handed down from teacher to pupil until they form a well-established methodological tradition. Very often it takes years before they are systematically reviewed and their logical background scrutinized. Authorities in related fields have often rendered valuable service by analyzing the methods used in a special field of research. Much can be gained by listening to them carefully and matching one's own experience with the systematic approach offered. Both the methodological system and the practical techniques can be improved in this way.

A book by Carl G. Hempel and P. Oppenheim „Der Typusbegriff im Lichte der Neuen Logik" (The Concept of Types in the Light of the New Logic)[1]) offers such an opportunity. This book attempts to analyze the logic of typological procedures where these procedures are used in the social sciences and biology. The establishing of types has become more and more important in the recent developments of social research, and a systematic discussion of the problems involved is very much in order. The book should be discussed in detail by students of the social sciences; in certain points it needs to be improved and complemented by methods which the authors have overlooked because of their lack of actual experience in empirical research work. The following discussion attempts to present and to enlarge upon the ideas of the authors, applying them at the same time to practical problems of social research. As a result, these remarks are less than a review, inasmuch as they do not report the whole book, and more than one, inasmuch as they introduce additional experience and considerations.

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[1]) A. W. Siythoff, U. V., Leiden 1936.

II.

One is safe in saying that the concept of type is always used in referring to special compounds of attributes. In speaking of the Middle-western type of American, one may have in mind certain physical features, certain attitudes and habits, certain affiliations and talents attributed to the inhabitants of this region. In speaking of types of books or of types of governments, a special combination of attributes is thrown into relief. Sometimes not all the attributes entering a typological combination can be enumerated. When the psychologist describes the extrovert type, he hopes that subsequent research will find more and more attributes which enter into this particular combination. There can and will be much discussion on how such a special combination of attributes is found, delineated and justified. The very fact, however, that a type is a specific attribute compound will hardly be denied. Therefore, a methodological discussion of the concept of type can begin with a survey of the different kinds of attributes which can enter into such a compound.

Three different kinds of attributes may be distinguished advantageously. The first may be called a characteristicum; by that is meant an attribute which can be predicated only as belonging or not belonging to an object. Something can be either square or not square. It can be either all of wood or not all of wood. It can be either alive or dead. Any attribute which permits only two mutually exclusive applications shall be called a characteristicum. Different from the characteristicum is a variable, which is an attribute permitting any number of graduations and, in addition, implying the possibility of actual measurement. Size is a variable because an object can have any number of sizes and its size can actually be measured in inches. The variable is the attribute used in the natural sciences and the one presupposed in mathematics from which the term is taken.

Besides these two kinds of attributes, a third can be distinguished: the serial.[1]) A serial is an attribute which can be predicated of an object only in comparison with another object. It is distinguished from the characteristicum in as much as it permits the ranking of any number of objects in a certain order and is not restricted,

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[1]) Hempel and Oppenheim are mainly concerned with bringing clearly into relief the concept of serial and its differences from the characteristicum. But for the terms themselves, the whole analysis of serial follows closely the presentation given in the book.

like the characteristicum, which divides objects into two classes only. It is distinguished from the variable inasmuch as it does not permit actual measurement. A very good example is furnished by mineralogy. Minerals can be arranged in the order of their softness : of two minerals one should be termed softer than another when it can be scratched by the other. Thus it is not possible to decide whether or not one mineral alone is soft, but rather which of two is the softer. Current social and psychological research offers many examples of such serials. Intelligence is defined in such a way that with the help of tests, it can be determined which of two individuals is more intelligent. Attitudes are so defined that, with the help of expert opinions, one can state that one attitude is more favorable toward peace than another one. Therefore „intelligence" and „pacifism" are the kinds of attributes called serials.[1])

There is an important practical relation between these three kinds of attributes : it is always possible to transform a variable into a serial and a serial into a characteristicum, but no transition in the inverse direction is possible. This statement is easily exemplified. People can be grouped according to size by inspection without the use of a yardstick, and in this way it is possible to say which of two individuals is taller but not how tall one of the pair is. So the variable „size" becomes a serial. Minerals, after they have been arranged according to softness, can be grouped into two classes : the lower fifty percent, for instance, and the upper fifty percent of the arranged order. By calling the former „soft" and the latter „not soft" or „hard", „soft" becomes a characteristicum.

The difference between a serial and a characteristicum is reflected in everyday language in the use of positives and comparatives. It does not make sense to say that one object is squarer than another because the definition of a characteristicum does not imply the definition of its comparative. On the other hand, it emanates from the definition of a serial that it corresponds to a comparative and does not imply a positive. It might seem somewhat surprising that it is possible to say that one object is softer than another without its making sense to say when an object is soft. A further analysis shows, however, that additional definitions are required (either explicit or implied in the use of language) to ascertain what soft as a positive should mean. The

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[1]) Hempel and Oppenheim call the serials „abstufbare Begriffe" and define them exactly with the help of logistic symbols. For the purpose of those remarks, however, it is not necessary to go into those details.

transformation of a serial into a characteristicum, mentioned above, is a good example of the kind of additional assumption which would be necessary. The differences between a serial and a variable has one consequence which should be kept in mind : no concept of „distance" is implied in the definition of a serial. If three objects, a, b, and c, are given, they can be arranged in an order with the help of a serial, but it cannot be decided wether the difference between a and b is greater than between b and c in regard to softness, or intelligence, or pacifism, or whatever serial might be involved.[1])

III.

The logical analysis of the serial kind of attribute is of special importance because it permits a better understanding of what shall be called serial operations. The best known of these operations is the standardization of a serial. After having arranged objects in a certain order with the help of a serial, it is useful to subdivide those objects into quasi-intervals. After a number of individuals are ranked according to their pacifism, one might, for instance, separate the ten percent on the top, then the next ten percent, and so on down to the ten percent on the bottom, the ten percent least pacifistic in this group. These ten groups are called quasi-intervals because they correspond somehow to the real intervals which can be established with the help of a variable. The difference, however, is this : in regard to size, people can be grouped in classes 6' to 5' 9", 5' 9" to 5' 8" and so on. How many individuals in a given sample fall into those intervals is a matter of empirical inspection. With quasi-intervals, the number of individuals in each class is given by definition and the „length" of the interval is not established. The very idea does not make sense without the introduction of additional assumptions.

There are many cases where such a procedure is actually of great importance in empirical social research. A random sample of fifty political writers might be ranked with the help of judges according to their pacifism, introducing, in this way, an attribute „pacifism" which is evidently a serial. Then those fifty writers might be subdivided into ten groups from the five most pacifistic

[1]) In more exact terms, it might be stated that a serial can never lead to a distribution curve. Hempel and Oppenheim have themselves overlooked this fact. They speak, on page 85 of their text, about bi-model distributions. Such distribution can only be engendered, however, by a variable, and its applications to the logic of serials is erroneous in this connection. The possible interrelations between a serial and a distribution curve have been studied by L. L. Thurston.

to the five least pacifistic. This way, ten grades of pacifism are established, which are nothing but quasi-intervals. If later a new writer who was not included in the fundamental group is to be judged as to his pacifism, the procedure would be this : by some criterion established in advance, he would have to find his place between the writer in the basic sample who is just more and the one who is just less pacifistic then he. Thus, the new writer would automatically fall into one of the ten quasi-intervals, and therewith a certain grade of pacifism would be attributed to him. (The problem of borderline cases is omitted here as yielding no fundamentally new aspect.)

Since it might very often be impossible to go back to the original fifty cases, a substitute procedure could be thought of. For each of the ten grades of pacifism, one writer is selected and carefully described as characteristic for his own grade of pacifism. These ten characteristic writers shall be called standards. When, then, a new writer has to be classified, his grade of pacifism can be established according to the standard to which he is most akin.

The relation between a serial order and a standard can be inverted. So far, it has been assumed that the serial order was established first and the standards derived afterwards. In many cases, the standards are established first and the serial order derived from them.

It is easy to give practical examples of this procedure. Zimmerman[1]) groups fifty towns in Massachusetts in a serial order for which one standard is the idea of a completely agricultural community and the other a completely industrialized one. In these fifty towns the Relief Administration has tried to encourage the unemployed to cultivate little gardens which are turned over to them in order to give them more means of subsistence. Zimmerman reported that the nearer a community was to the industrial standard, the less successful for psychological reasons was the effort of re-education. Another example has been given by Charlotte Bühler[2]) in a study of the relation between man and machine. She establishes two standards : in one case, man controls a complicated machine as, for example, the driver of an automobile or the operator of a crane ; in the other case, the machinery dominates the man as, for instance, the worker on a moving belt who performs just one operation completely controlled by the whole setup. It is possible to group the various working procedures in a factory

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[1]) Family and Society, New York 1935.
[2]) Der menschliche Lebenslauf, Leipzig 1933.

in a serial order according to the similarity they have to the two standards. Bühler has shown that a very important relationship to age exists : the nearer the work is to the first standard (domination of machine by man), the higher the average age of the worker.

The definition of the serial, in these cases, is not given completely by the two standards. Two communities never differ in only one respect. They also differ in regard to size, number of foreigners or metereological conditions and, therefore, it is always necessary to indicate in which respect the two concrete objects shall be used for the establishment of a serial order. The common feature, therefore, of the two examples just mentioned (and many others which could be given) is the fact that two standards are offered and that an indication is added in which respect other objects should be ranked between the two standards.

In certain cases, however, the mere establishment of a series of standards without any further indication can be used for the definition of a serial. In a study undertaken by the International Institute of Social Research, a number of experts were asked various questions pertaining to the exercise of authority in the family.[1]) The answers were grouped according to the occupation of the experts questioned. The percentage of experts who assumed that youth organizations are detrimental to the authority of the family was as follows :

University professors	80 %
Ministers	75 %
Judges in juvenile courts	40 %
Social workers	38 %
Directors of institutions	24 %
Teachers.....	23 %
Leaders of youth organizations	18 %

A rough interpretation seems to indicate that the nearer an occupational group is to the actual life of youth, the more favorably does it judge the role of youth organizations. What is the logical structure of such an interpretation ? Apparently the statistical results of the inquiry enforce a certain order of the different occupational groups. The student wonders what might be the „meaning" of this order. He finally decides that the occupations are standards representing different degrees of a serial attribute ; the word „degree" is used here in the same sense that it was used

[1]) Studien über Autorität und Familie, Paris 1936.

to describe the procedure of standardization. The serial seems to be something like „nearness to actual life of youth". The assumption is that one would find the same order of occupational groups if the task had been to group the seven occupations according to their „nearness to the life of youth". In this sense the procedure is just the reverse of the procedure of standardization.

The same occupations in another order might suggest a very different serial. One might, for instance, get a sequence in which the occupations are grouped according to income or social standing. In this case, one would infer the serial „social bias". In empirical research it very often happens that one does not start with the final classification, but is led by the numerical results of the study to the method of combining single items. It clarifies the matter greatly to see that the logical meaning of this technique is to define a serial by a rank order of standards. The psychological and logical implications of this procedure are extremely interesting but cannot be discussed in this connection.

The whole procedure of standardization and its inversion might be called „serial manipulations", because they can all be explained and performed with the help of one serial. To summarize : A serial manipulation consists either in deriving standards from a serial order or in defining a serial order with the help of standards. In the latter case there are two possibilities : Either two standards and an indication in which respect they should be compared are given, or so many standards are given that the aspect of comparisons enforces itself more or less distinctly by a procedure of interpretation.

IV.

Standards and their connection with serial operations throw light upon the logic of certain typological systems. It can be shown that many typologies only standardize serials or define a serial with the help of one or more standards.[1]) In such cases, the concept of type is practically identified with what has been introduced here as a standard. It is mainly a matter of definition if those standards should be called „types" or not. At the beginning of this paper types have been defined as an attribute compound. It will clarify the whole discussion to call „quasitypes" all those types which are logically the result of serial operations on one attribute only. A final decision as to the most useful termi-

[1]) Hempel and Oppenheim demonstrate this very convincingly.

nology could be made only by covering all the different applications to which types have been put in different scientific pursuits. This paper, however, is concerned with the concept of type in social research. A review of current studies would easily show that in this field types in the sense of attribute compounds have been mainly used. For the rest of these remarks, therefore, the special connection with the serial is relinquished. One advantage of the careful survey of attributes still remains ; the realm of examples which can be drawn on is much greater and the interconnection much clearer. The weight, however, of the following remarks lies with the combination of attributes, whatever kind they might be.

It is now necessary to introduce the concept of attribute space. Suppose that for a number of objects, several attributes are taken into consideration. Let it be three attributes : Size (a variable), beauty, (a serial), and the possession of a college degree. It is possible to visualize something very similar to the frame of reference in analytic geometry. The X axis, for instance, may correspond to size ; in this direction, the object can really be measured in inches. The Y axis may correspond to beauty ; in this direction the objects can be arranged in a serial order so that each object gets a percent rank number, % no. 1 being the most beautiful. The Z axis may correspond to the academic degree ; here each object has or has not a degree. Those two possibilities shall be designated by plus and minus, and shall be represented arbitrarily by two points on the Z axis on the two opposite sides of the center of the system. Each object is then represented by a certain point in this attribute space, for instance, by the following symbol : (66" ; 87 % ; plus ;). If the objects to be grouped are the women in a certain sample, then this special woman would be five and a half feet tall, would rank rather low in a beauty contest, and have a college degree. To each individual would correspond a certain point. (Because of the fact, however, that a characteristicum and a serial are included, not every point would correspond to an individual.) The reader is invited to familiarize himself by examples of his own with this very useful concept of attribute space ; each space will, of course, have as many dimensions as there are attributes according to which the individuals of the group are classified.

In the frame of an attribute space, the operation of reduction can be defined and explained. In order to have a simple example, the case of three characteristica will be discussed first. They might be this : To have (+) or not to have (—) a college degree, to be of white (+) or colored (—) race, and to be native (+) or foreign

born (—) in America. Evidently only the following eight combinations are possible :

Combination Number	College Degree	White	Native Born
1	+	+	+
2	+	+	—
3	+	—	+
4	+	—	—
5	—	+	+
6	—	+	—
7	—	—	+
8	—	—	—

(Combination 6, e. g., is the white foreign born without a college degree.) By reduction is understood any classification as a result of which different combinations fall into one class. (One further qualification of these groupings will be added later—V.)

Suppose that an effort is made to estimate roughly the social advantages which correspond to the eight combinations of college degree, race and nativity. It is possible (no question of the actual facts shall be implied here) to argue in the following way : To be a negro is such a disadvantage in this country that college degree and nativity make little difference. Therefore, the combinations 3,4, and 7,8, fall into one class of greatest discrimination. For the whites, nativity is much more important than education because you can substitute for college by self-education, but you cannot amend foreign birth. Therefore, the combinations 2 and 6 form the next class — the foreign born white — which is presumably less discriminated against than the negroes. Among the native-born whites, education may be an important selective factor. Therefore, a special distinction is introduced between the combinations 1 and 5. Thus an order of social advantage is established : the native white with college degree, the native white without college degree, the foreign-born white irrespective of education, and the negro irrespective of nativity and education.

There are at least three kinds of reduction which should be distinguished :

a) The functional ;

b) The arbitrary numerical ;

c) The pragmatic.

a) In a functional reduction there exists an actual relationship between two of the attributes which reduces the number of combinations. If, for instance, negroes cannot acquire a college degree,

or if tall girls are always judged more beautiful, certain combinations of variables will practically not occur and in this way the system of combinations is reduced. The elimination of certain combinations can either be a complete one, or these combinations may occur so infrequently that no special class need be established for them.

b) The arbitrary numerical case of a reduction is best exemplified by index numbers. In the analysis of housing conditions, for instance, the following procedure is frequently used : Several items, such as plumbing, central heating, refrigeration, etc., are selected as especially indicative, and each is given a certain weight. Central heating and ownership of a refrigerator, without plumbing, might be equivalent to plumbing without the other two items, and, therefore, both cases get the same index numbers. The weights for such a procedure can originate in different ways, of course.

c) In the case of functional reduction, certain combinations are eliminated in view of relationships existing between the variables themselves. In the case of pragmatic reduction certain groups of combinations are contracted to one class in view of the research purpose. The example of degree-race-nativity, given above, offers such a pragmatic reduction. In considering the concrete problem of discrimination, no distinction was made between the other qualifications of the negroes, and all of them were regarded as one class. Here is another example from a study of leisure-time activities among young people. The question was raised : Are youngsters from less desirable homes more likely to stay at home than the more well-to-do young people who might more probably patronize the character-building organizations of the community ? For the distinction between a desirable and undesirable home, two data were available : The employment status of the father and the existence or non-existence of a living room in the home. It was decided to attribute a desirable home to those cases where the father was employed and a separate living room was available. When the father was unemployed or no living room was available or both disadvantages applied, the home was called undesirable. Here, by pragmatic reduction, three of the four possible combinations were opposed as one class to the fourth combination as another class. In any pragmatic reduction, numerical factors will play a role. The desirable type of home, for instance, was twice as frequent as the undesirable although this type included three combinations ; such numerical differences are frequently a very good lead for pragmatic reductions.[1])

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[1]) The two procedures of reduction, a and b, and the concept of reduction itself are clearly discussed by Hempel and Oppenheim. They lay much less stress upon

The operation of reduction can be clarified considerably by comparing it with the operation of standardization discussed above. The following four points may be made :

a) A standardization pertains to one attribute; a reduction involves more than one.

b) In an attribute space, standardizations as well as reductions are possible and the difference between the two operations has to be kept clearly in mind.

c) The reduction of a multi-dimensional attribute space can finally lead to a one dimensional order which might be treated as a standardized serial.

d) There is, in social research, a progressive trend toward treating problems with the help of reduction of an attribute space rather than with the help of a standardized serial.

a) and b)

That the standardization pertains to one serial, whereas reduction pertains to combinations of attributes, irrespective of what kind they are, is self-explanatory in view of the definition of those two operations. In a more dimensional space, standardizations are possible along each axis which represents a serial. Going back to the example on page 126, where women were distributed according to size, education and beauty, beauty as a serial could be standardized. This means, for instance, that only a limited number of degrees of beauty would be distinguished. The ten percent most beautiful, for instance, would have beauty grade-A ; all the combinations of beauty, size and education which differ only in regard to their rank number on the beauty axis in the range of the first ten percent would, therefore, fall into one class ; all the different combinations of size and education with the beauty grade-A constant would still have to be distinguished.

If we keep to the textual definition of reduction, we could say that standardization in an attribute space means reduction

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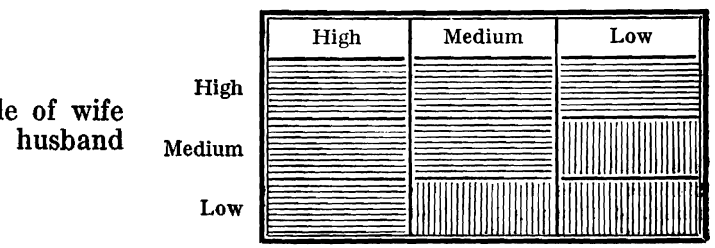
them, however, than is given in these remarks. The reasons lie in the following difficulty which permeates the whole book, beginning with the title. The book is called „The Concept of Types in the Light of the New Logic", but the authors do not proceed the way this title would lead us to expect. A more appropriate title would be „The Concept of Serial Demonstrated by Some Procedures in Typology". The main interest of the authors lies in the analysis of the serial kind of attribute, and therefore, the procedure of reduction comes in almost as an afterthought. In a logical analysis of typological operations, however, it ought to have a commanding place.

When it comes to empirical social research, the pragmatic reduction overshadows the other two kinds. Hempel and Oppenheim, however, have not included it in their analysis. The desire to discuss the method of pragmatic reduction has given rise to the present paper.

along one axis alone ; whereas all the examples given in the previous paragraph involved dealing with more than one attribute. It is advisable, however, to understand reduction as a grouping of attribute combinations involving more than one attribute. To make the matter quite clear, there is inserted here the simplest case of two attributes, x and y, both of which might be visualized as serials. Take, for example, the case in which a great number of married couples are studied and their relation analyzed as to the attitude of the women to their husbands, and as to the economic success of the husband. Y, the attitude of the wife, is ranked from a very favorable to a very unfavorable attitude, and X, the success of the husband, is ranked from very great to very little success. It would be possible to carry through two independent standardizations, each along one axis ; success and attitude might each be standardized to three grades (high, medium, and low). As a result, there would be nine combinations, themselves standards of different attitude-success configurations. In this case, no reduction has taken place. Suppose, however, that as a result of a further analysis, we find that if the wife's attitude toward the husband is favorable, then the economic success will not influence marital relations, whereas, if the wife has only a medium attitude toward him, he needs at least medium success to make the marriage a success, and only great success can save the marriage if the wife's attitude is altogether unfavorable. If then the problem is to classify all those marriages in two groups — one for which the attitude-success combinations are favorable for good marital relations, and one for which the combinations are unfavorable — the following diagram of a reduction would ensue :

X : Economic success of husband



If one keeps to the mere geometrical representation of these combinations he would say that the combinations resulting from a reduction always go „around the corner", because they involve more than one axis.

c) and d)

Take as an example of a rather complex serial the much-discussed extroversion-introversion distinction. One possible way is to describe vividly a person who corresponds very closely to the idea of an extrovert, and to give a corresponding standard for the idea of an introvert. Then it is roughly possible to observe a great number of individuals and to rank them in an order according to the degree to which they belong more to the extrovert or to the introvert side. There is, however, another way to proceed. One could measure by certain tests an individual's sociability, his adaptability, and many other attributes. Then it might be found that high adaptability, high sociability, optimistic mood, and several similar traits very frequently occur jointly; or, in other words, the corresponding attributes of which these traits are grades are highly correlated. That would, according to the procedures of functional reduction, lead to a one-dimensional order of combinations ranging from the combination of extrovert to that of introvert. This serial order might then be graded according to the procedure described above, and even re-defined with the help of standards.

The first rank order achieved by a rather primitive definition of a serial and the second one gained by the systematic reduction of a high dimensional attribute space might not show any difference. There is, however, a great likelihood that the second procedure leads, in its further application, to much more reliable and scientifically valuable results. It can safely be stated that most progress in measurement consists in taking this step : That for an impressionistic rank order, logically representing the definition of a serial, is substituted a systematic process of reduction.

V.

It is now the contention that these typological systems which are not the result of a serial operation (see IV) are nothing else but the result of a reduction of a more dimensional attribute space.[1]) This statement has to be understood in the right way.

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[1]) This statement is made in accordance with Hempel and Oppenheim. They do not seem to distinguish clearly enough, however, between those typological systems which are the result of a serial operation and those which are the result of a reduction. That can be understood by the fact that they draw their examples mainly from psychology where the serial operations are more prevalent. In empirical social research, however, the types which are logically the results of a reduction are much more frequent and of more practical importance. That is one of the main reasons why these remarks

It is by no means alleged that typological systems ought to originate in such a combination procedure as has been exemplified so far. Quite the contrary, there is great variety in conceiving a system of types for different scientific purposes and it would be very much worthwhile to analyze the different ways and means by which types have been established in different fields of research. That is, however, not the purpose of these remarks. The only claim made here is that once a system of types has been established by a research expert, it can always be proved that in its logical structure, it could be the result of a reduction of an attribute space.

This procedure of finding, for a given system of types, the attribute space in which it belongs and the reduction which has been implicitly used is of so much practical importance that it should have a special name; the term, substruction, is suggested.[1])

When substructing to a given system of types the attribute space from which, and the reduction through which it could be deduced, it is never assumed that the creator of the types really had such a procedure in mind. It is only claimed that, no matter how he actually found the types, he could have found them logically by such a substruction. In the case of a functional reduction, this fact is quite evident. If, for instance, two racial types are established, as, for example, the White and the Negro, and the former is supposed to have all good qualities and the latter all bad ones, the logical procedure evidently is this : In a very high dimensional space with a great number of attributes introduced, one among them racial descendence, the statement is made that there is a high correlation between racial affiliation and each of the other attributes. Therefore, most of the logically possible combinations (for instance, Negro race and high quality of character) should practically never occur, and in this way the two racial types would be established exactly according to the procedure of functional reduction described in III. In cases where arbitrary numerical reduction is used, the creator of the types is mostly aware of the procedure, as when cost of living indices or character „profiles" are suggested. Sometimes it may require more thought to bring the reduction used into clear relief. How about the old distinction between the visual, the acoustic, and the motor type ? Evidently the procedure is that each individual is placed in an attribute space of three dimensions, giving his visual, motor, and acoustic abilities.

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stress and enlarge the operation of reduction so much more than Hempel and Oppenheim do ; however, those authors deserve the credit for having seen clearly the logical meaning of this operation and having coined the very useful word „reduction".

[1]) From here on these remarks go beyond the book of Hempel and Oppenheim.

Then the following rule is used : The ability in which the individual is most outstanding would get the weight „1"; the other two would get the weight „0". In other words, only the best developed ability should be considered, the other two disregarded in deciding to which of the three types a certain person belongs. Thus, each individual is attributed to one type. (If intermediate types or correlations with other qualities are suggested, the matter becomes more complicated, but no new logical element is introduced.) The same analysis is possible, for instance, with the six value types of Spranger.

It is the substruction corresponding to the pragmatic reduction which is of the greatest practical importance in empirical social research. The most common use of types is made when a writer gives an impressionistic classification of the material he has at hand. Here is a student who groups different types of criminals, another who classifies reasons for marital discord, a third one who deals with types of radio programs, and so on. These types are conceived as an expediency and serve the purpose if they yield a valuable numerical distribution or correlation with other factors. In any given case, it can be shown that such typological classifications are the result of a pragmatic reduction of an attribute space even if the authors, in most cases, are not aware of it.

Whenever a writer uses such a typological classification, he should substruct to it a corresponding attribute space and the reduction connected therewith, in order to be aware of what is logically implied in his enumeration of types. There would be many advantages in this discipline. The writer would see whether he has overlooked certain cases ; he could make sure that some of his types are not overlapping ; and he would probably make the classification more valuable for actual empirical research. This practical value of a substruction deserves special attention. If a student creates types of family discord, his contribution is valuable only if in any concrete case it is possible to say whether the given discord belongs to a certain type or not. For this purpose, criteria have to be worked out. These criteria, in general, point directly to the attribute space from which the type has been reduced. Therefore, the substruction of the adequate attribute combinations to a given system of types adapts them better to actual research purposes. As an example, there is reported here an adventure in substruction which summarizes once more all the points made so far.

For a study of the structure of authority in the family, conducted by the International Institute of Social Research, a questionnaire was devised pertaining to authoritarian relations between

parents and children.[1]) E. Fromm, the director of the study, suggested as theoretical basis in outlining the study, four types of authoritarian situations :

Complete authority
Simple authority
Lack of authority
Rebellion

By using the procedure of reduction and substruction, it was possible to attain a thorough research procedure, and at the same time to exhaust all possible significance of Fromm's types.

An authoritarian situation in a family is determined by the way the parents exercise their authority, by the way in which the children accept it, and by the interrelations between exercise and acceptance. Two main categories in the questionnaire covered the matter of exercise : Questions were asked to discover whether parents used corporal punishment and whether they interfered with the activities of their children such as recreation, church attendance, etc. Two groups of indices were used in regard to acceptance : The children were asked whether they had confidence in their parents, and whether conflicts in various fields of their activity were frequent.

To study the exercise of authority, the indices of corporal punishment and interference were treated as characteristica. (No new problem of principle would arise if they were treated as serials ; as a matter of fact, interference was a serial since the number of interferences was used as an index.) By this means, the following combinations are reached :

Corporal punishment	+	+	—	—
Interference	+	—	+	—

(Plus, in this scheme, means that the characteristicum was present and minus that it was absent.) It is then possible to reduce this scheme to a rough one-dimensional order of intensity of exercise. The combination plus-plus (corporal punishment is used and interference is frequent) is apparently the strongest form, and minus-minus, the weakest. The type of exercise in which corporal punishment is used but no interference in the child's act vities was attempted, can be eliminated as practically contradictory.

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[1]) Studien über Autorität und Familie, Paris 1936.

The combination minus-plus was therefore left as a median degree of exercise. These three combinations, plus-plus, minus-minus, and minus-plus can then be reduced to a one-dimensional order, -X,Y, and Z, -X being the strongest degree.

The same procedure may be applied to the indices pertaining to acceptance of authority :

Conflicts	—	—	+	+
Confidence	+	—	+	—

The combination minus-plus (absence of conflicts and existence of confidence) is readily seen to be the highest degree of acceptance. Plus-minus, the inverse combination, is the weakest. The combination plus-plus can practically be disregarded. Confidence will hardly exist together with persistent conflicts.[1]) The combination minus-minus (no conflicts and no confidence) is roughly a median grade. The three grades of acceptance are then labelled A, B, and C, -A being the highest degree.

Here two separate reductions have been carried through : The two dimensional space constituted of corporal punishment and interference, has been reduced to the serial „exercise of authority". In the same way, conflict and confidence were reduced to „acceptance of authority".

A further step leads to the drawing of a chart with constitutes the attribute space into which the four initial types of authority will have to be placed. It turns out that nine combinations are logically possible, while Fromm suggested only four types. By the procedure of substruction, the last scheme will have to be matched with Fromm's types (which were, of course, conceived in a wholly different way).

	Acceptance	A	B	C
Exercise.....	X	1	2	3
—	Y	4	5	6
—	Z	7	8	9

It may be assumed that Fromm's type of complete authority is covered by the combinations 1 and 2. Simple authority is covered by combinations 4 and 5. The lack of authority is repre-

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[1]) If a few such cases come up, they might first be either eliminated or be lumped together with the medium degree of acceptance. Later, they might be studied separately.

sented by combination 8, and rebellion by 3 and 6. For greater clarity the substruction is repeated in another form :

Combination	Type	Exercise	Acceptance
1 and 2	Complete authority	Strong (X)	Voluntarily accepted (A) or just accepted (B)
4 and 5	Simple authority	Medium (Y)	Voluntarily accepted (A) or just accepted (B)
8	Lack of authority	Weak (Z)	Just accepted (B)
3 and 6	Rebellion	Strong (X) or medium (Y)	Refused (C)

Combinations 7 and 9 are not covered. Apparently it was assumed that neither voluntary acceptance nor rebellion against an authority which is scarcely exercised is possible. The substruction, however, may be used as a tool for discovery. It discloses the possibility that children might long for an authority which no one offers them. These discovered combinations suggest further research.

The reader may disagree with the above substruction, and may think that other combinations should be matched with Fromm's types ; or he may feel that there are certain contradictions between the combinations and the types. Then he may try to improve the types on the basis of the general scheme suggested above. He will see for himself that the procedure of substruction may very probably lead to improvements in typologies which have been construed on the basis of theoretical considerations or intuitions. The proof of the success of the procedure lies, of course, in concrete applications which lie beyond the scope of the present exemplification.

It may again be stressed strongly that this whole analysis does not limit the research man in the actual sequence of his work. It is by no means postulated that he should start by deciding what attributes he wants to use, then proceed with the reduction, and so finally gets his system of types. Ever so often, and especially if many attributes are at stake, it might be much better for the student to become deeply acquainted with his material and then bring order into it by first blocking out a few main types on a completely impressionistic basis. Only thereafter would he reconsider the matter and substruct to his own typological intuitions an adequate attribute space and bring into relief the reduction which he has used implicitly, led merely by his impressions. The best results, probably will be gained in just this combination of a first general survey and a subsequent systematic analysis. The elaborate example just given provides a good illustration.

VI.

The problem comes up whether to every given system of types only one attribute space and the corresponding reduction can be substructed. The answer is probably „no". At least the typological classifications used in current social research are somewhat vague and therefore more than one logical substruction can usually be provided for them. The different attribute spaces originating this way can be transformed one into another, however. The procedure of transformation is very important because it is the logical background of what is in general understood as an interpretation of a statistical result. It could be shown that such an interpretation is often nothing else than transforming a system of types from one attribute space into another with different coordinates, and therewith changing simultaneously one reduction into another. There is, no opportunity here to discuss this question beyond giving one example.

A few hundred pupils were grouped in a rough way, according to their physical development and according to their scholastic achievements. (Both concepts, by the way, were introduced as serials.) Combinations of these two attributes yielded five rather distinct types. The physically under-developed children were either especially bright or especially unsuccessful. The same was true for well-developed children ; most of them also appeared among the two scholastic extremes. The children of medium physical development were, on the whole, medium in their scholastic achievement as well. Relatively few children were of medium physical development and especially good or bad in their school work ; and relatively few children of unusually good or bad physical condition were medium in their ability in school.

The result was interpreted in about the following terms. Among the physically under-developed children there are two types : those who were too handicapped to be successful in school ; those who overcompensated for their physical weakness and did especially well in school. Every teacher knows those two types from his own experience. Among the especially well-developed children, one group was the all-round type, combining mental with physical maturity. The other group was the „hoodlum" type which, on the basis of strength, has such a good position in class that it does not consider it necessary to make an effort in school work. If this interpretation is analyzed in the light of the previous considerations, it turns out that these types can be described in two completely different sets of dimensions. Instead of the original attributes of physical and mental developments, new terms are

now used, such as over-compensation, which is or is not operative; parallelism between physical and mental activity; recognition by school mates, which is or is not present. Such an interpretation consists logically of substructing to a system of types an attribute space different from the one in which it was derived by reduction, and of looking for the reductions which would lead to the system of types in this new space. That is what transformation means.

The operations of reduction, substruction and transformation could be called „typological operations" because their application links any system of types with an attribute space. These typological operations correspond closely to the serial operations which link a special group of types to one serial. It is a matter of convenience whether types corresponding to serial operations and types corresponding to typological operations should be distinguished. Good reasons could be given for calling the former group „quasi-types" and for reserving the word „type" for those systems where more than one attribute is at stake and where the reductions cut across the axes of the attribute space. If this terminology is accepted, the content of these remarks can be summarized in the following way. The word „type" in current social science literature is used either to describe standards developed from one attribute by serial operations or to designate attribute combinations developed from more than one attribute by typological operations. The logic of these typological operations has not been given enough attention so far, and its careful study could improve considerably the use of types in practical research. These remarks were mainly concerned with illustrating those typological operations. The main one is the reduction of an attribute space to a system of types. Three kinds of reduction were distinguished : the functional, the arbitrary numerical and the pragmatic. The latter one is the most frequent and most important in empirical research; its inversion is called substruction. Substruction consists in matching a given system of types with that attribute space and that reduction from which it could have originated logically. This substruction of an attribute combination to a given system of types permits one to check the omissions or overlappings in this system and points the way to its practical applications.

Zur Verwendung von Typen in der empirischen Sozialforschung.

Ein eben erschienenes Buch „Der Typenbegriff im Lichte der neuen Logik" (von C. Hempel und P. Oppenheim) wird zum Anlass genommen, methodologische Probleme der Verwendung von Typenbegriffen zu diskutieren. Drei verschiedene Arten von Attributen werden unterschieden :

klassifizierende Merkmale, abstufbare Merkmale und Massgrössen. Abstufbare Begriffe können standardisiert werden. So entstandene Standards werden als Quasi-Typen bezeichnet. Echte Typen entstehen aus Merkmalkombinationen. Diese Kombinationen werden in einem Merkmalsraum vorgenommen mit Hilfe sogenannter Reduktionen. Drei Arten von Reduktionen werden unterschieden. Die für die empirische Sozialforschung wichtigste Reduktion ist die pragmatische : sie fasst Klassen von Merkmalkombinationen so zusammen, wie es ein vorliegendes Erhebungsproblem erfordert. Im allgemeinen werden Typen intuitiv gebildet, und erst nachher wird die ihnen entsprechende Merkmalskombination aufgedeckt. Dieses Verfahren heisst Substruktion. An Beispielen wird seine Bedeutung für die Praxis dargestellt. Es wird betont, dass die typologischen Operationen (Reduktion, Substruktion und Transformationen) nichts darüber aussagen, was ein Typus ist und wie er gefunden wird. Sie weisen nur gewisse formale Eigenschaften auf, die allen typologischen Systemen gemeinsam sind.

L'emploi des concepts de type dans la recherche sociale.

Un livre récemment paru „Le concept de type à la lumière de la nouvelle logique" (de C. Hempel et P. Oppenheim : „Der Typenbegriff im Lichte der neuen Logik") fournit l'occasion de discuter quelques-uns des problèmes que pose l'emploi des concepts de type. On distingue trois catégories de caractères : caractères classificatoires, caractères gradués et mesures de grandeur. Les concepts gradués peuvent être standardisés de telle manière que naissent des standards que l'on peut qualifier de quasi-types. Les types authentiques naissent par combinaison de caractères. Ces combinaisons s'opèrent dans un „lieu de caractères" (Merkmalsraum) à l'aide d'un procédé nommé réduction. On distingue trois sortes de réduction. La réduction la plus importante pour la recherche sociale est la réduction pragmatique : elle embrasse des classes de caractères combinés en fonction des exigences d'une enquête donnée. En général, les types sont formés intuitivement, ensuite seulement on découvre la combinaison de caractères correspondante. Cette démarche s'appelle substruction. On en montre la signification pour la pratique dans une série d'exemples. On souligne que les opérations typologiques (réduction, substruction, transformations) ne nous permettent nullement de dire ce qu'est un type et comment il a été découvert. Elles indiquent seulement certains caractères formels qui sont communs à tous les systèmes typologiques.