

Chapter 5

AN EXPERIMENTAL STUDY OF CONCEPT DEVELOPMENT

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Until recently, a major impediment to the study of concepts has been a lack of experimental methods that would allow the investigation of their formation and their psychological nature.

Traditional methods for studying concepts fall into two basic groups. The first is typified by what is called the method of definition. This method involves the study of fully developed and fully formed concepts through the use of verbal definitions. Despite its wide acceptance, this method suffers from two fundamental inadequacies that make it unreliable for any realistic investigation of concept formation.

1. This method deals with the results of the completed process of concept formation, with the ready-made product of that process. When we use this approach, we are not looking at the dynamics of the process itself, at its development, its course, its beginning and its end. This method is an investigation of the product not of the process that leads to its formation. Consequently, in studying definitions of developed concepts, we are frequently dealing less with the child's thinking than with his reproduction of fully formed knowledge and definitions. Thus, when we study the child's definitions of a particular concept, we are studying his knowledge or experience and the level of his verbal development more than we are studying his thinking in the true sense of the word.

2. The method of definition depends almost exclusively on the word. It overlooks the fact that, for the child in particular, the concept is linked with sensual material, the perception and transformation of which gives rise to the concept itself. This sensual material and the word are both necessary for the concept's development. Divorced from this material, the word transfers the process involved in the concept's definition to a purely verbal plane, a plane that is not characteristic of the child. When this method is used, we therefore rarely succeed in identifying the relationship that exists between the meaning the child attributes to the word in a purely verbal definition and the word's real meaning in the process of its living relationship to the objective reality it designates.

When this method is used, that which is most essential to the concept (i.e., its relationship to reality) remains unexplored. When we attempt to approach the meaning of the word through other words in this way, what we discover would better be attributed to the relationships among word families that have already been learned or mastered than to a true reflection of the nature of the child's concepts.

The second group of methods used in the study of concepts attempts to overcome the inadequacies of the purely verbal approach of the method of definition by focusing on the mental functions and processes that underlie the formation of concepts. These methods are concerned with the functions and processes that underlie the transformation of the concrete experience from which the concept is born. Here, the child is presented with the task of isolating some general feature from several concrete impressions, of isolating or abstracting this feature from others that are perceptually intertwined with it. The child is presented with the task of generalizing or abstracting this feature.

The inadequacy of this second group of methods is that they replace a complex synthetic process with an elementary one that constitutes only one part of the whole. The role of the word or sign in the process of concept formation is ignored. The result is that the process of abstraction is radically oversimplified. It is torn away from its relationship with the word. This relationship, however, is fundamental to the process of concept formation. It is, indeed, the determining feature of that process.

Thus, both of these traditional methods for studying concepts divorce the word from objective material. One begins by isolating the word from the objective material. The other begins by isolating the objective material from the word.

The development of an experimental method that could adequately reflect the process of concept formation by including both features of the process, by including the material on the basis of which the concept is worked out and the word through which it arises, represented an important step forward in the study of concepts.

We will not dwell on the complex history of this new method. We will only note that its introduction opened up an entirely new plane for the researcher. This method created the potential for studying the process of concept formation rather than merely studying the fully developed concept. As used by N. Ach, the method was justifiably called the synthetic-genetic method. It involves investigating the process through which the concept is constructed, the process involved in the synthesis of the several features that form the concept. That is, this method involves the investigation of the process of the concept's development.

This method involves the introduction of: (1) artificial words that are initially meaningless to the subject and have no connections with the child's previous experience, and (2) artificial concepts that are composed for experimental purposes by combining features so that the resulting set of features is not encountered in the concepts designated by our normal speech. In Ach's experiments, for example, the word "gatsun" was initially meaningless to the subject but acquired a certain meaning over the course of the experiment. This word became the bearer of a concept designating things that are big and heavy. In a similar way, the word "fal" became the bearer of a concept that designated things that are small and light.

In this experiment, the whole process through which the initially meaningless word acquires meaning (i.e., the concept's development) is laid out in front of the investigator. Through the introduction of artificial words and concepts, this method overcomes a critical failing of other methods. Specifically, the subject's resolution of the task that faces him in the experiment presupposes no previous experience or knowledge. Therefore, the positions of the young child and the adult are equalized in

this respect. Ach utilized his method with both a five year old child and an adult. This allowed him to study the process involved in concept formation in pure form.

A major deficiency of the method of definition is that the concept is torn from its natural connections. It is isolated in a congealed and static form from the actual processes of thinking where it is encountered. It is isolated from the processes of thinking where it is born and lives. The experimenter selects an isolated word and the child must define it. This definition of the isolated word taken in a congealed form tells us nothing of the concept in action. It tells us nothing of how the child operates with the concept in the real-life process of solving a problem, of how he uses it when some real-life need for it arises.

As Ach suggests, ignoring this functional aspect of the concept reflects a failure to remember that the concept does not live in isolation, that it is not a congealed, static formation but a formation that is always encountered in the vital and complex process of thinking. A concept always fulfills some function in communication, reasoning, understanding, or problem solving.

The new method is not deficient in this way. Here, the *functional conditions of the concept's origins* are the focus of investigation. The concept is taken in connection with a particular task or need that arises in thinking, in connection with understanding or communication and with the fulfillment of a task or instruction that cannot be carried out without the formation of the concept. As a consequence, this new research method is an extremely valuable tool for studying concept development.

Although Ach himself did not study the formation of concepts in the transitional age, he could nonetheless not help but note the dual transition (involving both the content and the form of thinking) that occurs in the intellectual development of the adolescent. This transition signifies the transition to thinking in concepts.

Rimat⁴⁸ conducted a special and thorough investigation of the processes involved in the formation of concepts in adolescence. These studies were based on methods developed by Ach. Rimat found that concept formation begins to occur only when the child approaches the transitional age, that it is inaccessible to the child before this period. Ach writes that:

We can firmly establish that only toward the end of the twelfth year of life do we see a sharp increase of the capacity for independent formation of general objective representations. In my view, it is extremely important to turn our attention to this fact. Thinking in concepts divorced from immediately perceivable features presents the child with demands that exceed his mental capacities before the age of twelve years (Rimat, 1925, p. 112).

We will not dwell on how this study was conducted or on the other theoretical conclusions Rimat derives from it. We will limit ourselves to emphasizing its central findings. Specifically, Rimat's findings contrast with the claims of psychologists who reject the emergence of any new intellectual functions in adolescence, psychologists who claim that the three year old has all the intellectual operations of the adolescent. His research shows that it is only after the age of twelve (i.e., with the beginning of adolescence and the completion of the first school age) that the child begins to develop the processes that lead to the formation of concepts and abstract thinking.

One of the basic conclusions to which we are led by the research of Ach and Rimat is the refutation of the associative perspective on concept formation. Ach's research shows that however numerous and strong the associative connections between verbal signs or objects, the presence of such connections is insufficient for the formation of concepts. There is no experimental support here for the old idea that the concept arises through associative processes, through the reinforcement of the associative

connections that correspond to the features common to several objects and through the weakening of the connections that correspond to the features with respect to which these objects differ.

Ach's experiments show that concept formation always has a productive rather than reproductive character. They show that the concept arises and is formed in a complex operation that is directed toward the resolution of some task. They show that the simple presence of certain external conditions and the mechanical establishment of connections between objects and the word is not sufficient for the emergence of the concept. In addition to establishing the non-associative and productive character of the process of concept formation, these experiments led to another equally important conclusion. Specifically, Ach's experiments identified what he views as the basic factor which defines the course of concept formation. Ach calls this factor the *determining tendency*.⁴⁹

Ach uses this phrase to refer to the tendency that regulates the flow of our representations and actions. The tendency emerges from the representation of the goal toward which these actions are directed and from the task that the activity is meant to achieve. Prior to Ach, psychologists distinguished two basic tendencies that subordinate the flow of our representations, specifically, the reproductive (or associative) tendency and the perseverative tendency. The first is the tendency to elicit representations associated with a given representation in previous experience. The second is the tendency of each representation to return or re-enter the flow of representations.

In his early studies, Ach showed that these tendencies are insufficient to explain consciously regulated acts of thinking that are directed toward the resolution of some problem. The latter are regulated not by acts of reproduction of representations through associative connections or by the tendency of each representation to re-enter consciousness but by a special determining tendency deriving from the representation of the goal. In studying concepts, Ach once again showed that the critical feature in the emergence of a new concept is the determining tendency that regulates the action, the tendency that emerges from the task presented to the subject.

Thus, according to Ach's scheme, concepts are not constructed as associative chains, where one connection elicits another that is connected with it through processes of association. Rather, they are constructed through a goal-directed process composed of several operations that function as means for the solution of the basic task. In itself, learning words and their connections with objects does not lead to the formation of concepts. The subject must be faced with a task that can only be resolved through the formation of concepts.

We have said that Ach's work represents a tremendous step forward in comparison with earlier research. He included the process of concept formation within the structure of the resolution of a particular task. He studied the functional significance and the role of this aspect of the problem. However, this is not a complete solution to the problem. Of course, the goal or task that is established is necessary for the emergence of the process that is functionally linked to the task's resolution. There are, however, goals in the activity of the preschooler and even younger children. As we have seen, however, no child younger than twelve years is fully capable of conscious awareness of the task before him nor is he capable of working out a new concept.

Ach himself demonstrated experimentally that the difference between preschool children and adults or adolescents in the solution of a problem is not that the former represent the goal of the task less fully or correctly than the latter but that the act of resolving the problem unfolds in a completely different manner. In an extensive experimental study of concept formation in the preschooler (which we will discuss in more detail later), Uznadze⁵⁰ has shown that in functional terms the preschooler en-

counters the problem in precisely the same way as the adult who is operating with concepts. However, the preschooler resolves the task in an entirely different way. Like the adult, the child uses the word as a means. Consequently, the word is for him connected in the same way with the functions of communication, interpretation, and understanding.

Thus, it is not the task, the goal, or the determining tendency but factors not considered by these researchers that underlie the difference between adult conceptual thinking and the forms of thinking characteristic of the young child. In particular, Uznadze pointed out the importance of a functional factor which is advanced to the forefront by Ach's research, specifically, the factor of communication, of mutual understanding between people through speech.

However, the word is a tool used for the attainment of mutual understanding. This plays a decisive role in the development of the concept. In the process of attaining mutual understanding, a complex of sounds acquires a definite meaning and is consequently transformed into a word or concept. If this functional aspect of mutual understanding did not exist, this complex of sounds could not be transformed into a carrier of meaning. Not a single concept would arise (Uznadze, 1966, p. 76).

Contact between the child and the adult world that surrounds him is established extremely early. From the outset, the child develops within the atmosphere provided by a speaking environment. He begins to use the mechanism of speech in the second year of life. "There is no question that what he uses are not complex meaningless sounds but true words. In time, they acquire increasingly differentiated meanings" (ibid, p. 77). Nonetheless, it seems to be relatively late that the child achieves the degree of socialization in his thinking necessary for the emergence of fully developed concepts.

Thus, we see on the one hand that the true concept, which indicates a high level of socialization of thinking, develops only at a late stage. On the other, we see that the child begins to use words and understand the words of adults at a very early age. It is clear, then, that before it attains the status of a true concept, the word can take on this communicative function and serve as a means of establishing mutual understanding. A special investigation of the appropriate age group would show how these forms of thinking (the equivalent of conceptual thinking though non-conceptual) develop and achieve the level characteristic of fully developed thinking (ibid).

Uznadze's research shows that though these forms of thinking are the functional equivalent of conceptual thinking, they differ qualitatively and structurally from the more developed thinking of the adolescent and adult. Nonetheless, this difference is not a function of the factor that Ach identifies. As Uznadze has shown, it is precisely in the functional sense, that is, with respect to the resolution of particular tasks and with respect to the determining tendencies that are derived from representations of goals, that these forms are the equivalent of the concept.

We are confronted with the following situation. First, the task - and the goal representations that are derived from it - turn out to be accessible to the child at a relatively early stage of development. Precisely because the task of understanding is the same for the child and the adult the functional equivalents of the concept develop at a very early stage of childhood. Given this identity in task, this functional equivalence, there is nonetheless a profound difference in the composition, structure, and mode of

activity of the forms of thinking that function to resolve the task in the child and the adult.

Obviously, the task and the representation of a goal do not themselves determine and regulate the entire process. There is an additional factor that Ach has failed to consider. It is also apparent that the task and the determining tendency that is associated with it are inadequate to explain the genetic and structural differences that we observe in these functionally equivalent forms of thinking in the adult and child.

The goal is not a sufficient explanation. Of course, without the goal no form of goal-oriented action is possible. However, irrespective of whether we are speaking of its development or its structure, the presence of this goal does not explain the process through which it is attained. As Ach himself says with reference to the older methods, the goal and the associated determining tendency make the process possible but they do not regulate it. The presence of the goal and task is a necessary but not sufficient condition for the emergence of goal-oriented activity. They do not guarantee that a true goal-oriented activity will emerge. At any rate, they do not possess the power to determine and regulate the course and structure of that activity. The child's experience and the experience of the adult correspond fully when unresolved tasks arise before them. Thus, we must begin with the goal in our attempt to explain the nature of the mental processes that lead to the resolution of a task, but we cannot limit our explanation to it.

As we said earlier, the goal cannot explain the process. The basic problem associated with the process of the concept formation, and, more generally, with the process of goal-oriented activity, is the problem of the means through which a given mental operation is fulfilled, the problem of how a given goal-oriented activity is completed. In much the same way, we cannot satisfactorily explain labor by saying that it is called to life by the goals and tasks with which man is faced. Labor must be explained in terms of the use of tools and the application of the means without which it could not arise. In precisely the same sense, the central problem for the explanation of the higher forms of behavior is the problem of the means through which man masters the processes of his own behavior.

As is indicated by the study that we will discuss here, all the higher mental functions are mediated processes. A central and basic aspect of their structure is the use of the sign as a means of directing and mastering mental processes.

In the problem of interest to us, the problem of concept formation, this sign is the word. The word functions as the means for the formation of the concept. Later, it becomes its symbol. Only the investigation of the functional use of the word and its development from one age to the next (a development where the various uses of the word are genetically linked with one another) provides the key to the formation of concepts.

The major inadequacy of Ach's method is that it cannot help us clarify the genetic process involved in concept formation. It can only establish the presence or absence of this process. The organization of Ach's experiment presumes that the means through which the concept is formed (i.e., the experimental words which function as signs) are given from the outset; it presumes that they are constants that do not change over the course of the experiment. Moreover, their mode of application is predetermined by the instructions. Given his critical and polemical goal of trying to show that a single associative connection between words and objects is insufficient for the emergence of meaning, the goal of trying to show that the meaning of the word or concept is not equivalent to an associative connection between a sound complex and a series of objects, Ach consistently maintained a scheme that can be expressed in the following

words: from below to above, from separate concrete objects to the concepts that grasp them.

Ach himself shows, however, that the organization of this kind of experiment directly contradicts the actual process involved in concept formation. Fogel has stated that concept formation cannot be reduced to a movement upwards through a conceptual paradigm, to a transition from the concrete to the increasingly abstract. This is the basic conclusion of Ach and Rimat's research. They have demonstrated the falsity of the associative perspective on concept formation. They have shown the productive, creative character of the concept and clarified the essential role of function in the concept's origin. They have emphasized that the concept is formed only with the emergence of a need that can be satisfied in the concept, only in the process of some meaningful goal-oriented activity directed on the attainment of a particular goal or the on resolution of a definite task.

These studies have done away with the mechanistic representation of concept formation once and for all. Nonetheless, they have failed to reveal the actual genetic, functional, and structural nature of this process. They have taken a common path in using a purely teleological explanation of the higher functions. In essence, they are reduced to the assertion that the goal itself creates the corresponding goal-oriented activity through a determining tendency. They are reduced to the assertion that the solution is contained in the task itself.

We have mentioned that, in addition to the general philosophical and methodological inadequacies of this perspective, it leads to an irresolvable empirical contradiction. Given the functional identity of the tasks and goals throughout the process, it is impossible to explain within this framework why there are such profound differences in the forms of thinking with which the child approaches these tasks at various stages of development. It becomes incomprehensible how these different forms of thinking develop.

The studies of Ach and Rimat have initiated a new epoch in the study of concepts, but they have failed to offer a causal-dynamic explanation of concept formation. Therefore, experimental research is presented with the task of studying the development of concept formation, the task of studying how this process is causally and dynamically determined.

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To resolve this problem, we have used an experimental method that we call the functional method of dual stimulation. In using this method, we study the development and activity of the higher mental functions with the aid of two sets of stimuli. These two sets of stimuli fulfill different roles *vis-a-vis* the subject's behavior. One set of stimuli fulfills the function of the object on which the subject's activity is directed. The second function as signs that facilitate the organization of this activity.

In the present context, we will not provide a detailed description of the application of this method to the study of concept formation. The method was developed by our colleague L. S. Sahkarov⁵¹ and described elsewhere (Sahkarov, 1930). We will outline only the most basic characteristics of the method, focusing on those which are of particular significance to the problems discussed above. In this research, we wanted to clarify the role of the word -- that is, the nature of its functional application -- in the process of concept formation. In this respect, the organization of this experiment was the opposite of Ach's.