

2. Concept-Formation

A *concept* is a mental integration of two or more units which are isolated according to a specific characteristic(s) and united by a specific definition.

The units involved may be any aspect of reality: entities, attributes, actions, qualities, relationships, etc.; they may be perceptual concretes or other, earlier-formed concepts. The act of isolation involved is a process of *abstraction*: i.e., a selective mental focus that *takes out* or separates a certain aspect of reality from all others (e.g., isolates a certain attribute from the entities possessing it, or a certain action from the entities performing it, etc.). The uniting involved is not a mere sum, but an *integration*, i.e., a blending of the units into a *single, new mental* entity which is used thereafter as a single unit of thought (but which can be broken into its component units whenever required).

In order to be used as a single unit, the enormous sum integrated by a concept has to be given the form of a single, specific, *perceptual* concrete, which will differentiate it from all other concretes and from all other concepts. This is the function performed by language. Language is a code of visual-auditory symbols that serves the psycho-epistemological function of converting concepts into the mental equivalent of concretes. Language is the exclusive domain and tool of concepts. Every word we use (with the exception of proper names) is a symbol that denotes a concept, i.e., that stands for an unlimited number of concretes of a certain kind.

(Proper names are used in order to identify and include particular entities in a conceptual method of cognition. Observe that even proper names, in advanced civilizations, follow the definitional principles of *genus* and *differentia*: e.g., John Smith, with "Smith" serving as *genus* and "John" as *differentia*—or New York, U.S.A.)

Words transform concepts into (mental) entities; *definitions* provide them with *identity*. (Words without definitions are not language but inarticulate sounds.) We shall discuss definitions later and at length.

The above is a general description of the nature of concepts as products of a certain mental process. But *the* question of epistemology is: what precisely is the nature of that process? To what precisely do concepts refer in reality?

Let us now examine the process of forming the simplest concept, the concept of a single attribute (chronologically, this is not the first concept that a child would grasp; but it is the simplest one epistemologically)—for instance, the concept "*length*." If a child considers a match, a pencil and a stick, he observes that length is the attribute they have in common, but their specific lengths differ. The *difference* is *one of measurement*. In order to form the concept "*length*," the child's mind retains the attribute and omits its particular measurements. Or, more precisely, if the process were identified in words, it would consist of the following: "Length must exist in *some* quantity, but may exist in *any* quantity. I shall identify as 'length' that attribute of any existent possessing it which can be quantitatively related to a unit of length, without specifying the quantity."

The child does not think in such words (he has, as yet, no knowledge of words), but *that* is the nature of the process which his mind performs wordlessly. And that is the principle which his mind follows, when, having grasped the concept "*length*" by observing the three objects, he uses it to identify the attribute of length in a piece of string, a ribbon, a belt, a corridor or a street.

The same principle directs the process of forming concepts of entities—for instance, the concept "*table*." The

child's mind isolates two or more tables from other objects, by focusing on their distinctive characteristic: their shape. He observes that their shapes vary, but have one characteristic in common: a flat, level surface and support(s). He forms the concept "table" by retaining that characteristic and omitting *all* particular measurements, not only the measurements of the shape, but of all the other characteristics of tables (many of which he is not aware of at the time).

An adult definition of "table" would be: "A man-made object consisting of a flat, level surface and support(s), intended to support other, smaller objects." Observe what is specified and what is omitted in this definition: the distinctive characteristic of the shape is specified and retained; the particular geometrical measurements of the shape (whether the surface is square, round, oblong or triangular, etc., the number and shape of supports, etc.) are omitted; the measurements of size or weight are omitted; the fact that it is a material object is specified, but the material of which it is made is omitted, thus omitting the measurements that differentiate one material from another; etc. Observe, however, that the utilitarian requirements of the table set certain limits on the omitted measurements, in the form of "no larger than and no smaller than" required by its purpose. This rules out a ten-foot tall or a two-inch tall table (though the latter may be sub-classified as a toy or a miniature table) and it rules out unsuitable materials, such as non-solids.

Bear firmly in mind that the term "measurements omitted" does not mean, in this context, that measurements are regarded as non-existent; it means that *measurements exist, but are not specified*. That measurements *must* exist is an essential part of the process. The principle is: the relevant measurements must exist in *some* quantity, but may exist in *any* quantity.

A child is not and does not have to be aware of all these complexities when he forms the concept "table." He forms it by differentiating tables from all other objects *in the context of his knowledge*. As his knowledge grows, the definitions of his concepts grow in complexity. (We shall dis-

cuss this when we discuss definitions.) But the principle and pattern of concept-formation remain the same.

The first words a child learns are words denoting visual objects, and he retains his first concepts *visually*. Observe that the visual form he gives them is reduced to those *essentials* which distinguish the particular kind of entities from all others—for instance, the universal type of a child's drawing of man in the form of an oval for the torso, a circle for the head, four sticks for extremities, etc. Such drawings are a visual record of the process of abstraction and concept-formation in a mind's transition from the perceptual level to the full vocabulary of the conceptual level.

There is evidence to suppose that written language originated in the form of drawings—as the pictographic writing of the Oriental peoples seems to indicate. With the growth of man's knowledge and of his power of abstraction, a pictorial representation of concepts could no longer be adequate to his conceptual range, and was replaced by a fully symbolic code.

A concept is a mental integration of two or more units possessing the same distinguishing characteristic(s), with their particular measurements omitted.

The element of *similarity* is crucially involved in the formation of every concept; similarity, in this context, is the relationship between two or more existents which possess the same characteristic(s), but in different measure or degree.

Observe the multiple role of measurements in the process of concept-formation, in both of its two essential parts: differentiation and integration. Concepts cannot be formed at random. All concepts are formed by first differentiating two or more existents from other existents. All conceptual differentiations are made in terms of *commensurable characteristics* (i.e., characteristics possessing a common unit of measurement). No concept could be formed, for instance, by attempting to distinguish long objects from green objects. Incommensurable characteristics cannot be integrated into one unit.

Tables, for instance, are first differentiated from chairs,

beds and other objects by means of the characteristic of *shape*, which is an attribute possessed by all the objects involved. Then, their particular kind of shape is set as the distinguishing characteristic of tables—i.e., a certain category of geometrical measurements of shape is specified. Then, within that category, the particular measurements of individual table-shapes are omitted.

Please note the fact that a given shape represents a certain category or set of geometrical measurements. Shape is an attribute; differences of shape—whether cubes, spheres, cones or any complex combinations—are a matter of differing measurements; any shape can be reduced to or expressed by a set of figures in terms of *linear measurement*. When, in the process of concept-formation, man observes that shape is a commensurable characteristic of certain objects, he does not have to measure all the shapes involved *nor even to know how to measure them*; he merely has to observe the element of *similarity*.

Similarity is grasped *perceptually*; in observing it, man is not and does not have to be aware of the fact that it involves a matter of measurement. It is the task of philosophy and of science to identify that fact.

As to the actual process of measuring shapes, a vast part of higher mathematics, from geometry on up, is devoted to the task of discovering methods by which various shapes can be measured—complex methods which consist of reducing the problem to the terms of a simple, primitive method, the only one available to man in this field: linear measurement. (Integral calculus, used to measure the area of circles, is just one example.)

In this respect, concept-formation and applied mathematics have a similar task, just as philosophical epistemology and theoretical mathematics have a similar goal: the goal and task of bringing the universe within the range of man's knowledge—by identifying relationships to perceptual data.

Another example of implicit measurement can be seen in the process of forming concepts of colors. Man forms such concepts by observing that the various shades of blue are

similar, as against the shades of red, and thus differentiating the range of blue from the range of red, of yellow, etc. Centuries passed before science discovered the unit by which colors could actually be measured: the wavelengths of light—a discovery that supported, in terms of mathematical proof, the differentiations that men were and are making in terms of visual similarities. (Any questions about “borderline cases” will be answered later.)

A commensurable characteristic (such as shape in the case of tables, or hue in the case of colors) is an essential element in the process of concept-formation. I shall designate it as the “Conceptual Common Denominator” and define it as “The characteristic(s) reducible to a unit of measurement, by means of which man differentiates two or more existents from other existents possessing it.”

The distinguishing characteristic(s) of a concept represents a specified category of measurements within the “Conceptual Common Denominator” involved.

New concepts can be formed by integrating earlier-formed concepts into wider categories, or by subdividing them into narrower categories (a process which we shall discuss later). But all concepts are ultimately reducible to their base in perceptual entities, which are the base (the given) of man’s cognitive development.

The first concepts man forms are concepts of entities—since entities are the only primary existents. (Attributes cannot exist by themselves, they are merely the characteristics of entities; motions are motions of entities; relationships are relationships among entities.)

In the process of forming concepts of entities, a child’s mind has to focus on a distinguishing characteristic—i. e., on an attribute—in order to isolate one group of entities from all others. He is, therefore, aware of attributes while forming his first concepts, but he is aware of them *perceptually*, not conceptually. It is only after he has grasped a number of concepts of entities that he can advance to the stage of abstracting attributes from entities and forming separate concepts of attributes. The same is true of concepts of

motion: a child is aware of motion *perceptually*, but cannot conceptualize "motion" until he has formed some concepts of that which moves, i.e., of entities.

(As far as can be ascertained, the perceptual level of a child's awareness is similar to the awareness of the higher animals: the higher animals are able to perceive entities, motions, attributes, and certain numbers of entities. But what an animal cannot perform is the process of abstraction—of mentally separating attributes, motions or numbers from entities. It has been said that an animal can perceive two oranges or two potatoes, but cannot grasp the concept "two.")

Concepts of *materials* are formed by observing the differences in the constituent materials of entities. (Materials exist only in the form of specific entities, such as a nugget of gold, a plank of wood, a drop or an ocean of water.) The concept of "gold," for instance, is formed by isolating gold objects from all others, then abstracting and retaining the material, the gold, and omitting the measurements of the objects (or of the alloys) in which gold may exist. Thus, the material is the same in all the concrete instances subsumed under the concept, and differs only in quantity.

Concepts of *motion* are formed by specifying the distinctive nature of the motion and of the entities performing it, and/or of the medium in which it is performed—and omitting the particular measurements of any given instance of such motion and of the entities involved. For instance, the concept "walking" denotes a certain kind of motion performed by living entities possessing legs, and does not apply to the motion of a snake or of an automobile. The concept "swimming" denotes the motion of any living entity propelling itself through water, and does not apply to the motion of a boat. The concept "flying" denotes the motion of any entity propelling itself through the air, whether a bird or an airplane.

Adverbs are concepts of the characteristics of motion (or action); they are formed by specifying a characteristic and omitting the measurements of the motion and of the entities

involved—e.g., “rapidly,” which may be applied to “walking” or “swimming” or “speaking,” etc., with the measurement of what is “rapid” left open and depending, in any given case, on the type of motion involved.

Prepositions are concepts of relationships, predominantly of spatial or temporal relationships, among existents; they are formed by specifying the relationship and omitting the measurements of the existents and of the space or time involved—e.g., “on,” “in,” “above,” “after,” etc.

Adjectives are concepts of attributes or of characteristics. *Pronouns* belong to the category of concepts of entities. *Conjunctions* are concepts of relationships among thoughts, and belong to the category of concepts of consciousness.

As to concepts of consciousness, we shall discuss them later and at length. (To anticipate questions such as: “Can you measure love?”—I shall permit myself the very philosophical answer: “And how!”)

Now we can answer the question: To what precisely do we refer when we designate three persons as “men”? We refer to the fact that they are living beings who possess the *same* characteristic distinguishing them from all other living species: a rational faculty—though the specific measurements of their distinguishing characteristic *qua* men, as well as of all their other characteristics *qua* living beings, are different. (As living beings of a certain kind, they possess innumerable characteristics in common: the same shape, the same range of size, the same facial features, the same vital organs, the same fingerprints, etc., and all these characteristics differ only in their measurements.)

Two links between the conceptual and the mathematical fields are worth noting at this point, apart from the obvious fact that the concept “unit” is the base and start of both.

1. A concept is not formed by observing every concrete subsumed under it, and does not specify the number of such concretes. A concept is like an arithmetical sequence of *specifically defined units*, going off in both directions, open at both ends and including *all* units of that particular kind. For instance, the concept “man” includes all men who live at

present, who have ever lived or will ever live. An arithmetical sequence extends into infinity, without implying that infinity actually exists; such extension means only that whatever number of units does exist, it is to be included in the same sequence. The same principle applies to concepts: the concept "man" does not (and need not) specify what number of men will ultimately have existed—it specifies only the characteristics of man, and means that any number of entities possessing these characteristics is to be identified as "men."

2. The basic principle of concept-formation (which states that the omitted measurements must exist in *some* quantity, but may exist in *any* quantity) is the equivalent of the basic principle of algebra, which states that algebraic symbols must be given *some* numerical value, but may be given *any* value. In this sense and respect, perceptual awareness is the arithmetic, but *conceptual awareness is the algebra of cognition.*

The relationship of concepts to their constituent particulars is the same as the relationship of algebraic symbols to numbers. In the equation $2a = a + a$, any number may be substituted for the symbol "*a*" without affecting the truth of the equation. For instance: $2 \times 5 = 5 + 5$, or: $2 \times 5,000,000 = 5,000,000 + 5,000,000$. In the same manner, by the same psycho-epistemological method, a concept is used as an algebraic symbol that stands for *any* of the arithmetical sequence of units it subsumes.

Let those who attempt to invalidate concepts by declaring that they cannot find "manness" in men, try to invalidate algebra by declaring that they cannot find "*a*-ness" in 5 or in 5,000,000.