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# ANATOMY OF ANALOGY: A NEW LOOK

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THIS paper will be an attempt to dispel an old notion. Namely, that analogy is a superficial phenomenological means of perception, which if applied to psychological methodology merely ornaments the procedure and consequently adds nothing of import to our knowledge. The subject has long been a neglected, if not closed, topic of discussion. Admittedly for some time now analogy has been the debate of many a philosopher and logician, but in a most superficial manner. Nevertheless in whatever manner analogy has been discussed, the overwhelming conclusion has been that, though it is a handy device, its validity as a thought process in the scientific endeavor is one not unlike that of its use in the literary world, that is to say, analogy is a device for the writers in the Humanities to approximate picturesquely the world in which we live. In short, it has been regarded as a supernumerary of correct thought and valid reasoning.

In all fairness, however, it must be said that although its merits in the literary and other related media have been recognized, there is, to paraphrase a cliche, more than what meets the eye of tradition. Because of its many idiosyncratic nuances such as metaphor and simile, analogy has been studied by psychologists for quite some time, but oddly enough _without their knowing it. For example, what investigations have been accomplished have been done under a myriad of rubricons not traditionally considered the domain of analogy. Yet, in fact, analogy may be equated with the well-known constructs of stimulus generalization, constancy and transposition phenomena, isomorphic relations, metaphor, abstraction, transfer, and the more recent signature of science-model.

From this author's point of view a few investigators have shown insight into the nature or analogy (Anderson, 1964; Bruner, Wallach & Galanter, 1959; Cohen; 1958; Erickson, 1942; Gerard, Kluckhohn & Rapoport, 1956; Koestler, 1964; Kubie, 1961; Miller, 1955; Mostofsky, 1965; Nosh, 1963, 1965; Oppenheimer, 1956; Osgood, 1949; Reiser, 1958, 1963; Rohovit, 1960; Schon, 1963; Spengler, 1932) but its wide significance for the psychology of thought has yet to be recognized. To facilitate this recognition, it is hoped that the terms which must follow will not deter the reader from this general theory of analogy, but rather enhance his fundamental knowledge of the subject in terms of future application and understanding. This, at least, is the purpose of this paper.

## Epistemological Considerations

Before advancing further, the epistemological key to the understanding of analogy should be stated. The key concerns the form of "reality." We will begin with the words of Susanne Langer (1942) who has so

aptly noted that since no experience is ever exactly repeated, all so-called repeated experiences are but analogous experiences fitting an abstract form. The philosopher Henri Bergson (1923) states essentially the same thesis. He says if everything is in time, the same concrete reality never recurs; repetition therefore, is possible only in the abstract. Consequently, all reality is analogue as abstraction.

It follows, then, that the literal statement is a fiction; it is an analogue. Scott Buchanan in his far too little known book, *Poetry and Mathematics,* (1929) brings this point poignantly home. From this point of view, literalness is only to be found in figurative statements and their expansions; literalness is a condensed analogy, as analogy is a condensed allegory or metaphor. For example, the proposition "man is a machine" taken literally as a statement of fact is a condensed allegory of the analogies between a machine and a human being; expanded progressively, however, it is a detailed analysis and scientific description of a man's body.

The consequences of an analogue reality, when accepted, asserts a reality which is symbolic, not "real." From here the ambiguousness of all phenomena becomes too uncomfortable for most people; meaning is rendered vague; many symbolic relations are capable of being attached to a meaning matrix (Schon, 1963). Traditional ontological categories are crossed, leading to the breakdown of the normal category of meaning. From the standpoint of epistemology, these two reasons are at least a partial answer to why analogy has never been quite accepted as the legitimate child of pure thought and reason.

**Relativity of Analogy**

There has long been a distinction, taken as absolute between analogy and non-analogy, e.g., metaphor. By way of illustration, one writer on the subject (Hesse, 1954) maintains that the distinction between analogy and metaphor is the following: The word "anger" is "properly" used in reference to human beings, but when "anger" is utilized in reference to the sky as in the statement "there is an angry sky," metaphor is said to be used; for there is no implication of any similarity between the sky and human beings. It is, therefore, said that the metaphor can be done away with by simply stating that there is a black sky, not an "angry" sky, the more picturesque meaning notwithstanding, though the use of the term black as non metaphor is a moot point.

Now when speaking of an angry dog, however, this is said to be closer to analogy than metaphor. But this reasoning is based on a one-perspective view of the phenomenon, for if one changes his thought matrix in terms of turbulence and conflict and up-heavel, that is, progress to higher levels of abstraction, the angry sky becomes just as much an analogy as that between the "angry dog" and the "angry person." Thus as Colin Turbayne puts it (1963), "a metaphor is not a metaphor per se but only for someone, from one point of view."

As we will have occasion to see, the thought complex is a mixed jumble of half reified, some not so reified, analogies from many levels of reality.

The process which gives the "allusion" of differences from a particular frame of reference is *the* constant oscillation of the focus of attention which results in the transformations of invariants, creating the "illusion" of separate levels as well. Any change in focus or attention will yield transformations which are invariant with respect to new categories which were not invariant with the previous focus. Other invariants, of course, which were invariant with respect to the first focus will not, under the new focus, be invariant. This same process is to be seen in micro-version in the functioning of the scanning[1] operations of the visual apparatus. The same is true with the learning of concepts. The invariants--- analogies--- change with focus. On the macro-scale the relations and categories of science change in this manner.

Moreover, in recent times creativity has become integrally related to analogy, of seeing similarities in nature which have been overlooked by others. Further, the psychologist George Thompson (1962) has said that creativity, artistic or scientific, is in all probability directly related to the parameters of stimulus generalization. Kubie (1961) has concluded that most of the creative analogic connections are preconscious; that the preconscious makes extensive use of analogy and allegory, the combining of much information into one symbol. The analogic from this point of view not only provides economy of understanding but of all thought and learning (Hebb, 1961); it is an unconscious effort of the mind to reduce the incongruent, to supplant complexity with simplicity (Wheeler 1965).

**Physiological Grounds of Analogy**

The notion of the neurone and brain as strict digital mechanisms is becoming strained as a principle of explanation of mental functions (Allport, 1955; Wiener, 1950). The brain works by fitting inputs into already existing models learned from past experience (Young, 1960). Whitehead (1958) has said that the main *recurrences* of life are much too insistent to escape the attention of the least rational of humans, and that the very nature of the nervous system has adapted to them. Another function of the analogue nature of the brain is directly related to the need for continuity (Grinker, 1956); for the fact that the mind constantly sees similarities and derivations between one system and other systems makes it obvious that the mind needs to maintain continuity.

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[1]Scanning is a process taken from electronic engineering and computer processes; it is the transformation from spacial to temporal coordinates. Simplistically this involves searching amongst the storage circuits of a system for data which is relational or analogous. The information can then be transmitted as one datum. Illustration: circuit one $C_1$ for example may be constituted by the word "read," $C_2$ by the word "step" and $C_3$ by the word "bee." Now the scanning process abstracts the invariant relations which in this case is the letter "c."

On a complex level in the psychological realm we obtain analogies between any given set of systems of universe of discourse. Kubie (1961) has advanced the hypothesis that this is the mechanism of the psychoanalytic process of free-association. It may very well be that this process is also responsible for the workings of puns as well as information retrieval. Thus, analogy as a mental process is an important concept which has hardly been recognized.

Of cardinal significance for the understanding of the analogic have been the little-known studies of the bio-physicist John Platt (1958). He concludes from his investigations of the physiology of the eye, that its information processing and coding operations suggest that by way of its scanning functions and specialized cells, the eye abstracts from the mosaic environment invariant relationships and transformations. He further suggests that this process is extended up through to thought processes; that it may be conceived of as a formal calculus of abstraction.[2] What is called intelligence may be the ability to perceive successive analogies at higher and higher levels of abstraction; a multiple repetition of a single basic neural process of organization - a process which this author prefers to call analogic progression. One may recall here the words of Aristotle: "The greatest thing by far is to be a master of metaphor. It is the mark of genius."

**Analogic Progression**

Analogy as analogic progression is not only manifested in but is basic to mathematical thought. The basic form of analogy in terms of progression is what is known to mathematicians and electrical engineers as a harmonic series, an integral multiple of a more fundamental series or frequency. In Platts's terms this is the calculus of abstraction. This type of phenomenon in mathematics is called mathematical progression, a progressive series of numbers with a constant single or multiple ratio between them. An example of the single ratio is the spiral of Archimedes, a spiral with a constant radius of curvature; the multiple ratio is illustrated *by* the logarithmic spiral, giving rise auditorially to the siren whistle.

An example of this phenomenon in the functioning of the nervous system is as follows: In an experiment with cats (McCleary, 1965) which consisted of teaching the animals to respond to a particular tone in a particular manner, they were then subjected to decortication of their auditory cortex. Upon completion of the operation the cats no longer responded to the tone to which they were taught response. They did, however, respond to a tone one *octave* from the original training tone. Of significance here is the "harmonic effect" of the older levels of the brain which some how made the appropriate transformations of its higher level counterpart's function. It made an analogic transformation. It may be that there are lower substrates responsible for analogy on many levels which are extended upward.

Analogic form and mathematical form, according to Ernst Cassirer (1957) may be almost indistinguishable. Articulation of one element of experience with other equally possible relations and simultaneous orientations of these relations is an operation essential to thinking in analogies as well as numbers and numerical signs. The Greeks used the term *analogia,* not only in the sense

[2]It is interesting that Platt should connect analogy with intelligence in the progressive manner in which he states, for the Miller Analogies Test seems to predict success in graduate school. It also is highly correlated with intelligence. Moreover, there seems to be no difference among high scores between the sciences and humanities, both groups are equally adept. The calculus is to be seen manifested in mathematical progression, and the compounding of an allegory in both science and literature.

of a linguistic equation but in terms of mathematical proportion as well. George Boole, one of the most creative mathematicians, wrote much on his use of the analogic in the mathematical endeavor; so did Henri Poincare (1952). And A.S. Eddington has been quoted as saying that he believes the process of finding analogies follows closely the mathematical process of a Hamiltonian differentiation of an invariant (Korzybski, 1933). Others (Reiser, 1958) have recognized the function of the analogic in such mathematical domains as group theory, and maintain that analogy-isomorphic relations-are the basic mode from which all order is made.

A simple example of the analogic is the transformation of a set of integers, say 1, 2, 3 with a law of transformation given by the function y = 2x. The result is the manifold of even integers 2, 4, 6. The values of the integers changes but there remains a constant or invariant ratio between them. That is 1 is to 2 and 2 is to 3 as under the new set 2 is to 4 and 4 is to 6. Trebled it would yield 3, 6, 9 and so on progressively. In addition, locating a corresponding term in a series of analogies is strikingly similar to finding the fourth term of a proportionality -given, that is, the other three terms (Hesse, 1963). In terms of ratios, the abstractive properties are that of analogy: Though no similarity is stated between the terms of the proportions the relations between the terms is said to be similar or invariant (Buchanan 1929).

When analogy is recognized as the connecting link between constructs, be they vast networks or simple concepts, it then becomes clear that any constructs may be traced in time to gain a *better* understanding of their past relations (their origins) as well as the future direction of the concept. Once the analogic structure of theories, on a multiple of levels, is understood the way is then clear to guide their development and to generally predict their progression.

**Analogy and Science**

Despite the lamenting cries of many scientists analogy is used extensively in all sciences. But it remains true as Oswald Spengler said years ago (1932, p. 5):

> From any technique of analogies we are far distant. They throng up (today more than ever) without scheme or unities, and if they do hit upon something which in true--in the essential sense of the word that remains to be determined - it is thanks to luck, more rarely to instinct, never to a principle. In this region no one hitherto has set himself to work out a method nor has had the slightest inkling that there is here a root, in fact the only root, from which can come a broad solution of the problems of History.

The one exception to this rule today is the work of the general systems theorists.

By the utilization of the analogic the same information can be transmitted by different means and translated from one medium to another. In short all that is needed is a system of isomorphic relations. Another

author calls them "homomorphic images" (Reiser, 1963). The systemization of analogies in science is the analogue of the allegory in literature. The use of analogy have been generally thought to be

the plaything of the poets, but as Ludwig von Bertalanffy has shown from general systems research, the analogic is a potent tool in science (1951). The difference between the use of analogy in science and in the humanities is the more systematic use of it in science (Burke, 1954). This has not been widely realized before, and the implications are vast.[3]

Though analogy is often relegated to a low position in the scientific enterprise, Ernest Nagel in his *Structure of Science* (1961) has made it clear that if a theory were stated as a set of uninterpreted postulates, showing not even a formal analogy to some already existing system of abstract relations, *the* formulation would provide no means as to how the theory could be applied to concrete problems. Thus all that would be available to the theoretician would be flat description. Of course, this is only describing a high level analogy in the sense of a model as the term is used in science today. It hardly is permissible to use the term analogy in science today but one may use the term model. Thus models arc analogies traveling incognito.

There are a few exceptions in science. One investigator in the field of archaeology (Ascher, 1961) has said that analogy is the main tool of his trade in the interpretation of data. In history, a respected historian believes that even the words used in his field are functions of analogic borrowing (Gottschalk, 1956). In physical anthropology Le Gros Clark (1960) maintains that it is justifiable to assume that animals which show a preponderation of resemblances to one another are anatomically related. Again in history, the existence of similarities in the historical flow is a necessary condition of testability (Gerschenkron, 1962).

In the biological theory of evolution the analogic is integral; for the idea of transformism is the basis of classification. The naturalist brings together organisms which are like one another and then divides the group into sub-groups in which the likeness is still greater. The characters of each group appear as themes upon which variations are played (Bergson, 1923). Here is illustrated the concept of analogic progression in the biological realm. Moreover, in biology the use of analogy and homology is extensive.

Generalization, a variant form of analogy, is also critical to prediction. Poincare (1952) has demonstrated with immutable logic that in mathematics, although not confined to it, prediction without generalization is impossible. Since the circumstances under which one operates will never be the same, all that can be affirmed is that under analogous circumstances an analogous fact will be analogously produced. To predict, therefore, the aid of analogy must be invoked.

In the historical scheme or things analogies may be overlooked because of too much time elapsing between the events which are analogous. Time

[3]For further clarification of the systematic progression of analogy in psychology, see the author's "The Analogic and Psychoanalytic Theory." *Psychoanalytic Review*, in press.

veils their sameness. As an example, take the two phenomena of gross combustion and the rusting of iron. The two processes were considered separate until the experiments of Priestly with red oxide of mercury.

One of the grave dangers of being unaware of the wide use of analogy is its one- way use. In psychology one-way analogies are used unconsciously, for example the rattomorphic (Koestler, 1964) view of man which-prevailed for so long. The reverse logic, however, was not tolerated; that is, one could not attribute to the rat any anthropomorphisms. The same one-way operation is to be seen in dealing with the phenomenon of consciousness. Man is compared to the rat because of the many similarities, but to reverse the logic is not considered cricket: to attribute any subjective phenomena to an animal is not scientific (Fletcher, 1966).

Kenneth Burke sums up the situation quite well concerning the nature of analogy in science and thought (1954, p. 95):

> Indeed, as the documents of science pile up are we not coming to see that whole works of scientific research, even entire schools are hardly more than patent repetition, in all its ramifications of a fertile metaphor? Thus we have at different eras in history, considered man as the son of god, *as* an animal, as a political or economic brick, as a machine, each such metaphor, and a hundred others serving as the cue for an unending line of data and generalizations. The attempt to fix argument by analogy as a distinct kind of process separable from logical argument seems increasing futile.

By way of conclusion, Scott Buchanan in his *Poetry and Mathematics* (1929), advances an index for measuring one's place upon a continuum of analogic thought. He says seven prime analogies have been applied to Man: 1) Man is a machine, 2) Man is a system of electrons, 3) Man is an animal, 4) Man is a bundle of habits, 5) Man is a soul, 6) Man is divine, and 7) Man is an angel. The writer then goes on to say that one can measure his progress in the school of modernism or hardheadedness by how many of these analogies one considers "real" as opposed to analogical. If one considers them all analogies, as does this author, then one is considered by most people, "just philosophical and a little bit mad."

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