Function, Fiction, and Fact[1]

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God said let Newton be, and all was light.

In the beginning God created the heavens and the earth.

In the beginning was the Word, and the Word was with God.

According to many philosophers, the essence of knowledge is warranted belief, mostly about how the world is. Since little of my knowledge is warranted and that little not detectably warranted, I am more modest in my desires of knowledge. I want it to fit[2] the world as I come to experience it, that is, not to be disproved too often for comfort and safety. As a non-believer in essences in any case, I prefer an ostensive definition and see knowledge as a broad range typified by my three epigraphs, the mathematical/scientific, the mythical, and the literal. These three have typical heydays and modes of expression, but they overlap in both time and modes.

I should like to elaborate a theory in which it would be shown that literal language grows out of mythical language and mathematical expression out of literal language, with a clear rationale for the successive developments. However, I cannot elaborate such a theory and doubt that it is possible. So what I shall do is sketch my ideas of myth and math as the banks between which a stream of literal language flows, nourishing them both. It does seem that the literal meanings of words must underlie their poetic uses. I want then to indicate a principle that underiies literal uses, interpretation of myth, and application of mathematics.

We have on the one bank myth, originally oral, poetic in language, consisting of specific stories with universal significance involving persons or anthropomorphisms so as to include final causes and other nuances. Myth is typified by Genesis 1 (second epigraph) and is striven after by much poetry and fiction, much of which is not formally distinct from myth but only distinct in value. In its application to the world of here and now, myth requires interpretation. A myth may tell how the world is or how to behave in it[3] in a variety of ways.

Opposite myth we have mathematics, written out in symbols, saying nothing about anything non-mathematical except by interpretation. Final causes are inexpressible and unexpressed. Mathematical science, its application, is typified for Pope (first epigraph) and history by Newton's physics.

Between myth and math we have the mass of literal language, written or writable prose that says no more and no less than it means. Less nuanced than myth, more so than math, it is typified by history and theology, including the *Gospel according to John* (third epigraph), where facts are just as much made as fictions and functions. It is used by writers of science Fiction and romances on the one side and by scientists when they want to achieve relevance.

This is the merest sketch of three tendencies in knowledge. There is much overlap, for instance Aratos's star chart[4] written in Greek verse. There is a lot of fiction that is not science fiction that fails to have universal significance. And there are prose myths like Tolkein's. Likewise there was long ago prose mathematics; the spherical astronomy of Euclid[5] and Autolykos[6] eries out to be put into symbols, but it is all in nearly impenetrable prose. More recently the rhetorical algebra of the renaissance makes clear how important has been the ideographic script of all mathematics since. Jumping across from math to myth, there have been attempts to import the ngour of mathematics into theology, which has traditionally been treated either by the myth of scripture or by the literal language of theology. And the mythical responsibility of Chance (the Greek god Tyche) is much assumed by scientific workers.[7] One can even understand mathematics as myth.[8]

The need that both myth and math have for interpretation before they are relevant to the present time and place, or even to thought, contrasts with the apparent lack of this need on the part of literal language, which is widely thought to be self interpreting. I mention this notion because I think it is a mistake, the correction of which fonns the basis for what I want to say here that I think is not often said. I want to have a theory of meaning and communication that takes account of the fact (as I see it) that we have to lea~n everything that we know of an informational nature. Our instincts simply do not extend to any positive knowledge of the world; it must all be learned. I agree with the evolutionary epistemologists[9] that our learning must be of a piece with, thongh more

advanced than, the learning of the lower animals[10] . We construct ourselves, as Maturana suggests with his word autopoiesis[11] . Each of us is a poem of our own telling. Moreover, and as a part of our construction of ourselves, we construct the worlds in which we live, as von Glasersfeld and others emphasize following Piaget following Kant. The result of this self-constructedness is that when I hear a word, even the simplest sort of noun that suggests most clearly a Platonic idea, like dog, I do not have happen in my head the same thing as happens in any other head in the world. Let me explain as briefly as I can.

My personal notion of what the word dog applies to is something that obviously only I have, because it is a vague class of objects that, if presented to me, would be called dog by me. This class has been built up over fifty years of meeting dogs and things that are not dogs. It is completely beyond my mental capacities to imagine how anyone else could have had exactly the experiences, including several pets and one attack, that have formed my notion of dog. I therefore cannot see how anyone else could have my idea of dog, much less my idea of more subtle notions like blueberry pie. While I do not doubt that my class of dogs is unimportantly distinct extensionally from those of most persons in the room, I do doubt that the class of associations that I bring to blueberry pie is comparable to that of any other person in the room. So I shall proceed without flogging this horse to the idea that I forrn my own classes that correspond to words; I call these assimilation classes[12] because I form them by assimilating things to categories[13] . As I assimilate them, the categories are modified by the process Piaget called accommodation to fit the things I put into them. By assimilation of particulars and accommodation of categories, I determine how I cut up the world to talk about it and even partly to understand it. I can, if I want to, identify my assimilation classes with those of other persons or relate them to Platonic ideas, but these are voluntary actions on my part. Both of them have often been done by others. I find that I am more understanding of other persons if I do not do so but rather keep in mind their distinctiveness.

Let us now go up a level to the word dog used in common speech. If we all have our own ideas of dog, how do we communicate? Well, the answer seems to me both easy and to be fully consistent with the lower level. We assimilate everyone's uses of the word dog. I hasten to point out that this is the same neither as assimilating the dogs themselves nor to identifying the many persons' ideas of dogs with one another or with a Platonic idea. Just as dogs are similar enough to one another to be assimilated, so different persons' assimilation classes of dogs are similar enough to be assimilated, and that is what we do. We ignore differences. We treat the dog notions as 'the same' even thongh, if we think about it or have it poInted out to us, we know that they are not identical. I say that different persons' assimilation classes of dogs are similar enough to be assimilated, but there are no limits on what *can* be assimilated, since it is an entirely voluntary action in no way dependent on the raw material; what I mean is that they are close enough that it is rational to assimilate them. One of the main features of rationality, it seems to me, is the heroic assumption that what appears uniform in the world is a genuine uniformity and will persist through space and time. The rationality of assimilating the assimilation classes of speakers of the same language is borne out by the success of our communication. It is part of what we mean by being speakers of the same language. Indeed we use the word 'same' frequently more loosely than saying 'we are in the same room'; and, when we do use it so loosely, we are assimilating. It is often called identifying because there is no word in common use for this trick, but what is often meant is assimilation. The English of no two persons in this room is identical, but when we are speaking English we are speaking what is called, by assimilation, 'the same language'.

Where do I want to take this accommodating idea of assimilation? Three directions occur to me. One would be to consider in detail the way in which assimilation of things here and now to things understood in terms of myth helps us to understand how to behave, how not to behave, what to expect, and what to fear. But I am not sufficiently expert at mythology to be able to do this effectively. A second would be to explain how assimilation of what goes on in our mental models to the objects of mathematical study allows us to apply mathematics to the world and to have what are called mathematical models. This is a particular interest of mine and probably not of many others here, and so I shall not mount a hobby horse.[14] Thirdly, I do want to look at how assimilation is a foundation stone of the rational process called scientific induction, which has little to do with any peculiarities of modern science. Scientific induction is the much more modest assumption that 'instances, of which we have had no experience, must resemble those of which we have had experience,' as Hume put it in 1738[15] What Hume does not mention in this quotation, or in the other instances conveniently collected by Stove[16] , is that the objects of which he speaks are of the 'same kinfi. When I say, using a typical instance of this process, that I expect the sun to rise tomorrow, what I am doing is assimilating tomorrow to the days of which I have had experience. I claim that this is rational. I do not claim that it is arrived at by any process with deductive validity. Nor do I claim to *identify* tomorrow with today or yesterday or any of my other thousands of days—only that I assimilate it to them. For me to say that tomorrow is the same kind of tùing as today is just to say that it is sufficiently like today and the days to which I assimilate today (though it started half an hour earlier than usual[17]) rightly to be so assimilated. This process is, I hasten to add, both voluntary and fallible. One might have said, 'Because the Titanic has not hit an iceberg so far this voyage, it will not hit one tomorrow', and been right several times.

Hume drew attention to the fact 'that there can be no demonstrative arguments to prove, that those instances of which we have had no experience resemble those of which we have had experience'[18] . And I think that he was correct in doing this, though he is probably partly responsible for the confusion of logic and rationality. I think that in this matter there are at least three different points to consider. One is the past uniformity of nature. One is the future uniformity of nature. One is our assimilation of the future to the past. Supposing ourselves to have experienced past uniformity, it is rational for us to assimilate the future to the past. If we are right, then the future will indeed be like the past. Our assimilation capacity is something that evolution has given us because it has had survival value for us and for lower species for millions of years. We are designed this way; it is difficult to conceive of how we could be designed otherwise, but computers are. My computer is completely without expectations when I turn it on in` the morning. The future uniformity of nature is not deduced, certainly not deduced by any considerations of probability; it is merely expected, and that expectation is rational but may be diappointed.

So important a basis as this for human and even sub-human action needs a name, and I am not aware of one, and so I call it the principle of assimilation, after the Piagetian notion on which it is based. When I came upon this principle in the late seventies, I did some research to see who had come across it first. The best answer I found was the German physicist and physiological psychologist G. T. Fechner (1801-1887), who is remembered chiefly as the author of the Weber-Fechner law in psychology. He shified the matter from the uniformity of nature[19] to our responses with a principle described by Copleston in his *History of Philosophy*[20] thus,when objects agree in possessing certain qualities or traits, one is entilled to assume hypothetically that they agree also in other qualities, provided that one's hypotheses do not contradict established scientific theory.
From this principle Fechner deduced that for the sake of their souls one should talk to one's houseplants. That seems to have caught on with some people, and now I am campaigning not very seriously for his principle.[21] I find it interesting, and I hope that some others do too, that this one principle, which is much broader in scope than merely inductive inference (which I don't in any case think is inference) applies to the application of mathematics, to the interpretation of myths, and to the working of natural language.

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[1] Slightly expanded version of a talk given at the interdisciplinary conference, Myth and Knowledge, held at Sir Wilfred Grenfell College, Comer Brook, Newfoundiand, May 2~24, 1992.

[2] The fit of constructivism; cf. Ernst von Glasersfeld, 'An introduction to radical constructivism' in *The invented reality,* Paul Watzlawick, ed. (Norton, New York, 1984).

[3] For instance, *Medea.*

[4] *Phaenomena* in *Callimachus, Lycophron, and Aratus,* edd. A. W. Mair and G. R. Mair (Heinemann, London, 1921).

[5] Phaenomena in *Euclidis opera omnia,* edd. J. L. Heiberg and H. Menge. Vol. V111, *Euclidis Phaenomena et scriptia musica,* ed. H. Menge, *Fragmenta,* ed.]. L. Heiberg (B. G. Teubner, Leipzig, 1916).

[6] *Autolycus de Pitane: Histaire du texte, suivie de l'édition critique des traités de la sphère en mouvement et des levers et coachers,* ed. J. Mogenet
(Publications universitaires de Louvain, 1950).

[7] I owe this observation to Heinz Steinbring, 'The concept of chance in everyday teaching: aspects of a social epistemology of mathematical knowledge.' *Educational Studies in Mathematics* 32 (1991), 503-S22.

[8] Faik Seeger and Heinz Steinbring, 'The myth of mathematics', in F. Seeger and H. Steinbring, eds., *The dialogue between theory and practice in mathematics education: overcoming the breadcast metaphor* (Bielefeld: Institut fÅr Didaktik der Mathematik der Universitat Bielefeld, 1992).

[9] The term is due to Donald T. Campbell, whose essay in *The philosophy of Karl Popper,* ed. P. A. Schilpp (Open Court, La Salle, lllinois, 1974) bears 'Evolutionary Epistemology' as title.

[10] My thinking on these matters began on a logico-linguistic basis, but I have found remarkable concordances with the genetic epistemology

of Piaget and parts of the evolutionary epistemology of Rupert Reidl in *Biology of Knowledge: The evolutionar~v basis of renson* (Wiley, 1984), translated by P. Foulkes from *Biologie der Erkenutnis* (Verlag Paul Parey, 1981).

[11] H. R. Maturana and F. *Varela Autopoiesis and cognition: The realization of the living* (Reldel, 1980).

[12] I *have* discussed these classes in 'Meanings in ordinary language and in mathematics', *Philosophia Mathematica* (2) 6 (1991), 3-38. It is close to an idea of Stephen Pepper, *Concept and quality* (Open Court, La Salle, lllinois, 1967).

[13] Works on categories that I take as supporting my views are those of George Lakoff, W*omen, fire, and dangerous things* (University of Chicago Press, 1987) and Mark Johnson, *The hody in the mind* (University of Chicago Press, 1987).

[14] A beginning of this is made in my paper in n. 12.

[15] Hume, *Treatise of Hurnan Nature, 1738, p. 91* in Everyman edition.

[16] D. C. Stove, *The rationality of induction* (Oxford, 1986), p. 8.

[17] Because of being in Newfoundland, whose time zone is displaced half an hour.

[18] Hume, *idem.*

[19] *'Natura nonfecit saltus',* J. Fournier (1613), reference from Riedl, op.cit., p. 20.

[20] Hardcover vol. 7, p. 375

[21] My own version of the principle is,

I take what I have assimilated to be different only as known to be different, in the absence of contrary evidence.

Cognitive science confirms our sensitivity to evidence contrary to our expectations, e.g., J. H. Holland, K. J. Holyoak, R. F. Nisbett, P. R. Thagard, *Induction* (MIT Press, 1986) §7.2.2.

A similar principle that I have noted recently, which has the drawback that it seems to regard kinds as given but admits that evidence overrules, is Fodor's principle of inductive inference, If D is a true description of the etiology of an event *e*, and if *e'* is an event numerically distinct from e but of the same kind as *e*, then it is reasonable to infer *ceteris paribus*, that D is a true description of the etiology of *e'*. (J. A. Fodor, *Representations* (MIT Press, 1981), p. 77). Much much more along these lines, but based on biology, can be found in Riedl, op. cit., including his version of the principle, not, of course, in terms of assimilation.

I venture to remark that it can be argued that the principle of assimilation, when applied to the form of arguments, is even the foundation for formal deductive inference on the ground that a proposition is of 'the same form' as a model kind of deduction. Nelson Goodman has written, 'Principles of deductive inference are justified by their conformity with [i.e., the assimilation to them of] particular deductive inferences we actually make and sanction.' (*Fact, fiction, and forecast*, 3rd ed. (Bobbs-Merrill, 1973), pp. 63f.)