The Origins of Knowledge and Imagination

J.Bronowski

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I got acquainted with the author in the late 70's when I was still at Columbia. Not personally of course bit through his books which at the time made a splash, or at least his TV-series on the Ascent of Man a few years earlier. An acclaimed series I may even have watched some reruns of. I was at the time enamored, and I recall when reading his book on the Western Intellectual Tradition I set myself the goal to read the classical books he referred to, in the hope of starting a systematic self-education. In this way I read Tomas Moore's Utopia but did not come much further, and the book itself I abandoned half-ways, as testified by a bookmark form the Godiva chocolate store in New York. And the systematic self-education would have to wait a few decades.

This book is a collection of six lectures given as part of the so called Silliman lectures established at Yale in 1901 and then given more or less every year. Among his predecessors can be mentioned Rutherford, Nernst, Arrhenius, Hadamard, Bohr, Hubble, Fermi, and von Neumann, and as successors Weinberg, Gelfand, and Cavalli-Storza. He finds himself in august company. Although the lectures supposedly are meant for a wide audience, one suspects that they often became quite technical, but not the six lectures by Bronowski. They are philosophical in tone providing a bird-eyes view of the land below, and seldom becoming very specific save for an anecdote or two. Nevertheless the tone is light without degenerating into the jocular, and he clearly struggles to have something interesting and arresting to say in each lecture. Their oral nature is obvious throughout, as in a lecture you cannot expect the same attention span from the audience as you can from a reader of a book.

It starts out as man as an animal, but a very specific animal, having cognitive faculties unmatched by any other being. Man gets knowledge of the world through his senses, of which the sight is the primary, as with all primates, and he gets knowledge of other people through sound[1]. As Kant inuited, our conception of the world is very much formed by our perceptions, but this does not mean that it is a mere mental construct, although one nearly comes to believe so[2]. But animals communicate too, especially the higher apes

[1] Sight involves by far the most bits of information, and to be blind most of us thinks of as the worst of all calamities brought about by sensory deprivation, but apparently being deaf is even worse, as far as it makes you isolated from other people. Then there are of course other senses but they do not play the same fundamental role in getting us around.

[2] The summer I turned 16 I became aware of the very indirect way we actually conceive of our surroundings, that we do not really see it as it is, in fact, as I would have learned had I studied Kant, there is no thing as such 'it really is'. A few days of reflection and the idea of solipsism entered into my mind, and it scared me deeply, later on I came across the terminology, and as with everything you put your name on, it was tamed to some extent. Anyway I must also have come across Russell at this time, and when reading his autobiographical recollections of renouncing idealism in his youth, of once again being allowed

which may have fairly large vocabularies of sounds[3]. But, he informs his listeners, they speak in sentences not words, and their communications are in the nature of commands and specific instructions, never information. However, human language evolved out of the primitive communications of our proto-human ancestors, through which sentences were split up into single words, denoting things (nouns) and actions (verbs), which were able to be recombined in endless ways. A Russian scientist made an extensive study of the sounds of Baboons in order to find out whether a Baboon expressed the same thing in two different ways, and never found a single instance, while we of course do it all the time. And science is just a further development splitting up reality in smaller and smaller constituencies which can be recombined. Thus science is a kind of language, with its own syntax, its own way of translating its sentences into physical manifestations. Newton's celebrated law about the inverse square of gravitational action is a grammatically correct statement, but inverse cube would not be allowed. One may find this analogy with language helpful (it seems rather popular), I find it a bit contrived. One big difference is that humans share a language, while they really never share a science. Most humans are competent in handling their native tongues, but few are competent as scientists, in fact most people come across science only by hearsay or through its applications; and worse, most scientists are so specialized that outside their narrow expertise they are no more at home than the proverbial man in the street. So to whom does science in general belong? Not to individuals but only to societies. Language is a part of the phenotype of man, science is not. Yet of course science arises out of human curiosity, predominantly by people who are exceptionally curious and contrary in their attitudes, to refer to Bronomwski's chain of thought. But science must be a social venture, it does not survive being an individual quest[4] and he takes the example of da Vinci who in spite of all his talents, ingenuity and restless curiosity made no impact on science at all, for the simple reason that he had no peers, no colleagues around him. He knew painters of course, so his painting developed and he is known to posterity as a painter although that, as far as he was concerned, was just a sideline.

Science is all about truth, but absolute truth is the evasive goal of a quest doomed never to be completed, and this is a good thing too, because why search for something which will make your search eventually redundant, as it is the search itself which is exciting, and discoveries are only interesting as far as they provide stepping stones to further discoveries. His explanation for this state of affairs is that in order to make progress you need to box things in, cut out a piece of reality and pretend that what is outside does not matter, but in the universe everything is connected and everything bears on everything else, so this cutting off into a closed system is impossible, but necessary in order to make progress. So advances in the sciences, according to Bronowski, consists in opening up the box a little, letting in a new discovery, and closing it off again, but no being slightly larger, awaiting new discoveries to upset its apparent self-sufficiency. In this sense there will be an unending source of new discoveries and never any end of excitement. In short, we are presented with

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to believe that the grass is really green, it struck me as having regained the paradise of a lost innocence, giving me some hope that I would succeed too.

[3] Bronowski believes not more than a hundred, more like forty, and half of them being gestures anyway.

[4] Incidentally stressed by Popper as well, for reasons very similar to those of Bronowski.

a meta-physical version of immortality, assured of a pleasure never to run dry.

Science is about truth, but how do you find it? He ventures into mathematics and Turing's solution of Hilbert's Entscheidung Problem, and the even deeper achievement of Gdel and his incompleteness theorem adding to that lengthy quotes from the autobiographical writings of Russell (who at the time (1967) of the lectures given was still alive) to illustrate the latter's excitement of getting logic to explain and reduce mathematics, a vision that eventually came to grief. He points as to how Russell found his famous paradox without actually mentioning what it is[5]. It all boils down to paradoxes of self-references familiar from the time of the Greek, and those paradoxes seem to be inescapable if you want to preserve both the freedom of self-reference and the unforgiving precision of logic. Russell wanted to prevent such things by his theory of types, which had the consequence that he could not do mathematics so he had to salvage the situation by introducing a new axiom, but by that time everybody had gotten bored with it. (Not excluding Russell himself who embarked on a career of popularization and celebrity). You cannot formalize mathematics and hope to capture it all, there will always be new things which need new principles of reasoning, and more generally the same thing holds for science. There will be no universal axioms which will last for ever, new ones as well as modifications are inevitable as we discover more and more things. Our conceptions are bound to evolve and change, and he speculates than in fifty years the notion of gravity will be as obsolete as phlogiston is now, a prophecy that definitely did not come true. If you want to speak to posterity you should not do any predictions, because you will only make a fool of yourself talking about things posterity will know much better, instead stick to the past or better still the present and posterity will be fascinated.

The human brain is not a digital computer, he warns the audience. Many people, mostly men, he remarks seems to want the human brain to be a computer, and he cannot understand why. The brain of humans work in mysterious ways, it is not yes or no, as in rigid logic, but more like a gas working probabilistically. With this loss of precision you gain much, and humans are prone to self-reference, natural languages speak naturally about themselves, being their own meta-languages, unlike those of strict and artificial languages, and this is possible due to the lack of precision, not allowing contradictions to be pinpointed. This means, that unlike the computer, men can literally think outside the box. If a system is inconsistent we are not stopped in our tracks but start anew, hope springing eternally. And he also seems to suggest that computers cannot outwit humans in chess, a statement which no longer has the same persuasiveness it had fifty years ago.

Science and the Arts have much in common, and Bronowski is fascinated by William Blake to the point of even having written a book on him, and he gives a few quotes from Blake and Yeats, and speaks approvingly about Epsom, a fellow mathematics student at Cambridge who became a poet and wrote his seven types of ambiguities, celebrating the ambiguities of language, which, according to Bronowski are inevitable, preventing him from summarizing each of his talks into half a dozen well-formulated sentences. Because when you write, every sentence is there to try and resolve the ambiguities of the previous. But there is a difference between science and art, as far as the judgment of scientists on

[5] Cantor had proved that the power-set has higher cardinality than the original set, but what about the set of all things? If you inspect the proof, you come up with Russel's paradox right away.

science is far more reliable than artists on art. He takes as an example the Nobel Prizes. Those in science tend to be uncontroversial, but those in literature seem to be of great variability. He takes as an example the Swedish writer Selma Lagerlof, who has ever heard of her, making a bet that probably no more than one or two in the audience have ever read a book by her. Obviously 'Nils Holgersson' must have gone him by, a book which fired the imagination of many curious children the world over who were born just after the turn of the century [6].

Finally Bronowski takes exception to the so called naturalistic fallacy. When it comes to look for truth you have to be truthful, i.e. be honest and put that quest over everything else, meaning not making it subservient to other considerations. You do not try to push your findings by withholding negative aspects of it, nor bribe people to praise it. Of course you may not mind becoming famous and admired, but such accolades must come your way fairly. Thus in this sense an 'is' begets an 'ought'. The search for truth is a moral undertaking, because it cannot be pursued in immoral contexts. Nazi science made no progress because it could not thrive in an immoral context in which it was not allowed the freedom to operate beyond the prejudices of the regime.

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[6] Popper and the mathematician André Weil comes to mind