

## THE PURPOSE OF SCIENCE.

**Science in Transition** is a group that “wishes to consider the various issues involving science in a comprehensive way.” Quoting from “Agenda for change”, point 3: “Not everything of importance, not all kinds of products or possible scientific results, can be assessed fairly. For instance, we should be aware that the sciences, the social sciences and the humanities each have a proper, mutually different style. Not all kinds of scientific practice are equally suited for the quantitative expression of quality. Is the present system still adequate for measuring quality? Is it possible to map more diverse results? In what ways can the discussion about **the nature of quality and about possible desirable qualities**, be conducted best? How can such a dialogue be turned into a structural part of scientific work?” The key to the answer is provided by an article in the NRC of 19/1/14 by Huub Dijkstra: “Certainly, all academic policy programs emphasize their concern for the ethics of science. But these are empty words as long as have not established what **the real purpose of science is**”.

So it is. That question can be answered once we acknowledge that science is part and product of our living world and subject to all its properties, as revealed half a century ago by the discoveries of molecular biology of, and vulgarized for instance by Nobel prize winner Jaques Monod in his essay “Le hazard et la nécessité”. These findings provide a common basis for all philosophy and science about the living world. The academic world has not yet digested them and drawn its consequences for science and philosophy about living beings in general and humans in particular. I had to devote 52 pages to it in my book on democracy (\*). Some conclusions relevant for this discussion are:

- 1) Most models about the living world and certainly about a human society are complex, interdependent (recursive) and dynamic, with elements that can learn from experience. Such systems must be apprehended as a whole.
- 2) The function (not utility) fulfilled by an element, product or property of a living being is the natural, the ‘default’, start for its understanding and evaluation. It is not equal to utility because that is a totally subjective value that the being assigns to that function. Economics attempt to attach a quantitative value, a price, to utility. As noted in the Agenda, that should not serve as a guide for setting priorities in scientific research, for science has an inner dynamic and much of it cannot be part of a market.
- 3) ‘Perfection’ and ‘optimum’ are not part of the language of life. ‘Better’, ‘good-enough-to-survive’ and ‘not viable’ (in the case of information, ‘false’) are. Absolute truth may be beyond reach, but also is not necessary. The quality (precision, reliability etc.) of a piece of knowledge is adequate if further refinement would not change the decisions taken.

Quality of a product is a totally subjective concept. As such, we cannot measure it, nor even rank it with any level of objectivity. Human products usually have diverse properties that affect the perception of their quality. The importance of each of them is a subjective matter; discussions are bound to be a dialogue of the deaf. With one exception: in most cases a product has one function that is the very reason of its existence. We can usually determine with a reasonable level of objectivity how well it can fulfill it. The prime **function** of all knowledge, especially scientific, is to supply the relevant facts in decision-making so that the decision taken will achieve the objective of the decision-maker. It will do so only if it is correct, if it is reliable. The feature that distinguishes scientific knowledge from other kinds of information is that we can – at least in

theory – **assess its reliability and justify that verdict**. The users presume that the qualification of ‘scientific’ implies that this is possible and has been done. If that is not possible, the information will not be able to fulfill its basic function; if it has not been done, it does not merit the qualification ‘scientific’. Other properties therefore are only relevant if the information has passed that test. As noted by ter Molder, (“Voorbij blijf wetenschap en boze technologie”), the problem of the user, usually a technician, is that, notwithstanding the immense crowd of scientists, if he looks to science for an answer about a fact he often gets various and incompatible answers, he sees little ‘science’. A politician can usually find a scientist who can provide him with ‘scientific’ arguments that support his proposal and/or undermines that of a competitor. If democracy is to survive, science must reclaim its preferred position as supplier of the facts engaged in social decision-making and justify it by the maximal possible reliability and objectivity of its products.

**ALL SCIENCE CAN BE TESTED FOR RELIABILITY.** That seems to be in contradiction with point 3 of the Agenda for Change and many of the articles. Yet, **provided we limit the evaluation to what is possible and necessary (for a user), we can test all products of science on reliability.** By determining the level of precision we require, we usually can do so fairly and objectively (see below), provided the indispensable conditions for a fruitful scientific discussion are fulfilled: a will to reach an agreement and respect of the rules of the formal languages of logic and mathematics. Cardinal measuring of reliability sometimes maybe impossible, but it may not be necessary. In decision-making we usually can do with ranking reliability, with ‘total ignorance’ as a default value. Ignorance, or an equal rank for all alternatives, must be stated. Given the complexity of a human society, we often will have to limit our verdict to false, mainly by having failed the test of axiomatization. It is always possible and cheap, and eliminating false ‘scientific’ theories and statements must have priority because they reduce they probability of making the correct decision below that of ignorance. Eliminating false ‘scientific’ theories and statements is in tune with science as a living and therefore evolutionary phenomenon and very welcome in today’s deluge of contradictory scientific publications.

**THREE, NOT TWO, WORLDS.** The relevant difference between various worlds of knowledge is not so much a matter of style, but of method. It divides the realm of the search for knowledge into **three** areas: two for empirical sciences (the inert and the living world), and one that comprises the rest, let us call it ‘humanities’.

**The inert world.** Those who need knowledge about the inert world are best served; there is a large body of theories and facts that are generally accepted a valid. Rutherford summed it up: “All science is physics, the rest is stamp collecting”. Given the chaos in social science, his smugness may be understandable; yet it is not justified. The objects of the inert world are sitting ducks. Most science about the inert objects larger than – say – a molecule, **can** meet Popper’s conclusive demarcation criterion and thus allows evaluation in terms of truth or a probability-bordering-on-certainty; it can predict. The examples of failure in this world given in the articles on the SIT site are mostly incidents, an error or a lack of integrity. Yet even when dealing only with the inert world, physicists can and do draw opposite conclusions, for instance on climate change. Not because they differ on the theories of physics, but because of the prejudiced way in which they are applied. In vain, for in the inert world there is one implacable and incorruptible judge, nature: the collapsed bridge etc.. And because the inert world usually allows a one on one determination of the result and its cause, science about the inert world is, or could be, largely

self-policing.

**The living world.** The problems of science dealing with the living world in general and in social science and philosophy in particular are fundamental, methodological, and concern its whole organization. No more sitting ducks. Models of living systems, and certainly of a human society more, as well as the facts deduced from them, are complex, interdependent and dynamic, with elements that can learn from experience. Such systems are recursive and thus rarely allow a one on one determination of cause and effect. The principal means for survival of living beings is the information process. As soon as the object of the investigation engages an information process, experiments and history almost never allow Popper's **conclusive** decidability of the resulting knowledge by confrontation with basic facts.

Bereft of a conclusive selection criterion, the main factors determining the acceptance of social theories and the facts deduced from them seem to be fashion, the prominence of their protagonists and/or their rank in the pecking order of their universities seem. Fortunately, social science (and the philosophy that lies at its roots) is not completely powerless to deal with reliability, **if it really wanted to**. Popper offers two avenues. While a chance-element is unavoidable in a theory about living beings, many theories and statements allow an estimation of its probability. Popper's test by confrontation with facts then could allow ranking scientific statements in terms of **verisimilitude**. It is expensive and not conclusive, but better than fashion or throwing dice; anyway, in life very few things are certain, except death.

Popper's other answer is **axiomatization**. It is cheap and it is conclusive: if a theory and the facts deduced from it fail this test, they can be eliminated from the realm of science. It can be performed by anyone having the logical, mathematical and 'experimental' competence to be expected of a master of science, and it is applicable to any scientific or philosophical statement that claims validity. Therefore it should be the first step for an evaluation. Definitions merit special attention, for they lie at the root of many disagreements, with *petitio principii* as a good runner up. While I agree with Ravez that perfect axiomatization is not always practicable, in decision-making we often can do without such perfection, as explained above. **The 'natural', evolutionary road to progress is to eliminate all claims to 'scientific' by axiomatization; all others should get a fair chance.** That last requirement is not on the agenda of SIT, even though there is ample evidence and literature proving that it is not met.

I recently saw a program about the state-of-the-art observatory on the highest mountain of Palma de Majorca. Its main objective is to detect planets that could or even do support life. Its power is downright fantastic. "That is the most exiting project there is" exclaimed the ecstatic astronomer who presented the program. Maybe, but it is not the most urgent. Urgency is a subjective concept, but there is one program that must have priority over all others: the viability and well being of humanity and **the peaceful cooperation** that this requires. That is the domain of social science and philosophy. Top priority for science should be to close the abyss between the development of our technical capabilities and of our social incompetence, the subject of my 1979 book "Vooruitgang zonder blauwdruk".

**WHAT TO DO AND WHO MUST DO IT?** Most subjects mentioned in the articles quoted on this site concern the functioning of the organizations of **producers** of science, especially the universities. Judging by the newspaper space devoted to it, plagiarism seems the most common

misdemeanor, followed by fraud, doctoring the results of samples by ‘forgetting’ those that do not support the theory etc.. The main culprit is held to be the outside pressure by the economy and politics, etc. resulting in excessive competition within science. All these are problems of the organizations of science, of their functional rationality. In his book 1971 “Scientific Knowledge and its Social Problems” Ravetz already drew attention to them, and he is a participant in ‘Science in Transition’, which inspires confidence in that venture. The closing chapter of my book about democracy is titled “The social responsibility of scientists”, and a part of it is devoted to Ravetz, p.410-419.

But the major cause of the poor performance of social science and philosophy has not yet been dealt with, and even today is given at best lip service. It is systematic, methodological and organizational: the barriers erected between the disciplines dealing with the living world, and the consequent need of **internal integration** mandated by its ‘wholistic’ nature: the findings of one discipline are used as axioms in others. Specialization is inevitable, but only if accompanied with a generally accepted (or acceptable) frame for integration; my above-mentioned 52 pages about life and information are a such an attempt. The barriers erected between disciplines must be dismantled, and cross-fertilization and critical appraisal by other faculties and even from outside the university should be facilitated. It exposes many paradoxes as a misuse of information; it helps us to avoid dead-end alleys and to solve squabbles originating in differences in axioms, definitions and objectives. The internal integration of science belongs to its ‘Weberian’ functional rationality. It should get a place on the “Agenda” and I see no compelling reason, other than bureaucracy and the problems mentioned on the SIT site, why it could not be left to the academia.

My concern is with the **external integration** of science, with its primary function, its substantial rationality. Science has fulfilled its function if the user can understand it, can assess its reliability and determine how to use it. As explained above, it is always possible to assess its current (un)reliability if ignorance is included. Depending on the outcome, the other two are either possible or irrelevant. Ravetz and other contributors, f.i. te Molder, take the social context as given, while I first define the **kind of society** we (want to) live in (democracy), for that will be the final judge about the quality of science, as will be evident if you consider the various alternatives: theocracy, plutocracy, dictatorships, various ideologies and democracy. Our choice for the democracy dictates the above primacy for reliability and the related striving for maximal objectivity in the establishment of facts in social decision-making. Fortunately that also is what most scientists would consider good science. (The scientist can and should be concerned about the use to which his science is put, but only as a concerned citizen, not as a scientist.) In today’s political system the establishment, as well as in many discussions between scientists, both the facts and the interests are part of one and the same the same argumentation/negotiating process. That allows disguising divergences of objectives as differences in the perception of facts, or – as noted by te Molder – it may even generate these divergences. (External integration does **not** imply that the user should dictate the subjects and money flow of scientific research at universities. The progress of science has an inner dynamic and a stochastic component that should have right of way.)

That brings me to the final question: who should and can fulfill the job of settling disputes amongst scientists concerning the relevance (is it adding to our knowledge?) and reliability, its **scientific** status. **Not its academic** status, not its style, scholarship, how well it fits in current

research programs etc.. (Notably that last exclusion could speed up the acceptance of a fruitful new scientific contribution that is “not invented here” from the current excessive delays, 5 years (chaos theory) to twenty (fractals), and in philosophy 25 (Frege), and a plethora of others, not to mention those that never made it.) As said, a simple analysis of the experimental setup, definitions and deductions of the contestants is often all it takes. The prime objective is to settle what **can** be settled, given the will to do so, and thus increase the stock of certified axioms available to settle the next bone of contention. An example on my website is the status of reason and rationality, underestimated by brain researchers (Netherlands) and overestimated by economists. Quoting from the closing chapter of my book: “The interests of the **users** of science (Weber’s substantial rationality) and the propositions of scientists working outside of institutionalized programs can only be given their due if at least some individuals make the required effort and obtain the necessary power by forming a group as mentioned above. To that end there must be a framework for cooperation and sufficient members to obtain the required authority. That cannot be achieved on an ad hoc basis; some kind of institution should be ready the moment a problem emerges. Furthermore, to fulfill its role of deciding in a democratic way about controversies about facts, such an institution must be independent from the interests engaged in the controversy, a condition that again can only be met if the institution exists before the controversy arises. And to prevent the group from becoming entangled in its own functional rationality, its members must not depend on it for their income or status. It should be a loose association of scientists willing to sacrifice some time and effort at the service of good (and thus democratic) science, staffed on the basis of co-optation and relying for its authority on its reputation of competence, integrity and objectivity, a reputation which it has to earn by the quality of its ‘verdicts’.”

Its job requires analytical power and a passion for truth. Selling the verdict requires the ‘political’ sense and connections, which the many activists of SIT need and have. As it must be independent of any other organization, the “truth” group would not impinge on the SIT Agenda. On the contrary; the SIT agenda will generate clashes between different interests. If these engage disagreements about theories and facts, the neutral truth group could come in handy. The truth group will need support from the SIT for getting it under way, for the above qualifications for membership are not conducive to political sense and connections. **Peter Pappenheim**