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# The two cultures revisited: new widening gaps

Ladislav Kováč

Center for Cognitive Biology, Faculty of Science, Comenius University, Mlynská dolina, 841 15 Bratislava, Slovakia. E-mail: kovacl@fns.uniba.sk

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# Abstract

Aristotle continues to be a highly cited author in cultural sciences (human and social sciences) and humanities. In the last two decades, his work attracted up to hundred times more attention than the work of Konrad Lorenz or Edward O. Wilson, who have attempted to synthesise new knowledge on behaviour and society and proposed alternatives to traditional, intuitively appealing, explanations. Aristotle's interpretations of the world, which appear to be intuitive to human mind, were abandoned in natural sciences upon introduction of the experimental method. Human intuition may have been appropriate in conditions under which it was originally selected: for life of small non-anonymous groups of hunters and gatherers in the savannah. Intuition confines human understanding to a simple reality circumscribed by a boundary that can be called Aristotle's barrier. The barrier may only be crossed by experimentation, which is largely missing in cultural sciences. Snow's concept of two cultures may be revisited to characterise a splitting of natural sciences *versus* cultural sciences. It may also be applied to a widening gulf between science and technoscience. Diverging of the two cultures may have far-reaching consequences for prospects of humankind's survival.

# Introduction

It the middle of the 20th century, subsequent to the Second World War, when the atrocities of Nazism had become notorious, Theodor Adorno exclaimed that after Oswienczim poetry could no longer be written so as before. At the end of the century, other atrocities, still larger in scale, were made public: the number of victims of communism had been estimated to be as high as one hundred million of human lives (Courtois *et al.*, 1997). It would be appropriate to paraphrase Adorno by saying: After the disaster of communism, after the Gulags and Lao-kay, not only poetry, but all culture, and in particular human and social sciences and humanities, should no more be the same as before. Substantial break with traditional views on human nature and on social dynamics would be expected. Incorporation and assimilation of new knowledge acquired in the 20th century by natural sciences, in particular biology, may be a prerequisite for such a break.

Inspection of papers and books on evolution of social sciences does not detect any discontinuity with tradition and with conventional thought. A typical example has been presented by Coakley and Trent (2000): Various editions of an authoritative textbook on the history of political theory (Sabine, 1963) devote most of their space to the period 1500-1900 and the rest of the book is accounted for principally by the ancient and medieval periods rather than by the 20th century. This holds for editions issued both before and after the Second World War. If the 20th century is to be viewed as "the century of the social sciences" (Wagner, 1999), it should be admitted that these sciences have continued to adhere to the profound legacy of antiquity (Almond, 1996).

In this paper, deep rooting of cultural (*i. e.* human and social) sciences in the soil of antiquity is demonstrated by a high number of papers devoted to Aristotle and by a high frequency of citations of Aristotle's books in citation indexes of social sciences and humanities. Lagging of cultural sciences behind natural sciences is considered to be an aspect of the phenomenon of two cultures (Snow 1969), along with another new aspect, a distinction between science and technoscience. Both the lag and the distinction may have far-reaching consequences for the future of humankind.

# Elaboration of conceptions

## 1. A postulate of Kant's and Aristotle's barriers

Human cognition has limits characterised as a double epistemic closure (Kováč, 2000a). Along with a closure imposed on any formal system by Gödel's theorem, another closure has been imposed by contingencies of biological evolution of the species: *Homo sapiens* is an animal equipped by natural selection for life in a world of medium dimensions, which is called in physics the "macroworld". The human mind can perceive phenomena of this macroworld and to conceptualise them appropriately, but has not been constructed to conceive of the microworld, the world of elementary particles, described by the mathematical formalism of quantum physics. To give this formalism a "human-tailored" explication, humans have to take recourse to their percepts and concepts fitting the macroworld. Reality, a model of the world in all its forms, is species-specific. All the constraints of the human mind confine humans to the world of medium dimension and low complexity. The world outside is separated by barriers which have been called "Kant's barriers" (Kováč, 2000a). The term has been proposed to honour Immanuel Kant, who sketched out such limits to human comprehension in his transcendental philosophy.

A comprehensive description of the world behind Kant's barriers may require two or more complementary interpretations, each internally consistent but mutually exclusive. Niels Bohr (1964) has called this manner of description the principle of complementarity. The comprehension of the world of large dimensions, the world of galaxies, the "megaworld", may also presuppose complementarity. But the principle of complementarity may also apply to worlds of "high-dimensional" complexity, the "psychoworld" – as envisaged by Bohr (1964) in explaining brain-mind dualism – and the "socioworld", the world of huge, anonymous, over-biological social groups, a product of cultural evolution (Kováč, 2000a).

Before bouncing into the insurmountable Kant's barriers, human efforts at understanding of the world encounters another obstacle, Aristotle's barrier (Kováč, 2000b). Aristotle's barrier is a boundary in human species-specific reality separating the space that can be captured by sheer contemplation and reasoning from an additional space that can only be reached by experimental falsification of hypotheses. The reality circumscribed by Aristotle's barrier is simple and easy to human comprehension, often

familiar if not self-evident. It is also related to the *Lebenswelt*, the "natural world" or "life world", of phenomenology (Kováč, 1992).

The name of Aristotle in the specification of this barrier has been used to acknowledge the widths and depths of the exploration of the most various areas of human interest accomplished by this ancient scholar. Yet, the value of the experimental method of science was not known in his time. There was no means of how to cross the barrier. However ingenious may have been Aristotle's insight, it remains confined within the boundaries erected by the evolution of the cognitive apparatus of *Homo sapiens*.

## 2. Aristotle's citation frequency and its implication

Aristotle can be considered as a founder of a number of branches of inquiry, such as physics, biology, anthropology, politics, ethics. He also served as the indisputable authority of the medieval science (Russell, 1946; Bernal, 1954). His physical theory, including for instance an explanation of why a thrown stone is falling down to earth, had dominated physics for eighteen centuries. The theory was falsified and substituted by another theory in the early 17$^{th}$ century by Galileo, who was the first to introduce into science the experimental method. According to René Thom (1983, 125), the replacement of Aristotelism by Galileo's explanation is an example in the history of science when a new theory has not assimilated the previous one as its "special case", but has completely annulled its predecessor. Galileo's (and Newton's) theory notwithstanding, both children (Piaget and Garcia, 1989) and adult laypersons (McCloskey, 1983) spontaneously conceive of the physical world in the Aristotelian manner: Aristotle's physics is intuitive to the human mind (McCloskey, 1983). The same may apply, to a considerable extent, to Aristotle's biology.

Physics and biology have much changed since the antiquity: physical and biological theories of Aristotle are absent from textbooks and from publications of physicists and biologists (except, in the latter case, for some rare biological Aristotelians). On the other hand, Aristotle's explanations of human individual and social behaviour, his theories of morals, aesthetics, politics keep inspiring specialists in social sciences and humanities and abound in their textbooks and publications. In the last decades, the work of Aristotle has received up to hundred times more attention,

mainly by the authors recorded in citation indexes of social science and of the arts and humanities, than the work of Konrad Lorenz or Edward O. Wilson (Fig. 1). The two latter scientists have attempted to synthesise recent empirical knowledge on human behaviour and society and have proposed alternatives to the traditional explanations. Papers concerning Lorenz and Wilson were mainly critical reviews of their books, while those devoted to Aristotle were mostly analyses of his ideas with apparent appreciation and approval. In 1999, books of Aristotle were cited considerably more often than the books of Lorenz and Wilson. Incidentally, a closer analysis has shown that the difference was particularly conspicuous in the case of political science.

Was Aristotle wrong in his understanding of simple events, such as the movement of a thrown stone, and was he right in his intuition concerning such complex phenomena as human behaviour and social dynamics? Hardly so. Human intuition may be adaptive. Yet adaptive in conditions under which it was selected: for life in small non-anonymous groups of hunters and gatherers in the savannah. Throwing was an important factor in human evolution (Darlington, 1975). What Aristotle conceptualised was the human intuitive understanding (and mastering) of throwing which had been worked out by evolution and had been appropriate for human survival in the savannah. In the natural setting, the concept of inertia, which holds for movement in vacuum, would have been of little use, or would have been even misleading. This may be reason why it lies outside Aristotle's barrier.

In the small groups of our ancestors, other mental faculties conceptualised by Aristotle may have been adaptive. For instance, to ascribe conscious intentions to oneself and to other people. Or even to believe in the unity of Beauty, Good and Truth. The post-savannah evolutionary novelty, the socioworld, the world of tribes, nations and states, may be anti-intuitive. There has been not enough evolutionary time to endow human cognition with the capacity to grasp the structure and dynamics of the socioworld easily and appropriately. In addition, as already mentioned, the complexity of the socioworld, its extension beyond Kant's barriers, may necessarily presuppose complementarity of its descriptions. The intuitive appeal of contemporary prevailing (as gauged by citation frequency) theories of human nature and human society, with their Aristotelian flavour, does not prove that the theories are right. More likely it suggests that ignorance of matters dealt with by social sciences and humanities has not much changed since the time of Aristotle. Despite the mass of accumulated speculations, it

may resemble the state of physics in the pre-Galileo period. So dramatically the progress in social sciences may be lagging behind the progress in physics and biology.

## 3. The concept of two cultures revisited

In the course of 42 years that have passed since the first edition of the memorable book of C. P. Snow, in which he described the existence of two cultures (Snow, 1969; first published in 1959), the spiritual situation of the world has changed considerably. The intellectual landscape has become much more rugged. Snow contemplated it as being occupied mainly by two communities, almost isolated and with little mutual communication: a community of scientists and a community of literary intellectuals. He found the mid-20$^{th}$ century literati to be as ignorant about science as had been their Neolithic ancestors. He himself was aware of the deficiency of reducing the multiplicity of the world into a dichotomy (Snow, 1969, 65): "The number 2 is a very dangerous number: that is why the dialectic is a dangerous process. Attempts to divide anything into two ought to be regarded with much suspicion." Yet, the dichotomous parcelling appears to be useful heuristically and may be applied to the present situation.

The community of intellectuals ignoring science and indifferent to it, which had been the main subject of Snow's solicitude, has dwindled. Even uncompromising critics of science tend to pretend that they do understand it. This is also the case of the intellectuals who adhere to the doctrine of postmodernism and who consider science as just a brand of meganarrations equivalent to religion, myth, literary fiction. It is so despite the fact that they happen to be caught at feigned knowledge and massive ignorance, provoking a deserved mockery (Sokal and Bricmond, 1998; Dawkins, 1998). Their effect is essentially harmless in a plainly intellectual milieu, but it cannot be neglected once such intellectuals assume positions in politics and affect other politicians. A case in point has been analysed and subjected to stern criticism by a number of American scientists (reviewed by Chaloupka, 1993; and by Guston, 1995).

More important is a contemporary gulf between "hard" and "soft" sciences (Diamond 1987). The citation analysis of Aristotle is a symptom of it. As the "hard" sciences deal with non-living nature and with those phenomena of living nature that have emerged in the course of biological evolution, it may be appropriate to call them natural sciences (equivalent to German Naturwissenschaften). They would include

studies on human nature as a product of biological evolution. Human nature should be distinguished from those human properties that are linked to cultural evolution. It would be appropriate to establish also in English the term “cultural sciences” that is in use in German (Kulturwissenschaften; originally proposed by Rickert (1899) for the sciences that deal with phenomena brought about by culture). The term “cultural sciences” would encompass both “human sciences” and “social sciences” and also part of humanities.

The virtual absence of the experimental method from cultural sciences, even the failure of approaching historical events as sort of unintended social experimentation, may explain the fact that evolution of cultural sciences has differed from that of natural sciences: it lacks a patent Popperian trajectory of falsification of hypotheses and their replacement by more comprehensive ones and it exhibits little cumulativeness. The lessons of history notwithstanding, Aristotle (and, for that matter, Machiavelli, Locke, Hume, Weber, until lately Marx) remains essentially on a par with contemporary social scientists. How strange it appears when compared with the imposing cumulative progress of natural sciences. This may be one of the reasons of a different status of cultural sciences in society. American National Academy of Sciences, that has been founded by Congress in 1863 to act as official adviser to the U. S. government on questions of science and technology, began to admit social scientists as its members only in the early 1970s (Diamond 1987). Biomedical, high-performance computing, and global-change research have been named as congressional and administration priorities in the U. S. in the 1990s, receiving an increased funding, along with federal funding reductions ranging from less than 1% in civil engineering to nearly 70% in sociology (Merill and McGeary, 1999). At a conference on human and social sciences in Europe of research in October 2000, the French minister of research Roger-Gérard Schwartzenberg (2000) characterised the position of these sciences as “poor relatives in European space of research”, assigned to function as supporting disciplines, reduced to a secondary and instrumental role. In his view, Europe is not only a place of technological and industrial innovation, it involves “European cultural identity”, so that “if Europe continues to turn away from human and social sciences it will no longer be Europe”. Incidentally, pan-European scientific projects, approved by the European Commission to begin in 2003, encompass programs in information technology, genomics and biotechnology, sustainable development and global change, nanotechnologies, intelligent materials and new production processes, and aeronautics and space (Koenig 2001), but none of cultural sciences. The Swiss National Science

Foundation has chosen ten proposals for exceptional elite funding in next three years, centred on molecular life sciences, nanoscience and novel materials, and no proposal from cultural sciences has been accepted (Ku 2001). "Social sciences has been relegated to second-class citizenship", contended a Swiss political scientist.

The underestimation of importance of cultural sciences correlates with a conspicuous disproportion in state financing of cultural sciences when compared with natural sciences. As shown in Table 1, less than 10% of the total budget for research and development of the French government in 2001 is allotted to human and social sciences. In the U. S. A., the major agency for basic research, the National science foundation (receiving mere 3% of federal research and developmental spending) is given less than 5% of its budget in 2001 for social, behavioural and economic sciences (Table 2).

The skewed financing of different branches of scientific research reflects also another dichotomy. The character of science has changed to such an extent that two distinct kinds of scientific endeavour can be distinguished: science and technoscience. In the tradition which can be traced back to its origin in European antiquity as a transition from myth to Logos, science aims at comprehension of the world in order to satisfy the human need of orientation in the environment and suppressing cognitive chaos. The mission of technoscience is different: to serve technology – human striving that has another origin than had science: to make practical tools and devices, and today various facilities of entertainment, for easing human life. Scientific research turns to a considerable extent to a new sort of industry and practical application of scientific knowledge becomes more and more *conditio sine qua non* of research funding, by the state just as by private corporations. Money is flowing into fields where chances of technological exploitation are rather high. Even when major funding is channelled to pure science, it usually targets an area of clear benefit to industry. Simultaneously, instrumentalisation of science is on the rise: knowledge of techniques, rather than of theoretical principles, has priority. With cultural sciences underrated and undervalued, there are two dominating cultures at the beginning of the 21$^{st}$ century, a culture of science that aspires to understanding of the world and a culture of technoscience that strives for intervention into the world, for manipulation with it and for its remodelling. As pointed out by Takashi Tachibana (1998) most people who like to think as knowledgeable about modern science really know only about technologies, and specifically those technologies considered likely to bring economic profits in the short term. In his opinion, this is also the mind-set of most governmental officials and

lawmakers who consider themselves sympathetic to science budget requests. As he put it, "science for homo economicus and homo faber is flourishing, while science for *Homo sapiens* is diminishing".

## Discussion

Human beings are mythophilic animals (Kováč, 2000a). Humans firmly stick to their beliefs, shared by members of their own group, often ready to die for the beliefs, but also inclined to hate and annihilate those with other beliefs, belonging to other groups. Seeing in this way, Nazism and communism were nothing exceptional; innumerable had been their predecessors. What made them unique in history is the size of massacres they had caused and the omnipotence and omnipresence of the centralised political power – totalitarianism. Plainly, in the previous centuries, the motifs and intentions had been the same, but no technological means had been available for accomplishing such hecatombs and, perhaps more importantly, for imposing the totalitarian rule. As Gould (1998) put it, "I suspect that 20 Hitlers ruled over small groups of Europeans a thousand years ago. But what could such petty monsters accomplish with bows and arrows, battering rams, and a small cadre of executioners?" The main achievement of science of the 20$^{th}$ century was a dramatic perfection of technology of power, of killing and indoctrination, contrasting with insufficient progress in knowledge of human nature and human affairs. A paradigm of the 20$^{th}$ century's science, a full stop behind its story, was the 78 days bombing in the war of Kosovo: Almost perfect pre-programmed laser-guided destruction of material targets, with almost no casualties, paralleled with ignorance of the profound causes of the conflict, with neglect of collective myths and omnipotence of human self-deception, with misjudgement of unintended, exherent consequences, and with a clash between international law and the doctrine of human rights.

Yet, to conceive of the events of the 20$^{th}$ century as a proof of failure of science, or even failure of reason in its entirety, and to see a remedy in revulsion from science would be a flagrant misconception of the situation and a recipe for its substantial aggravation. "The fall of communism can be regarded as a sign that modern thought based on the premise that the world is objectively knowable, and that the knowledge so obtained can be absolutely generalised has come to a final crisis. (…) I think that the

end of communism is a serious warning to all mankind. It is a signal that the era of arrogant, absolutist reason is drawing to a close and that it is high time to draw conclusions from that fact" (Havel, 1992). Such an attitude, articulated by one of the prominent post-communist politicians, has been rejected by scholars both from natural sciences (Chalupka, 1993, Holton 1994, 1996; Cole, 1966; Bičák, 1966) and from cultural sciences and humanities (Keane 1999; Čulík 1999; Zizek 1999). The attitude has also engendered a singular conception of politics: a politician must trust not only an objective interpretation of the world, but also its soul; and he must trust his own instincts, his intuition (Havel 1992, 1994). As argued in this paper, human intuition had been selected as an adaptive trait to fit life in small groups of hunters and gatherers in the savannah. It had been instrumental in mutual competition, fighting and annihilation of members of alien groups. Upholding reliance upon intuition, claiming that "today we may know immeasurably more about the universe than our ancestors did, and yet, it increasingly seems they knew something more essential about it than we do" (Havel, 1994) represents a cultural regression that would push humans back into pre-cultural conditions of life in the savannah. At the background of technology of both destruction and entertainment maintained at its modern level, it would grossly amplify the contrast between how much we can do and how little we know.

A dizzy rate of progress of technoscience and technology may have been widening the chasm between natural sciences and cultural sciences and aggravating the lagging behind of the latter. Inevitably, the technological progress also generates new complex problems whose solutions may only be achievable through comprehension and intervention of cultural sciences. In addition, if „dawning of the age of spiritual machines", due to exponential growth of computer technology, is indeed imminent (Kurzweil, 1998; Moravec, 1998), the transition period, if ever surmountable for humanity, would pose tremendous demands upon cultural sciences. All this implies that humankind is facing the need of massive reorientation of scientific research and its priorities, with emphasis upon cultural sciences. Assimilation of data of contemporary biology (Wilson, 1998) and replacement of the dominating "standard social science model" by recognising the "psychological foundation of culture" (Tooby and Cosmides, 1992) seem to be necessary, but not sufficient prerequisites to achieve "consilience" (Wilson, 1998) and synthesis of natural and cultural sciences (Kováč, 2000b). Because of the limits of human comprehension, sociology or political science cannot be reduced to biology, just as biology cannot be reduced to chemistry and chemistry to physics. A

substantial progress in field-specific knowledge is needed. It would require major restructuring of curricula in preparing new specialists. A substantial shift in priorities of funding may be inevitable if experimentation should become a standard methodology of cultural sciences. Only in taking all the measures may cultural sciences be capable to cross Aristotle's barrier, to overcome their pre-Galileo state and to catch up with their much more successful partner, natural sciences.

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**Figure 1.** Citations related to Aristotle, K. Lorenz and E. O. Wilson**. a,** Number of publications dealing with the work of Aristotle as compared with that of K. Lorenz and E. O. Wilson. Collected, in the mode Easy search, from data of the Institute for Scientific Information (SCI, 2000) in the Science citation index expanded (SCI), Social science citation index (SSCI) and Arts & Humanities citation index (A&HCI) for the period of 1975 to 1999. **b,** Number of citations in 1999 of selected books of Aristotle as compared with those of K. Lorenz and E. O. Wilson. Collected as in **a**, but in the mode Cited reference search.

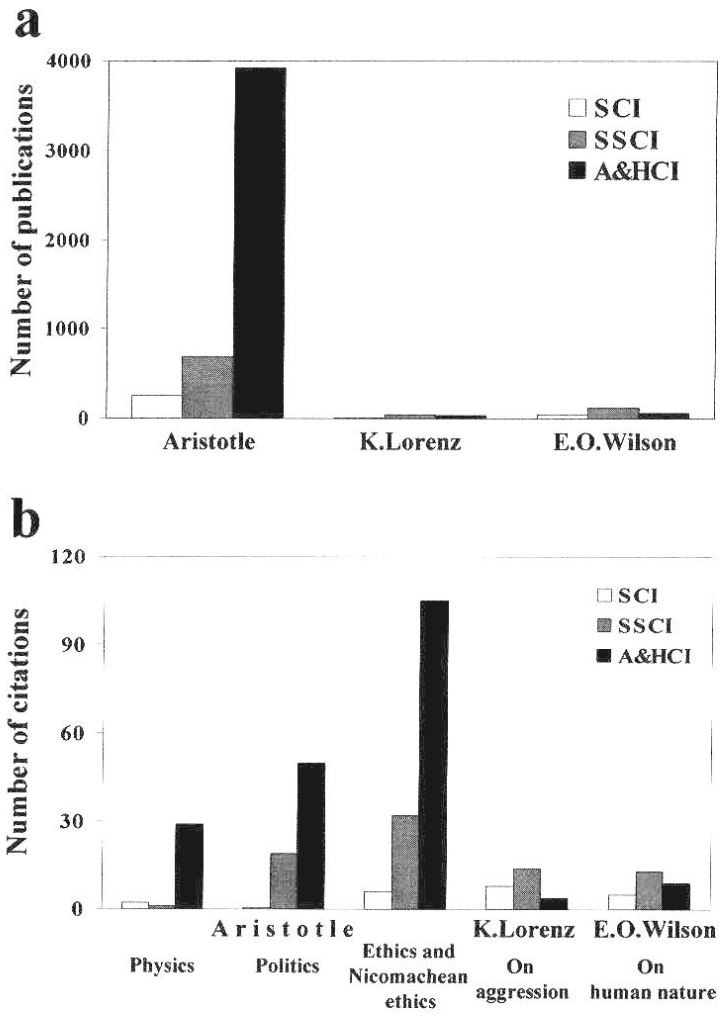
a
Number of publications
4000
3000
2000
1000
0
SCI
SSCI
A&HCI
Aristotle
K.Lorenz
E.O.Wilson
b
Number of citations
120
90
60
30
0
SCI
SSCI
A&HCI
Aristotle
K.Lorenz
E.O.Wilson
Physics
Politics
Ethics and Nicomachean ethics
On aggression
On human nature

**Table 1. Proportions of funding different sciences in France in 2001**

| Branch of science | Per cent of total budget |
|---|---|
| Life sciences | 24.8 |
| Space | 17.0 |
| Mathematics, physics, chemistry | 11.7 |
| Transport, aeronautics, materials and processes | 10.0 |
| Human and social sciences | 9.3 |
| Energy | 7.9 |
| Information and communication sciences | 7.9 |
| Environment | 7.3 |
| Others | 4.1 |

From the Civil budget of research and development of France (Ministère de la recherche, 2000).

**Table 2. Proportions of funding different sciences by the National Science Foundation in 2001**

| Branch of science | Per cent of total budget |
|---|---|
| Mathematical and physical sciences | 24.2 |
| Geosciences | 16.0 |
| Computer and information science and engineering | 14.5 |
| Biological sciences | 14.0 |
| Engineering | 12.5 |
| U.S. Polar research programs | 6.1 |
| Social, behavioural and economic sciences | 4.8 |
| Integrative activities | 3.3 |
| Reimbursable programs | 2.7 |
| U. S. Antarctic logistical support activities | 1.7 |

From the Budget of the U. S., FY 2001 Online (2001).