



**HAL**  
open science

**Practical diversity. Why a socio-technical perspective on communication must lead to standardisation and a practical perspective might prevent it ; with illustrations from the field of science communication**

Gitte Meyer

► **To cite this version:**

Gitte Meyer. Practical diversity. Why a socio-technical perspective on communication must lead to standardisation and a practical perspective might prevent it ; with illustrations from the field of science communication. Communiquer dans un monde de normes. L'information et la communication dans les enjeux contemporains de la " mondialisation ", Mar 2012, France. pp.154. hal-00835846v2

**HAL Id: hal-00835846**

**<https://hal.univ-lille.fr/hal-00835846v2>**

Submitted on 22 Jul 2013

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Practical diversity

# Why a socio-technical perspective on communication must lead to standardisation and a practical perspective might prevent it ; with illustrations from the field of science communication

*Abstract:* The widespread understanding of human communication as a socio-technical activity and the equally widespread commitment to diversity do not add up, this essay argues. It is suggested that the classical notion of *praxis* offers a wider framework that might serve to delimit standardisation and further diversity. Illustrations are drawn from the discourse on science communication, and particular attention is paid to challenges that relate to the role of science in knowledge societies.

### Key words:

practical reason, pluralism, complexity, standardisation, science communication

Understandings of human communication as a socio-technical activity are widespread in academic discourse. At the same time, there is an equally widespread commitment to diversity, and many regard standardisation as a problem. It is, however, hard to see how a socio-technical perspective on communication can lead to anything but standardisation and, thus, to a reduction of diversity.

Whether such standardisation should be considered advantageous or not depends on the context and the substance of the issues in question. Communication on purely technical matters may benefit from standardisation, while standardised communication procedures are likely to distort exchanges on complex, societal issues. The very use of a socio-technical perspective tends, however, to prevent a preoccupation with substance and context. In effect, the assessment of whether or not particular cases are suited to standardised and standardising procedures is prevented. Wholesale standardisation may be the net result.

The classical concept of *praxis*, on the other hand, comes with a distinction between technical and practical reason and case by case connects the latter to a preoccupation with substance. This essay, therefore, suggests that a re-introduction of the concept into current work on communication in general – and on science communication in particular – might serve to delimit standardisation.

## The socio-technical perspective

The technical perspective or *techne* comes from the sphere of production. Technical reason concerns the control of things and is strongly present in art as well as in technical science. Because of the use of force on objects that is inherent to technical procedures, classical thinkers, it has been argued, feared *techne* as a possible threat to the freedom of public, political life [1]. Still, the artists' use of creative force resulted (and results) in unique products.

In today's technical sciences that are intimately connected to mass production, the logic of control is expressed as an aim of standardisation. That aim, in turn, can be seen as the technical equivalent to the religious concept of (universal) truth and its secularised version: the scientific concept of *episteme* (derived from a classical name-sake).

The twin concepts of *techne* and *episteme* constitute the bases of the academic science tradition (as distinct, for instance from the wider tradition of *Wissenschaft*) as it has evolved and expanded since the seventeenth century. The development has been marked by a continuous stress on science as technical by definition, but also by a continuous struggle regarding the relationship between the technical aims of understanding natural mechanisms in order to achieve control over things, and the epistemic aims of uncovering universal truth(s).

At the outset, the relationship between *techne* and *episteme* was assumed to be harmonious and to form the basis of scientific unity. In that traditional monistic shape – ascribing, in a straightforward way, epistemic value to understandings of natural mechanisms and the development of technical procedures – science is committed to searching for universal, unequivocal answers and solutions that can be applied regardless of the specific context and substance of issues. There is an aim for the reduction of complexity and diversity. Thus, *Homo faber* is adverse to the open-endedness and inherent pluralism of human language [2]. The latter feature, which is of particular significance to the study of communication, has been prominent since the dawn of modern natural and social science [3, 4, 5].

In monistic schemes, however, dualism is never far away. The focus on universal truth and unity is accompanied by a polarising tendency. Accordingly, the tradition of science abounds with assumed dichotomies, partly inherited from medieval scholasticism. The material versus the spiritual; facts versus values; facts versus emotions; objectivity versus subjectivity; observation versus participation; cynicism versus moralism; realism versus idealism; practice versus theory; and consensus versus conflict are just a few examples of assumed widespread dichotomies which have informed different interpretations of, and scientific infighting concerning, the relationship between the twin founding concepts of science – which may even be taken to constitute a dichotomy of *techne* versus *episteme*. In such a case, questions of precedence and dominance arise. The science-critique generated by the student movements of the 1960s and 70s is a relatively recent example of a dualistic turn [6, 7, 8] within the science tradition. Demanding that *techne* be subordinated to higher (epistemic) aims it is likely to

have informed the past half-century's expansion of the technical-scientific perspective to encompass ever more walks of life. When expanded from encompassing only physical objects to including human relations the technical perspective becomes a socio-technical perspective. Humankind, then, is observed – from the position of an outside observer – as one of the animal species that live in groups. This position facilitates that mechanisms relating to status, power relations and aggression or to the degree of distance or intimacy within or between groups become visible, and the perspective is frequently accompanied by a particular concern with questions relating to social (in)equality [9] and/or to consensus and conflict within or between groups. Furthermore, human groups appear to the observer as possible targets of technical intervention or social engineering aimed at affecting the social relations or mechanisms of or between groups.

Along such lines, understandings of the study of communication as a socio-technical science have been widely taken for granted since communication was introduced as an academic topic. Those understandings, again, seem connected to the interrelated interpretations of technology as the extension of man, and of man as some kind of mechanical apparatus [10]. Traditional socio-technical approaches carry incentives for intervention, to discipline, to control, to bring into line, to create order out of chaos. Incentives to intervene for any purposes other than the purely experimental seem on the other hand absent in some more recent socio-technical approaches, popular for instance in the Science and Technology Studies community [11, 12].

The latter approaches are critical to features of traditional technical-scientific thought such as aims of reducing complexity and diversity, and assumed dichotomies such as nature versus society. The attempts to obviate dichotomies, however, seem distorted by a *de facto* adherence to the very framework of thought that shaped dichotomies in the first place, taking, or so it seems, all distinctions to be of a dichotomic nature. In effect, the dissolution of dichotomies comes at the cost of the renouncement of any ability to distinguish between different qualities.

The overall outcome appears to stand traditional values on their head and to represent a renewed, but somewhat twisted idea of the unity of science: the absence of order, for instance, is celebrated and the claim that science is good for society is replaced by the claim that there is no such thing as society (for an account of the early history of such turns, see [13]). Nature and society, then, become one. Furthermore, no distinctions are made between humans, (other) animals and things, all of which are perceived as actors in the sense of actants that participate in endless, natural processes of negotiations, tests and trials, deprived of any meaning or ethical significance. Socio-technical scientists may, thus, observe and record those processes in the same way that chemical processes may be observed and recorded.

Some features, it appears, are shared by all socio-technical varieties. Prominent among these are the position as outside observers of human affairs, and a normative stance of anti-normativity, connected to an assumed dichotomy of facts versus values and to the belief that humans, as seekers of knowledge, can and should avoid making any judgements. Traditional socio-technical approaches allow that ethics may be added on, as long as they do not affect the factual knowledge claims. To the above-mentioned more recent socio-technical approaches, there appears to be no such thing as ethical values.

## Science communication as a socio-technical activity

Seen as a socio-technical activity, communication can be viewed as the final link in an assumed production line which includes a social relationship between producers and consumers. Communication, thus, is seen as a kind of transport operation. In the following discussion we will call this the traditional approach. As an example of a more recent approach, communication may be perceived as just another step in an endless series of negotiations, tests and trials between actants.

Within the field of science communication, the traditional understanding has prevailed for decades. Working within a convention of science transmission [14], science communicators have been seen as disseminators and ascribed the task of transporting scientific knowledge, viewed as products and goods for possession, distribution and consumption, to a lay public of consumers [15]. Metaphors – such as production, construction, consumption, toolboxes and effective communication – have been borrowed from the sphere of production. And scientific 'producers' and lay 'consumers' of knowledge have been widely perceived according to an assumed dichotomy of facts versus feelings. The use of emotional appeal and dramatisation in order to achieve fascination in lay audiences, thus, have generally been taken to be crucial elements of science communication methods, techniques and guidelines [16].

The overall transportation simile encourages the potential use of identical recipes, not only regardless of the context and substance of individual cases, but also to serve different and even to some extent conflicting purposes such as *marketing* (selling particular scientific outcomes or institutions), *missionary activities* (spreading the gospel of science) or *democratisation* (seeing scientific knowledge as a good that ought to be equally shared by all).

As a rule, the social perspective facilitates communicative approaches that address distinct social groups marked by shared sociological features which can be observed from the outside, such as age, education, ethnicity, income, gender, nationality or occupation. In science communication, however, the above distinction between the social categories of scientific knowers and lay non-knowers has been pervasive. Such framing, in turn, facilitates the concept that science communication can or should be viewed as a social relationship between elites and the masses of so-called ordinary people or average citizens. Thus, it connects to one of the staples of Western social thought: the assumption of a dichotomy between the economic, intellectual and/or political elites or power holders, and the people, perceived as the masses [17, 18, 19, 20, 21, 22].

Guided by an interpretation of the scientist-cum-knowledge-producer as a holder of power, the recently introduced concept of scientific citizenship [23, 24] is a current example of attempts along those lines to come to terms with the advent of

knowledge societies that are pervaded by science in all walks of life [25]. The notion is accompanied by a suggestion that the citizenry at large should be enabled – supported, it seems, by social scientists – to adopt a scientific framework of thought so that they may confront scientists as holders of knowledge powers. There is an aim of inclusion. Underneath that aim there seems, however, to be an unspoken assumption that science constitutes, and must perforce constitute, the wider entity in the science-society relationship: not science, but citizens need to be integrated.

Bottom-up egalitarian aims of inclusion and top-down hierarchical aims of behavioural control are examples of widespread socio-technical aims of current science communication. Both share the above unspoken assumption and the perspective of an outside observer and potential operator of human affairs. Traditional aims of behavioural control – conspicuous, for instance, in the shape of attempts to persuade the public to obey scientific life-style guidelines – appear as straightforward technocratic attempts to discipline the lay masses of non-knowers. The understanding of those lay masses of non-knowers as possible objects of standardised and standardising socio-technical intervention seem, however, also to be present in aims of inclusion.

Some more recent socio-technical approaches, originating from actor-network theory, appear to lack or to be unwilling to admit to having any other agenda than to observe and record social and other natural processes as exchange of matter – the latter Hobbesian terminology [3] seems appropriate here – between actants. Renouncing a priori categories and framing any kind of editing as deplorable censorship, those approaches seem to be returning to some of the key stances of the earliest representatives of modern science, renowned for their peculiar combination of a clever use of rhetoric *and* confessions to “things, not words” [5, 26].

## The knowledge society challenges

The socio-technical perspective facilitates perceptions of and approaches to science communication as transport operations and/or as processes of social positioning that allow the fittest and most powerful to dominate. There is a focus on natural mechanisms, power relations included. Where, now, does that take us with respect to present challenges?

Currently, scientific enquiry plays a crucial role in relation to vast, complex and controversial societal issues such as biotechnology, climate change, food production, environmental protection and human fertilisation, to name but a few. In these contexts, approaches to science communication as a socio-technical activity – and, thus, as even more applied science – seem inadequate.

Social analysis directs attention to participants in communication and can indeed be helpful in deliberation about, for instance, social barriers that may hamper participation in debates about science- and technology-related issues. It does, however, divert attention from the substance of issues.

Similarly, the transport and production metaphors do indeed make sense when applied to technical questions – such as how a new gadget works and must be operated or how a tsunami occurs and may be measured – and to technical aspects of more complicated issues. For something to be transported, however, it must be pre-packaged. Transportation only takes place when production has been completed. Closure is presupposed and uncertainty comes to be seen as a particular challenge [27]. The transport metaphor, thus, only works if scientists have the final say. In the context of doubt and disagreement it breaks down and may even generate polarised science wars [28].

The interpretational framework of production, producers and consumers, in other words, furthers neither the inclination nor the ability of scientists to contribute to an open public debate on complex societal issues. Within that framework, the traditional scientific commitment to sceptical and critical discussion remains restricted to internal communication between peers [29, 16]. But as science continues to expand, that restriction is likely to undermine the political institution of public discussion on public affairs – a prospect that renders some topicality to the warning issued by Hannah Arendt several decades ago about “the disintegration of all political institutions that preceded the great catastrophes of the thirties” [30].

The technical perspective as such is bound to facilitate technical approaches and to discourage reflection on whether or not, or to which extent, issues should indeed be considered to be technical in the first place. Ethical reflection and consideration of the limitations of the technical perspective must be made from other positions. Societies pervaded by science and, thus, by technical perceptions and approaches, therefore, need other perspectives in order to be able to deal with technical perceptions and approaches.

The extension of a technical perspective into a socio-technical one does not help. Rather, it disallows addressing the public as a citizenry in the classical sense: as a diverse plurality of individual citizens who are only bound together by shared responsibility for public affairs and by the human capacity for thought and speech that marks out humans as political animals. That definition, in fact, is directly at odds with the way social groups are defined; namely by reference to shared social features and, thus, to homogeneity. Moreover, there is no way the classical understanding of the citizenry can be verified by observation of social relations. From a socio-technical perspective, therefore, the public as a citizenry in the classical sense seems not to exist. But that raises the question of how political life and democracy, perceived as more than mere social competition and power play, may be maintained in today’s knowledge societies?

## The classical notion of praxis

The classical notion of *praxis* [31, 32, 33] offers another and wider framework of and for thought.

The idea of humans as political animals is connected to the notion of *praxis*. According to Aristotle, human life is not production, but action (*praxis*) [34]. Life as *praxis*, including politics as the highest form of *praxis*, is uncertain and complex: The world is inhabited by a plurality of human beings, all representing different perspectives on human affairs: universal truth belongs in another sphere. Not least because of that diversity of humans, consequences of actions cannot be foreseen: possibilities for control belong in the technical sphere of production.

As political animals, however, human beings have been ascribed the interrelated capacities of thought and speech and, thus, action. Therefore, public discussion between multiple points of view – as in today’s political institution of public discussion (Öffentlichkeit) – is considered pivotal to the life of humans as political beings. It is the political mode [35] of civilised living-together and is seen as a form of enquiry [36] into public issues and questions which can neither be solved by technical means nor, for that matter, answered by religion. Crucial elements of action as *praxis* include the assumption that only humans (as distinct from other animals and gods) have the capacity to act, because only humans have the interrelated capacities for thought and speech. Action as *praxis* differs from production in the sense that it is connected (more or less consciously) to purposes, but has no object and is not aimed at gaining control, but at dealing with diversity, uncertainty and unpredictability as human conditions. Thus, action as *praxis* is constituted by a combination of freedom, related to thought and speech, and limitations related to diversity, uncertainty and unpredictability. It follows that the consequences of actions cannot be foretold and that actions cannot be undone or withdrawn. Against that background, the need to actually make use of the human capacity for thought and speech – for communication, if you like – seems imperative.

The distinction between production and *praxis* is intricate: production is, at the same time, a form of *praxis* and at odds with the conditions of diversity, uncertainty and unpredictability. From a technical point of view, one may build a house and tear it apart again, but the actions of having built the house and tearing it apart cannot be undone. Furthermore, the builder of course aims at – and usually succeeds in – controlling his object, so that the house does not fall apart, but there is no absolute certainty. Technical activities take place within the wider framework of *praxis* even though the conditions of that framework may not be recognised by producers as technical reasoners. They might, on the other hand, place their technical reasoning within a wider framework of practical reasoning and thereby become less vulnerable to hubris.

Practical reason or *phronesis* corresponds to the notion of *praxis* and signifies a worldly, temporal and personal kind of reason. Case by case it draws on past experience and aims at future action while including, at the same time, ethical and factual assessments of the conditions for action. To that form of reason, thus, thought and action, and knowledge and ethics, are inter-connected. Characteristically, in classical thought *phronesis* was considered an intellectual virtue and the general use of thick concepts – which include descriptive and normative aspects at the same time [37] – can be seen as a constitutive phronetic element.

This ancient, three-dimensional and therefore non-dichotomic approach to human affairs and communication has been largely ignored in the evolution of the field of communication science since the end of the Second World War. The classical notions were revived by humanists during the renaissance, but then passed over by science [38]: the renunciation of the Aristotelian distinction between production and *praxis* can be found as early as the mid-seventeenth century in the writings of Thomas Hobbes [3].

In the 1940s – in the early childhood, that is, of today’s communication science – the American sociologist Robert K. Merton struggled to understand and pinpoint the differences between American “mass communications research” and what he called the “the European species” of “*Wissenssoziologie*” or “the sociology of knowledge”. Firmly rooted in the American, Anglo-Saxon science tradition – the origins of which he saw in the marketplace – Merton was bemused by the humanist approaches of the Europeans. He noted that while American social scientists depended on an abundance of techniques in order to secure the reliability of their data, to the European sociologist of knowledge “the very term *research technique* has an alien and unfriendly ring”. The Europeans, he found, were prone to declare that other scholars probably would have ended up with quite different interpretations of the material at hand. In Merton’s analysis, the European approaches were marked by a commitment to “diversity of interpretation” and “an aversion to standardizing observational data and the interpretation of the data”. That simply did not make sense to American social scientists with their commitment to the achievement of consensus [29].

Seven decades on, the understandings that Merton connected to American mass communications research appear to have retained their status as the backbone of the study of communication and of social study at large. Attempts have been made within the field of American pragmatism to integrate crucial elements of the notion of *praxis*, such as its relativity, into scientific thought [39], but the technical-scientific scheme has been maintained as the baseline.

As an overall consequence of the above developments, the classical notion of *praxis*, concerned specifically with the world of human affairs, has been engulfed by *techne* and production metaphors. Correspondingly, practical reason has been submerged under technical rationality; the distinction between ethical reflection on the one hand and moralism based on absolute values on the other, has become blurred; and politics has come to be widely perceived as no more than a type of socio-technical activity.

## Science communication as praxis

Useful as it is for many purposes, the scientific framework (as defined by the socio-technical perspective and the logic of production) is likely to increase standardisation and prevent diversity when applied prescriptively to communication and other human affairs. It comes with techniques, toolboxes and ideals of unambiguous language. It suits the transportation of information, but does not cater for communication as discussion between different points of view, and can be seen as particularly ill-suited to current science communication – that is: to the task of dealing with outcomes of enquiries that have been based, precisely, on technical perspectives and frequently concern complex societal issues. The science communication discourse seems, however, to be trapped in an understanding of science- and technology-related issues as scientific issues by definition.

The wider framework of *praxis*, on the other hand, comes with a pluralistic understanding of human reality. It is not, therefore, at odds with the open-endedness of human language that allows multiple interpretations to unfold; and its case-by-case approach directs attention to the context and substance of individual instances. That, again – supported by the distinction between technical and practical issues – may facilitate different cases being treated differently.

From a practical point of view it is not a given that science- and technology-related issues shall be seen and debated purely or predominantly as scientific issues. There are more options. Importantly, some such issues may be regarded as political issues with significant scientific elements. The task of science communication, then, becomes one of integrating science into a wider and more complex societal sphere [32] and of introducing the issues into an ongoing public discussion that must include a multiplicity of perspectives on public affairs. To the science communicator as a practical reasoner, then, aspects of uncertainty and diversity – including, of course, disagreement – become crucial.

There is no denying that approaches to science communication as *praxis* are more demanding than approaches to science communication as merely a socio-technical activity. Practical reason is more demanding than technical reason. It is not aimed at making life easy, but presupposes that life is difficult. It cannot be converted into techniques, but emphasises the virtue of good judgement in reasoners.

If seen from a social perspective, that kind of emphasis might well be considered elitist [40]. From a practical point of view, critiques along such lines should neither be rejected nor accepted at face value, but be attended to in the general discussion of the role of science in society.

While science, as defined by the socio-technical perspective, has expanded and come to be ever more concerned with practical, political issues proper in the classical sense, the ability to even think in terms of *praxis* and politics in their own rights has been substantially weakened. At the same time, the socio-technical scheme has become almost invisible as a particular framework of and for thought and action, suited to some, but hardly to all challenges to humankind.

One of the main challenges to today's knowledge societies is how to cope with the expansion of science while maintaining a public and political life marked by diversity and pluralism. One possible response might be that in the first place the expansion of science be dealt with as a practical, political challenge, rather than as merely a socio-technical one. To that purpose, the possible re-introduction of the notions of *praxis* and practical reason into the discourse on communication in general and science communication in particular offers a non-scientific, but far from anti-scientific, framework which might serve both to sustain and delimit the role of science in society.

## References

- [1] Arendt, Hannah (1958-1959), "Kultur und Politik", *Merkur Deutsche Zeitschrift für Europäisches Denkens*, 12: 1122-1145
- [2] Frisch, Max (1957/1998), *Homo faber: Ein Bericht (Text und Kommentar)*, Frankfurt am Main, Suhrkamp
- [3] Höffe, Otfried (2010), *Thomas Hobbes*, München, Verlag C.H. Beck
- [4] Schnädelbach, Herbert (2007), *Vernunft*, Stuttgart, Reclam
- [5] Sprat, Tho. (1667/1734), "Their manner of Discourse", in *The History of the Royal Society of London, for the Improving of Natural Knowledge*, The fourth Edition, London, J. Knapton, J. Walthoe, D. Midwinter, J. Tonson, A. Bettesworth and C. Hitch, R. Robinson, F. Clay, B. Motte, A. Ward, D. Brown, and T. Longman, 111-115.
- [6] Alinsky, Saul D. [1971/1989], *Radicals: A Pragmatic Primer for Realistic Radicals*, New York, Vintage Books
- [7] Gilcher-Holtey, Ingrid (2005), *Die 68er Bewegung: Deutschland, Westeuropa, USA*, München, C.H. Beck
- [8] Marcuse, Herbert (1968), *One-Dimensional Man*, Boston, Beacon Press
- [9] Sloterdijk, Peter (2000), *Die Verachtung der Massen*, Frankfurt am Main, Suhrkamp
- [10] McLuhan, Marshall (1964/2001), *Understanding Media*, London & New York, Routledge
- [11] Callon, Michel (1986), "Some elements of a sociology of translation: domestication of the scallops and the fishermen in St Brieuc Bay", in J. Law (ed.) *Power, action and belief: a new sociology of knowledge?* London, Routledge, 196-223
- [12] Latour, Bruno (1996), "On Interobjectivity", *Mind, Culture, and Activity*, 3: 228-245
- [13] Popkin, Richard H. (1979), *The History of Scepticism from Erasmus to Spinoza*, Berkeley, Los Angeles & London, University of California Press
- [14] Meyer, Gitte (2006), "Journalism and science: how to erode the idea of knowledge", *Journal of Agricultural and Environmental Ethics*, 19: 239-252
- [15] Friedman, Sharon M.; Dunwoody, Sharon & Rogers, Carol L. (eds.) (1986), *Scientists and Journalists: Reporting Science as News*, New York & London, The Free Press
- [16] Meyer, Gitte & Sandøe, Peter (in press), "Going Public: Good Scientific Conduct", *Science and Engineering Ethics*, doi:10.1007/s11948-010-9247-x
- [17] Veblen, Thorstein (1899), *The Theory of the Leisure Class*, <http://xroads.virginia.edu/~HYPER/VEBLEN/veblenhp.html> (accessed 17 Feb 2012)
- [18] Ortega y Gasset, José (1930/1993), *The Revolt of the Masses*, New York, Norton
- [19] Wright Mills, C. (1956/2000), *The Power Elite*, New York, Oxford University Press
- [20] Hill, Christopher (1961/2010), *The Century of Revolution: 1603-1714*, London & New York, Routledge
- [21] Bottomore, T. B. (1971), *Elites and Society*, Middlesex MD & Victoria, Pelican Books
- [22] Carey, John (1992), *The Intellectuals and the Masses: Pride and Prejudice among the Literary Intelligentsia 1880-1939*, London, faber and faber
- [23] Goede, Wolfgang (2002). *Civil Journalism & Scientific Citizenship: Scientific Communication "of the people, by the people and for the people"*, The keynote address to the Third World Conference of Science Journalists, November 2002, [http://www.forum-community-organizing.de/goede\\_journalism.htm](http://www.forum-community-organizing.de/goede_journalism.htm) (accessed 17 Feb 2012)
- [24] Felt, Ulrike (ed.) (2003), *O.P.U.S. Optimising Public Understanding of Science and Technology: Final Report*, <http://www.univie.ac.at/virus/opus/mpapers.html> (accessed 17 Feb 2012)
- [25] Stehr, Nico (1994), *Knowledge Societies*, London & New Delhi, Sage
- [26] Porter, Roy (2001), *Enlightenment: Britain and the Creation of the Modern World*, London, Penguin Books
- [27] Friedman, Sharon M.; Dunwoody, Sharon & Rogers, Carol L. (eds.) (1999), *Communicating Uncertainty: Media Coverage of New and Controversial Science*, Mahwah NJ & London, Lawrence Erlbaum Associates, Publishers
- [28] Meyer, Gitte & Lund, Anker Brink (2009), *The climate debate's debating climate: polarisation of the public debate on climate change*, [http://curis.ku.dk/portal-life/files/13701354/The\\_climate\\_debate\\_Meyer\\_Lund](http://curis.ku.dk/portal-life/files/13701354/The_climate_debate_Meyer_Lund) (accessed 17 Feb 2012)
- [29] Merton, Robert K. (1949/1968), *Social Theory and Social Structure (Enlarged edition)*, New York & London, The Free Press & Collier-Macmillan Limited
- [30] Arendt, Hannah (1975), *Sonning Prize acceptance speech*, <http://miscellaneousmaterial.blogspot.com/2011/08/hannah-arendt-sonning-prize-acceptance.html> (accessed 17 Feb 2012)
- [31] Arendt, Hannah (1958/1969), *The Human Condition*, Chicago IL & London UK, The University of Chicago Press
- [32] Gadamer, Hans-Georg (1960/1975), *Wahrheit und Methode. Grundzüge einer philosophischen Hermeneutik*, Tübingen, J.C.B. Mohr (Paul Siebeck)
- [33] MacIntyre, Alasdair (1984), *After Virtue: A Study in Moral Theory*, Notre Dame IN, University of Notre Dame Press
- [34] Aristotle (4<sup>th</sup> Century B.C./2004), *The Nicomachean Ethics*, Translated by J.A.K. Thompson, revised by Hugh Tredennick, London, Penguin Books
- [35] Crick, Bernard (1962/2005), *In defence of politics*, London & New York, Continuum
- [36] Aristotle (4<sup>th</sup> Century B.C./2002), *Retorik* [translated into Danish by Thure Hastrup], Copenhagen, Museum Tusulanums Forlag
- [37] Williams, Bernard (1993), *Ethics and the Limits of Philosophy*, London, Fontana Press
- [38] Toulmin, Stephen (1990), *Cosmopolis: The Hidden Agenda of Modernity*, New York, The Free Press
- [39] Shook, John R. & Margolis, Joseph (eds.) (2009), *A Companion to Pragmatism*, Chichester, Blackwell
- [40] Porter, Theodore M. (1995), *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*, Princeton NJ, Princeton University Press