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Introduction: The Five Senses of Science

Making Sense of Senses

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Social studies of science are mostly preoccupied with scientific practices that include texts and pictures. An increasing use of images in scientific practice has sparked a greater interest in visual representation, which creates a drift in science towards a dominance of the visual. This interest may be more generally embedded in the predominance of the sight over other senses in Western cultures. This status, however, implies the demotion of hearing, touching, smelling and tasting in the analysis of scientific practice. Even though it has often been pointed out that scientific work is conducted with the whole body, involving all senses, we nevertheless find a preoccupation with the visual in social studies of science. In addition to earlier studies on how the body becomes a subject (e.g. Cussins 1996; Berg/Mol 1998; Mol 2002; Alac 2008) or a scientific instrument in research (e.g. Latour 1986; 2004; Hirschauer 1991; Knorr Cetina 1999), scholars in social studies of science have only recently started to focus on how the body and sensory actions such as, for example, touching, grasping, and pointing are employed, for instance in modelling and image interpretation (Prentice 2005; Myers 2008; Burri 2008). This thematic issue underlines the importance of including the bodily senses in the social analysis of science.

We propose that studying the relevance of all five (or more?) senses in science can roughly be subsumed under three main topics. First, the significance of all senses in scientific work inevitably highlights the significance of the scientists' bodies. Reconstructing science as a material practice, firmly built and inscribed into scientific instruments, at the same time demands understanding science as fundamentally embodied practice.

Second, the materiality of scientific practice cannot be analysed by studying instrumental and embodied practices side by side, but has to be understood as a reciprocal interweaving of bodies and instruments. This may offer some insights into the dominance of the visual, since most scientific instruments deliver a visible output. The microscope and the telescope then serve as paradigmatic models of imaging technologies.

Third, we have to address the relations between the different senses. This

leads to a critical discussion of the hierarchy of senses with respect to institutional conditions of science. Is the sense of sight preferred because pictures, graphs and diagrams make it easier to show results, to present and create evidence – as several prominent STS scholars have underlined (Latour 1986; 1990)? Are sight and speech more public and therefore more convincing in processes of peer review than the personal senses of touch, taste and smell? Or is this bias a mere reflection of the broader visual culture? In the following sections, we will address these three topics in more detail.

1) Embodied epistemic practices in science are often addressed in the discussion of explicit and implicit – or tacit – knowledge. Generally, embodied practices are assumed to express types of knowledge which largely correspond to concepts such as tacit knowledge (Polanyi 1983 [1966]). In this understanding, embodied practices present a contrast to concepts of scientific knowledge as objective and rational. In the body remain those aspects of knowledge which we know but we can't tell, those aspects of knowledge which cannot be put into words (Polanyi 1983 [1966], p.4). In Polanyi's argument, modern science ideally seeks detached and objective knowledge and therefore is prone to the fallacy of disregarding the constitution of all knowledge by bodily perception. Even more to the point, scientific objectivations inevitably rely on prior tacit knowledge, yet this dependency is actively obscured by idealisations of science which emphasise abstract formalisations as the essence of scientific knowing. Thus, the concept of tacit knowledge is closely related, but should not be reduced to, bodily experience. More generally, Polanyi targets the relation of theory and practice. Even though they are closely related, we should not conflate embodied epistemic practices with tacit knowledge.

For instance, Collins (2001) distinguished between three approaches to tacit knowledge: the motor-skills metaphor, the rules-regress model and the forms of life approach. He does not see embodied motor skills as the constitutive element of tacit knowledge, but rather locates further instances of tacit knowledge in traditions as well as the dynamics of social life. In fact, he proposes that a "true" tacitness of knowledge – that which fundamentally cannot be formalised – rests within the vast realm of social dynamics. From Collins' perspective, embodied knowledge in the case of motor skills is, in a way, too "small" to withstand a prolonged analytical scrutiny and subsequent formalisation. Only the contingent interdependencies of social life constitute the fundamentally exclusive realm of the tacit.

Therefore, tacit knowledge is not the answer to the question of embodied scientific practices, because its basic distinction between that which fundamentally can be formalised and that which can't, does not fully coincide with the boundaries of the body. What is needed is a more detailed account of the relation of the senses and epistemic practices. This demand is hardly new (cf. Dewey 1929, pp. 219; Merleau-Ponty 2002 [1945], pp. 77). The contributions to this special issue employ qualitative, microanalytical approaches in order to uncover specific epistemic arrangements and the involvement of the senses. As it turns out, the authors do not find a simple privileging of a single sense (e.g. sight) but a mix of different senses and, interestingly, cases in which modalities are switched. Switching modalities might actually be seen as an epistemic tactic with which the different senses are put into productive relations.

2) The second topic addresses how the senses are engaged with technical instruments. The ways in which senses and instruments may be coupled are manifold. In real-life entanglements of bodies, instruments, and perceptions, the instruments cannot be seen as neutral extensions of the senses, but always entail transformations of perceptions. For instance, a microscope amplifies the visual resolution while at the same time it reduces the scope.

Ihde (1991, pp. 67) has argued that such transformations constitute the perceptual foundation of all scientific instrumentation. However, the question of what is reduced and what is amplified can only be answered empirically. For instance, the mechanisms of initial data production may lie outside human perception (e.g. detecting invisible electromagnetic radiation or minimal seismic movements). However, the presentation of the data must be perceptible to the bodily senses. Similarly, the epistemic practices in the laboratories might include a wide use of different senses, but the subsequent electronic or printed publication mainly allow for written text and pictures.

As Fujimura (1988) has argued, it is not only texts and pictures which circulate in science, but packages of methods, tools and instruments. The authors in this issue explore different fields in which bodily senses and technical instruments are related in various ways. The inclusion of those epistemic practices which cannot easily be inscribed in pictures and texts will be a challenge for future analyses in the social studies of science.

3) The third topic addresses the relation of the senses themselves. Much has been written on the primacy of the visual in Western cultures. Recently, pictorial, iconic, and visual turns have challenged the scientific preoccupation with text and argued for a better understanding of visual culture (Mitchell 1992; Boehm 1994). Also, natural sciences – in line with the Aristotelian hierarchy of the senses – typically conceptualise vision as the primary human sense to which the others are subordinate. In contrast to other mammals, humans are said to primarily live in a visual environment. In sociology, Simmel supposed that exchanging glances might be the most immediate and pure of all social interactions (Simmel 2009 [1908], pp.570). Foucault conceptualised the emergence of the clinical gaze at the heart of the transformation of medicine in the 19th century (Foucault 1973). One motive for assembling this thematic issue was to challenge the preoccupation with the visual in social studies of science and explicitly look for contributions which address an engagement with other senses or the mixing of the visual with the audible, the tactile, as well as smell and taste. This is matched by an increasing interest in the other senses coming from diverse scientific fields (for instance in the journal "The Senses & Society" founded in 2006). The growing field of sonification highlights the importance of the audible in scientific research. But it is not only the classic hierarchy of the senses which is being questioned. Scholars are also questioning the adequacy of the classic taxonomy of five senses and considering its expansion. For instance, neurologists include balance or the perception of heat and pain into a broader set of human senses.

Different perceptual preoccupations of scientific fields or research areas would have to be explained by their object of research (e.g. is it visible or not) as well as their epistemologies and the relation between the two. Any given hierarchy of the senses would then be the explanandum, not the explanans. Again, this thematic issue offers different empirical cases and conceptions of how the senses are related to each other in the respective epistemic practices. We hope that the articles in this special issue will be beneficial for comparing differences and similarities of the interplay between the various senses. Let us finish by briefly introducing the contributions of this volume.

Siegfried Saerberg compares two epistemic strategies, "blind variation" on the one side and "care of the self" on the other. Taking the epistemic practices of blind navigation as a starting point, he contrasts blind and visual modes of perception in everyday life. He relates his phenomenological analysis of different types of orientations and ways of dealing with crisis to the epistemic practices of different scientific communities, namely high energy physics and molecular biology.

High energy physics, because of the invisible and ambiguous nature of its objects, essentially follows a "care of the self" style of perception. In contrast, molecular biology employs a strategy closely related to visual perception and therefore tends to use "blind variation" as a dominant epistemic practice.

Katja Mayer explores performative aspects of the visual cultures of the social sciences. By drawing on ethnographic fieldwork among social researchers working with network diagrams, her essay shows how corporeal and sensual dimensions are involved in visual knowledge production in social network analysis. By criticising theories of embodied knowledge and inscriptions which would treat the body as passive medium, the article suggests the inclusion of corporeality in analyses of the interplay of imaging techniques, bodies, and imaginations. Corporeality should thus be regarded as one important dimension of the visual cultures of the social sciences.

Bernadette Emsenhuber addresses the field of olfactory perception and its impact on science and technology development. In tracing the cultural history of smell and smelling, she draws a line from early enlightenment philosophers' devaluation of smell as disreputable and irrational to the current renaissance of olfactory perception in science, technology and consumer production. Being able to reproduce and to technically identify and distinguish smells, modern research and technology development start to regard the olfactory sensorium as a useful medium rather than an unreliable physical organ.

Michael Guggenheim's essay explores culinary taste and cooking as a new medium in the sociology of translation. Starting from the claim that the sociology of translation follows a belief which builds on mechanical objectivity and exclusively trusts in written texts as valid translation devices, the article considers cooking as an alternative medium of translation. As one example of how this may work in practice, it reports on a buffet that was prepared as a comment to a symposium which discussed the relationship of food and emotions.

Jörg Potthast extends the idea of epistemic practices from the laboratory to the field of security studies. The difficulties of identifying dangerous substances and persons in airport security serve as focal point to analyse different modes of control in departures and arrivals. Even though we see a trend towards instrumentation and increased visualisation, he argues for an analysis the involvement of multiple senses and the extent to which sensory switching and combinations of the senses form distinct patterns of control practices.

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