# Sims, Benjamin, Safe Science: Material and Social Order in Laboratory Work, *Social Studies of Science*, 35(3), 2005, 333-366.[1]

**Keywords (*Standard Keywords* – see PratiScienS' Database)**

Physique (pulsed-power physics), sciences en général, techniques et technologies, aspects tacites, robustesse, calibration, SHS

**Domain & Topic**

Physics (pulsed-power physics); safety practices.

**Summary (Author's Abstract)**

Scientific laboratories can sometimes be dangerous places to work, and safety concerns can have a significant impact on the scientific research process. Because safety practices specify both behavioural norms and technical standards, they provide an opportunity to better understand the relationships between the organizational and epistemic aspects of scientific culture. This paper presents a case study of a 'pulsed-power' facility at the US Los Alamos National Laboratories, where electrical hazards are a major concern. Drawing on work by Mary Douglas and others, I show how safety in the pulsed-power laboratory can be understood in terms of concepts of order and pollution. In particular, I argue that the laboratory is a cultural setting that generates both material and social order in science. The concept of 'traceability' – the ideal of being able to trace visual and logical connections between system components – is the central metaphor for material order in this setting. This metaphor is enacted in the design of pulsed-power systems and through various safety procedures that function as rituals. These rituals, and the concept of traceability itself, also contribute to social order by helping to shape norms of conduct in the laboratory, which in turn structure relationships between the laboratory work group and the larger institution.

**Thèses, Organisation de l'Article/Thesis & Argument, Narrative Organisation**

This paper is organised in six sections: 1/ Some introductory comments (pp. 333-335), 2/ "Safety and Order" (pp. 335-338), of which "Material Order" (pp. 336-337) and "Order in the Laboratory" (pp. 337-338), 3/ "Los Alamos and Pulsed-Power Structure" (pp. 338-342), 4/ "Traceability: A Metaphor for Social Order" (pp. 342-351) (of which "Sources of Uncertainty", "Designing for Traceability", and "Ritual and Traceability"), 5/ "Safety and Social Order" (pp. 351-357) (of which "Caring", "Competence", and "Social Order and Material Order", and 6/ "Conclusions" (pp. 357-359), of which "Safety Culture" (pp. 357-358), "Order, Pollution and Scientific Culture" (pp. 358-359). The authors adds in, too, the usual notes and references.

In his introductory comments (Section 1, p. 333-335), Sims spells out his agenda, that is, within the domain of science studies and their exploration of the mundane activities taking place in scientific labs, his proposal to explore about, out of these mundane activities, activities related to, aiming at controlling human safety-related issues, using exemples and case studies based upon ethnographic fieldwork in pulsed-power physics. Based on this, his proposal and argument is that safetypractices and cultures in scientific labs, potentially, reflect, relate to what is going on in labs as regards to their knowledge-making.[2] Briefly, his proposition is thus that norms, spaces and practices of safety are reflection of the types and issues with knowledge taking place in the labs where they are implemented, and brings out "connections between scientific work and social order," as "safety is an epistemic problem and it can have epistemic consequences" (p. 334).[3] Doing so, Sims also stresses the point that

[1] This paper is referenced in the PratiScienS bibliography under: Sims, Bejmamin, 2005, Safe Science: Material and Social Order in Laboratory Work, *Social Studies of Science*, 35(3), 333-366.

[2] For instance: "Safety can be understood as an effort to order the environment in such a way that danger is eliminated or contained. In the course of research, scientists are already engaged in a struggle to create order – to understand, predict and modify the behaviour of objects of study as well as the machines and instruments used to study them" (p. 334), or "Safety makes connections between scientific knowledge and the larger cultural and organizational context of science" (p.334).

[3] In that sense, Sims's proposal quite looks like proposals on scientific errors by authors like Hon, or Schickore.

taking the issue of safety practices is a way of more or less directly connecting these knowledge issues related to safety to the various organizational contexts of science, the ways science is made, leading out to exploring safety practices as providing "opportunities to consider how scientists situate research, as a moral and technical enterprise, in relation to the very normative context of bureaucracy," which "brings issues of scientific identity and cultural boundaries into sharper focus" (p.335). Latest points in this introduction relate to how safety practices also allow telling workplace culture – thus bringing out pratical impacts from for such studies focused on safety.

In Section 2 ("Safety and Order," p. 335-338), Sims proposes a review of the literature on laboratory practices and moral order, alike some proposed by Mody, Lynch and Douglas.[4] That is, he comments on Douglas's proposals about the interrelation between pollution issues and moral order – and papers based on similar premises – to argue that safety issues (policies, norms) are not be seen or considered, ideally, in a positive way (making the lab a safe palce), but rather as evading strategies for dealing with danger issues in the laboratory (that is, making the lab a safe place by removing dangers away or keeping them at bay). Two authors are here particularly commented upon: Douglas and Turner.

In Section 3 ("Los Alamos and Pulsed-Power Structure," p. 338-342), Sims reports of his fieldwork on safety practices in pulsed-power physics and biology in some of the Los Alamos national laboratories, fieldwork aimed at "understanding how scientists and technicians integrate safety into their work practices" (p. 338-339). Therethrough, he emphasises the relative normality of these labs, socially (as constituted of researchers, technicians etc...) and technically (as filled in with loads of materials, some of them intertwined with each other, all over the place, in a more or less orderly manner). Thereafter, he expands on some of the specifics of what he calls "pulsed-power technology," that is, labs filled in with racks after racks of capacitor banks, high voltage switches, coils, electrical capacity of these places etc... This allows him to expand and argue on how this technology "structure[s] work, and danger" in these places (p. 340), and to his argument and point that, in these places, due to the "unique technical challenges involved in operating a pulsed-power system" (p. 340), work and expertise in labs hosting such technology "has the potential to be very dangerous," leads to "distinctive work cultures[s]" wherein "compromis[ing] real safety... for the sake of scientific productivity ... [is] deviant, not heroic," and where there is "risk-aversion and deference to more experienced colleagues" (p. 341). He contrasts this to studies such as by Mody or Galison wherein the argument was that safety pursuits were discussed as imposed regime of surveillance by researchers. Last comments in the section expand on how such culture comes hand in hand, and evolves alongside the implementation of systems for regulatory safety procedures.

In Section 4 ("Traceability: A Metaphor for Social Order," p. 342-351), Sims introduces, and discusses about pulsed-power cultures, his concept of "traceability," as specifying the kinds of ideal standard situation in which information about components of labs (systems and people....) that will allow safe and effective work in the lab are set as easy to obtain and reach. He particularly discusses issues as visual, logical and material order, emphasising for instance on how (lack of) clutter and (dis-)organised 'safing' practices of control of 'arcing behaviour' of components are all part of operators' ways of (non-)dealing with the potential risks and danger from pulsed-power technology. In the last part ("Ritual and Traceability," p. 349*ff*), Sims then comes back to comments, based on Douglas's work, summarising his discussion about safing practices as a matter of rituals allowing the easy identification, and avoidance, of departure from safe practices.

In Section 5 ("Safety and Social Order," p. 351-357), Sims comments on how his earlier discussion also *has* to somehow be understood as "play[ing] a role in setting up certain norms for human conduct, particularly for the interaction between humans and machines," engaging in a discussion on "the norms that people use to guide and evaluate their daily work in the laboratory," emphasising how "such mlocally meaningful norms can help us understand the connections between technically mediated norms like traceability and the broader moral constitution of the scientific community" (p. 351). In this discussion, Sims particularly emphasises some linguistic issues such as the commonplace use of words as "caring" as reflecting, beyond basic scientific ethos, the role of issues related to interpersonal care in the lab about (non-)risk-taking, carefulness and carelessness. This leads to comment on how safety can be reframed, in analytical terms, in terms of competence, knowledge and know-how (thus relating here to his earlier argument about deference for more 'experienced' peers). Safety

[4] For references, cf. Mody, Cyrus M., 2001, A Little Dirt Never Hurt Anyone, *Social Studies of Science,* 31(1), 7-36, and the bibliographic notes on this paper by S. Mols on http://poincare.univ-nancy2.fr/PratiScienS/Basedonnees/?contentId=8300.

then becomes in Sims's analysis a way to taking on issues of competence. As he states, "competence was also the main criterion to draw distinctions between the Plasma Lab group and outsiders," and to allow for dismissing or accepting additional members in the group, some "problematic" individuals being potentially 'faulted' for lacking sufficient experience (p. 354). Sims also discusses here issues related to authority, e.g. technical authority as it relates to how to deal safely in the labs, and also institutional authority in the ways it does (not) manage to intrude the lab with its own ways of proposing and making safety standards, commenting e.g. on the "strained relationships" between lab workers and outsiders.

In Section 6 ("Conclusions," p. 357-359), Sims comments on two main themes: "Safety Culture" (pp. 357-358), and "Order, Pollution and Scientific Culture" (pp. 358-359). His discussion here focuses first on recapitulating how his study and his conclusions are specific to labs wherein safety and danger are central issues (contrasting here for instance his work with what could be said about a biophysics lab), emphasising how his work is not valid for analysing all scientific activities but rather those wherein work is dependent on high-reliability organisation. Second, he recapitulates on his concept of traceability, stressing how commitment to safety is a transversal issues in such high-reliability organisations, and reflects transversally in the lab, from the technical to the social, cultural, and moral level, through the process of identification of points wherefor norms for conduct are required, and the very making of these norms. His latest comments in the paper turn around his proposal that the major input from his paper, in the follow-up from lab studies that examine the techniques scientists use "to order the material environment of their laboratory," is the proposal that, "the concepts that underpin this material ordering influence and interact with the behavioural norms and social structure of laboratory work group" (p. 359), that is, the issue that, while critically attending laboratory practices, there is a need to take also into account some 'morality'-related issues in that these may effectively, and even sometimes, significantly affect knowledge-making practices.[5]

**Démarche/Approach**

Assembly of SSK-like case studies on practices of danger and risk management in pulsed-power technology, evoking and referring to Mody and Douglas's use of the concept of pollution and moral order.

**Apports Spécifiques/Specific Inputs**

*Additional keywords*

Physics (pulsed-power physics), order, pollution, standards and norms (social, cultural), instrumentation & techniques, tacit know-how, laboratory, norms, risk & safety, ritual

*Commentaires/Comments*

In some ways (see footnotes), Sims's work quite evokes studies on scientific practices analysing the problems raised through making knowledge, rather than knowledge per se, such as studies by Hon and Schickore on scientific errors, Mody on materials science, or Gooday on electrical measurements.

*Bibliographie sur laquelle s'appuie l'auteur/Literature used by the author*

- Authors by themes
  - ✓ Notions of purity and dirt: M. Douglas
  - ✓ Laboratory studies, ethnography of science: Lynch, Knorr-Cetina, Orr
  - ✓ Tacit knowledge in science: H.M. Collins
  - ✓ Rituals in science: Douglas, Hirschauer, Turner
  - ✓ Safety practices as knowledge practices: Gherardi....

[5] In this sense, Sims's work is very similar to Gooday's (Gooday, Graeme J.N., 2004, *The Morals of Measurement. Accuracy, Irony, and Trust in Late Victorian Electrical Practice*, Cambridge: Cambridge University Press).

- Examples of cited literature (usually cited literature is not mentioned here below)


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