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Drawing, judgement and design of “epistemic things”: windows on the corporeal body of the scientist and her or his relations in new knowledge-making culture (0247)

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**Synopsis**

Contemporary work in the philosophy of science, science culture studies and the (micro) history of science, all tend to share a “practice turn”, focusing on how the different branches of science make-knowledge - where for establishing the reach of an the epistemic claim (of research, but also pedagogy), understanding depends on being able to identify/articulate the specific locus as well as the process of new knowledge-making. In this context, the development of pedagogy based on body-sense (embodiment) of material experience is a much neglected issue. While issues of scientific misconceptions (e.g. Driver, 1985) and/or scientific literacy (e.g. Florence & Your, 2004) have received some prominent attention, the “corporeal body of the scientist” appears to be a new and controversial issue (Myers, 2008). This is despite the fact that so much of the research which distinguishes between the knowledge-making practices occurring *in* the laboratory *versus* the knowledge which *leaves it* (cleaned and fixed (Amman & Knorr Cetina, 1988) for formal scientific presentation in research papers, review articles and textbooks), points towards the physical, sensory and imaginative body of the scientist as being the most vital transaction site of scientific realization (Knorr Cetina, 1999; Radder, 2012).

This paper will explore and develop these contentions, developing a new account of the body-knowledge of contemporary scientific experimentation where pedagogy might depend on choreography which conveys the body-sense of leading scientists. My purposes are threefold. To:

- 1) Explore new choreography of teaching/learning which is based on practice turn approaches to analysis of science culture.
- 2) Develop frameworks/methods for the test of these potential choreographies in terms of impacts on new science knowledge-making practice.
- 3) Discuss/present new avenues of research in these fields - using drawing, images and new choreography in development of higher education teaching, learning and research.

## **Introduction**

For some time science education has been shifting away from the memorization of facts and moving toward educational experiences which correspond with authentic research experience (McCartney, 2013). But while this shift has resulted in gains being made in research on scientific literacy (e.g. Osbourne, Simonds & Collins, 2003), until recently there has been little published work on the development of the imaginative practice traits which correspond to the manufacture of the new material identities (Knorr Cetina, 1999) corresponding to the inscription of otherwise invisible abstract entities (Latour & Wolgar, 1985) in experimental systems (Radder, 2012; Rheinberger, 2009a). The recent work of Hay *et al* (2013) is a new breakthrough in this field, however (review by McCartney, 2013), showing how it is possible to “place” students in the same creative knowledge-making “sense” arena as lead researchers, so that they (the students), like their laboratory-leading (Principal Researcher) counterparts are more able to “experiment” with drawing and design of “epistemic things” (Rheinberger, 2009a), thereby developing the imaginative body-sense (Myers, 2008) by which plausible identities might be made known to science through new experiment design (Hay *et al*, 2013).

Indeed this view of experimental science and experimental science education depends upon the grasp of a complex (but coherent) system of analysis developed in the literature of scientific micro-histories (e.g. Daston, 2003; Rheinberger, 1997; 2009b), laboratory ethnography and science culture studies (e.g. Latour & Wolgar, 1985; Knorr Cetina, 1999; Myers, 2008), as well as a contemporary philosophy of science which resolves within “experimental realization” (e.g. Radder, 2012). It will be the purpose of this paper to review this collected work, using the literature to demonstrate why “pedagogy of the body” now becomes the priority for developing a future generation of creative scientists. In this regards I will attempt to show how: a) the corporeal body of each experimental scientist is the *primary* transaction site of their own experimental system; b) why the new design of scientific knowledge involves a body-sense imagination which is analogous but non-identical to the literary imagination of academic literacies (Lea & Street, 1998); and c) how a *sense* of material plausibility (including both a grasp of what is plausible for an abstract “possibility” as well as grasp of what is possible to manufacture in experimental settings) balance and moderate the rein of scientific creativity which students can and must acquire in order to become practicing scientists.

## **Development**

The second half of this paper will begin to explore some new research directions in relation to these aspects of scientific culture analysis and related pedagogy. First, I will explore some of the simple steps which might be taken to make use of the existing literature in science and technology studies in order to project pedagogy relevant to research culture. Second, I will use Rheinberger's work on "an economy of scribble" (Rheinberger, 2009a) to suggest new methods for the simultaneous development and testing of drawing-type discrimination tasks. This will build on some of the ground-breaking work of Abercrombie (1989) which sets out to develop an "anatomy of judgement", but it will also take in the more recent work on "drawing to learn" (Ainsworth, Prain & Tyler, 2011) in scientific settings. Here I will present some new (and tentative) analysis of the drawings collected from undergraduates, laboratory apprentices and scientific leaders (Principal Investigators) working in neuroscience, molecular genetics, poly-carbon chemistry and nano-facture, developing new frameworks which: a) enable tests of expertise which can be implemented independently from data about qualifications/faculty positions/employment/status and the like; and b) forge links between a culture of embodiment which is not ostensibly sign based but nevertheless becomes visible in the fleeting, transient and ephemeral negotiations of sketches, dreams, imaginations all of which can be gathered in "criteria of judgement".

### ***Relevance***

This paper will be relevant to scientists and science teachers. It will also be important for developing debates in simulation and haptics based educational technology as well as drawing on the literature of knowledge as design.

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