Representational, Textual, and Experimental Practices: The Case of Michael Faraday

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The expansion of cognitive-historical methods and theory within cognitive science in recent years (e.g., Gooding; 1990; Gorman, 1997; Klahr & Simon, 1999; Nersessian, 1999; Tweney, 2001) has relied in part on the application of existing cognitive scientific methods to important historical cases of scientific research. Michael Faraday (1791-1867) has served as a case study in many of these efforts, partly because the extensive diary and notebook record of his work is so large, and also because substantial amounts have been published (e.g., Martin, 1931-36).

In this symposium we present three different uses of the vast case material available to the student of Faraday, with a view toward understanding and extending the accounts of Faraday's representational practices. The complexity of Faraday's work requires that the larger social and material context of his work be approached from a variety of points of view, each of which can be grounded in cognitive scientific principles.

Each of three speakers will discuss recent research using primary source materials (Faraday's diaries and notebooks, surviving specimens from his laboratory, and experimental replications of his work), in addition to Faraday's published writings (e.g., Faraday, 1839-1855), with a special focus on understanding the representational dynamics of his scientific practices.

Faraday and Piaget: Experimenting in Relation with the World

Elizabeth Cavicchi

The experimenting of Faraday resonates provocatively with that of psychologist Jean Piaget. From everyday materials like water in a dish, Faraday evoked and investigated physical effects, such as rippling patterns, that no one had ever "seen" before. Similarly, Piaget elicited and probed active developing processes in children that had gone unnoticed.

For both, interacting with phenomena was inseparable from the formation of understandings. Shining a candle flame across the moving liquid surface, Faraday saw its darting reflections, queried "Does this not shew that the waves are … continually moving to and fro?", and resolved to compare this with a rigid rippled surface that he constructed (*Diary*, June 20, 1831). While his 9 month old son looked on, Piaget put his pocketwatch – a prized toy – under a blanket. Lifting the cover gradually, the child spied the watch and grabbed it. However, wherever Piaget hid the watch, under that blanket or elsewhere, his son searched for it only under the first cloth. Wondering if his son's search was becoming systematic, Piaget continued engaging his son, to explore this idea. By replicating these activities today, with water and a child, we too can experience the coevolving of observation and thought.

As each experimenter's work brought out more details of change and development, their personal sense of orderliness and consistency in the underlying phenomena deepened. Faraday inferred that the water itself was oscillating, much like a vibrating harpstring. Piaget made out distinctive transitions in the development of the child's search – such as a phase where the child had not yet accounted for successive displacements of the watch.

By bringing together the experimenting, questioning, and inferences of Faraday and Piaget, we can learn more about the dynamic relation between an investigator and something in the world.

Epistemic Artifacts in Faraday's Research on Gold

Ryan D. Tweney

The understanding of Faraday's 1856 research on the optical effects of thin, transparent, gold leaf, has been greatly extended by the discovery of over 600 specimens prepared by Faraday, and keyed to his diary entries (Tweney, 2002). Replication of some of these specimens has further opened the process by which Faraday coordinated his beginning notions in a confused (and confusing) realm, and has illuminated the way in which such confusions were turned into lawful relationships (Cavicchi, 1997). The results of this research enrich the way in which, in Gooding's (1990) terms, Faraday's experiments could "make

meaning." By creating slides, Faraday sought to enter a dialogue with nature on questions of matter and force. Similarly, replicating his experimentation has forced us into a dialogue with his experimental and representational practices.

Language and Representation in Faraday's Experimental Researches in Electricity
Ronald Anderson

One of the significant features of Michael Faraday's writing is a careful attention to matters of language when describing experiments and experimental outcomes and when theorizing on their significance. Examples of such practices include his concern for the choice of a proper name for a new phenomenon or entity (e.g., "ion") and a concern for carefully fixing the meaning of terms. A project will be traced, drawing partly on the resources of contemporary post-structuralist studies on language and representation, to indicate how attending closely to this dimension of Faraday's writings provides a valuable way to map aspects of his theorizing and the texture of his thought. Moreover, given the essential social role of language, exploring this dimension of his writing assists in contextualizing Faraday's thought in the textual and cultural networks that formed his life. In particular, resonances from the writings of Isaac Watts and John Herschel on the importance of language in thinking and scientific writing are evident in Faraday's practices (both experimental and linguistic); similar topics were often the subject of his correspondence with William Whewell. These reveal Faraday to be within a long British tradition of concern for the proper language for science. Faraday's considerations of the physical significance and meaning of several key concepts invoked to explain the nature of electromagnetic action provide a focused illustration of how these language concerns are woven into a subtle and persistent concern with representation (Anderson, 1993; 1994). These dimensions of Faraday's work provide an example of a remarkable set of interpretative practices related to various textual, logical and mathematical systems emerging in other disciplinary contexts in the early to middle period of Victorian thought.

Symposium Discussant
Elke M. Kurz-Milcke

In providing commentary on the presentations, Kurz-Milcke will draw upon her multidisciplinary research collaborations which have emphasized an understanding of the cognitive practices of scientific thinking in real world contexts (e.g., Nersessian, et al., in press) and on her own experience replicating the classic experiments of Egon Brunswik (Kurz & Hertwig, 2001).

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