The Crafting of Scientific Meaning and Identity: Exploring the Performative Dimensions of Michael Faraday’s Texts

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Texts bear traces of complex struggles. For scientific texts, issues to do with the meaning of words and their reference are often where such struggles occur. In texts too identity is fashioned in the social realm and texts are woven closely into human cognition. The focus on how texts function to produce meaning, characteristic of recent literary theory, provides remarkable resources for locating these features in scientific texts. The project sketched here in a preliminary manner seeks to bring such resources to bear on Michael Faraday’s writings and explores in Faraday’s rich and reflexive “textual space” his persistent concern to stabilize the meaning and reference of words as well as the less conscious subtle complexities associated with the production of meaning. Both weave closely into his scientific theorizing and fashioning of identity.

“There remains little besides to perfect the preliminary furniture of a laboratory. A blank writing paper book should be upon the table, with pen and ink, to enter immediately the notes of experiments.” Faraday (1827)

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1. Resources from literary theory for exploring the production of textual meaning

One of the predominant sources for tracing the history of science is in the form of texts, texts as letters, laboratory notes, lecture notes, annotations of other texts, and most significantly, texts as publications. Texts come in various forms of inscriptions such as handwritten or typeset, and in various material forms. Texts too will often have circulated in diverse and intersecting spaces such as the public and private, the professional and lay. In addition to locating and fixing the textual deposit from the past, the historian is presented with the challenge of reading and interpreting texts across boundaries of time, space, and culture. Scientific texts are literary productions and resources from traditional studies of literature have long been at hand to assist such reading and interpreting, indeed often intuitively so. They go along with the necessary competencies of the historian such as a detailed knowledge of the scientific worlds of the works under study and the now necessary historiographic awareness and reflexivity that goes with writing the history of science.

Recent literary theories, however, those forged in the past few decades, in particular, those influenced by post-structuralism and figures such as Jacques Derrida, have provided new dimensions to these projects by providing powerful resources for the task of exploring the ways texts generate meaning. Characteristic of these studies, which overlap with the field of Deconstruction in literary contexts is a focus on the act of writing, on the construction and structure of texts, and on how issues of syntax irreducibly and deeply affect the production of meaning.1 To quote an evocative expression of Derrida, they confront “the irreducible excess of the syntactic over the semantic” (Derrida 1970, p. 221). The structure of language that allows meaning to be generated is such that meaning is seen to become irrevocably diffused and deferred throughout the language. And moreover, meaning is often dependent on metaphor in a way that blurs the distinction between figurative and literal writing. One reads then attending in particular to concepts that function together in an opposing manner such as nature and culture, experimental and theoretical, and abstract and concrete. With such “binary oppositions” one of the of the pair is often privileged over the other. Also, one attends to the ways texts seek to delineate boundaries, locally, and for the text as a whole.

The notion of “textuality” captures a central theme of such a perspec-

1. For those looking for a foray in the dense if fertile landscape of post-structuralist literary theory, the reader by Julian Wolfreys (1999) and the introductory text by Peter Barry (2002) are recommended.
tive on meaning production: “The text is what is read, but its textuality or textualities is how it is read. . . . Through its textuality, the text makes itself mean, makes itself be, makes itself come about in a particular way” (Silverman 1994, p. 91). As Jonathan Culler characterizes deconstruction, a central if contested thread of these studies is such that by “granting primacy not to what a text ‘says’ but, rather, to how what it ‘does’ relates to what it says, deconstruction emphasizes that rhetorical structures are centrally at work in language of all sorts and that discourse has an important ‘performative’ dimension, structuring experience in particular ways” (Culler 2001, p. 3345). In short: it is not simply what a text means, but how it means that’s crucial.

As well, it is on the basis of a close reading alert to the text’s performative dimension that there arises the move characteristic of deconstruction readings, that of attending to the tension between the rhetorical ways a text generates meaning and what the texts seeks to say. Specifying the activity of reading texts in this deconstructive manner in formal terms has been resisted within the field, but helpful expressions abound in the literature. Again in Culler’s terms:

It is a mode of analysis that examines not only the arguments of philosophical texts but also the rhetorical procedures and devices they employ and the tensions or contradictions between what is claimed or assumed and what the texts themselves must do in order to support such claims. (Culler 2001, p. 3344)

And to Christopher Norris:

To deconstruct a text is to draw out conflicting logics of sense and implication, with the object of showing that the text never exactly means what it says or says what it means. (quoted in Wolfreys 1999 p. 275)

A colorful expression by Peter Barry that captures such a reading “against the grain” in order to reveal conflicts a text cannot stabilize is to see it as “waking up the sleeping dogs of signification and setting them on each other” (Barry 2002, p. 77).

Another post-structuralist notion with resources for the historian is the stress given to how texts are woven together as tissues of other texts. Such a feature, referred to by Kristeva as “intertextuality,” refers to how “every text is from the outset under the jurisdiction of other discourses which impose a universe on it” (cited in Culler 1981, p. 105, see also Kristeva, 1980). Intertextuality upsets the notion of clear boundaries to texts. As Foucault noted earlier of the idea of the book:
The frontiers of a book are never clear-cut: beyond the title, the first lines and the last full stop, beyond its internal configuration and its autonomous form, it is caught up in a system of references to other books, other texts, other sentences: it is a node within a network . . . The book is not simply the object that one holds in one’s hands . . . Its unity is variable and relative (Foucault 1972, p. 23).

Then perhaps most significant for the historian interested in unearthing how texts function in their referential import is the persistent theme from the world of deconstruction expressed in a cluster of notions such as the “metaphysics of presence” and “logocentricism.” Here attention is given to how a text implicitly or explicitly seeks to ground meaning and explanations in that which lies beyond a text, such as in nature or God. Such a “beyond” is taken as having a “presence” to consciousness that is unmediated by forms of representation. The project of deconstruction is to unearth however how forms of representation are implicit in all levels. On the topic of representation deconstruction aligns with traditions of 20th century philosophical and artistic culture where traditional realist concerns have been contested. And on a broader canvas, this topic, together with other themes of post-structuralism appear simply as themes long of concern to philosophy and in this perspective some of the reactive heat they generated in the 1980s and 1990s appears misplaced.

The value for the historian of science of attending to these textual features and the manner in which meaning is generated lies in providing new perspectives on how science is generated. How scientific texts generate meaning brings one as well to a crucial issue of the strategies whereby terms and concepts within the theoretical structure are taken to represent features of the world. Also new resources abound for contextual projects as textual practices in a particular disciplinary context often share features of those in adjacent contexts and in a broader sense map to the larger cultural ways in which meaning is generated (that open up to projects in interdisciplinary fields such as Semiotics).

Faraday presents the historian with a rich archival deposit of texts. He was a generator as well as preserver of texts of all sorts. The project here will be to explore various of Faraday’s textual practices with a focus on the issue of fixing words and concepts to things—the key strategy of reference and representation (itself a major concern in post-structuralism). Faraday’s texts abound with references to the use of words and phrases and questions to do with defining meanings. This persistent concern with meaning goes with a concern for the appropriate choice of words to describe an idea or concept. Such concerns flow over in key passages to reflections on the place of language itself in scientific thinking. His direct
textual awareness of crafting meaning in writing makes Faraday a particularly rich example for the sort of project explored here. The focus on meaning brings to the foreground in an acute way the issue of the referents of words and the manner in which they express a phenomena in nature. The way in which Faraday refers to other texts and is thus embedded in a "textual context"—his own and others—is also a significant part of his writing. In attending to these and other features of Faraday's texts in the spirit of a deconstructive reading, I'll also suggest that there's an occasional dissonance and instability between Faraday's actual textual practices on the one hand and his views on how language relates to ideas and things on the other. I've chosen to focus largely on places where Faraday is directly addressing issues of meaning, the natural starting place for the sort of project undertaken here and one prior to a more extensive probing of features such as the "textual unconscious" (Culler 1984) that places of textual dissonances reveal. The latter task has only been started in a preliminary way here.2

Language is deeply woven into our thinking and attending to Faraday's theorizing about words and language and their meaning also sheds light on his scientific reasoning. This brings the present project into a cognitive science domain, one having to do with the intersection of language and cognition. Much of what I will address has to do with meaning construction at a high level, not the level of the more impenetrable fundamental cognitive processes. But matters of language touch all levels and touch deep, and another theme of post-structuralist literary theory appears as a resource: a language is beyond a writer, it writes through the writer and unconsciously works to structure a text and meaning. Such problematizing of the traditional notion of an "author" was made famous by Roland Barthes's essay, "The Death of the Author" (Barthes, 1977). The act of writing generates the “author” and the site of production is in language, not the unified subject. Language is an internal as well as external form of representation which also makes it a productive topic for exploring the social and cultural dimension of cognition.

The intersection of literary theory and cognitive science is a an emerging disciplinary configuration at the moment, with a program prophetically outlined by Herbert Simon twenty years ago:

Written texts, literary and other, provide a rich source of data for understanding cognition. Enormous thought goes into the production of texts and perhaps even more (given the ratio of readers to

2. For an earlier exploration of literary features of Faraday’s texts, in accord with the spirit of the project here, one with reference to the notion of "voice" and the manner in which it is woven into issues of identity see Fisher (1992).
writers) into interpreting them. These data have not been much mined by cognitive scientists . . .

Literary criticism concerns (among other things) the meanings of, in, and evoked by literary texts. Cognitive science concerns thinking, by people and computers, and extracting or evoking meanings while reading and writing requires thinking. Hence, there is a wide expanse of ground common to literary criticism and cognitive science (Simon 1994, p. 1).

Texts not so long ago such as Mark Turner’s Reading Minds (1991) and The Literary Mind, (1996) and Lakoff and Johnson’s, Philosophy in the Flesh (1999) that have brought cognitive models into contact with the study of language and literature are representative of this emerging field. Turner’s focus in particular, by considering narrative flow at various levels of textual formation and matters having to do with the production of meaning overlaps with poststructuralist concerns.3

While Faraday’s ways of constructing meaning through experimental practices have been well explored such as in the work of David Gooding (1989 & 1990) using the notion of an “experimenter’s space” the argument implicit in this paper is that there awaits a project exploring the construction of meaning by close attention to the features of his textual practices. Indeed, from a post-structuralist perspective such a project appears as a conjoint one: at no level are textual forms of representation absent (captured in the slogan—“no presence without representation”). Using Gilles Fauconnier’s rich notion of a “mental space” (Fauconnier 1985, Fauconnier & Sweetser 1996, Fauconnier & Turner 2002) which seeks to capture how the mind forms multiple cognitive spaces in the creative activities of thought and action in the world, the project can be posed and continued on a cognitive level as one of attending to the relationship of “textual space” of his writing with his other “mental spaces.”

Many of us have walked the streets of London to visit the extraordinary archives of 19th century British science, such as those at the Royal Society, Royal Institution, and the University College London, tracing threads that reveal contexts and practices, all of which go into contemporary history of science, together with tracing the unfolding of events that go into any historical venture. One of the underlying concerns driving the projects in this paper is that there await resources more directly before our

3. However, other features of his analysis such as the location of universal mental processes that make these meanings possible place him at odds with the spirit of these concerns (see Richardson 1988).
eyes in the very texts themselves, ones whose full investigation lies ahead and ones that continue in new ways the traditional spirit that drives the historian to understand the past.

2. Faraday’s Early World: Texts, Language, and the Culture of “Improving the Mind”

Faraday’s early world from age 13 when he started work for George Riebau, a bookseller and bookbinder, was formed by the material aspects of books and their production. Part of the work during the first year, 1804, was spent delivering newspapers and then often picking them up again. The following year he became a bookbinding apprentice under Riebau where he was to stay for seven years, years that left a legacy in Faraday of an interest about the physical details of notebooks and their composition and binding. It was a work of service for a culture of books and learning of a society to which he was an outsider. During this time his entrée into the world of science took place by reading the scientific books that came to the store. From a report of Riebau, Faraday copied the plates in any “curious book” that had turned up for binding that he thought “Singular or Clever” (cited in Williams 1965, p. 11). Faraday also notes he studied perspective drawing closely during this time and that he was always fond of copying things in ink, noting significantly that at that earlier time he had no sense of the “power of the lines” in producing perspective effects (Bence Jones 1870, vol.1, p. 12). Around 1810 he also encountered Isaac Watts’s book, *The Improvement of the Mind*, an inspiring and encouraging type of self-help book. Watts’s book extolled the value of practices of reading, listening to lectures, and conversations for improving the mind. One striking feature that runs through Watts’s study is a sustained consideration of the nature of language, reflecting an influence of Locke.

During the years 1810–1811 Faraday attended lectures by the silversmith John Tatum, a number of which he copied out carefully afterwards, with color illustrations, no doubt following a prescription in Watts’s book that writing out what one had heard preserved it better in memory. In his notes for one of them Faraday gave an outline of how he went about composing such notes, including the materials he used to take notes and how they were bound together (cited in Williams 1965, p. 16). The remarks hint at a self-consciousness of one entering a new world. The outcome of the notes was considerable. Through impressing a member of the Royal Institution with them he obtained admission in 1812 to Humphry Davy’s lectures and most likely an introduction to Davy directly. Again Faraday

4. See Tweney (1991a) for an exploration of Faraday’s note taking practices with particular reference to the place of memory.
took notes and wrote them up and bound them. Sending them to Davy asking for an opportunity to work produced a favorable response that led to a job at the Royal Institution in early 1813. During 1813 he took private elocution lessons from Benjamin Smart, several of which are copied out in detail in his Commonplace Book (Faraday, 1813–46). At this time he also worked with friends to improve his language skills, in writing and speaking (Williams 1965, p. 30). Davy before him also had dealt with issues of presentation of self at the Royal Institution. His brother in a memoir of his life draws attention to letters Davy had received when he had started lecturing, pointing out “what was considered faulty in his manner, and even in his pronunciation.” (Davy 1839, p. 97)

From the latter part of 1813 through to April of 1815 Faraday toured Europe with Davy and his wife. Comments from Faraday on matters of language are telling. He felt an outsider to the social class of the Davys. Lady Davy in particular made him feel he did not belong. When commenting on her towards the end of the time away he observed in a letter that, on leaving London, one reason he felt he did not match up or belong to the “high life” was his being “unused . . . in the art of expressing sentiments” (Faraday to Abbott, 23 February 1815, Correspondence, v. 1, p. 117). Then in a poignant remark, sitting alone in the heart of Paris, desolate, one finds Faraday observing on his lack of French that: “I must exert myself to attain their language so as to join in their world” (Bence Jones, I, p. 84). Language and its proper use was necessary in order to belong to a culture and group.

3. Language and Isaac Watts’s “The Improvement of the Mind”
In his first letter to Benjamin Abbott, who became a regular correspondent, Faraday’s ideals of improving his grammar and reasoning are touchingly outlined along with enticing Abbott to engage in correspondence. Faraday writes:

... let me notice, before I cease from praising and recommending epistolary correspondence, that the great Dr. Isaac Watts (great in all the methods respecting the attainment of Learning;) recommends it, as a very effectual method of improving the mind of the

5. The significance of Smart’s work has been considered by Tweney (1991b), and more recently by Morus (1998, pp. 20–21). Smart was to dedicate a later work “with vivid recollections of early friendship and continued kindness” to Faraday (Smart 1855). In a chapter with perceptive review of Smart’s writings, Bartine (1989, p. 133) notes that Smart’s theory of language was linked to an epistemology found in the works of Isaac Watts.

6. References to the Correspondence are to Faraday (1991–1996).

7. For details on this correspondence see James (1992).
person who writes, & the person who receives . . . (Faraday to Abbott, 12 July, 1812. Correspondence v.1, p. 3).

As the letter to Abbott hints at and as Faraday indicates elsewhere, Isaac Watts’s book, The Improvement of the Mind, was of considerable influence on him. One striking feature that runs through Watts’s study is a sustained consideration of the nature of language, partly an influence of Locke. Watts’s book has yet to be fully used as a resource for exploring Faraday’s views on language. From a literary theory point of view it’s a rich mine of interesting issues having to do with language and the production of meaning. The following features are directly relevant for exploring Faraday’s writings.

3.1. Spatial metaphors for knowledge

One of the characteristics of Watts’s writing is the use of spatial metaphors when addressing the nature of knowledge. The reader is advised to take a wide survey of the “vast and unlimited regions of learning” and to survey knowledge “on all sides” (Watts 1809, pp. 8, 291). Knowledge appears represented by going beyond the ordinary, in depth and height: one is not to “hover always on the surface of things nor to take up suddenly with mere appearances; but penetrate into the depth of matters” and “fetch down some knowledge from the clouds, the stars . . . and all the planets . . . and to dig and draw valuable meditations from the depths of the earth” (Watts 1809, pp. 14, 49). There is too a “depth and difficulty” to truths (Watts 1809, p. 8). A metaphor of “penetration” which also shares spatial features is commonly used for matters to do meaning, thinking and reading. Early in the text, when pointing out the need for a capacious memory a warning is given that mere amassment of what others have written must go with a “due penetration into their meaning” (Watts 1809, p. 12). Later the reference is to how with thinking and the “Labour of the mind”—“we penetrate deeper into the themes of knowledge” (Watts 1809, p. 37). And the re-reading of a book that may be required for understanding is described with the metaphors of what “we cannot reach and penetrate at first” (Watts 1809, pp. 48–9).8

3.2 A sustained concern for the meaning of words

In a chapter on inquiring into the sense and meaning of words, Watts’s begins a series of rules with prescriptions:

8. The association of knowledge with a voyage of exploration has a long history. In the British context, Francis Bacon’s well known use of the imagery of geographic exploration in the New Organon was of enormous influence. The use of metaphor of penetrate for the process of knowledge has a long history and may also be found in Bacon.
[Rule] I. Be well acquainted with the tongue itself, or language wherein the author’s mind is expressed. Learn not only the true meaning of each word, but the sense which those words obtain, when placed in such a particular situation and order. Acquaint yourself with the peculiar power and emphasis of the several modes of speech, and the various idioms of the tongue. The secondary ideas which custom has superadded to many words should also be known, as well as the particular and primary meaning of them, if we would understand any writer. . . . [Rule] II. Consider the signification of those words and phrases more especially in the same nation . . . of the person . . . Upon this account we may learn to interpret several phrases of the New Testament . . . Remember always, that a writer best interprets himself (Watts, 1809, pp. 92, 93).

The issues dealing with an acquaintance with a language is captured in five related words: of “expressed,” “meaning,” “sense,” “signification” and to “interpret” words. Moreover to Watts an author may use the “. . . same words in a very different sense . . .” so the context must be used to discover the meaning. Words too possess a “true meaning” and the teacher needs to possess them to communicate properly and the student needs to acquire them (Watts 1809, p. 87, 92).

3.3 A separation of ideas, words and things:

The separation in this threefold classification of entities was a well established one in the British tradition by Watts’s time (on this topic see Ulman 1994). Locke presents the distinction clearly in An Essay Concerning Human Understanding:

We should have a great many fewer disputes in the world if only words were taken for what they are, the signs of our ideas only, and not for things themselves. (Locke, 1690, III, 10)

The distinction between these three entities can be seen as a characterizing (and unsettling) feature of modernity: to separate them raises the problem of their relationship, and from Locke onwards the arbitrary connection taken to hold between words and ideas has only heightened the issue of their relationship. Much of 20th century theorizing on language, linguistics and semiotics is woven around Locke’s separation. Watts’s statement of the separation is associated with comments on the functioning of language:

9. Italicizing in quotations here and in the following quotes is mine in order to highlight textually significant words.
When you have learned one or many languages ever so perfectly, take heed of priding yourself in these acquisitions: they are but mere *treasures of words*, or instruments of true and solid knowledge, and whose chief design is to lead us into an acquaintance with *things*, or to enable us the more easily to convey those *ideas* or that knowledge to others... I should make but a poor pretence to true learning or knowledge, if I had not clear and distinct *ideas*, and useful notions in my head *under the words* which my tongue could pronounce (Watts 1809, p. 91).

The first direction for youth is this, learn betimes to distinguish between *words* and *things*. Get clear and plain *ideas* of the *things* you are set to study. Do not content yourselves with mere words and names, lest your laboured improvements only amass a heap of unintelligible phrases, and you feed upon husks instead of kernels. This rule is of unknown use in every science (Watts 1809, p. 150).

The warning is against mere words, detached from things and ungrounded in ideas, a warning that has as an underside the haunting problem of language’s potential to be detached from its referent. Moreover, for Watts the meaning of a language is grounded outside itself. One can find that echoed in various places throughout the text in the relationship between words and ideas such as how the memory is assisted by the acquaintance of words with things and on the contents of memory being associated with “Ideas or propositions, words or things...” (Watts 1809, p. 189). And to take all opportunities to inquire about “the meaning of a word, the nature of a thing, the reason of a proposition...” (Watts 1809, p. 104).10

Of special significance is the depth metaphor: that ideas and notions are “under words.” The expression is used earlier in the text in reference to the imposition of unknown words and phrases in teaching without “any Ideas under them” as a piece of “useless tyranny, a cruel imposition.” (Watts 1809, p. 91). Implicit here is a promotion of language as secondary to prior ideas.

10. William Whewell’s review of Mary Somerville’s *On the Connexion of the Physical Sciences* provides another example of this threefold division: “Words can call up thought as well as things; and in spite of the philosophers of Laputa, with their real vocabulary, the trains of reflection suggested in the former way are often more to our purpose, because more rapid and comprehensive, than those we arrived at in the latter mode” (Whewell 1834, p. 55)
3.4 The problem of the ambiguity of words
One of Watts’s concerns on meaning and language is the problem of the failure of words to have stable meanings. In a chapter devoted to inquiring into the sense and meaning of a writer or author with prescriptions to fix meanings, Watts begins:

It is a great unhappiness that there is such an ambiguity in words and forms of speech, that the same sentence may be drawn into different significations. (Watts 1809, p. 92)

His concern is also present in rules for disputes, that one is to seek the “true meaning” of an adversary and settle the “sense and meaning of the words” in a dispute (Watts 1809, pp. 96, 118). The theme reflects a persistent concern with the ambiguity of language that one finds in the British context, e.g. Francis Bacon in the Novum Organum in Aphorism XLIII. “For it is by discourse that men associate; and words are imposed according to the apprehension of the vulgar. And therefore the ill and unfit choice of words wonderfully obstructs the understanding.” Without giving details Faraday notes the works of Bacon as an early influence on him (an influence that awaits full tracing). The same concern is there in the documents on the foundation of the Royal Society (e.g., in Thomas Spratt’s History of the Royal Society), in the desire for a proper language for discourse about nature, and in 18th century universal language projects.11

In another text that influenced Faraday, Herschel’s Preliminary Discourse of 1830 (see Faraday to Herschel, 10 November 1832, Correspondence vol. 2, p. 87), Herschel expresses the same caution in a discussion on the nature of language. For example, “It is, in fact, in this double or incomplete sense of words that we must look for the origin of a very large portion of the errors into which we fall.” (Herschel 1830, p. 21) For Herschel it was the study of the abstract mathematical sciences that provided us with the training to steady us from the “reeling tempest of conflicting meanings” associated with fragments of thought and with examples of how our “words and signs” are “full and true representatives of the things signified.” (Herschel 1830, p. 22, 20). The texts of Watts and Herschel both point to a cultural anxiety about language having to do with the problem of fixing and stabilizing meanings.

3.5 Priority of the spoken to the written word
One of Derrida’s famous deconstructive examples is directed to what he identifies as a priority given to speech within the western tradition. The priority has made writing secondary. In Of Grammatology, Derrida quotes

11. See for example, the studies by Markley (1993) and Aarsleff (1967).
“Writing is nothing but the representation of speech; it is bizarre that one gives more care to the determining of the image than to the object”—as representative of the tradition (Derrida 1976, p. 27). Speech has been taken to give direct access to the thought of the speaker compared to the written text. A quote given from de Saussure—“Language and writing are two distinct systems of signs; the second exists for the sole purpose of representing the first”—further captures the downplaying of writing (Derrida 1976, p. 30). For Derrida neither the opposition, nor the priority in this pair given to speech can be sustained, rather, speech itself irretrievable has features ascribed to writing. From this perspective several phrases in Watts’s text stand out in privileging speech. In a chapter comparing “Observations, Reading, Instruction by Lectures, Conversation and Study” a clear preference is given to speech, to verbal modes of communication. And with books, the author who could explain the meaning of a obscure passage is absent, in essence, “Books cannot speak” and are “a sort of dumb-teachers” (Watts 1809, pp. 33, 76). Along this line, Watts also has a chapter on the values of “living instructions and lectures.”

Language as well plays a secondary role, as in the reference quoted above to “mere treasures of words” whose role is to lead us to know things and to communicate ideas, a position that goes with the earlier expression of pre-linguistic or textual ideas being “under” words. Again such a belief, familiar to those influenced by the work of Derrida, is one of the “themes” of western thought, in particular that the meaning of a text is grounding in a non-textual reality outside the text such as in nature of an inner form of pre-textual ideas. From a post-structuralist perspective all forms of knowledge on the contrary are taken as being constituted “textually”: “There is nothing outside of the text . . .” (Derrida 1976. p. 158). The control of meaning too for Watts is in the author, as quoted above: “Remember always, that a writer best interprets himself” (Watts 1809. p. 93), contrary to the post-structuralist notion mentioned above of language “writing through” an author.

Another significant features of Watts’s text is the central place given to memory. Without it “there can be neither knowledge, nor arts, nor sciences . . . nor improvement of mankind in virtue or morals, or the practice of religion” (Watts 1809, p. 190). It enables the orator to speak without reading, with a greater possibility of “. . . penetrating the soul and awakening the passions” (p. 190). Various techniques to fix ideas are given, including the promotion of writing: “once writing over what we design to remember . . . will fix it more in the mind than reading it five

12. For a consideration of the speech, writing distinction as it appears in later Victorian language theory see Hirsch (1988).
times.” (Watts 1809, p. 213). Most likely the origins of Faraday’s concern with his memory lie in Watts’s text.

One steady feature of Faraday’s early life is a determination to become part of the world of science. He came as an outsider, socially, intellectually, and culturally to the world around the early 19th century Royal Institution, even if eventually becoming an adept insider. Outsiders tend to keep a consciousness of what was required in order to belong that a native to a world does not possess and often do so in an unsettled way. The post-colonial theorist, Edward Said refers to the state of the exile when in a new land as “the state of never being fully adjusted, always feeling outside the chatty, familiar world inhabited by natives” (Said 1984, p. 35), a description that captures features of Faraday’s life. Such a perspective arguably accounts for Faraday’s sensitive awareness of the practices associated with knowledge and its production and in particular, those to do with language and its function in writing and lecturing. Watts’s text would only confirm this self-consciousness by its promotion of the project of the care and culture of the self by a deliberate exploration of all that goes into improving the mind with a central concern on matters to do with language. The state of being an immigrant to a world, as Faraday was, brings a level of textual reflexivity and awareness rarely possessed by the natives, and in tracing that resides part of the project of this paper ahead.

4. Early Illustrations of Faraday’s Concerns with Modes of Textual Production
Several brief examples illustrate features considered so far. The first is in a talk by Faraday in 1819 to the City Philosophical Society where in a significant passage Faraday drew the distinction between nature and our language about nature. When remarking on the range of views on the nature of topics such as heat Faraday writes:

We may think of heat as a property, or as matter: it will still be of the utmost benefit and importance to us. We may differ with respect to the way in which it acts: it will still act effectually, and for our good; and, after all, our differences are merely squabbles about words, since nature, our object, is one and the same. (Faraday (1819) cited in Bence Jones 1870, vol. 1, p. 272)

Nature is that beyond words and text where real meaning is grounded—that is the same for all. The sentiment here is echoed throughout Faraday’s writings in a similar stress that knowledge is grounded in the “facts” of experiment that can be stated independently of theory. Faraday’s reference to merely squabbles about words matches Watts concern for “mere trea-
sures of words” ungrounded in acquaintance with things. The disavowal of language implicit in this statement invites a deconstructive project that explores its instability in various of Faraday’s texts: the very statement of the position, and its development requires the use of language.

Another example is from Faraday’s 1821–22 “Historical Sketch of Electromagnetism.” In this series of articles Faraday sought to present an overview of various papers on electromagnetism (Faraday, 1821–22). Faraday carefully locates the context whereby the result was presented, and in addition occasionally comments on the mode of presentation of the content. The italicized words in the following excerpts illustrate this feature: “M. Oersted’s own account . . . has been published in your Annals. . . . It is full of important matter and contains in a few words . . . On Sept. 25, M. Arago stated to the Royal Academy of the Sciences . . . On Nov. 13, M. Lehot stated to the . . . On Nov. 13 also M. Ampere read a note . . .” etc. When outlining Ampere’s theoretical views that he was hesitant about, Faraday carefully uses language referring to Ampere’s meaning of terms, what he has chosen to refer to, and what he “means to speak.” The Chemical notes of 1822 too begin with a statement about their nature as texts: “I already owe much to these notes and think such a collection worth the making by every scientific man.” (Faraday 1822 in Tweney & Gooding 1991, p. 3). Together these places point to a consciousness of “textual performativity,” a consciousness evident early in Faraday’s writings.

5. Faraday’s 1831–2 Induction Experiments and Their Textual Expression

Faraday’s experiments on the ways changing electric currents and moving current carrying wires and magnets induce other currents formed a set of experiments of enormous significance for 19th century science. Faraday begins his account of the experiments by defining how he is to use the word “induction”:

The power which electricity of tension [i.e. static electricity] possesses of causing an opposite electrical state in its vicinity has been expressed by the general term Induction; which, as it has been received into scientific language, may also, with property, be used in the same general sense to express the power which electrical currents may possess of inducting any particular state upon matter in their immediate neighbourhood, otherwise indifferent. It is with this meaning that I purpose using it in the present paper (ERE-I 1832, §1, vol. 1, p. 113).

13. References to the Experimental Researches in Electricity will be denoted by ERE following by the series number. All references to ERE are to Faraday (1839–1855).
This is a significant move. The term “induction” was common for describing the effects of static electricity and magnetism in the early part of the 19th century. By placing the effect in this context Faraday has situated his experiments within a tradition of interpretation of electric and magnetic effects in a way that reveals the intertextuality of the passage, as well as entailing Faraday in various complexities when expressing his results. Besides not including magnetic phenomena, which is probably why Faraday later refers in places to the “evolution” rather than the induction of electricity from magnetism, the central complexity arises from the notion of a state simply being associated with an electric current—inductive effects, however, require more than electrical currents, changing electrical currents are needed. There is no apparent inductive effects with steady currents, and Faraday’s concept of an “electro-tonic state” that plays a central if hesitant explanatory role in the paper appears as driven to preserve the surface sense of this definition.

On such a state—the “electro-tonic state”—Faraday carefully indicates how the choice of name has come from “advising several learned friends” and in a letter to a friend on naming this concept he notes in a light-hearted manner: “... What do you think of that; am I not a bold man, ignorant as I am, to coin words, but I have consulted the scholars.” (Faraday to Phillips, 29 November, 1831. _Correspondence_ vol.1, p. 589). Faraday here is undertaking a textual practice of defining that one finds throughout his writing, reflecting a desire to stabilize and fix meanings, a theme in Watts’s text. Playfully in a letter to Abbot in 1812 Faraday remarks: “Definitions dear A. are valuable things and I like them very much...” (Faraday to Abbott, 11 August, 1812 _Correspondence_ vol. 1, p. 17). An epigraph to _Chemical Manipulation_ (Faraday 1827) that has a definition of “manipulator” from a French dictionary reveals the same concern, and a lecture at the Royal Institution during the same years, begins with a careful specification of the meaning of the word “manipulation.”

The passage above is significant for the active textual words: an entity (a power) has been “expressed” by the “word” induction, received into a “language” with a particular “sense” and with a “meaning” according to which he proposes to use it. There is a presence too of the tripartite division of things, words, and ideas in the reference to powers, terms and language, and the idea of induction.

In other places, Faraday labels parts of the induction effects as “magneto-electric” induction and others parts as “volta-electric” induction, defending the introduction of these terms in various ways:

14. Lecture, February 13, 1827: “Philosophy and Practice of Chemical manipulation” (Royal Institution manuscripts, FC4).
For the purpose of avoiding *periphrasis*, I propose *to call* this action of the current from the voltaic battery *volta-electric induction* (ERE-I 1832, vol. 1, §26, p. 7).

The similarity in action, almost amounting to identity between common magnets and either electro-magnets or volta-electric currents, is strikingly in accordance with and confirmation of M. Ampère’s theory . . . but as *a distinction in language* is still necessary, I propose *to call* the agency thus exerted by ordinary magnets, magneto-electric or magnelectric induction (ERE-I 1832, vol. 1, §58, p. 16).

The distinction via *definition* between the two forms of induction can be seen as a pointer to Faraday subtly crafting an identity that distinguishes his work from Ampere, someone whose name appears 17 times in ERE-I, and one whose work forms a theoretical and experimental backdrop to Faraday’s in this series.

Another key term Faraday invokes when describing the relationship between currents, magnets and their movement is that of “magnetic curves.” In a footnote Faraday elaborates:

> By magnetic curves I *mean* the lines of magnetic forces, however modified by the juxtaposition of poles, which would be depicted by iron filings; or those to which a very small magnetic needle would form a tangent. (ERE-I 1832, vol. 1, §114, p. 32)

The term “magnetic curves” was in well established currency at the time. Peter Mark Roget, e.g., in the year of Faraday’s experiments had published a paper on the mathematical construction of such lines in order to represent magnetic forces (for further on the use of the notion of curves at that time see Gooding (1998)). Friedrich Steinle perceptively labels the role of magnetic curves in this passage as “systematizing language” (Steinle 1996). The concept of lines of force came to play an enormous role in Faraday’s thought. In invoking the “magnetic curves” there is a further illustration of intertextuality stressed in the forms of literary theory mentioned above (and seen as more than simply a conscious move as important features of texts are beyond the control of writers). One can explore Faraday’s First Series from this perspective for other words, attending to how his text is structured by the worlds associated with his inherited language.15

15. E.g., Peter Mark Roget’s series, *Treatises on Electricity, Galvanism, Magnetism* arguably appear as a textual backdrop for Faraday’s writing at that time (Roget, 1832). For exploring the relationship between Faraday’s text for the first series and the referee’s reports on it see Anderson (1993).
In addition to defining meaning of terms, Faraday uses other performative words in the text, such as his referring to having “described” in various ways (34 times) and his use of the words “expressed” and “express” (8 times). In this way Faraday, like in the earlier account of the history of electromagnetism, is expressing the nature of textual generation directly, in this case his own, and within his text. Moreover, another aspect of the text is Faraday’s use of the autobiographic “I”, a common feature of Faraday’s writing, and one that may be found in Davy’s texts (see, e.g. Davy 1822). The combined effect of these textual features is to subtly solidify an identity of one in control of the phenomena of nature. Attending, however, to another feature of the text reveals a pattern of Faraday referring to phenomena using general and vague terms such as of “results” (44 times), “phenomena” (22 times), “effect” or “effects” (over 100 times), “power” (34 times), “cause” (12 times) and an even more general pronoun “these” (57 times) often stands alone as the object of a sentence. While the context in the text usually sets the referent the result overall is to say little about the nature of what’s being described. In the spirit of reading against the grain of the text, these general terms can be seen to unsettle and displace the effect of the performative words. In addition, both features point to an influence of Faraday’s lecturing context on his textual generation, a crucial role he occupied within the Royal Institution. And on this point Frank James has observed “. . . Faraday owed the beginning of his career in science to the lecture theatre, and it seems unlikely that he forgot this debt.” (James 2002, p. 226)

Another textual feature is a shifting referent of the phrase “induction of”—in some places it refers to the causal power of a current to induce other currents, in other places to the induction of currents. We can naturally ascribe the latter sense to the phrase due to its later dominance of this meaning. The result is a hovering between a property and an effect, a form of “causal opacity” in the meaning of the phrase, one that in this case services to unsettles Faraday’s surface concern to fix meanings.

These moves in the First Series constitute a set of textual practices, ones where Faraday is mapping out a textual landscape as surely as he is an experimental landscape. The study of Romo and Doncel (1994) on the complex layered creation of the final text over several months bears witness to the struggle that went into its production.

In the Second Series on induction Faraday has a remarkable extension of

16. Tyndall (1868, chapter 5) perceptively comments on vagueness of this sort elsewhere in Faraday’s work: that Faraday’s conception of a current as “an axis of power having contrary forces exactly equal in amount in opposite directions” teaches us “nothing regarding the current.”
the notion and language of “magnetic curves” in a way that also raises textual features. He makes “intersection of the magnetic curves” by a wire the dominant manner whereby induction is understood. Changing currents are seen as setting up what he refers to as “moving” magnetic curves. To Faraday this provides a causal account of the effects:

The law under which the induced electric current excited in bodies moving relatively to magnets is made dependent on the intersection of the magnetic curves . . . seem now even to apply to the cause in the first section . . . (ERE-II 1832, vol. 1, §231, p. 66)

On this Faraday writes:

In such cases the magnetic curves themselves must be considered as moving (if I may use the expression) across the wire under induction, from the moment at which they begin to be developed until the magnetic force of the current is at its utmost . . . On breaking the battery contact, the magnetic curves (which are mere expressions for arranged magnetic forces) may be conceived as contracting upon and returning towards the failing electrical current. . . . (ERE-II 1832, vol. 1, § 238, p. 68)

And in conclusion:

All these in fact are variations of one simple condition, namely, that all parts of the mass shall not move in the same direction across the curves, and with the same angular velocity. But they are forms of expression, which being retained in the mind, I have found useful when comparing the consistency of particular phenomena with general results. (ERE-II 1832, vol. 1, §264, p. 75)

Faraday’s language on one level is that of a causal description, but the magnetic curves which form the central concept of that description are written about as a “mere expression” of the forces, useful to express ideas, and the referent of the phrase “moving curves” is left unclear with the phrase “if I may use the expression.” These two features—a language of causes, yet a reference to the terms as mere forms of expression—are in unsteady relationship, another form of the “causal opacity” to that present in the First Series.17 The legacy of this remained with Faraday to haunt him.

17. Faraday also has a related causal or substantive (material) uncertainty persistently throughout his writing, sometimes acknowledged, as to whether physical phenomena are to be accounted for by properties or entities: e.g., from the passage quoted earlier in §4: “We may think of heat as a property, or as matter” (see also, ERE-VII 1834, vol.1, §852, p. 249, and ERE XXVIII 1851, §3083, p. 332). Davy may be source here, as a similar division may be found in a paper read to the Royal Society in 1821, “Is electricity a subtile
and to return around 20 years later in a series of attempts to clarify the
status of the lines of force. It is as if Faraday is strategically using a causal
language to imply a discourse associated with laws to describe the phe-
nomena as well as (on a textual level) to present the necessary caution the
investigator of nature in the tradition of Bacon must exhibit in proposing
a hypothesis. Faraday’s textual landscape functions as the site for theoriz-
ing, and instead of drawing attention to its conceptual and hypothetical
nature directly, Faraday is using a discourse on the hypothetical nature of
language in scientific reasoning to displace one on the hypothetical nature
of his ideas.18

6. Defining Words and Scientific Thinking, 1834
In the 7th Series of the Experimental Researches, on the electro-decomposi-
tion of chemicals, Faraday begins with a preliminary section defining a
number of terms, ones that still remain part of our terminology. His rea-
soning is that the present terms make it difficult for him to state his own
theory. The first move is to replace the word “pole” with “electrode”:

The poles as they are usually called, are only the doors or ways by
which the electric current passes into and out of the decomposing
body. . . . In place of the term pole, I propose using that of Electrode,
and by that I mean thereby that substance, or rather surface,
whether of air, water, metal or any other body, which bounds the
extent of the decomposing matter in the direction of the electric

For the particular electrodes, Faraday proposes the terms cathode and an-
ode, and cations and anions for the substances attracted to the electrodes
(in general, ions) instead of referring to substances as electronegative and
electropositive. For Faraday on the latter:

But these terms (electro-negative, electro-positive) are much too
significant for the use to which I should have to put them; for
though the meanings are perhaps right, they are only hypothetical,

18. The rhetorical significance of Faraday’s “causal opacity” bears an intriguing al-
though distant resonance to a “strategic opacity,” a rhetorical ploy that Stephen Greenblatt
has recently ascribed to Shakespeare’s plays. By excising various causal explanations to
characters Shakespeare, to Greenblatt, was able to immeasurably deepen the effect of his
plays, as well as release his own energy that was blocked by familiar or reassuring explana-
tions (Greenblatt 2004, p. 43).
and may be wrong; and then, through a very imperceptible, but still very dangerous, because continual, influence, they do great injury to science, by contracting and limiting the habitual views of those engaged in pursuing it. (ERE-VII 1834, vol. 1, §665, p. 197)

And on the new terms:

These terms being once well defined, will, I hope, in their use enable me to avoid much periphrasis and ambiguity of expression. I do not mean to press them into service more frequently than will be required, for I am fully aware that names are one thing and science another.¹⁹ (ERE-VII 1834, vol. 1, §666, p. 198)

William Whewell was the one Faraday consulted on these terms, someone he continued to consult on numerous other occasions. Indeed in a letter to Whewell on these names, Faraday remarks:

I wanted some new names to express my facts in Electrical Science without involving more theory than I could help & applied to a friend. . . . (Faraday to Whewell, 24 April 1834, Correspondence vol. 2, p. 176)

Later Whewell suggested the words paramagnetic and diamagnetic for magnetic properties of substances and in one of his letters to Faraday pointed to a value to watch for in the crafting of new words:

I am always glad to hear of your wanting new words, because the want shows that you are pursuing new thoughts, and your new thoughts are worth something: but I always feel also how difficult it is for one who has not pursued the train of thought to suggest the right word, There are so many relations involved in a new discovery and the word ought not glaringly to violate any of them. (Whewell to Faraday, 12 August, 1850, Correspondence vol. 4, p. 169)

Thus to Faraday proper names were crucial to good scientific thinking, with a special attention needed for words embodying ideas that contained precisely that which the phenomena was taken to suggest. But then Faraday’s ambivalent view of language as mere words is present in the phrase “names are one thing and science another” suggesting the presence of the phenomena and facts of experiment independent of their expression. At places like this, a deconstruction suspicion is raised, inviting one to

¹⁹ A footnote to this paragraph contains one of the places Faraday echoes Locke’s threefold things-ideas-words division. Faraday expressed the hope that new terms he had used were “simple in their nature, clear in their reference, and free from hypothesis.”
attend to the way such a disavowal of language is undermined by tensions and the texture of his writing and so by the very centrality Faraday gives to the concern with language and meaning and its necessity to state the issues.

A further feature of many of Faraday’s definitions that have to do with electromagnetic phenomena is that they are often relative terms, terms such as cathode and anode, and paramagnetic and diamagnetic form pairs that express relative knowledge and the sort often to avoid any commitment to theory about the nature of electric currents and magnetism. They define by difference, a feature that touches another aspect of post-structuralist (and structuralist) focus on meaning: meaning is often generated by differences in structures.

7. Clarifying the Nature of Magnetic Lines: the Struggle with Meaning and Representation, 1851–52

Faraday’s discovery in 1845 of the rotation of polarized light by a medium in a magnetic field opened out a new series of reflections on the nature of magnetism and a return to his earlier thoughts on magnetic lines or curves. Faraday had called his paper on this phenomena: “On the magnetization of light and the illumination of magnetic lines of force” and in a note on the published version remarked that the phrase had generated confusion. He had not meant he had rendered them visible, rather their effects had been rendered visible. Early in the Series Faraday notes:

But before I proceed to them, I will define the meaning I connect with certain terms which I shall have occasion to use—thus by line of magnetic force, or magnetic line of force, or magnetic curve, I mean that exercise of magnetic force which is exerted in the lines usually called magnetic curves, and which equally exist as passing from or to magnetic poles, or forming concentric circles round an electric current. (ERE XIX 1845, vol. 3, §2149, p. 2)

Then beginning with a talk at the Royal Institution in April of 1851, through several publications over the next two years Faraday addressed the nature of the magnetic lines or curves. They form an extraordinary set of explorations from the perspective of a project concerned with text and meaning in Faraday and at the moment I can only highlight the way in which Faraday often posed the issues, viz., as one having to do with meaning and representation. In the Royal Institution talk, Faraday writes:

External to the magnet those concentrations which are named poles may be considered as connected by what are called magnetic curves, or lines of magnetic force, existing in the space around. These phrases
have a high meaning, and represent the ideality of magnetism. They imply not merely the directions of force, which are made manifest when a little magnet or crystal or other subject of magnetic action is placed amongst them, but those lines of power which connect and sustain the polarities, and exist as much when there is no magnetic needle or crystal there as when there is; having an independent existence analogous to (though very different from) a ray of light or heat . . . (Faraday 1839–55, vol. 3, p. 323).

Faraday’s way of stating their significance is to label them as having “high meaning” with an obscure phrase: they “represent the ideality of magnetism.” In the 28th Series later in 1851, Faraday outlines a project of clarification:

From my earliest experiments on the relation of electricity and magnetism. . . . I have had to think and speak of lines of magnetic force as representatives of the magnetic power; nor merely in the points of quality and direction, but also in quantity. The necessity I was under of a more frequent use of the term in some recent researches (2149. &c) has led me to believe that the time has arrived, when the idea conveyed by the phrase should be stated very clearly and should be carefully examined, that it may be ascertained how far it may be truly applied in representing magnetic conditions and phaenomena . . . how far it may assist in leading the mind correctly on to further conceptions of the physical nature of the force (ERE-XXVIII 1851, vol. 3, §3070, p. 328).

Here the threads of language, of ideas, phenomena, and the issue of representation are all present. Moreover, a heuristic role of the idea is alluded to: a good concept will lead to new productive thinking about nature. Faraday takes up the latter feature in a more speculative article in the Philosophical Magazine in 1852, noting how these ideas “may lead on, by deduction and correction, to the discovery of new phaenomena . . .” (Faraday 1839–55, vol. 3, §3244, p. 408) and how the “study of these lines have, at different times been greatly influential in leading me to various results, which I think prove their utility as well as fertility” (ERE-XXVIII 1851, vol. 3, §3174, p. 368).

At this point too Faraday begins to separate out the lines as purely representative of the conditions of force from the issue related to the physical nature of that force:

I desire to restrict the meaning of the term line of force, so that it shall imply no more than the condition of the force in any given place, as to strength and direction; and not to include (at present)

And then later:

Having applied the term line of magnetic force to an abstract idea, which I believe represents accurately the nature, condition, and comparative amount of the magnetic forces, without reference to any physical condition of the forces, I have now applied the term physical line of force to include the further idea of their physical nature (Faraday 1839–55, vol. 3, §3299, p. 437)

Another property of magnetism, polarity, also emerges in Faraday’s discussions, one Faraday also frames as an issue of “meaning.” From 1851:

If the term polarity has any meaning, which has reference to experimental facts and not to hypotheses only, beyond that included in the above description, I am not aware that it has ever been distinctly and clearly expressed (ERE-XXVIII 1851, vol. 3, §3155, p. 360).

And later in an article in the Philosophical Magazine in 1855:

The meaning of this phrase (magnetic polarity) is rapidly becoming more and more uncertain... (Faraday 1839–55, vol. 3, §3307).

The numerous meanings of the term polarity, and various interpretations of polarity at present current, show the increasing uncertainty of the idea and the word itself Faraday (1839–55, vol. 3, §3308).

Faraday’s persistent exploration of the nature of magnetic forces in his last papers reveal the extent to which they are dominated by a discourse on meaning and reference. While this set of textual practices has only been sketched briefly here it is sufficient to indicate how deeply the texture of his thinking is determined significantly by such textual practices. Their presence balance Gooding’s claim of the importance of “non-verbal modes of representing sensory and mental experience” residing in instrumental procedures prior to their articulation in “verbal or visual imagery” (Gooding 1989, p. 192), at least in the sort of struggle evident in Faraday here on matters to do with representing the magnetic field.

8. Strategies for Dealing with Controversy: a Matter of Meanings of Words

Another context where Faraday invoked the meaning of words was in controversies. I will allude to two of them, the first is his exchange with R. Hare of Pennsylvania in 1840 on the nature of transmission of the static electrostatic force. The issue was a good one: how could Faraday dis-
tistinguish his view of forces transmitted between adjacent particles from an action at a distance view, since even with adjacent particles there is a space between them between which the force must act? In his response Faraday’s invoking the issue of meaning of words occurs as follows:

As the reconsideration of them (his earlier remarks on electrostatic action) has not made me aware that they differ amongst themselves or with facts, the resulting impression on my mind is, that I must have expressed my meaning imperfectly, and I have a hope that when more clearly stated my words may gain your approbation. I feel that many of the words in the language of electrical science posses much meaning; and yet their interpretation by different philosophers often varies more or less, so that they do not carry exactly the same idea to the minds of different men; this often renders it difficult, when such words force themselves into use, to express with brevity as much as, and no more than, one really wishes to say. (Faraday 1839–55, vol. 2, p. 262)

The obscurity in my papers, which has led to your remarks . . . as it appears to me (after my own imperfect expression), from the uncertain or double meaning of the word “discharge” (Faraday 1839–55, vol. 2, p. 270)

To Faraday then the problem the lies in inherited words that have a variety of meanings that allow of different interpretations. It is not his ideas so much as his manner of exposition that is at issue.

Then in 1857 Faraday gave a lecture at the Royal Institution entitled “On the Conservation of Force” where he seemingly questioned the inverse square law of gravitation by raising issues about the origin and cause of forces. The lecture provoked a critical response by Augustus De Morgan in The Athaneum as well as other adverse reactions, and in a supplementary note a year later, on republishing the lecture, Faraday remarks:

During the year that has passed since the publication of the preceding views . . . I have come to knowledge of various observations upon them, some adverse, others favourable, these have given me no reason to change my own mode of viewing the subject, but some of them make me think that I have not stated the matter with sufficient precision. The word “force” is understood to mean simply “the tendency of a body to pass from one place to another,” which is equivalent, I suppose to the phrase “mechanical force” those who so restrain its meaning must have found my argument very obscure. What I mean by the word “force,” is the cause of a physical action . . . (Supple-

Faraday’s response, as before when in controversy, is to give prominence to matters of language and interpretation in carving out a space for his position and moreover to write from a perspective stated in Watts’s text “that a writer best interprets himself.” In places though, Faraday’s attempts to fix and clarify meanings hint at a task that gets away from him.

9. Recapitulating Themes of an Early Inspirational Text

My last example is a brief one from a talk Faraday gave in 1854 at the Royal Institution entitled “Observations on Mental Education” where themes of his first lectures at the City Philosophical Society re-emerge along with those of his master formative text of Isaac Watts. The crucial value for Faraday for the life of the mind is correct judgment; a prerequisite is clear ideas:

One exercise of the mind, which largely influences the power and character of the judgment, is the habit of forming clear and precise ideas. . . . Before we proceed to consider any question involving physical principles, we should set out with clear ideas of the naturally possible and impossible. (Faraday 1855, p. 478. Italic emphasis in the original)

Then the importance of language:

In like manner we should accustom ourselves to clear and definite language, specially in physical matters; giving to a word its true and full, but measured meaning, that we may be able to convey our ideas clearly to the minds of other. Two persons cannot mutually impart their knowledge, or compare and rectify their conclusions, unless both attend to the true intent and force of language. (Faraday 1855, p. 480)

That issues of language follow those of forming clear and precise ideas (notions with a long lineage) reflects again Faraday’s position of giving a priority to ideas (and the facts of experiment) rather than to matters to do with their expression and language.

10. Exploring Further Faraday’s Contexts and Projects Ahead

Faraday’s deep concern with language, while grounded in his early formative influences, reflects a long British tradition of reflection on language and its place in knowledge. Education too in the classical languages was a way into an elite culture, a phenomenon perhaps behind the child-rearing
practices at the turn of the century and early in the 19th century that resulted in extraordinary childhood acquisition of remarkable numbers of languages by figures such as Thomas Young in England and William Hamilton in Ireland. As well, particular issues having to do with language and signs abound at that time. Thomas Young’s work, for example, on deciphering the Rosetta stone and the priority controversy with Champollion had raised the issue of hieroglyphics and their interpretation in the 1820s in a public manner. In various contexts one finds use of the notion of hieroglyphics as an illustration of issues to do with interpretation and meaning.20 Language is also a central theme in Mary Shelley’s Frankenstein. The manner in which the Monster learns a language reflects Locke’s ideas of an arbitrary link between words and things, attesting again to the importance of the language tradition set by Locke. Learning a language is the Monster’s way to join humanity and through language he communicates with his creator but through it he also discovers the pathos of his situation. To one recent commentator, the problem of the monstrous is played out above all in the “question of language” and “in the Monster’s use of language the novel poses its most important questions, for it is language alone that may compensate for a deficient, monstrous nature” (Brooks 1978, p. 593). For Shelley language proficiency leads to belonging and identity.

Moreover, Faraday’s religious world, where interpreting the bible was a central concern (a major theme in Watts’s treatment of language), provides a further context for his scientific theorizing (on this see Cantor 1991).

In addition, and briefly, the following all point to a deep and pervasive concern with language and sign in a general sense that spans early 19th century British culture from literature through to mathematics: a concern with notation in chemistry and mineralogy (a matter of special interest for Davy, see Knight 2003); the formation of the Philological Association of London in 1842 (see Aarsleff 1967); the extensive discussions of the meaning of the symbols in the abstract algebra formed in the 1830s and 1840s (e.g. Peacocke 1830); the reform of the notation of calculus in Cambridge some decades earlier; and the reflections on the interplay of language and logic, from Richard Whately’s influential Elements of Logic continuing

20. E.g., Augustus De Morgan in his opening lecture of his mathematics course at the University of London in 1828, illustrated the absence of meaning of a page of mathematics to the uninitiated as like confronting a “system of hieroglyphics.” (De Morgan Papers, University College London. MS ADD 69), and the botanist John Lindley’s textbook of 1846 used the phrase that the “language” in which nature is written “is not indeed human; it is in the living hieroglyphics of the Almighty, which the skill of man is permitted to interpret” (Lindley 1846, p. viii).
through the work of George Boole mid-century and beyond. Exploring textual practices for generating meaning within Faraday’s writings then provides contextual projects to locate their resonances in contexts such as these that occur in the larger cultural and intellectual landscape.

Exploring another set of Faraday’s writings, his extensive laboratory notes, with an eye to the production of meaning from the resources of literary theory is a project left untouched here. Here the approach “New Historicism” of recent literary theory with its stress on how texts of various kinds, such as Faraday’s published texts and his laboratory notes, “circulate inseparably” (Wolfreys 1999, p. 421) has potential to provides ways to explore how textual features of both sorts of texts are related and find their way into the crafting of scientific meaning (complementing the study in Tweney 1991 and the speculation there that Faraday’s desire for law like order in nature found its way into the textual ordering evident in his notes).

As noted earlier, Faraday writes as if to give a priority to ideas and the phenomena of experiment (things) rather than to language (he will though refer in places to the need to interpret experiment). The role of language is to communicate ideas.21 The judge of theories is always experiment, and words appear as bypassed in referring to an abstract idea representing a physical condition. From a post-structuralist perspective all forms of thinking and representing are textual. Such a position suggests a project characteristic of the deconstruction practices in literary theory of exploring how Faraday’s position on the secondary nature of language undermines itself as hinted at above. The clearest evidence of this is in the way language remains to the foreground in his writing on key themes such as the lines of force: he cannot escape the place of language in his thinking and writing. By revealing such stress or fault lines in textual functioning and the creation of meaning, potential indications of the (partly unconscious) functioning of language in thought is brought to the surface.

Faraday’s reflections on language consider the problems of inherited words and phrases and the ideas they carry with them. Scientific thinking is structured by the words it inherits, an issue stressed in the Baconian British tradition of reflection on language and science, and Faraday represents an excellent example of that tradition.22 In a complex “meta-level

21. Faraday on this is reflecting a widespread understanding of language in the early 19th century. E.g. William Brande, Davy’s successor at the Royal Institution, referred to language as “the expression of our ideas and their various relationships . . .” (Brande 1842, p. 632).

22. See Bradbury 2003 for a consideration of the influence of Bacon on subsequent prose styles in science writing.
manner” Faraday also weaves these considerations into his actual scientific practice. The latter presents a complex interrelated textual and cognitive dynamic, one to do with the retention and extension of meaning and one crucial to science and Faraday’s texts provide a series of clear and interesting examples of such a process.

One of Derrida’s themes is of an extended notion of writing, an “arche-writing” which dwells on a writing that is a system of signs that refer to each other in functioning to generate meaning (Derrida 1976). It is common to and pre-exists writing and speech as commonly understood. The notion can be seen as broadening the notion of “text” from words, written and verbal, to texts as general symbolic structures such as images that work through their differential structures to generate meaning. The questions of meaning and mathematics that followed Peacock’s work on abstract algebra in the 1830s, for example, can productively be explored with some of the approaches sketched above, taking mathematics as a “text.” Here too the projects of this paper potentially overlap and align with those of David Gooding’s in this issue. A Derridian perspective, however, where divisions such as the speech-writing opposition are questioned (see section 3.5), would instinctively see the image-verbal division in Gooding’s study (where the latter of the pair is seen as aligning with higher level more abstract modes of reasoning), as dissolving to some extent on examination. The boundary blurs in a deeper way than allowing a hybrid from of “word-image” reasoning considered in the paper. “Images” consisting of figures and diagrams can themselves be seen possessing features of “texts.”

These last few features call for a more sustained analysis, one that explores ways in which cognition, via language as well as images is grounded in, structured by, and saturated by various (sometimes diverse) local cultures. In Simon’s words: written texts, literary and other, provide rich sources for understanding cognition. Such an undertaking provides energy for new historical projects too, ones alert to the issues of cognition and literary theory. Here, in addition to the resources of contemporary literary theories, those of the cognitive sciences aid in bringing added features in the texts from the archive to the foreground for the historian of science to trace.

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