LITERATURE, EXACT AND BIOPHYSICAL SCIENCES

Isabel Capeloa Gil
Faculty of Human Sciences, Catholic University of Portugal

Keywords: Comparative literature, history of science, objectivity, subjectivity, conflicting paradigms, scientist

Contents

Summary

The notion of science and the scientific has been changing rapidly from the 18th century onwards, shifting from a model of integrated knowledge that comprehended both the so-called human as well as the exact sciences into a model of sedition, epitomized in the image of the two cultures. The article deals with the historical, cultural and epistemological background that has led to the concept of literature and science as separate star-crossed spheres and discusses models of interaction between the two. On a micro scale, the study then moves on to describe how literature integrates and discusses scientific discoveries and how the exact sciences draw on aesthetic energies to convey their discoveries and also use literary metaphors as rhetorical devices to explain their theories. Special attention is also devoted to the writer as scientist and to the scientist as a literary character. By viewing literature and science as value systems and, the article argues that there is a reciprocal illumination between the two fields that goes beyond ideological and professional arguments in favor of a separation of the spheres, and is deeply grounded on the fact that all science is practiced by embedded subjects, so that all science is indeed human science.

1. Science and Literature: theoretical debates

The star-crossed relation between Western arts and sciences, that came to be known as the “two cultures”, after C.P. Snow’s influential 1959 Rede Lecture, is neither new to the academia in the field of humanities nor to historians of science, but has in fact acquired a new momentum in the 20th century. The radical change in traditional ways of life brought about by the increasing presence of technology in the social tissue has displaced the debate from the academic milieu and renewed it with energies arising from the community’s awareness of the clash. For the sake of textual economy this article will use the term science to refer to a body of knowledge involving rigorous universal laws, modeled on mathematics, and particularly including the exact sciences,

mathematics, physics, astronomy, chemistry and engineering sciences, as well as the natural sciences and sciences of the body, biology, medicine, genetics, gene technology, as well as geology.

However, as late as the 19th century, science was still perceived as a variety of literature. In fact, not only were Newton's *Principia*, Benjamin Franklin's *Electricity* and Lavoisier's treaty on Chemistry understood as both scientific and literary works, as the scientist, under the denomination of the natural philosopher, was essentially perceived to be a humanist. The noun scientist is reported to have been coined in 1833 by William Whewell at a meeting of the British Society for the Advancement of Science from the model of the term artist. Noted the absence of a fitting term to describe researchers of natural phenomena, scientist was chosen as more representative over the current expression natural philosopher, which was perceived as not sufficiently distinct from its usage in philosophy. The trend to stress the separation between the arts and natural science followed in the footsteps of the laws devised almost a century earlier by the Enlightenment philosophers, namely their defense of a natural, enlightened and objective science, unhindered by the shackles of tradition and not blinded by emotion. Others still believed in the necessary articulation between the *belles letters* and the new scientific project and drew on the issue of morals to enhance their views. In the wake of the Lisbon earthquake (1755) the Marquis de Condorcet argued that the harmonization of the arts and the natural sciences would not only bring about global tolerance and a stricter control of natural phenomena but also promote progress, justice and happiness. That was also the point made by Jean-Jacques Rousseau in his address to the Dijon Academy (1750), entitled *Discours sur les sciences et les arts*, where he argued that the natural sciences separated from the arts would not contribute to the moral advancement of humanity. However, the cover of Denis Diderot and d'Alembert's *Encyclopédie* (1751-1772), showing a female figure treading under the sun of reason is a remarkable icon of the universal enlightenment project, and its institution of an objective natural science.

Despite calls for a dialogical articulation and not less so because natural and exact scientists, due to the incipient development of the mathematical language, still used the same language as literature to put across their views (Michael Faraday, James Clerk Maxwell, Charles Babbage, Luigi Galvani or Louis Pasteur) the gap was to be definitely widened along the 19th and into the 20th century. A remarkable debate on the place of science and literature within the canon of classical academic education ensued in the 1880's between T. H. Huxley and Matthew Arnold. In the speech "Science and Culture" given in 1880 at the Royal Academy, T. H. Huxley defended a revision of the curriculum in favor of a predominance of scientific subjects against the ineffectual and slight study of the *belles lettres*. Responding to Huxley, Matthew Arnold in the 1882 Cambridge Rede Lecture "Literature and Science" privileged the humanities, arguing in favor of literature as the "large word" that could encompass the whole of the world and engaging Newton, Euclid, Galileo and Darwin as rightful literary authors.

Another Cambridge debate in the 20th century would dress old arguments in new clothes. In 1959, C. P. Snow, again in the Cambridge Rede Lecture, presented the view that there is a "gulf of mutual incomprehension" between literary scholars and scientists, caused by a flaw in education strategy that has prompted specialization at a far early stage of the curriculum and led to a debasement of traditional liberal education. Responding to Snow in 1962 F. R. Leavis criticized C. P. Snow's appraisal in the Rede

Lecture, by branding it an intellectual embarrassment and considering Snow's call for literary scholars to be acquainted with the Second Law of Thermodynamics and physicists with Shakespeare an example of academic dilettantism.
Both this and later debates surrounding the relation between arts and sciences dwelt over the grounds of scientific knowledge. The epistemological claim to truth as the outcome of research resulting from measurement methods to test the validity or falsity of the hypothesis lay at the ground of a wider discussion which led to the questioning of the scientific nature of research within the humanities. Can there be an objective knowledge within the practice of research in the humanities? Can research be measured? Are relations of cause and effect pertinent to the study of literature as an object of science? Can the results of this practice lead to the discovery of universal laws? These questions that are pertinent to the paradigmatic definition of a field of study within instrumental science may be weighed differently in literary analysis. On the other hand, issues that are pivotal in contemporary research in the humanities, such as the question of power, identity or diversity are not to be slightly disregarded as subjective and thus outside the scope of real science, as the intervention of the researcher acquires new visibility within the practice of the exact sciences. As chemist Ilya Prigogine has stated, science too has moved from a world of certitude into a world of probability and reality has increasingly become a construct set by the observer (Prigogine, Stengers 14). The importance of the interaction between literature and science has been widely acknowledged and recognized in the most important associations of the field. "Science and Literature" is a an important sub-field within the activities of the ICLA (International Comparative Literature Association) and since 1939 there has been a discussion panel on this theme at the annual convention of the MLA (Modern Languages Association).

In fact, the debate that has became known within the English-speaking academic tradition as that between "sciences" and "humanities" refers indeed to a methodological distinction between "natural sciences" and "human sciences" (*Geisteswissenschaften*), defended by German philosopher Wilhelm Dilthey (1900), who distinguished between the explanatory mode of the natural or exact sciences based on practices of measurement and addition, and the interpretative, i.e. hermeneutical, approach needed for human sciences, grounded on the notion of understanding.

Whilst the hermeneutical tradition lay its roots within the German academia, as epitomized in Emil Staiger's dictum that the literary scientist (*Literaturwissenschaftler*) lacked either the sense for literature or for science (Staiger 60), both the new critics in the U.S. as the structuralists in Europe drew on the formalist tradition to uphold a form of empirical research focused on the material regularities of the text and on a problem solving outlook, thus trying to establish causal relations among the several dimensions of the literary system. Moreover, within the history of science in the 1960's and particularly due to the work of Thomas Kuhn, knowledge was understood to be fundamentally scientific knowledge (Kuhn 9), i.e. submitting to the measurement and addition paradigm of the exact sciences. Drawing on this tradition, arguments have been made particularly within the scope of the empirical studies of literature in favor of a structural modeling of the field of research according to the paradigm of normal science. However, George S. Rousseau, in a 1978 article on "Literature and Science: The State of the Field", published in the journal *Isis,* argued that researchers of literature and science were not able to formulate solid scientific questions and respond with adequate

theory, presenting structuralism as a strong theoretical backbone for further advancement (Schatzberg 18). Stating that scientific knowledge is acquired through methods that may be repeated, validated, falsified (K. Popper, Feyerabend) and tested, Douwe Fokkema and Elrud Ibsch have argued for their universal dimension, stating that scientific methods may be applied to all disciplines and under any cultural context (Fokkemma, Ibsch 17). The methodological debate became more complex when Wolf Lepenies (1985) proposed the introduction of a third category, that of "social sciences" that would differ both from the natural and the human or cultural sciences and turn the two culture debate into a three-culture one. The epistemological assumptions at the base of each argument foreground a problem of quite a different nature, as Douwe Fokkema has argued (Fokkema 18), in that they justify a division of labour among the different branches of the university. The debate must therefore be perceived under a threefold perspective: epistemological (the questioning the paradigmatic dimensions of the different field of knowledge and the nature of knowledge itself), social (the impact of the theoretical discussion in the social structuring of the scientific community) and cultural (the way in which the two former reflect on the cultural identity of practitioners and impact their surroundings).

Despite the statements of dissent between the practice of the natural sciences and that of the humanities and coming both from the exact sciences arena (E. Schrödinger, T. Kuhn, A. Eddington) and the literary scholarship side (Leonard B. Mayer, George Levine, Odo Marquard, Emil Staiger), others have argued for the unalienable link between the two. Stemming from the notion that all knowledge is basically human-based, subjective and value-laden, philosopher Friedrich Nietzsche (1873) argued in "Über Wahrheit und Lüge im aussermoralischen Sinne" that scientific knowledge depends on its empirical appropriation by the subject. Science without subjectivity thus becomes the "grave of perception". The argument for a human-based knowledge and a human-dependent science was in fact already acknowledged by E. Kant in his first Critique when stating that only that which could be submitted to the a priori categories of knowledge, space and time, could truly be known. In the late 1950's, Karl Popper moves further in this direction by arguing that all science is practiced by human beings laden with values, embedded in social communities and with different identities. Science is therefore a human practice so that foreclosing the claims to absolute objectivity and human distinction he argued that all science is human science.

-
-
-

Bibliography

Barthes, R. (1977). *Image, music, text*, New York: Farrar, Straus and Giroux. [Included in the selection of texts is Barthes' 'The Structural Analysis of Narrative' where, by drawing on the simile of Newtonian

physics, the author argues that Structuralism disrupted the work of art as unity and substituted it by the text as a network of diversity relations, where the absolute categories of author, reader and critic are displaced and intermingled.]

Beer G. (1996). *Open Fields: Science in Cultural Encounter*, New York: Oxford U. Press. [Beer treats the presence of scientific discourse in cultural and literary environments by focusing particularly on the impact of Darwinism and on Victorian encounters between Art and Science, whilst also discussing the literary dimension of scientific discourse, particularly with a focus on the structure of description, allusion and parabolic writing. The author draws from instances of human encounter between Europe and its Others in the 19th century to ask how new scientific developments affect the experience of humanity and how this is in turn refracted by scientific knowledge].

Brandstetter G., Neumann G. (2005). *Romantische Wissenspoetik. Die Künste der Wissenschaft um 1800*, Würzburg: Königshausen & Neumann. [The collection of essays draws on German Romanticism's poetics of knowledge in order to show the deep affinity between the development of science in the nineteenth century and romantic literary theory. Going well beyond the theory of universal poetry as put forward by the Jena group, the essays provide an in-depth and up-to-date look on the impact of scientific developments in the performative arts or on how medicine discourse is pervaded by literary impressions].

Bruce, D.; Purdy, A.(eds.) (1994). *Literature and Science*, Amsterdam: Rodopi. [This is a selection of essays providing a good insight into current trends in literature and science research and how this affects disciplinarity].

Daston, L.; Galison, P. (1992). "The Image of Objectivity", *Representations* 40, 1992, pp. 81-128.

Daston, L.; Gallison, Peter (2007). *Objectivity*, New York: Zone Books. [The essay and book by Daston and Gallison analyze scientific images in order to chart the emergence and development of the idea of objectivity in mid-nineteenth-century sciences. Their work shows how epistemic ideas were pervaded by everyday views, hence disclosing objectivity as a historical and social construct, associated with changing views of the practices of seeing and a social valorization of sight over the other senses].

Fokkema, D.; Ibsch, E. (1999). *Knowledge and Commitment. A Problem-Oriented Approach to Literary Studies*, Utrecht: U. Utrecht. [Fokkema and Ibsch's standard work on the knowledge-based dimension of literature. By arguing that nowadays literary scholarship is not purely literary, the authors test a problem-oriented methodology for the study of literature. They draw from systems theory, empirical analysis and the social sciences to address issues as canon formation, literary historiography and literary analysis].

Gilman, S. (1985). *Difference and Pathology: Stereotypes of Sexuality, Race and Madness*, Ithaca: Cornell U. Press. [This is Sander Gilman's standard work on the cultural value of scientific views on sexuality and race in the 19th century and on the role literature and the arts have played in the dissemination of such ideas].

Haraway, D. (1991). *Simians, Cyborgs and Women. The Reinvention of Nature*, London: Free Association Books. [Donna Haraway's book has become a standard reference of cyberfeminism. The book focuses on the invention, transformation and reconstruction of nature in the 20th century and on the metaphorical role woman has played therein. In 'A Cyborg Manifesto', Haraway argues for a renewed form of embodiment that by blending a cybernetic mechanism with a natural body will definitely embody a post-human world overcoming the cultural debasement of women within the nature-sex conundrum].

Hayles N.K. (1984). *The Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth Century*, Ithaca: Cornell U. Press.

Hayles N.K. (1990). *Chaos Bound: Orderly Disorder in Contemporary Literature and Culture*, Ithaca: Cornell U. Press. [Katherine Hayles has become one of the reference thinkers on the negotiation between scientific models and literature in the 20th century. *The Cosmic Web* Hayles discusses quantum and relativistic field theories in Nabokov, Borges and Thomas Pynchon amongst others. In *Chaos Bound*, she draws from Chaos Theory to argue that many of the facets of the chaos paradigm such as a sensitivity for initial conditions, the search for similarity within seemingly disorderly events and the revelation of order within disorder are already inhabited by literary authors, critics and scholars].

Haynes, R. D. (1994). *From Faust to Strangelove: Representations of the Scientist in Western Literature*. Baltimore: Johns Hopkins University Press. [The book provides a comprehensive analysis of the scientist character in literature, focusing on the issues surrounding his demonization and euphoric celebration].

Jordanova, L. (1989). *Sexual Visions. Images of Gender in Science and Medicine between the Eighteenth and Twentieth Centuries*, Madison: The University of Wisconsin Press. [This is an historical account on the changing views of gender in science between the 18th and 20th centuries. By arguing that scientific views are always 'fluid', Jordanova draws from an interdisciplinary methodology to gather arguments from literature, philosophy, medical history and psychoanalysis, hence showing a continua between medicine and other fields of knowledge].

Kuhn T. (1970). *The Structure of Scientific Revolutions*, Chicago: Chicago University Press. (This is a standard work on the structuring of modern science according to paradigmatic shifts built on scientific revolutions and the implementation of change upon scientist communities by means of a new consensus on methodologies and theories).

Lacoue-Labarthe, P.; Nancy, J.L. (ed.) (1978). *L'absolu littéraire. Théorie de la literature du romantisme allemande*, Paris: Seuil. [A collection of essays by German romantics from the Jena group, which is particularly important for the discussion of German Romanticism's views on the syncretic nature of universal poetry as a holistic approach to science and art].

Popper K. (1959). *The Logic of Scientific Discovery*, New York: Farrar and Strauss. [This is Popper's standard work for the structuring of scientific discovery and its implementation according to falsification mechanisms. The author argues further that this same mechanism of falsification testing for science should be implemented in social theory, hence arguing for a proximity between the natural and the social sciences].

Prigogine I., Stengers I. (1996). *La fin des certitudes*, Paris: Éditions Odile Jacob. [A state of the art discussion by physicists Prigogine and Stengers on the disruption of certainty in science that provides an enlightening view of modern physics and its relation with cultural relativity].

Otis L. (ed.) (2002). *Literature and Science in the Nineteenth Century. An Anthology*, Oxford: Oxford University Press. [A collection of key literary and scientific texts from the 19th century, ranging from Poe and Kleist to Faraday and Galvani where the interaction between literary discourse and scientific development becomes apparent].

Schatzberg, W.; Waite, R.; Johnson, J. (1987). *The Relations of Literature & Science. An Annotated Bibliography of Scholarship 1880-1980*, New York: The Modern Language Association of America. [One of the most complete bibliographic tools on the research on literature and science].

Staiger, E. (1971). *Grundbegriffe der Poetik*, Munich: Fink. [First published in 1946, this is Staiger's polemical argument against the articulation between literature and science or literary scholarship and scientific methodology. Staiger follows Hegel's idealist hierarchy of the arts and sciences to support his outdated views].

Biographical Sketch

Isabel Capeloa Gil is Professor of German and Comparative Culture at the Catholic University of Portugal and holds a Ph.D. from that same university. She is currently the Dean of the School of Human Sciences at the Catholic University of Portugal (Lisbon) and the Vice-President of the Portuguese German Studies Association. Her main research areas include intermedia studies (literature and dance), modern and postmodern drama, gender studies as well as representations of war in literature and film and her work has been published in *Orbis Litterarum*, *Dedalus*, *Runa* as well as *Colloquia Germanica* and *Mythe et Modernité.* She is the author of *Mythographies.* (Lisbon, 2004), and co-editor of *Landscapes of Memory. Envisaging the Past/Remembering the Future*, Lisbon 2004. Her current work reflects on representational strategies and she has recently published several articles on the physics and literature. She has been visiting Professor at the University of Wales (Lampeter), at the National University of Ireland (Galway), at the Universität des Saarlandes (Saarbrücken), at the University of Hamburg as well as at the Western Michigan University (USA).