This paper has a double aim: to draw a general outline of the critical reflection on the relationship between science and literature in the past, and to classify the possible modes of inquiry into this subject at present. It is clear that our aim here can only be to offer the widest of panoramic views, since a detailed discussion of any of the issues involved would afford subject matter for whole treatises.

In the field of literary theory and criticism, it is Plato who broaches in an explicit way the question of the relationship between literature and knowledge. His immediate concern is the use of literature for education, for the acquisition of reliable knowledge, and he discusses whether "good poets really have sound knowledge of the things on which they are popularly supposed to speak well" (1962: 46). His conclusion is so emphatic that it threatens to close the debate forever: poets, and all artists, are imitators, and "the imitator knows nothing worth mentioning of what he imitates, but his imitation is a sort of game and not serious" (1962: 49). Poetry, then, does not provide knowledge; the most it can do is try to follow other disciplines; it is not exploratory in its own right, and its inner consistency is of a borrowed nature.

The Platonic position is challenged by Aristotle with a double argument:

a) Poetry does not need to borrow technical knowledge from other disciplines, since it is relatively indifferent to literal truth. The poet has a technique of his own to worry about: he is a "maker of plots," designs of human action, intention and values which are only indirectly related to technical accuracy in other fields. It is the internal coherence, or the verisimilitude of plot and characters which matters, and not their factual value.

b) This autonomous value of verbal structures, however, is not to be related to pleasure alone; it has a cognitive function. Literature, understood as
metaphor or as plot-making, is not a simple stringing together of words, characters and events: it is a practical embodiment of universal principles. Great literature, through its simultaneous action on our emotions and our intellect, provides an experience which is aesthetically satisfactory through its patterning of our desires, emotions and understanding.

Today the basic tenets of the Aristotelian position are widely shared; nowadays no critic questions the legitimacy of fiction as a medium where poetic structures can best manifest themselves and impose their shape on human experience. "The illusions of art are never de -lusions. The artwork interests, impresses, and moves us both as the thing represented and as the representing itself" and we are all Aristotelians to the extent we believe this. Aristotle is willing to acknowledge the intrinsic value of literature understood as representation. According to García Berrio, "se ha señalado desde Aristóteles que toda siembra artística se funda en el principio intelectual del re-conocimiento [...] por oposición al conocimiento; es decir, adquisición de una novedad antes absolutamente desconocida, que es propia de la experiencia lógico-científica" (1989: 470). From the Aristotelian point of view, then, the business of literature is the game of representations, of presenting again in a new perspective situations, images or characters which are already familiar.

In Plato and Aristotle, or in the Renaissance defenses of poetry like Sir Philip Sidney's, the opposition between literature and the "harder" disciplines of knowledge -technology, science, history or philosophy- appears as a static one. They are different realms, and that is it: each has its place allotted. A new note begins to ring from the moment more specialised knowledge appears with the scientific development of the seventeenth and eighteenth centuries. In England, Thomas Sprat writes a History of the Royal Society in which he advocates the rejection of rhetorical and poetic language as a requisite for the advance of science. He condemns the proliferation of rhetorical figures and ornate speech, which can only cause confusion and ignorance. Sprat is advocating something more than decorum in scientific language. The Royal Society, he argues, will restore language to its original purity,

1 Smith 1974. Cf. Poetics 1448b on the intrinsic qualities and values of representation apart from the qualities and values of the objects represented.

In these invectives against rhetoric and language that calls attention to itself we can discern a sign of the times: the humanities are being asked to retreat from the expanding domain of science. The opposition between the arts and the sciences is now perceived as historical: the arts belong to the past, and the future belongs to the sciences. The eighteenth-century Enlightenment is the crucial point where the opposition between the disciplines of knowledge becomes consciously historical. This fact is apparent in the works of Fontenelle, Montesquieu or Buffon, who ridiculed verse and the "polished expression" of eighteenth-century versifiers, holding that the age of poetry as a form of expression had come to an end, and that the new age of enlightenment required the clarity and precision of prose as a vehicle. The view that modern knowledge has outgrown poetry is implied even in Vico's appreciative account of poetic wisdom:

Hence poetic wisdom, the first wisdom of the gentle world, must have begun with a metaphysics not rational and abstract like that of learned men now, but felt and imagined as that of these first men must have been, who, without power of ratiocination, were all robust sense and vigorous imagination. This metaphysics was their poetry, a faculty born with them [...] born of their ignorance of causes, for ignorance, the mother of wonder, made everything wonderful to men who were ignorant of everything (1971: 296).


3 E.g. Buffon, Discours sur le style (1753). Although we can always find thinkers who, like Rousseau, deny this kind of sequentiality. For Rousseau (Discours sur les sciences et sur les arts, 1750) art and science alike are signs of decadence, corruption, and alienation, as entailed by his peculiar version of the myth of the Fall.
JOSE ANGEL GARCIA LANDA

Of course the opposition between the discourse of poetry and that of “knowledge” was already historical in Aristotle and Plato even if it was not perceived to be so: Plato reacts against the old Homeric myths in the name of a philosophical spirit which is the result of an historical development. And if Aristotle marks off an area proper to poetry, he does so from above, from the standpoint of a philosophical method which he considers to be a more radical approach to knowledge: poetry may be for him more philosophical and serious than history (which is all right) but it certainly is less philosophical and serious than philosophy.

The historical nature of the opposition between poetry and science is formulated most radically by Hegel. The vast philosophical system he devises tries to subsume within a coherent whole all manifestations of human culture. Each institution, intellectual discipline, or mode of social organization is a particular shape adopted by the Spirit in its way towards complete self-consciousness, a development which is both historical and conceptual - Hegel’s conception of history is the opposite of Aristotle’s definition of history as a simple collection of facts, since for Hegel history is conceptually patterned through and through; it is all plot and everything contributes to the final design. Each of the manifestations of the Idea belongs to a phase of development which remains active and progressing even when it has been superseded by a more radically self-reflective development. It is interesting to note that in the Hegelian system the physical or natural sciences belong to an early phase of this development, when the Spirit is still alienated from itself: the sciences deal with finite knowledge, while the highest knowledge is the absolute knowledge of philosophy (Hegel, 1990: 157). Art, and poetry among all the arts, represents a higher degree of self-consciousness; the extreme instance is Romantic poetry. But the full presence of the spirit to itself, that is, science in the higher sense of the word, cannot take place within the realm of art; it requires the complete reflexivity of philosophy. Hegel is among the first to proclaim the death of literature. As far as its cognitive aim is concerned, it is for him a thing of the past.

The Hegelian narrative of the supercession of the arts and the sciences by philosophical thought is not, however, fully in tune with the popular spirit of the age. The positivist version of historical development will be more congenial to the nineteenth-century, since it is in keeping with

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the evident technological transformations of the nineteenth century. It is factual knowledge, knowledge which can be determined, classified, compared, which the nineteenth century mind places at the forefront of cultural development. Already positivist avant la lettre is the spirit of the most radical and violent condemnation of poetic knowledge in the Romantic age, Peacock’s “The Four Ages of Poetry,” which sings the triumphant march of science while poetry remains hopelessly superseded:

A poet in our times is a semi-barbarian in a civilized community. He lives in the days that are past. His ideas, thoughts, feelings, associations, are all with barbarous manners, obsolete customs, and exploded superstitions ...

... intellectual power and intellectual acquisition have turned themselves on other and better channels, and have abandoned the cultivation and fate of poetry to the degenerate fry of modern rhymesters, and their Olympic judges, the magazine critics (Peacock 1987: 209, 211).

The Utilitarian spirit is not too far away - the spirit which made Jeremy Bentham define poetry as the kind of writing where lines do not reach the right margin of the page. In fact, both Peacock and the Utilitarians have their intellectual roots in the eighteenth-century Enlightenment and its one-sided emphasis on progress.

It is not uncommon to find, under the new rule of scientific method, claims of an irreducible opposition between the literary mind and the scientific mind. Charles Darwin, absorbed in the biological research, recognised that he had become completely insensitive to literature and art (Huxley, 1963: 40) - a far cry indeed from his grandfather Erasmus Darwin, who wrote epic poems on biology and botany using an incongruous mixture of scientific subject matter and Augustan poetic diction: “Say, Muse! how rose from elemental strife / Organic forms, and kindled into life ...”4

4 Erasmus Darwin, The Temple of Nature, in Eastman, 1931: 327. E. Darwin’s masterpiece in descriptive verse is The Botanical Garden, consisting of The Loves of the Plants (1789) and The Economy of Vegetation (1792). It is worth noting that he already defended evolutionist theories in these poems.
The opposite claim, and the concomitant rejection of the scientific world-view, is voiced by many Romantics, like Blake or Novalis, who see the advance of science and technology as the harbinger of bleak prospects for mankind. Poetry is seen as a force which will renew the spiritual energies of mankind, exhausted after the scientifically oriented thought of the previous century. Poetic imagination is then seen as the counterpart of logical and scientific thought. The poet, Goethe or Schlegel affirm, thinks like a primitive, not with concepts but with symbols, allegories, metaphors. His thought reinforces the links of man and nature. Conceptual thought estranges man from nature; the role of poetry is to effect the reconciliation, to make man one with himself and with the universe once more. Novalis believes that science turns “the infinite creative music of the universe into the dull clappering of a gigantic mill driven by the stream of chance and floating upon it, a mill, without architect and without miller, grinding itself to pieces, in fact a perpetuum mobile.”5 For Wordsworth, the spirit of his age is also the “light of common day” in which poetic knowledge fades; this is evident for instance in his sonnet “The world is too much with us, late and soon”, full of nostalgia for a poetic communion with an universe which has lost its mysteries, reified by science and the market economy:

The world is too much with us; late and soon,
Getting and spending, we lay waste our powers
Little we see in Nature that is ours;
We have given our years away, a sordid boon!

This Sea that bares her bosom to the moon,
The winds that will be howling at all hours
And are up-gather’d now like sleeping flowers,
For this, for everything, we are out of tune;

It moves us not. - Great God! I’d rather be
A Pagan suckled in a creed outworn,
So might I, standing on this pleasant lea,

Have glimpses that would make me less forlorn;
Have sight of Proteus rising from the sea;
Or hear old Triton blow his wreathed horn.

5 In Wimsatt and Brooks, 1957: 370.

The romantic defense of poetry against the imperialism of science continues into the Victorian age with the figure of Matthew Arnold. Like Carlyle or the Dickens of Hard Times, Arnold reacted against the Utilitarian ideology of the industrial bourgeoisie; and he diagnosed the central event of his age as the death of religion and the growth of mechanical and material civilization. According to Arnold, the nineteenth century is an industrial and technological age where transcendent values succumb to the technological spirit.

Faith in machinery is [...] our besetting danger; often in machinery most absurdly disproportioned to the end which this machinery, if it is to do any good at all, is to serve; but always in machinery, as if it had a value in and for itself. What is freedom but machinery? what is population but machinery? what is coal but machinery? what are railroads but machinery? what is wealth but machinery? what are, even, religious organizations but machinery? (Arnold, 1882: 15).

Without values that give a sense to all these means, progress and industry, the division of labour and the advance of material prosperity are but “a mere fetish” (1882: 173). The true advance of civilization, Arnold argues, is to be found in the progress of “sweetness and light”, the search for perfection, the formation of the spirit and character. This is brought about by culture, which in Arnold’s view is more akin to poetry than to science: “in thus making sweetness and light to be characters of perfection, culture is of like spirit with poetry, follows one law with poetry” (1882: 21). Science, on the other hand, belongs with “machinery”: it cannot give us ultimate values, it cannot occupy the empty place left by the decay of religion. According to Arnold, culture is an achievement of a higher level than science, and its fountainhead is to be found in poetry and the humanities. Poetry should not try to ape science, but know its real calling. The poet (and the critic) are the promoters of true values in an age of mindless, aimless machinery.

However, there have been some writers since the Enlightenment who have conceived or wished for some kind of integration or harmonisation of literature and science: André Chénier in the late eighteenth century is one of the last major poets to attempt didactic poetry after the manner of Lucretius' De Rerum Natura, on the subjects of geography, history, biology,
chemistry, etc. For Wordsworth himself, "Poetry is the breath and finer spirit of all knowledge; it is the impassioned expression which is in the countenance of all Science" (1905: 27). The poet is a joiner of men, and no aspect of human activity can be beyond the reach of poetry as long as it becomes involved with human action, desires and emotions:

Poetry is the first and last of all knowledge - it is as immortal as the heart of man. If the labours of the Men of science should ever create any material revolution, direct or indirect, in our condition, and in the impressions which we habitually receive, the Poet will sleep then no more than at present; he will be ready to follow the steps of the Man of science, not only in those general indirect effects, but he will be at his side, carrying sensation into the midst of the objects of the science itself. The remotest discoveries of the Chemist, the Botanist, or Mineralogist, will be as proper objects of the Poet's art as any upon which it can be employed, if the time should ever come when these things shall be familiar to us, and the relations under which they are contemplated by the followers of these respective sciences shall be manifestly and palpably material to us as enjoying and suffering beings. If the time should ever come when what is now called science, thus familiarized to men, shall be ready to put on, as it were, a form of flesh and blood, the Poet will lend his divine spirit to aid the transfiguration, and will become the Being thus produced, as a dear and genuine inmate of the household of man (1905: 28).

Shelley is ready to go even further, claiming that poetry is at the root of all knowledge and of every deed which furthers the advance of the human race: that is, he is willing to put in the same bag poetry, science, philosophy and indeed any inventive or heroic action (Shelley 1987: 220). In Eastman's view, however, the claims of the Romantics already evidence a lowering of expectations concerning the universality of poetic knowledge: "Wordsworth's definition of poetry as 'the breath and finer spirit of all knowledge' [...] was but a stage in the slow dying out of the view prevalent from Spenser to Milton that poetry is knowledge itself" (1931: 287).

Another major nineteenth-century theory remains to be mentioned: naturalism. Beyond the claims of mere realism, naturalism as defined by its main representative, Emile Zola, aims at the complete integration of literature and science. Zola conceives novel-writing as an experiment in psychology and sociology, and dreams of a future age when fiction will have become completely scientific. It is amazing to read his essay-manifesto on the "experimental novel" (Zola, 1971) and watch him transpose Claude Bernard's conception of the scientific method to novel-writing without taking into account the "slight" difference that in a novel the author invents the situation, instead of observing it in an objective way.

The foregone collapse of the naturalist project is felt throughout the twentieth-century, when no important attempts have been made to draw literature to the field of science, and the relation between both disciplines ceases to be a major topic for critical discussion, although voices may rise from time to time to defend the primacy of one mode of knowledge over the other.

In our own century we have often witnessed the rivalry between the arts and the sciences. Sometimes it repeats echoes of the past. In this vein, we have seen C. P. Snow (1959) speaking in favour of a new scientific culture, in opposition to a bad, old literary culture, and F. R. Leavis (1962) responding aggressively. This is a belated debate, which already took place in the thirties in America, on the question of the New Humanism. The twentieth century has witnessed a variety of continuations of Matthew Arnold's ideas. The American New Humanists (Irving Babbitt, Paul Elmer More, Douglas Bush) are the most literal followers of Arnold's doctrine in this respect. The debate assumes here the shape of a defense of "humanism" against its enemies: scientism, the belief that scientific research can provide a basis for meaningful action, for principles and morality. Science, the New Humanists argue, is only an instrument, not a source of values, and it is wrong to derive our principles from science. "The humanist is not hostile to science as such," Babbitt argues, but only to "a science that has overstepped its due bounds" (Babbitt, 1967). From the moment we want to pass from fact to value, the New Humanists argue, we need "another order of intelligence" different from the scientific one. Morality cannot be built upon scientific evidence, but the New Humanists were often accused of trying to perpetuate nineteenth-century modes of behavior without the religious faith which
made them meaningful. The New Humanists were political conservatives, but it was mainly their conservatism in literature, their rejection of modern literature and the narrow moral standards they applied to criticism, that ensured their disappearance as a significant critical movement.

II

The relationship between science and literature is still widely discussed in twentieth-century criticism, but the focus has shifted to some extent. Instead of an almost exclusive concern with comparing the different merits of science and literature as modes of cognition, now their common grounds and interpenetrations also become a subject of inquiry. We shall now attempt to classify some of the possible kinds of relationships that may be discerned between the two disciplines from a critical point of view.

- One area of critical inquiry is the possibility of a scientific study of literature. This issue, in its turn, may be approached in a variety of ways. For a critic like I. A. Richards, literary studies are pre-scientific. The answer lies in a psychology of poetry. This would involve a kind of colonization of the literary text by a science which is already established. Structuralist critics, on the other hand, favour the development of a literary science in its own right (Todorov, 1968). Still other critics oppose the analytical approach of modern critical schools, and accuse them of a "scientistic" approach which betrays the deepest experience of literature. This is an issue which could lead us far away from our topic, since it concerns the age-long debate between the sciences and the humanities. The debate is a complex one, since

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7 Eastman 1931: 31-53; Eliot 1951.
8 Richards, 1970: 16-19. In a 1970 note to his 1925 text, Richards is more sceptical about the scientific value of his own approach to poetry.
9 Van Wyck Brooks, for instance, rejects the idea of a science of literature. In The Opinions of Oliver Alistair (1941) he opposes theorizing, and what he considers to be the "scientism" of the New Critical approach.
enormous differences. According to Huxley, both the scientist and the man
of letters are observers, organizers and communicators of experience.
Edmund Wilson pushes the analogy further. For him, poetry and science are
not essentially different in their essence, but in their object. Both are
intellectual activities which try to make experience more meaningful, to
understand things in order to make them manageable. Both the scientist and
the poet are concerned with the discovery of hitherto hidden relations
between things; the scientist in the area of abstraction or of natural
phenomena, the poet in the realm of human impulses. He believes,
therefore, in a “kinship [...] of the purposes of science and art” (1952: 254).
But this claim remains unelaborated, and it is clear that for Wilson art is
basically an education of the emotions, learning to impose on experience the
order of an aesthetic pattern, representing it as “something orderly, symmetrical, and pleasing” - and any kinship between this ordering activity
and that of science is more apparent than real. In the last analysis Wilson’s
principles do not seem to hold a position different from the one defended by
I. A. Richards, since the meaning of poetry is subservient to its beneficial
effect on emotional balance; Wilson’s touchstone for quality is also “the
highly organized man” (1952: 255).

In our age the differences between literature and science have been
analyzed in greater detail than they had been ever before. They have been
summarised by Aldous Huxley as follows:

Public and private. Objective and subjective. The world of
concepts and the multitudinous abyss of immediate experience. The
simplified, jargonized purity of scientific discourse and the magical,
many-meaningd purity of literature (1963: 39).

The question then is not one of presenting “reality” instead of
fictions. Literature presents reality, or at least one variety of reality,
Observers experience, in a way science does not. Science abstracts and
distorts experience in order to make it manageable. But Huxley believes in
the possibility of integration to a certain extent, in spite of the differences.
When facing controversies between a literary and a scientific culture like
the Leavis / Snow debate, he favours a “middle road”: he wants to make
the best of both worlds, “the world of stars and the world of astrophysics”
(1963: 55).

- An approach would oppose literature to science as pleasure is opposed to
truth. In general we agree now with Coleridge’s statement that “A poem is
that species of composition which is opposed to works of science by,
purposing, for its immediate object pleasure, not truth” (1975: 172). But
this view does not preclude the notion of different degrees of literary truth.

- Literature deals with the private and unsystematic while the field of
science is that of public, systematic knowledge. Literature is concerned with
private words and their interactions with “the public universes of ‘objective
reality’.” (Huxley, 1963: 4). For Huxley, “science may be defined as a
device for investigating, ordering and communicating the more public of
human experiences” (1963: 5).

- While the poet is concerned with the concreteness of some unique event,
the scientist is concerned only with experience presented in an abstract
and generalized way (Huxley, 1963: 6-7). But Huxley does not forget the
Aristotelian universal: for the poet, “Every concrete particular, public or
private, is a window opening onto the universal” (1963: 7). This universality
seems to differ from that of science precisely in its inherent link with
particularity, with particular experience as portrayed in the work of fiction
and with the concrete, particular detail of the language and structure of the
work\(^1\). Another way of putting this would be to say that literature is an
idiographic discipline while science is a nomothetic one. Literature does not
look for abstract laws, but for qualities, relationships, inscapes and essences,
the suchness of things, a human world (Huxley, 1963: 8). The scientist looks
for coherent frames of reference which accommodate new facts into that
which is already known (Huxley, 1963: 38). While the scientist aims at
reducing multiplicity to unity, the man of letters accepts the uniqueness of
events, their ultimate incomprehensibility; his task is “rendering the
randomness and shapelessness of individual existence in highly organized
and meaningful works of art” (1963: 18). But can a work be highly
organized and meaningful without imposing some kind of purpose and form
on that shapelessness? In any case, for Huxley the feeling of “thingness,”
of concrete experience, provided by literature is central to its nature.

For I.A. Richards, too, the intellectual organization of a work is not
its main element: indeed, there is a danger in the case of poetry that we may

\(^1\) On this concrete universality of literature, cf. Wimsatt, 1967.
miss the poem if we respond to it intellectually. The intellectual backbone is only a means to provide the subliminal play of impulses or attitudes which is where the real value of the work lies (1970: 24–25). Indeed, Richards argues, poems are often successful in spite of the virtual absence of any intellectual interest.

It remains to see whether this peculiar way of meaning can be said to provide knowledge. Max Eastman draws a complete separation between scientific knowledge and poetry. He agrees that poetry conveys the qualities of an experience through its diction - poetry is inseparable from its language because it is "the attempt to make words suggest the given-in-experience" (1931: 175). But it does not count as knowledge, since it does not classify the qualities of experience and make them controllable. This restriction applies, however, only to the poetic element in literature, which is not the only element: "Literature at large [...] is a mixture of poetry, or words used to cherish and communicate experience, with practical and scientific talk in which words are used to interpret experience or convey knowledge about it" (1931: 211). Eastman is quite adamant that poetry is not a mode of knowledge, that its claims in this respect are an illusion. He sounds deliberately Platonic when he says that the poems "have gradually and fully been compelled to realize that as poets they don't know anything about life. That is not their business" (1931: 158).

Richards also sees the poetic work as the communication of an experience. In fact, he defines a poem as "the experience the right kind of reader has when he peruses the verses" (1970: 22). This experience, however, is defined in an unsatisfactory way by Richards. Both in Science and Poetry and in the more ambitious Principles of Literary Criticism, he leaves out of his account everything that is specifically literary: the play of forms, the intertextual network, the symbolic quality of the fictional universe. Indeed, his definition of experience as a whole is too simple and idealized. Richards pictures human personality as a mechanical system that aims at a perfect balance and poise between the opposed tendencies which constitute it. Conflict between different impulses is an evil to be avoided. This is an account built after a moral blueprint, and by no means an adequate representation of the much more complex workings of identity, affection and volition. In this day and age, adding to Richards's account the findings of psychoanalysis would only be the most obvious of the adjustments his theory requires.

Following this definition of mental structure, poetry is conceived by Richards as a way to readjust and organize that structure whenever there is a conflict between interests that threatens their adequate hierarchy and the overall aims of the individual. "We must picture then the stream of the poetic experience as the swinging back into equilibrium of these disturbed interests" (1970: 28). Like a behaviourist Matthew Arnold, Richards offers poetry as a substitute for tradition in order to balance and organize our impulses: poetry is the record of moments of exemplary balance of impulses experienced by rare individuals, codified for us to re-experience them. Literature is substitute or imaginal action, an exercise of mental attitudes: "In a fully developed man a state of readiness for action will take the place of action when the full appropriate situation for action is not present" (1970: 24). If the mind was a system of magnetic needles swinging into poise, we might be tempted to accept Richards' account of literature as a tuning up of the system, or as spiritual medicine. As the mind is infinitely more complex, we simply cannot be content with that univocal definition of the nature and function of literature: its functions are much more varied and problematic. The individual can never be a poise, since he is already unbalanced from the start with respect to other individuals. Not until desire ceases to be collective and becomes ideally restricted to the personal aims and frustrations of the individual subject can this poise be conceived, even. As it happens, desire and conflict have a social, planetary nature; this would be one of the obvious teachings of contemporary Marxist and feminist criticism.

Eastman works with a similar model of the relationship between poetry and attitudes, though he adds a Bergsonian perspective. He stresses the fact that attitudes, being incipient or imaginal action, tend to become automatized and unconscious when they are smoothed by custom: "what makes us conscious of one thing rather than another, is usually some difficulty that it presents from the standpoint or our activities" (1931: 187). Language as a rule falls under this general law: "practical words, in their simple and original function, not only do not heighten consciousness, but
reduce it and get rid of it” (1931: 187); at the very root of language we find
the principle of ignoring peculiarities of objects in order to concentrate on
their readiness to be used in a similar way. Poetic language reverses this
association between language and standardized perception:

It seems then that consciousness is, arises out of, or depends upon,
two things - a blockage of action, and an identification of one
experience with another so that action may be resumed. That being
the case, what could a person do who desired to heighten
consciousness, or intensify, or preserve, or prolong, or in any other
way cultivate it for its own sake - what could he do that would be
more fundamental than to suggest impractical identifications?
Poetic metaphor is the employment of words to suggest impractical
identifications (1931: 188).

But why this interest in bringing experience to consciousness? Because of
the general biological principle, Eastman argues, that experience as such is
pleasant, and that consciousness of experience is pleasant for human beings:
Poetry for Eastman is first and foremost a way of storing and evoking
pleasant experiences, not knowledge.

Richards thinks that the poetry which is peculiarly modern is the
one which adapts our impulses and attitudes to changes which have taken
place in the contemporary world. This poetry would fulfill the mission of re-
adapting us to our conditions. Now for Richards the greatest change can be
summarized as “the Neutralization of Nature, the transference from the
Magical View of the world to the scientific” (1970: 50). To this extent, his
view coincides substantially with Eastman’s, who argues that “science [...] is
steadily advancing into fields heretofore occupied by literary eloquence,”
and that this is “the great intellectual event of our time” (1931: vii).
However, Richards is less buoyant about Eastman about the benefits of
scientific progress. The problem faced by poetry in our age is peculiarly
difficult, since subliminal human attitudes are best suited for the magical
view of the world. This does not merely mean that it is easier to write poetry
from a magical (or religious) world-view than it is from ours. The magical
world-view was more congenial to man’s emotional equilibrium: “It gave
life a shape, a sharpness, and a coherence that no other means could so
easily secure” (1970: 52).

Richards does not find a sense of direction in knowledge, in
intellectual knowledge of the kind provided by science. He finds that it
cannot be the basis for morality. People tend to indulge in the false belief
that their attitudes, feelings and conduct spring from their beliefs, while in
fact they are quite autonomous. In the age of science we can obtain
enormous quantities of pure knowledge, and it is now that man “has to
recognise that pure knowledge is irrelevant to his aims, that it has no direct
bearing upon what he should feel, or what he should attempt to do” (1970: 54).
What human beings need is not knowledge, but assurance. Science can
help us survive (or the contrary), “But it cannot tell us what we are or what
this world is; not because these are insoluble questions, but because they are
not scientific questions at all” (1970: 55). We might observe that at this point
Richards either neglects religion and philosophy or bundles them up with
poetry. But the point now is the definition of the role of poetry: “The
business of the poet [...] is to give order and coherence, and so freedom, to a
body of experience” (1970: 57). This conception is not substantially
different from that of Frank Kermode, who argues that the fictional order of
narrative performs much the same imaginary function:

We have our vital interest in the structure of time, in the concords
books arrange between beginning, middle, and end, and [...] we lose
something by pretending that we have not. Our geometries [...] are
required to measure change, since it is on change, between remote or
imaginary origins and ends, that our interests are fixed (1967: 178-9).

This role of poetry as imaginary compensation or imaginative
resolution of conflict is summarised in Richards’ definition of pseudo-
statements as the central symbolic function performed by poetry. Truth in
poetry is not a matter of empirical verification or connexion with facts; it is
defined by the acceptability of a play of attitudes and the organization it
introduces in the subject’s mental disposition. Richards asserts emphatically
that “it is not the poet’s business to make scientific statements” (1970: 58),
which in turn necessitates the conclusion/ assumption that “we do not and
[...] cannot order our emotions and attitudes by true statements alone” (1970:
60). Science and poetry, therefore, are not two versions of the same thing,
one more important or perfect than the other. Richards’ attitude leads to a
problematic separation of poetic enjoyment from belief, and to the assertion
that “the imaginative life is its own justification” (1970: 66). It is the
imaginative life, then, which is capable of "saving us [...] of preserving us or rescuing us from confusion and frustration" (1970: 78). This extreme divorce of poetry and imagination from reality and referentiality is challenged by many critics, starting with the New Critics who use in part Richards' ideas but want to preserve the notion of poetry as a mode of knowledge. Nevertheless, the New Critics are very careful to distinguish the "concrete knowledge" provided by poetry from the abstractive knowledge of science. According to Allen Tate, "poetry is not only quite different from science but in its essence opposed to science". As to Eastman, he rejects Richards's last-ditch version of a cognitive poetry:

With all respect to Mr. Richards's great merits, I think his plan for saving the race from moral and political chaos by uprooting emotions from the authentic objects to which nature had attached them, cultivating them in the library, and passing them round in little verbal capsules guaranteed to make people virtuous without troubling their intelligence, is merely the most fantastic and last effort of poetic literature to save its dignity in isolation from scientific knowledge. There is no hope of any renaissance in this (1931: 250).

Eastman criticises Richards's conception of both science and poetry: "To identify poetry with the use of words to convey attitudes and prepare for action, and leave to science the role of merely pointing to things, is to turn the most obvious history of the matter exactly upside down" (1931: 302). Science, or practical language, "does not merely point to things but organizes experience" (1931: 207). And we should model our values on scientific principles.

Eastman rejects the notion that poetry provides any mode of knowledge, even knowledge peculiarly human. There are human sciences for that: "it is no longer a question of the relation between natural sciences and humane letters. It is a question whether scientific method shall replace the method of 'letters' in the study of man himself" (1931: 10). However, Eastman does not really address the real question here, which is the interpretative character of history or literary studies, and its essentially temporal nature. As far as criticism is concerned, he conceives only the poles of loose talk and a psychology of poetry (1931: 266). As to the role of literature as a "lay" religion, Eastman is less positive than Richards. He does admit that "the artists [...] are in revolt against the tyranny of the practical [...] with religious contemplation fading in our blood they alone can redeem us from that tyranny" (1931: 206) but then his notion of art is more contemplative, less interpretive than Richards's. Poetry heightens awareness of experience, but it is not a provider of values. Poetry must yield to science the realm of the interpretation of experience and of helping us to decide on action (Eastman, 1931: 239). This uninterpretive conception of literature put forward by Eastman is ultimately limited, unable to explain our experience of literature. A conception such as Frank Kermode's, who describes the articulation of plot as an interpretive act, seems much more adequate. Eastman's concept of interpretation is restricted to scientific interpretation, and he ignores other kinds of interpretive activities.

- Literary language/scientific language. Common language is inadequate for the purposes of both literature and science. Both refine conventional language. But the poet does so in search of "subler and more penetrating forms of expression. The ambition of the literary artist is to speak the ineffable, to communicate in words what words were never intended to convey" (Huxley, 1963: 11) - the privacy of experience and its multiple significance. The scientist, on the other hand, is looking for disambiguation and a single meaning; this requires technical vocabulary (1963: 12-17). Literary language is not transparent, while this is all the aim of scientific language: to disappear behind its object. Much valuable literature uses linguistic strangeness as a medium, experiments in "verbal recklessness" (Huxley, 1963: 32) to force us into new meanings and developing the potentialities of experience. According to Richards, the scientist concentrates on the denotative value of the words he uses, and tries to suppress any added value of tone or connotation (1970: 31). The poet relies on tone and connotation to build his meaning in advance, making the form and the content of the poem all one. If poetry works by arising and dynamizing attitudes, by making our impulses play against each other, Richards argues, in the poem the words used by the poet are not gratuitous:

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14 See on this question Gadamer, 1960.
they are “the key [...] for this particular combination of impulses” (1970: 33). Barthes argues likewise that in science language is only an instrument which the scientist tries to render as transparent as possible; in science there is an absolute split between the content and the language that renders it (1984: 14). Unlike science, literature is an essentially linguistic activity; it does not exist apart from its contact with the word. Barthes suggests that this is why literature is not a discipline of learning the way the sciences are - “l’une s’enseigne, c’est à dire qu’elle s’énonce et s’expose; l’autre s’accomplice plus qu’elle ne se transmet (c’est seulement son histoire que l’on enseigne)” (1984: 15). According to Roland Barthes, literature fully accepts its nature as writing, its condition of language, it is non-transparent and reflexive. He rejects the idea that language can exist in a pure state from which partial sub-codes would derive. “Le discours scientifique croit être un code supérieur; l’écriture veut être un code total, comportant ses propres forces de destruction. Il s’ensuit que seule l’écriture peut briser l’image théologique imposée par la science, refuser la terreur paternelle répandue par la ‘vérité’ abusive des contenus et des raisonnements”, etc. (1984: 19). It seems that Barthes’ concept of science is unexplored, since in this discussion he ignores the nature and function of scientific theories.

Eastman points out that many literary men tend to build a simplified image of science and he also asserts that “[t]he most progressive scientific men in these days realize that their methodological assumptions are not ultimate descriptions of the universe” (1931: 5). Eastman adheres to this non-transcendental, pragmatist epistemology when he argues that knowledge originally grew out of purposive activities and is still much bound up with them. Knowing is not a state of being in which “the mind” becomes a copy or reflection of “things.” Knowing is the act of comprehending the elements of experience in their relations to each other and to our human interests and modes of behavior (1931: 6).

The ideas of scientific knowledge and transcendental objectivity are incompatible for Eastman. Science cannot claim to have definitive knowledge about its object, since knowledge is related to our ability to see significant relationships between that object and other phenomena, a process which can never stop.

SCIENCE AND LITERATURE: SOME ...

In proportion as science has grown mature [...] - and grown even godlike in its power to perform miracles upon reality - the men of science have more and more clearly realized that their theories do not tell us what reality is, but only how we must conceive it if we wish to perform these miracles. This realization had gone so far in 1901 that the French mathematical physicist Henri Poincaré [The Foundations of Science] exactly reversed that grandiose declaration of Democritus in which his science began. “The void,” he said - or to quote him more accurately, “our idea of space” - is nothing but a “convenient convention.” “Euclidean geometry itself is only a sort of convention of language” - and he ridiculed, too, the idea that an “atom” is a fact (1931: 220).

In Barthes’ account it is the naïve positivist conception of science which is under attack - but this may be a straw target in the twentieth century. Psychology and sociology appear as pseudo-sciences (1984: 20) - a conception which is all too close to the New Humanist blind defense of literary knowledge. Moreover, Barthes puts forward the very idea he tries to attack: in his essay it is literature which appears as the pure form of language, which is more “sincere” than the scientific one, and recognizes its true nature: “le rôle de la littérature est de représenter activement à l’institution scientifique ce qu’elle refuse à savoir, la souveraineté du langage” (1984: 20). It seems rather that we should recognize in science and literature two different modes of discourse, and not much is gained by judging one with the standards proper to the other.

- Literature cultivates its own past, while science concentrates on the present. The literary past is intrinsically valuable, since it provides a background against which present works are understood and in itself it fulfills one of the primary aims of literature, which is to ensure the communication of human experience in its multiplicity. The scientific mind, on the other hand, is much less governed by this sense of a tradition, and old scientific theories cease to be scientific. The literature of the past is more and more literary for us, while the science of the past is... more and more literary too.

- An intrinsically literary line of inquiry would be the study of the structural fuction of scientific motifs in the literary work of art: at which level of the literary structure is a scientific motif introduced?
- At the level of the fictional world and the fabula; that is, as a part of the represented fiction.

- As an analogical device for large-scale construction of the story, such as plot structures, patterns of focalization, etc.

- As a representative technique, a metaphor or image used by the narrator or the characters (that is, as an element of voice).

Any combination between these three basic positions could in principle be devised. For instance, a diagrammatic icon modelled after a scientific concept or theory can be introduced as an image by the narrator but serve as a blueprint for the reader's construction and interpretation of the plot.

- Another kind of inquiry is whether the integration of scientific elements is successful. Aldous Huxley is concerned with the difficulty there is in making science enter literature in a successful way in the modern age, although it is always present in some hidden way (Huxley, 1963: 49). When machines enter a poem, or even a novel, they are usually humanized; they perform a literary and not a technological function, and their presentation is rhetorical or symbolic, not technical. Science often becomes obsolete, and it has an extrinsic nature in a poem which adds a difficulty when scientific references become dated: Huxley adds the interesting observation that outdated science in a literary work usually becomes rhetoric. This is the case with Dante or Donne; Shakespeare's science is much more vague and superficial, more general and less dependent on specialized knowledge on the part of the reader; it ages better (Huxley, 1963: 52).

When the present-day specialization of activity and discourse was still in its prehistory, scientific poems such as Lucretius ware possible. But the gradual "division of labor between the two [...] has been in progress since the sixteenth century" (Eastman, 1931: viii; cf. 128f.). Modern attempts are relative failures:

Literature is becoming more and more deeply differentiated from science. [...] What had been "literature" - an amateur conflation of experience with interpretation - falls apart into a more universally reliable interpretation on the one hand and a more individual and reliable experience on the other (1931: 212-4).

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SCIENCE AND LITERATURE: SOME ...

Is the possibility of poetry, or more widely, of literature, threatened in the age of science? One aspect of this inquiry could relate to the appearance of new media (cinema, TV) which challenge the social function of literature and fulfill some of its functions. Technological development has certainly changed our attitude to art, mainly through the phenomenon of massive reproduction of artworks (see Benjamin, 1969). We could explore the direct connections, if any, between the development of literature and that of technology. Edmund Wilson, for instance, asserts that electric light killed the ghost story. This is too direct a conclusion - not least because the ghost story is alive and kicking as a genre. But studies of the sociology of literature, the way literature is written, distributed and read, are obviously dependent on the technological development of mass media: not so long ago Marshall McLuhan announced the imminent disappearance of the written word under the pressure of the more aggressive audio-visual media.

In any case, it is clear that some genres seem to be more hospitable than others to science. Huxley notes that the subject matter of poetry is now the same as ever; it has not really been enlarged. We can, of course, think of Futurism and its cult of technology. But as a rule, Modernist poets worked on words, and did not try to make poetry out of the new world-view afforded by science. It is a paradox that nowadays poets use less science than ever in their poems. Apparently, Huxley argues, they feel it has become a subject matter for specialists, and is best ignored (Huxley, 1963: 60-2). This he feels to be an impoverishment of poetry, since scientific knowledge is relevant to the human world which is the poetic subject matter; science is giving new answers to age-old questions. Similarly, Huxley finds little place for science in the drama.

The novel, on the other hand, is a genre which gives more scope to scientific subject matter (Huxley, 1963: 71). Eastman, too, finds that the novel, "a kind of mongrel child of poetry and prose," is "a species most admirably adapted for survival in this practically scientific world" (1931: 225). Being based on make-believe, on fictional information rather than on heightened consciousness, it is more suited to an age of information rather than of contemplation. It is not surprising that science-fiction has thrived in narrative genres like the novel or film. Science-fiction literature has an

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important role in diffusing scientific conceptions and developing fictional worlds where the practical consequences of scientific and technological development can be imaginatively tested.

A general knowledge of science is sufficient for literary purposes, both for the author and for the reader (Huxley, 1963: 72). Storm Jameson complained of a divorce between the Georgian novelists and the scientific achievements of the age they lived in: “Now it is not in any way required of a novelist that he should know, actually know, anything about the scientific achievements of his age [...] but it is required of a great novelist that he should be awake to the spirit that is producing these achievements”

Huxley observes that atomic physics is opening a new realm of experience and giving man a new place in the order of things. Physics changes the nature of perception, and raises such philosophically relevant issues as the questioning of the principle of non-contradiction, the problem of things in themselves; while psychology and sociology give us new knowledge about the nature of human personality and behaviour (Huxley, 1963: 75, 82). Old poetic myths are both being challenged and developed by the advance of science; it is up to the poets to accept the old poetic treatment as a part of the tradition while they enlarge it with our different present-day outlook. “The sciences of life have need of the artist’s intuition and, conversely, the artist has his need of all that these sciences can offer him in the way of new materials on which to exercise his creative powers” (Huxley, 1963: 79). Huxley seems too restrictive when he argues that “The only explanatory hypotheses that it is permissible to incorporate into a contemporary poem about changing moods are those of contemporary science” (1963: 106). Literature can be more playful than that with historical distance and relativity. But this overestimation of the significance of science for modern literature comes from a salutary anxiety that literature be intellectually relevant and engaging. As a rule, he complains that the knowledge of man (including the knowledge about man) has increased enormously during our century, but that most of this new knowledge remains outside literature. Eastman complains that many of his contemporary fellow-critics “are not only ignorant of the scientific investigations of their subject-matter but militantly opposed to them” (1931: 19), preferring to emit “literary loose talk” which passes as “poetic intelligence” (1931: 20), and

indulging in psychological amateurishness. “A ‘literary truth’, may therefore be defined - provisionally at least - as a truth which is either uncertain or comparatively unimportant” (1931: 244). This is one of the reasons for modernist art retreating from interpretation into presentation.

As to Huxley, Eastman argues, he does not distinguish sufficiently between teaching science through literature and using science as a poetic material; he ignores the real measure of the distance between science and poetry and their diverging aims. “It is idle to deny this opposition, or imagine that poets can recapture the realms of science by merely going there, or by thinking up a new ‘method of dealing with abstractions’” (1931: 239). Scientific poetry is now impossible because abstractive knowledge “has gone so far and flourished so fantastically, that even the minimum of immediacy essential to poetic literature is incompatible with its further growth” (1931: 241). But the need for a rapprochement is also voiced, with more qualifications, by Eastman. Able literary men must try to feel at home in some area of science:

There is no denying a stern limitation of the possibilities that lie before the literary mind in an age of science, an age which is perhaps the future history of man. I should express those limitations, however, not by saying that there will be no more great truth-speaking poets, but by saying that in the future such poets will have to be very great (1931: 255).

By way of conclusion, I would like to point out that no “true” relation between science and literature can be defined once and forever, due to several reasons. The first is that the relationships which we effectively discern change with time. Therefore, a definition of the relationship between science and literature must be a history of the relationship between science and literature. Moreover, as science and criticism develop we discern new kinds of relationships between both disciplines. And the great writers Eastman calls for keep appearing and modifying through their work the panorama we have tried to describe. The diverging channels of science and literature are the result of the division and specialization of labour and discourse which we call progress. New scientific perspectives on literature, new literature which accommodates scientific doctrine, or new discoveries of the way in which science is still “poetic” are also the result of this division of discourses, and a further complication of their relationships.