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From The Times Literary Supplement

April 9, 2008

The neuroscience delusion

Neuroaesthetics is wrong about our experience of literature – and it is wrong about humanity

Raymond Tallis

Not long ago A. S. Byatt published a TLS Commentary ("Observe the Neurons", September 22, 2006) in which she purported to explain why, since she discovered John Donne's poetry as a schoolgirl in the 1950s, she had found him "so very exciting". She discussed some of his most compelling love poems and in places showed the kind of sensitive attention to the writer's language and intention that we look for in a good, that is to say helpful, critic. This made it puzzling, indeed exasperating, that the primary concern of her piece was to explain the poems and their effect on her by appealing to contemporary neurophysiology. She took up this theme again in a shorter piece, on the novel, last year (November 30). The literary critic as neuroscience groupie is part of a growing trend.

We have become accustomed over the past half-century to critics sending out to other disciplines for "theoretical frameworks" in which to place their engagement with works of literature. The results have often been dire, the work or author in question disappearing in a sea of half-comprehended or uncritically incorporated linguistics, mathematics, psychiatry, political theory, history, or whatever. Why do critics do this?

For an academic, there are many reasons for going "interdisciplinary". You can, as John Bayley once said, "rise between two stools". Most of the time you will be selling your product to an audience that is not in a position to judge the correctness, the validity, or even the probable veracity of the claims you are making about the guest discipline you exploit. Ingenious, not to say flaky, interpretations will pass unchallenged. A new paradigm also means lots of conferences and papers, and other ways of enhancing the path to professional advancement. It may also help you to overcome a crisis of confidence in the value of what you are doing. To modify what Ernest Gellner once said, "When a priest loses his faith, he is unfrocked, when critics lose theirs, they redefine their subject".

Approaches governed by very general ideas tend to bypass the individual work or author: understanding is replaced by what W. T. Mitchell called "overstanding". The capacious frame of reference in which the work is located – evident to the critic but not to the author – places the former in a position of knowing superiority vis-à-vis the latter. The work becomes a mere example of some historical, cultural, political, or other trend of which the author will have been dimly aware, if at all. The differences between one author and another are also minimized. Like hypochondriacs, theory-led critics find what they seek: so Jane Austen and the Venerable Bede are alike in representing the hegemony of the colonizer over the colonized, the powerful over the powerless, or the voiced over the voiceless; or in their failure to acknowledge the fictionality of the bourgeois fiction of the self. The fashions have moved on. Structuralist, post-structuralist, psychoanalytical (Freudian, Lacanian), historical materialist, Marxist approaches look pretty dated. "Literary studies" at the cutting edge has woken out of some of its most ambitious appropriations, though they are still inflicted on students. Dreams of explaining or even overthrowing Western capitalism by unmasking its discourses of power through an embittered analysis of Shakespeare look simply daft. The reign of Theory seems to be over. Unfortunately the habit of approaching literature through ideas assimilated uncritically from other disciplines, and of examining individual works through an inverted telescope, has not yet been kicked.

A generation of academic literary critics has now arisen who invoke "neuroscience" to assist them in their work of explication, interpretation and appreciation. Norman Bryson, once a leading exponent of Theory and a social constructivist, has described his Damascene conversion, as a result of which he now places the firing of neurons rather than signifiers at the heart of literary criticism. Evolutionary theory, sociobiology and allied forces are also recruited to the cause, since, we are reminded, the brain functions as it does to support survival. The dominant model of brain function among cognitive neuroscientists is that of a computer, and so computational theory is sometimes thrown into the mix. The kinds of things critics get up to these days are illustrated by a recent volume, Evolutionary and Neurocognitive Approaches to Aesthetics, Creativity and the Arts, edited by Colin Martindale and others (New York, 2007), with chapter headings such as "Literary Creativity: A Neuroevolutionary View" and a call for

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CONTENTS PAGE

This week's contents in full

This week

A brief introduction

TLS Newsletter

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Next week's TLS

Jeremy Adler: Novalis and Philo-Sophie

Timothy Hyman: Cranach's Golden Age Woman

Bernice Martin: God's own country



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enjoy literature, "neurocognitive frameworks" for aesthetics, and neural-network explanations for the perception of beauty are all linked through the notion that our experiences of art are the experiences of a brain developed to support survival. Byatt's approach to Donne's poetry through neuroscience, therefore, is not unique, nor even unusual.

At first sight, the displacement of Theory, with its social constructivism and linguistic idealism, by talk of something as solid as "the brain" of the writer and "the brain" of the reader may seem like progress. In fact, it is a case of plus ça change, plus c'est la même chose. The switch from Theory to "biologism" leaves something essential unchanged: the habit of the uncritical application of very general ideas to works of literature, whose distinctive features, deliberate intentions and calculated virtues are consequently lost. Overstanding is still on the menu. In many of the critical approaches that reached their apogee in the 1980s, there was a denial of the centrality of the individual consciousness of the writer; in approaches that purport to be neuroscience-based, the consciousness of the writer (and of the reader, as we shall see) is reduced to neurophysiology. Indeed, the reductionism of neuro-lit-crit is more profound. While aficionados of Theory regarded individual works and their authors as, say, manifestations of the properties of texts, of their interaction with other texts and with the structures of power, neuroscience groupies reduce the reading and writing of literature to brain events that are common to every action in ordinary human life, and, in some cases, in ordinary non-human animal life. For this reason – and also because it is wrong about literature, overstates the understanding that comes from neuroscience and represents a grotesquely reductionist attitude to humanity – neuroaesthetics must be challenged.

In fairness to Byatt, it should be said that hers is no mere hand-waving to a discipline that sounds impressive. She has read the theories of a very distinguished neuroscientist, Pierre Changeux, with care and attention. Changeux made his professional reputation with some exquisite studies of the stereochemistry of nicotinic receptors in the brain. He became famous among the wider public in the 1980s with the publication of *Neuronal Man: The biology of the mind*, in which he essentially explained humanity in terms of the biology of the central nervous system.

In Changeux, Byatt finds an explanation of the Donne who excited her as a schoolgirl. Yes, Donne is "a pattern-maker – with language"; but the effect of his verse is due to a certain kind of neuronal activity that Changeux has described. For Byatt, reading Donne's poetry leads to the formation of "mental objects", and the excitement induced by the poetry is due to the specific nature of the mental objects created in the reader. Byatt summarizes Changeux's account of the construction of mental objects from the activation of a large number of neurones in different layers of the brain. His account is hierarchical. He distinguishes between: "the primary percept – a mental object constructed by direct contact with the outside world"; "the image" (an object of memory); "the concept" (memory with diminished sensory content, an "algebra" derived from the isomorphs of perceptual acts); and "linked or associated concepts". These correspond to increasingly complex contents of consciousness physically realized in ever more complex linkages in the brain. While Byatt admits that "we are not yet within reach of a neuroscientific approach to poetic intricacy", she reports that she was "convinced on reading Changeux that the neurones Donne excites are largely those of reinforced linkages of memory, concepts, and learned formal structures like geometry, algebra and language".

She illustrates her theory with accounts of some of Donne's most wonderful poems – "Air and Angels", "A Valediction: Forbidding Mourning", "The Cross". Much of what she says about them could stand up as enraptured readings without reference to brain physiology. And the connection between the neurophysiology and her exposition of the poems strikes one as highly tendentious. For example, she claims that Donne, in playing with the idea of "crossing the heart" (in "The Cross") is "making an elaborate graph, in Changeux's terms, of images and connections with which to construct a world of ideas – derived oddly and distantly from percepts". "Graph theory", in fact, is a highly generalized mathematical model in neurobiology which links functional and anatomical development in the brain in response to experience and involves the deployment of complex matrix algebra. The very abstract and general nature of the graphs indicates at once that they could hardly account for something as specific as the effect of Donne's verse. Even more tendentious is her explanation of why Donne's poems are so easy to learn by heart, and convey "the feeling of thought": their syntactical quirks – such as delaying the verb to the end of a line – gives them a hotline "to the deepest and strongest neuronal reinforced links, where the firing of cells is surest, most frequent, steadiest". I find it impossible to make neuroscientific sense of this.

In short, I am not persuaded by the application of Changeux's extremely broad-brush ideas to such a specific target as the particular excitement produced in a brilliant schoolgirl by Donne's poems. Most of what Byatt says seems neurospeculation, not neuroscience. It would be interesting, given that she has embraced an empirical discipline, and that she is serious, to ask what experiments she might devise to support her theory.

The key point is this. The range of "mental objects" Changeux's theory encompasses is hardly unique to mentally demanding and enriching experiences such as those associated with reading poetry. The processes leading up to mental objects – if they really do correspond to distinctive realities and are anything other than artefactual dissections of consciousness – are ubiquitous. Bellowing in a rage when one discovers that the toilet paper has run out, and someone has neglected to replace it, would involve the very same processes Byatt invokes to explain the

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particular impact of the poems of a genius, if such processes do occur. The mental objects constructed under such irritating circumstances also involve percepts, memory images, abstract concepts, and an extraordinary confection-by-association of them, as one justifies one's rage and allocates blame, and deploys sophisticated neural algebras that simultaneously locate oneself in an unsatisfactory toilet and a careless world populated with thoughtless people.

That is, by adopting a neurophysiological approach, Byatt loses a rather large number of important distinctions: between reading one poem by John Donne and another; between successive readings of a particular poem; between reading Donne and other Metaphysical poets; between reading the Metaphysicals and reading William Carlos Williams; between reading great literature and trash; between reading and a vast number of other activities – such as getting cross over missing toilet paper. That is an impressive number of distinctions for a literary critic to lose. But that is the price of overstanding.

But there is something more important (and more worrying) in Byatt's neuroaesthetics than its failure to explain the distinctive effect of certain poems. By locating aesthetic pleasure in the stand-alone brain, and indeed in small parts of such brains, and invoking data obtained in part from animal experimentation, she is performing a reduction that even the most hard-line Marxist literary critics might shrink from. In her discussion of "The Cross", she argues that the comparison Donne makes between different crosses, including the crossed sutures in the skull containing the brain, "is nonsense at any level of logic except the brain's pleasure in noticing, or making, analogies". Note: the brain's pleasure – not the poet's pleasure. John Donne the poet is reduced to John Donne the brain and the latter to "Everybrain".

I shall return to this, but first I want to make some brief observations about the (in)capacity of contemporary neuroscience to explain human consciousness. There is at present no adequate theory of qualia (the actual experience of things – such as the sensation of yellow, the feeling of warmth, the taste of wine); of the way different qualia are seemingly associated with activity in different nerve pathways – why optic nerves give the feeling of brightness and the auditory nerves the sound of sounds; of how experiences cohere into the meaningful unity of the present moment and the unity of the self over time; and of how things that are supposed to merge into unities are also kept apart, so that I can, for example, experience at the same time the sensation of yellow and the shape of a yellow object and a feeling of warmth on my arm, and worry about an exam that I am about to take, without these simultaneous memories and experiences merging into a general mush of awareness. Most fundamentally, there is not even the beginning of an explanation of our deepest sense that we are subjects transcended by objects that are "out there" and exist independently of us. Intentionality – the property the contents of consciousness have of being "about" something, so that when the light enters the brain by the usual causal mechanisms, the gaze looks back to its intermediate cause – remains mysterious. It is not a feature of material objects, which are "wired" causally into what surrounds them, to be aware of the things that impact on them and grant them independent existence. (And it is interesting to note that full-blown intentionality is confined to humans. Daniel Povinelli has pointed out, in *Folk Physics for Apes: The chimpanzee's theory of how the world works* (Oxford, 2000), that our nearest animal kin do not form hypotheses about the invisible aspects of the world. Unlike us, they do not attribute intrinsic causal – and other – properties to the objects in their environment.) More specifically, Changeux's theories of the epigenesis of neuronal networks by selective stabilization of synapses – upon which Byatt relies – remain hypothetical. And he himself has agreed, in his dialogue with Paul Ricoeur, that neurobiological models cannot account for ordinary creativity in everyday experience.

You would not guess how little we know or understand from the hyping of popular neuroscience in which some quite reputable neuroscientists seem to collude. We hear daily of how brain science is "explaining" happiness, love, moral judgement, and so on. It is worth looking at this because it may explain why neuroaestheticians fail to realize that their approach is, at the very least, a little premature. The hype has increased in the last few decades since functional neuro-imaging has enabled scientists to observe directly the activity in the brains of conscious subjects exposed to certain stimuli or engaging in different tasks. The consequent brain activity is taken to be identical with an experience, emotion, or disposition. Even more tendentiously, the areas that light up are regarded as "the centre" for that experience, emotion, or propensity. For example, the neural basis for love is, according to Semi Zeki and Andreas Bartels, "restricted to foci in the medial insula and the anterior cingulate cortex and, subcortically, in the caudate nucleus and the putamen, all bilaterally".

Simply listing the fallacies that have led to some of the less cautious neuroscientists' conclusions (especially when they talk to the general public) would take many pages. It is, however, worth noting that apparent localization of human feelings in bits of the brain is a kind of artefact. First, when it is asserted that such-and-such a part of the brain lights up in relation to a particular stimulus, this conclusion is arrived at by subtraction. Much more of the brain is already busy or lit up; all the scientist can observe is the additional activity associated with the stimulus. Minor changes noted diffusely are overlooked. Secondly, the additional activity can be identified only by a process of averaging the results of subtractions after the stimulus has been given repeatedly: variations in the response to successive stimuli are ironed out. Finally, and most importantly, the experiments look at the response to very simple stimuli – for example, a

picture of the face of a loved one compared with that of the face of one who is not loved. But love is not like a response to a stimulus. It is not even a single enduring state, like being cold. It encompasses many things, including: not feeling in love at that moment; longing, indifference, delight; wanting to be kind, wanting to impress; worrying over the logistics of meetings; lust, awe, surprise, jealousy, anger; imagining conversations, events; imagining what the loved one is doing when one is not there; and so on. (The most sophisticated neural imaging, by the way, cannot distinguish between physical pain and the pain of social rejection: they seem to "light up" the same areas.)

When they are presented with such claims from respectable sources, it is hardly surprising that even intelligent, though scientifically naive, critics believe that the future of aesthetics is in neurology. If neuroscientists are claiming to find love among the neurones, one can hardly blame critics for being deceived into imagining that neuroscience can explain something as complex as reading or writing a poem, and that the experience of a poem, and the differences between the experiences of different poems, will be found in the tingling of a certain constellation of neurones. Little wonder they forget that different people read quite differently; or that there is a difference between reading a poem for a first, a second, or a hundredth time; or between reading it as a naive, delighted, or bored reader, and reading it as an erudite critic.

The appeal to brain science as an explain-all has at its heart a myth that results from confusing necessary with sufficient conditions. Experimental and naturally occurring brain lesions have shown how exquisitely holes in the brain are correlated with holes in the mind. Everything, from the faintest twinge of sensation to the most elaborately constructed sense of self, requires a brain; but it does not follow from this that neural activity is a sufficient condition of human consciousness, even less that it is identical with it. Although direct stimulation of the brain in the waking adult may generate quite complex hallucinations – even awaken elaborate memories – this occurs only because neural activity is associated with such experience under normal conditions. The experiences arrived at by the anomalous route are parasitic on those that are had in the ordinary way.

Under normal circumstances, experiences are had by a person, not by a stand-alone brain. The brain of an experiencing person is not isolated, like the famous "brain in a vat" of Hilary Putnam's thought experiment: it is in a body. Corresponding to this is the fact that when, for example, I see something I like, or someone I love, my brain, or some small part of it, is not the only part of me to light up. My heart may beat faster, or more thickly; a smile may appear on my face; and my step may be a little jauntier. The effects do not stop there. My body is located in a currently experienced environment; and, since I am human, that environment is situated in a world that is extended in all spatial, temporal, cultural directions. This world, too, may be transformed by my encounter with the loved one's face, and I may think differently about it. For the extraordinary thing about human beings – and what captures what is human – is that they transcend their bodies; that human experience is not solitary sentence but has a public face; it belongs to a community of minds. This is a process that has developed over many hundreds of thousands, perhaps millions, of years since hominids parted company from the monkeys. The neuro-mythologist, trying to find citizens and their worlds in neurones, stuffs all that has been created by the collective of brains back into a stand-alone brain; indeed into a small part of such a brain. True, we require a brain to participate in the community of minds; but that participation is not to be reduced to activity in bits of brains.

To overlook this is the grossest reductionism. Just how reductionist A. S. Byatt's "neuroaesthetic" approach is, is illustrated by her attribution of the force of those wonderfully randy lines from "On His Mistress Going to Bed" to the operation of mirror neurones. These fire not only when an action is performed but also when an action is observed in another individual, particularly if there is an intention to imitate it. She thinks they account for the particular erotic charge of "License my roving hands, and let them go / Before, behind, between, above, below". Mirror neurones, as Byatt correctly notes, were first described in monkeys. They are also ubiquitous in humans and may indeed have a potential to be exploited in the rehabilitation of very basic motor functions in stroke patients, as I and my co-workers set out in a recent review paper ("The potential for utilising the 'mirror neurone system' to enhance recovery of the severely affected upper limb early after stroke. A review and hypothesis": *Neurorehabilitation and Neural Repair*, 19:1, 2005; 4–13). Tickling up the mirror neurones does not explain why Donne's stanzas should have the particularly intense effect they (sometimes) do. The identification with the poet (or his mistress) and transplanting lustful caresses from the poem to one's present experience involve much more than mirror neurones operating in a way that is common to humans and monkeys.

Our enjoyment of those lines owes much to the thrilling directness of the poet's demand, in a context, that of poetry, which is traditionally indirect, complex and subordinated to custom. There is also the "scandal" (to use Roland Barthes's term) of rhyme, which forges links at the level of sound between words that have quite different meanings. There is the driving rhythm of the second line after the relatively circumspect opening request to "license" the poet's licentiousness. There is the image of the frantic hand of the poet wanting to possess all of his mistress's body at once, and itemizing the places he wants to visit. Beyond this, there is the issue of literary taste, of the reader consenting, for all sorts of reasons, to like a work of art, or to be prepared to give it a chance – a second reading. We are a long way from mirror neurones, which are about observing an action

with an intention to imitate it, rather than reading about an imaginary action in the context of a poem which at once respects and thrillingly transgresses the conventions of its genre.

While we have yet to make observations in or about the stand-alone brain that explain even simple experiences (and, in fact, outside of the laboratory no human experience is simple, as every experience is connected with, and belongs to, a constructed and collective world of experiences), it is true that brain science looks more plausible as an account of the damaged brain, or the activity and inactivity associated with brain damage, than as an account of ordinary successful functioning. As a doctor specializing in the care of people with epilepsy over the years, I found it easier to account in neuronal terms for an epileptic fit than for the patient's decision to come to see me and to trust or not trust my advice, or for my own decision to read the latest article on epilepsy. So why should I begin to believe in a neural account of the reading of a poem?

It is important not to suggest that it is only in rather special states of creativity – say, reading or writing poems – that we are distanced from animals. This is a mistake. We are different from animals in every waking moment of our lives. The bellowing on the lavatory that I referred to earlier demonstrates a huge gulf between us and our nearest animal kin. But if we deny this difference (invoking chimps etc) even in the case of creativity – and the appreciation of works of art – then no distance remains. That is why one would expect critics to be on the side of the poets, with their sense of this complexity, rather than siding with the terrible simplificateurs of scientism. A. S. Byatt's neural approach to literary criticism is not only unhelpful but actually undermines the calling of a humanist intellectual, for whom literary art is an extreme expression of our distinctively human freedom, of our liberation from our organic, indeed material, state.

At any rate, attempting to find an explanation of a sophisticated twentieth-century reader's response to a sophisticated seventeenth-century poet in brain activity that is shared between humans and animals, and has been around for many millions of years, rather than in communities of minds that are unique to humans, seems perverse. Neuroaesthetics is wrong about the present state of neuroscience: we are not yet able to explain human consciousness, even less articulate self-consciousness as expressed in the reading and writing of poetry. It is wrong about our experience of literature. And it is wrong about humanity.

Raymond Tallis is Emeritus Professor of Geriatric Medicine at the University of Manchester and the author of *The Enduring Significance of Parmenides: Unthinkable thought*, 2007. *The Kingdom of Infinite Space: A fantastical journey round your head* and *Hunger* are both published this year.

HAVE YOUR SAY

A hard but necessary criticism. Unbearable for those who always see in the literature the territory to solve all the questions that are provoked by a serious (or ridiculous too) theory in vogue or a la mode. In a time, all the answers on the creation, the art and about the literary composition it was given from the christianity; in other times, the responses came from the marxism, the psychoanalysis, the positivism and other trends that encouraged the academies of the twentieth century. The new century takes as tool to the neuroscience. In it all the solutions want to be extracted. With it we wish solve all mysteries. Though I admire Mrs A. S. Byatt, undoubtedly she fell into the trap that claimed at her time another remarkable woman, Mrs Susan Sontag, in a classic book: *Against interpretation*. Sadly, this irresponsibility, as it is said by Professor Raymond Tallis, is expanding in many universities in the world as if it were a new hypnotic effect on the life of art.

Luis Felipe Valencia T., Manizales, Colombia

A helpful perhaps analogy: the brain is the match, the mind, that is thoughts and the various products of the brain, such as language, fiction and neuroscience, and more, are the flame. The flame arises from the match, but is irreducible to the match

Howard, New York, New York

I think the author of the essay is being a little bit hard on literary critics. Literary critics live in the world of metaphor, and there is always the temptation to see connections between, say, a poem and anything else in the universe—including metaphors that come from science. In other words, when a scientist attempts to translate her discipline into words (as opposed to mathematical symbols) we invariably get metaphors and analogies (such as mirror neurons or string theory or selfish genes). Who can blame a literary critic for being drawn to metaphors and making still more metaphorical connections? There's nothing reductionist about the gesture (unless the critic claims that there is only one meaning to the poem—and few critics ever do that). Perhaps literary criticism is overdetermined, but this is what makes human creativity alive—making associations, usually via metaphor. If, for example, a rose is not a woman's privates, it is also true that a rose is not a rose.

Santi Tafarella, Lancaster, California

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