ILUMINACE
Ročník 23, 2011, č. 4 (84)

Theme Articles

"THE PIT OF NATURALISM"

Neuroscience and the Naturalized Aesthetics of Film

Murray Smith

It is hard to escape the brain these days – everywhere one turns, one encounters brain-scan images, claims about the neural basis of various human behaviours, and whole new sub-disciplines based on the application of neuroscientific ideas or techniques to traditional domains of enquiry – as in "neurolinguistics," "neurophilosophy" and "neuroeconomics." Another such emergent field of enquiry is "neuroaesthetics," which seeks to illuminate our understanding of aesthetics by examining the brain processes and structures upon which aesthetic experience appears to depend. Among those neuroscientists who have been ploughing this furrow, Semir Zeki and V. S. Ramanchandran – both eminent in their own fields– have attracted the most attention. Zeki is known for his arguments concerning object constancy (our ability to perceive the integrity of objects, in spite of changes of angle, lighting, distance and so on), visual abstraction (visual experiences of colours and forms, rather than of objects per se), and what the visual arts can tell us about these phenomena; Ramanchandran caused a stir with his proposed eight "laws" of artistic experience.[1] Many other researchers are at work in what is consolidating itself as a research programme. All of these developments have taken place against the backdrop of, or are constitutive of, the gradual move from "cognitive science" to "cognitive neuroscience," a shift expressive of the changing self-understanding of the broader domain of enquiry.

Why should we care? What does, or might, this have to do with the study of film? There are several reasons why we film scholars might turn our attention to these developments in neuroscience. First, in addition to the specific field of neuroaesthetics, which has focussed almost wholly on still depictions, there are now several teams of researchers tackling related questions on other art forms, including film: Uri Hasson and his collaborators, for example, have conducted early research in "neurocinematic studies."[2] Such research has one foot in an existing research tradition in film studies, namely cognitive

1) Semir Z e k i, *Inner Vision: An Exploration of Art and the Brain*. Oxford: Oxford University Press 1999; V. S. R a m a c h a n d r a n – William H i r s t e i n, The Science of Art: A Neurological Theory of Aesthetic Experience. *Journal of Consciousness Studies* 6, 1999, no. 6/7, p. 15–51.

2) Uri H a s s o n, et al, Neurocinematics: the Neuroscience of Film. *Projections* 2, 2008, no. 1, p. 1–26. Other teams of researchers working on related terrain include Gal Raz, Talma Hendler and their colleagues at Tel Aviv University, and Pia Tikka's NeuroCine research team at Aalto University, Helsinki.

film theory, which has gradually become more interested in neuroscientific research just as its "parent" research field, cognitive science, has come under the sway of the brain. Moving in the other direction, neuroscientific research on such fundamental mental capacities as perception, emotion, empathy, and memory is also relevant to film, as we will see in the course of this essay. Moreover, neuroscientific research (on film, on art, or on aspects of human psychology more generally) is pertinent not only to cognitive film theory, but to any approach to film with a significant psychological dimension, including phenomenological and psychoanalytic film theory. If Deleuze and some of his followers are prepared to allude to the brain, they ought, in good faith, to be prepared to follow those allusions to the place where research on the brain is actually conducted.[3]

The second reason neuroscience matters to the study of film, is because it matters to film practitioners – or to some of them, at any rate. In parallel with scholarly work on film and the brain, we also see filmmakers venturing into "neurocinema," that is, the application of neuroscientific tools to filmmaking. So far, this practice has taken at least three forms. First, brain scanning has been used as an extension of the venerable practice of test screenings, where scans provide another way of assessing the kind of impact particular moments in films possess; more generally, and not surprisingly, brain scanning is now being used as a tool in the advertizing industry, spawning the idea of "neuromarketing." The second practical application of neuroscience in the world of motion pictures concerns what we might call "neural interactivity" in narrative film and in game design, wherein brain signals transmitted from headsets worn by players and viewers affect directly the game world and the progression of the narrative, as in the game *Focus Pocus*; or the direction of the narrative, as in the films produced by MyndPlay.[4] A third practical application of neuroscience involves the conversion of neural data into animated moving imagery; a technique designed to represent mental imagery in filmic form – in effect, to realize not merely brain scanning, but *mind* scanning.[5] The techniques and the practices based on them are still in their infancy, and so it is too early to say much about their character or value. But that they exist at all is surely of note.

Perhaps there is a third, more general, reason for film studies as a discipline to take note of the burgeoning world of neuroscience. The current prominence of neuroscience is driven by the emergence of new technologies which are providing a picture of unprecedented detail of brain anatomy and function. Many scientists and philosophers believe

3) See, for example, Raymond B e l l o u r, Deleuze: the Thinking of the Brain. *Cinema: Journal of Philosophy and the Moving Image* 2010, no. 1. Online: <http://cjpmi.ifl.pt/1-deleuze/>, [cited 19. 11. 2011].

4) On brain scanning used as a vehicle of audience testing, see Curtis S i l v e r, Neurocinema Aims to Change the Way Movies are Made. Online: <http://www.wired.com/geekdad/2009/09/neurocinema-aims-to-change-the-way-movies-are-made/>, [cited 19. 11. 2011]; on *Focus Pocus*, see Christina D e s M a r a i s, Video Game Uses Brain to Control Action. Online: <http://www.pcworld.com/article/241993/video_game_uses_brain_to_control_action.html>, [cited 19. 11. 2011]; on MyndPlay, see Charlie B u r t o n, Directed by Brainwave. Online: <http://www.wired.co.uk/magazine/archive/2011/10/play/directed-by-brainwave>, [cited 19. 11. 2011].

5) Ben J o h n s o n, Scientists Turn Brain Activity into Moving Images. *Slate* (24. 9. 2011). Online: <http://slatest.slate.com/posts/2011/09/24/scientists_turn_brain_activity_into_moving_images.html>, [cited 19. 11. 2011].

that this new abundance of data will transform our understanding of phenomena across a wide range of fields. As we will see, there is much debate around these claims, but an adequate debate cannot be had without the participation of those individuals in possession of the requisite expertise– and in the case of "neurocinematic studies," that means both neuroscientists and film scholars. Make no mistake: neuroscience will continue to spread into the making and the study of film. Film scholars can stay in their comfort zone and pretend it is not happening, or they can look outward with an open mind as well as a skeptical eye, assessing just what neuroscience might or might not have to offer film studies.

In this essay, I make a start on that project of assessment. I begin by exploring some of the controversies surrounding contemporary neuroscience, and some of the arguments offered against its extension into new domains. This discussion will be largely philosophical, and the connections here with film will not always be obvious; it is, nevertheless, essential to a proper understanding of what is at stake. With a sketch of these critical concerns in place, I turn to two aspects of our experience of films – startling in response to films, and empathic mirroring of characters' states – where, I argue, insights from neuroscience deepen and enrich our understanding of the phenomena at stake.

Meet the Neurosceptics

Not everyone is impressed with or pleased by the rise of neuroscience. Jerry Fodor has given vivid expression to a long-standing vein of skepticism among philosophers and psychologists of a functionalist stripe who question whether the mind can be illuminated by evidence about the brain. Fodor decries in particular the vogue for brain-scanning, which he sees an as undisciplined "gold rush" for neural data unconstrained by the formulation of clear and testable hypotheses.[6] John Hyman has offered a critique of Zeki's and Ramachandran's arguments, stressing the mismatch between the intended scope and ambition of these theories, and their actual limitations.[7] Hyman dubs Ramachandran's account "the Baywatch theory of art," arguing that, while, on the one hand, it explains only a limited range of types or aspects of art, on the other hand, it seems to explain the attention-grabbing nature of many phenomena outside the purview of art and aesthetics.[8] Peter Hacker (like Fodor and Hyman, a philosopher) and Maxwell Bennett (a neurosci-

6) Jerry F o d o r, Let Your Brain Alone. *London Review of Books* 21, 1999, no. 19 (30. 9. 1999), pp. 68–69. In correspondence following the publication of this essay, Fodor remarks on "the difference between a scientist who has a hypothesis and one who only has a camera". Jerry F o d o r, Letter to Benjamin Martin Bly. In: Letters. *London Review of Books* 22, 2000, no. 1 (6. 1. 2000). Online: <http://www.lrb.co.uk/v21/n19/jerry-fodor/diary>, [cited 19. 11. 2011].

7) John H y m a n, Art and Neuroscience. In: Roman F r i g g – Matthew C. H u n t e r (eds.), *Beyond Mimesis and Convention: Representation in Art and Science*. Dordrecht – London: Springer 2010, pp. 245–261.

8) Hyman is, of course, alluding to the American television series BAYWATCH (1990–99), and its icons of exaggerated physical beauty – especially in its female variant, as embodied in the show by Pamela Anderson. Colin McGinn offers the same criticism in a review of Ramachandran's *The Tell-Tale Brain* (New York: W. W. Norton & Company 2011), which includes a chapter on neuroaesthetics: "The discussion of

entist) have together advanced a more wide-ranging critique of contemporary neuroscience, stressing the confusions that, they argue, can arise from speaking of neural processes in the language of personal agency.[9]

Perhaps the most voluble and prolific of the neurosceptics, however, is Raymond Tallis – author of *Aping Mankind: Neuromania, Darwinitis, and the Misrepresentation of Humanity* (2011),[10] and of various other works inveighing against the contemporary development of neuroscience. Tallis' views are worth engaging with for a number of reasons. Tallis is a (now retired) professor of geriatric medicine who boasts expertise in clinical neurology, and who has sustained a remarkable second career as a philosopher and a writer. Accordingly, one might have expected him to have considerable sympathy with the rise of neuroaesthetics and with the various tributaries of brain research that wend their way into the territory of the humanities and social sciences.[11] But Tallis is profoundly skeptical of many of the claims made by and on behalf of contemporary neuroscience. This skepticism takes us to the second reason for exploring Tallis' perspective in detail. In works such as *Not Saussure*[12] and *In Defence of Realism*,[13] Tallis was an early and significant critic of post-structuralism. He has long been critical of the tendency among humanist scholars to import and regurgitate half-digested ideas from various scientific and pseudo-scientific disciplines, such as Lacanian psychoanalysis; his critique of the currently fashionable appropriation of neuroscientific ideas and language by non-specialists represents a continuation of this theme. Given the significance of this earlier work, Tallis' current work surely deserves a hearing, even (or perhaps especially) from those of us sympathetically disposed towards the idea of neurocinematic studies.

Around the time of the publication of his book *The Kingdom of Infinite Space* (2008),[14] Tallis appeared on the UK's BBC Radio 4 show *Start the Week*. The book is concerned with the various features and functions of the human head, but pointedly *excludes* the brain. Tallis describes *The Kingdom* as "affirmative action for the body," underscoring his argument that human thought and behaviour cannot be understood as arising from the brain alone; the motor and expressive capabilities of the body must be given their due. Tallis also remarked that the book is intended as:

> [...] a way of getting hold of our curious situation of being embodied subjects [...] a way of putting forward a view of humanity that doesn't fall into either a superna-

art seems largely about another subject entirely – what elicits human attention." Colin M c G i n n, Can the Brain Explain Your Mind? Online: <http://www.nybooks.com/articles/archives/2011/mar/24/can-brain-explain-your-mind/>, [cited 19. 11. 2011].

9) M. R. B e n n e t t – P. M. S. H a c k e r, *Philosophical Foundations of Neuroscience*. Malden: Wiley-Blackwell 2003.

10) Raymond T a l l i s, *Aping Mankind: Neuromania, Darwinitis, and the Misrepresentation of Humanity*. Durham: Acumen 2011.

11) Neuroaesthetics is a particular target in Tallis' essay R. T a l l i s, The Neuroscience Delusion. *Times Literary Supplement* (4. 9. 2008); and in R. T a l l i s, *Aping Mankind*, pp. 60–63, pp. 284–306.

12) R. T a l l i s, *Not Saussure: Critique of Post-Saussurean Literary Theory*. Basingstoke: Macmillan Press 1988.

13) R. T a l l i s, *In Defence of Realism*. Lincoln: University of Nebraska Press 1991.

14) R. T a l l i s, *The Kingdom of Infinite Space: A Fantastical Journey Around Your Head*. London: Atlantic 2008.

> turalist viewpoint, or fall into the pit of naturalism. I think we cannot be explained as having fallen from the sky – I'm a good Darwinian, Dan [Dennett] will be glad to know – at the same time we are extraordinarily distanced from the rest of the animal kingdom that was generated by the standard Darwinian processes.[15]

Tallis' critique of "neuromania" (and its sibling "Darwinitis") focuses, then, on "the pit of naturalism." So what is naturalism, and why does Tallis find it so objectionable? It's important to be clear from the outset that the naturalism at stake here has nothing to do with naturalism as a literary or artistic style; naturalism here is rather a philosophical stance. As a first approximation, let us say that naturalism in this sense is the project of explaining human behaviour based on the assumption that the human species is a part of the natural world, and that consequently the methods and knowledge of the natural sciences will play a central role in such an explanation. Tallis regards such naturalism as a "pit" to be avoided because of its alleged failure to acknowledge and to accommodate the gulf – cognitive, behavioural, and existential – between humans and other animals. "The word is out in academe and more broadly among intellectuals that human beings are really beasts – and rather nasty ones at that – or zombies," writes Tallis: "Those who view us as zombies argue that we are wired in, via our evolved brains, to the outside world in such a way as to ensure replication of our genetic material. We are disposable phenotypes, utilized by the genome to ensure its own survival..."[16] One of the key ideas in this passage is that "we are wired in, via our evolved brains, to the outside world." What does this idea amount to? And how does it relate to the naturalistic stance?

In this passage, Tallis invokes a familiar contrast – between the behaviour of non-human animals, regarded as governed by evolved instincts and reflexes, and human behaviour, understood as characterized by deliberation and reflection. In Tallis' account, an evolutionary perspective on human behaviour compels us to do away with this contrast, instead regarding humans as "beasts" or "zombies" – presumably in the sense that human behaviour on this account is determined by evolved reflexes or reflex-like responses embodied in the brain and the nervous system more generally, thus leaving no scope for rational deliberation. Tallis' main target in this passage is genetic determinism à la Richard Dawkins, according to which the individual human agent is (from a genetic point of view) nothing more than a vehicle for genetic replication; we are "wired" to do the bidding of our genes.[17] The "wiring" metaphor in this context naturally extends to encompass the nature of the relationship between the actions of the individual agent and the

15) *Start the Week*, BBC Radio 4, 21 April 2008. Tallis refers in this passage to another guest on this episode of the show: Daniel Dennett, dean of Darwinian philosophers, and author of Daniel D e n n e t t, *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. New York: Simon and Schuster 1995, among many other works.

16) R. T a l l i s, *The Kingdom*, p. 288; see also R. T a l l i s, *Aping*, p. 319.

17) Richard D a w k i n s, *The Selfish Gene*. New edition. Oxford: Oxford University Press 1989. Dawkins' position is rather more sophisticated than this bald summary suggests, in particular because he is at pains to emphasize the ways in which humans transcend genetic pressures. This is an important dimension of his thinking routinely ignored or underplayed by his opponents, including Tallis.

environment in which the agent exists, with the "evolved brain" acting as the intermediary between the level of the gene and the level of the acting organism. According to Tallis' version of evolutionary theory, it is the brain that ensures that the individual is "wired into the world" in such a way as to prioritize genetic reproduction. Behaviourism, with its emphasis on physical stimuli and observable behavioural responses, and with its denial of the scientific credibility of mental phenomena, lurks not far behind the bogeyman of genetic determinism here. As Tallis writes: "[i]f you reduce human life to responses to stimuli, then you will seem to be justified in seeing us as biological devices programmed to respond to stimuli".[18]

Behaviourism is not Tallis' principal target, however. While dismissive of behaviourism, his real concern is with cognitive science, the movement that supplanted behavioural psychology. Indeed, an equally important source of Tallis' hostility towards the language of "wiring" is its origin (or at least widespread use) in cognitive theory.[19] In this context, "wiring" is used to refer to the physical constitution of thinking agents – like human beings – and is an extension of the analogy between the human mind and the computer, which is fundamental to mainstream cognitive science: the human mind as an information processor. A contrast is typically drawn between those aspects of our physical constitution which are "hard-wired" (innate and developmentally predetermined) and "soft-wired" (shaped by learning), though it is better to think of these as end points of a continuum – for even those aspects of our being that are heavily influenced by experience and learning, such as language, will nevertheless develop within certain fixed parameters. Tallis' objections to the wiring metaphor can be boiled down to two elements. The first is that such talk is reductive, appearing to treat humans as entities that can be exhaustively described in terms of physical properties; the second, related worry is that the language of wiring appears to leave no space for the rationality and flexibility of human action.

Another work by Tallis on the distinctiveness of *homo sapiens*, *The Knowing Animal* (2005),[20] articulates his own contrasting view: unlike all other animal species, Tallis argues, humans are "uncoupled" from – rather than "wired" into – the world. "Lots of triggers of our behaviour are very abstract," Tallis remarked on the radio show *Start the Week*; "we are not wired into the world the way other animals are," he continued, paraphrasing the passage from *The Kingdom* quoted above. Humans have the ability to grasp situations and problems, consider the possible solutions, and weigh up their respective pros and cons of. On the level of immediate action, we are capable of inhibiting (or stimulating) our instinctive desire for food or for sex, for example; on the level of long-term, strategic planning, we are able to transcend the imperatives of our genes, most obviously by choosing not to engage in reproduction. Even where we do engage in reproduction,

18) R. T a l l i s, *Aping*, p. 283.
19) R. T a l l i s, *Aping*, p. 319.
20) R. T a l l i s, *The Knowing Animal: A Philosophical Inquiry into Knowledge and Truth*. Edinburgh: Edinburgh University Press 2005.

we are not merely acting instinctively: we are choosing to act one way rather than another way within a field of possibilities. This description is, of course, nothing more than a thumbnail sketch of a traditional (and many ways powerful and plausible) picture of the distinctiveness of human behaviour, one which takes for granted both the normal development of the individual and a social context that enables the individual possessed of these rational capacities to act on them. But the sketch is sufficient to ask two questions: is this contrast between human and non-human animal behaviour tenable? And, does the contrast, as Tallis claims, undermine naturalism?

Normative Panting

In *The Kingdom of Infinite Space* Tallis discusses laughing and crying – behaviours in which the head plays a starring role – under the rubric of "normative panting." Citing William Hazlitt (and Aristotle indirectly), Tallis argues that laughter and crying are uniquely human behaviours; important types of response to the gap between our perception of the ways things *are* and the way they *ought* to be.[21] Laughter is "normative," then, in the sense that it is a response involving recognition of a standard or norm that some event or state of affairs fails to match, rather than it being simply a response to that state of affairs. For Tallis, this normative element is an example of the complexity of human behaviour, and its distance from simple instincts and reflexes. Normativity is one of the key ways in which we are "uncoupled" from the world, and is one of the main reasons that "aping mankind" – comparing human behaviour with the behaviour of other primates and exploring human behaviour more generally in the context of evolutionary theory – should be avoided.

But there is a curious and telling inconsistency here. By referring to laughter as a form of "panting," Tallis underlines the physiological similarities between laughter and homologous non-human animal behaviours , thereby gesturing towards the evolutionary roots of laughter. To be sure, when discussing tickling among chimpanzees, Tallis stresses both that their panting takes a different form from human laughter, and that the objects of chimpanzee laughter do not extend to the cognitively-elaborate, physically absent, normative cues that are, on his account, the characteristic triggers of human laughter. But, rhetorically at least, the cat is out of the bag: the link between human laughter and its evolutionary precursors has been made. As we will see, this link points to the way in which the unique features of human existence can be accommodated within a naturalistic perspective. As his language implies, Tallis is in fact a type of naturalist. He is moved to argue against naturalism – and cast it as a hellish "pit" – only because of an overly narrow and rigid conception of what is to be counted as naturalism.

Like most philosophers who are resistant to a naturalistic perspective on human behaviour, Tallis repeatedly stresses the uniqueness of human behaviour – the fact that, whatever similarities might obtain between, for example, human and chimpanzee behaviour, no such comparison will capture the particular capacities and attributes distinctive of

21) R. T a l l i s, *The Kingdom*, p. 68.

human beings. True enough; but how much of a problem is this argument for naturalism? In itself, it does not really pose a problem at all. *Every* species will possess one or more unique features – if only the feature that each species is *just that species and no other*. (And on the latest estimate, there are currently 8.7 million species on earth; that's a lot of uniqueness to go around.) As Helena Cronin puts it:

> [...] to erect a biological apartheid of "us" and "them" is to cut ourselves off from a potentially useful source of explanatory principles [...] Admittedly we're unique. But there's nothing unique about being unique. Every species is in its own way.[22]

One vivid exploration of this explanatory resource is Mark Rowlands' *The Philosopher and the Wolf*, a comparative study of human, simian, and lupine psychology, which brings out the distinctiveness of each lineage and species. Uniqueness *per se*, then, does not constitute grounds to reject naturalism.[23]

Consider a related point: pick any two disparate points on the tree of life – say, a bacterium and an earthworm or the same earthworm and a zebra – and we will be struck by the gulf between these forms of life. Two factors, however, make the gulf between humans and other animals, including other primates, more salient in everyday thought than the remarkable differences between many other species. The first factor is simply the fact that, when it comes to comparisons between humans and other species, we occupy one of the points of comparison subjectively. No matter how much we try to look upon our own species dispassionately, as a biological phenomenon to be studied scientifically, it is hard to lay aside the "view from within." We are always, in this sense, contending with a kind of "species egoism;" with a type of anthropocentrism. The second factor that makes the existential and behavioural gap between humans and primates stand out is our sharing with our fellow primates so much genetically – more than 99 per cent with our nearest relations, chimpanzees. Given this genetic intimacy, why the behavioural distance? Two points are particularly pertinent here. First, as these facts tell us, relatively small genetic differences can result in very large behavioural differences. And, second, it follows that some significant part of the gulf between humans and other primates cannot directly be attributable to our genetic makeup, but must instead be explained by the interaction between genes and the environment – including the environment of culture in which humans develop.

What all this suggests is that we need to look in more detail at the specific content (and history) of *human* uniqueness in order properly to assess Tallis' argument. This state of affairs returns us to Tallis' characterization of *homo sapiens* as the "uncoupled animal" – the animal who is not "wired into the world" in the way that other species are so wired; the animal who lives in the space of reason. It would be foolish to deny that rational deliberation is indeed an enormously powerful capacity possessed uniquely – or at least to

22) Helena Cronin, quoted in Matt Ridley, *The Origins of Virtue*. London: Penguin 1997, p.156; cf. de Waal, p. 126.

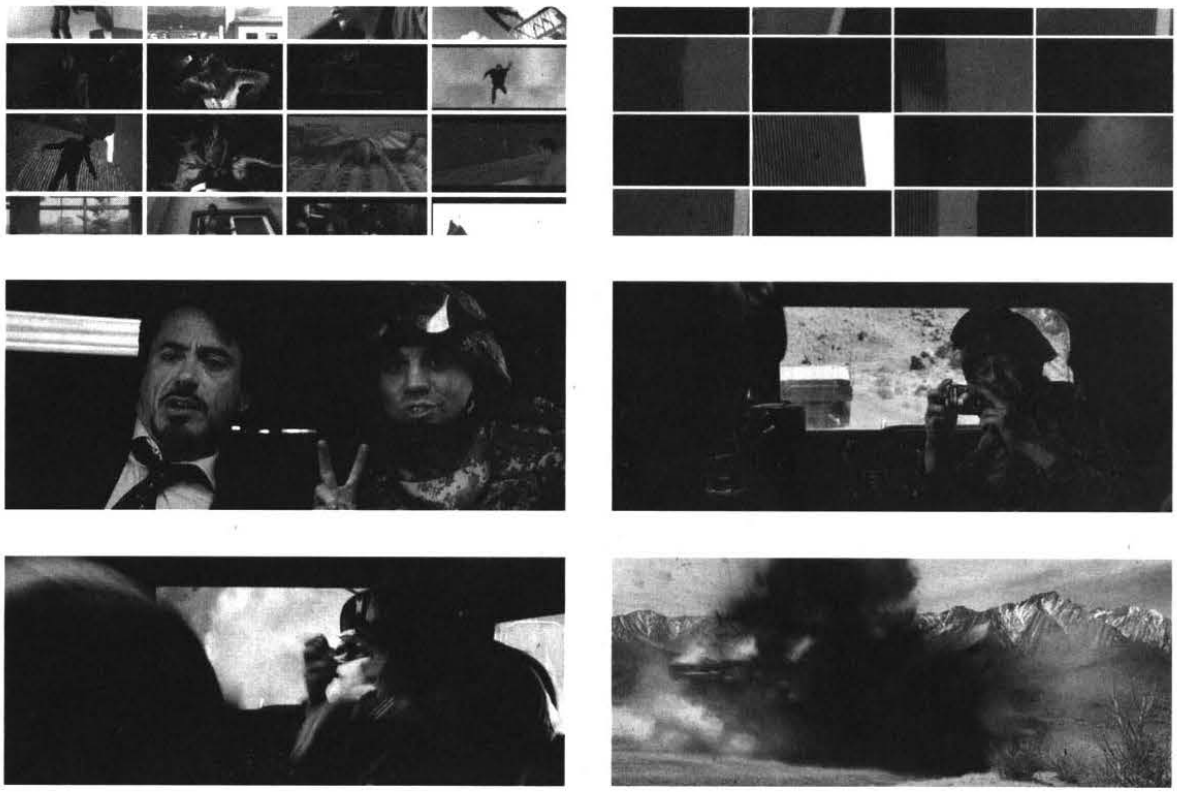
23) Mark R o w l a n d s, *The Philosopher and the Wolf: Lessons from the Wild on Love, Death, and Happiness*. London: Granta 2008.

a unique degree – by human beings.[24] But is it adequate to sum up human psychology as rational – as entirely characterized by detached and careful reflection? If we are looking for an accurate description of human psychology – as distinct from an idealized account of it – it should be obvious that we cannot simply describe *homo sapiens* as the "reasoning animal." This is the general burden of the now vast literature on "bounded rationality," and reasoning under time-bound, uncertain, or other sub-optimal conditions. Human cognition is comprised of a combination of numerous heuristics – cognitive short-cuts which are efficient and effective in the right context, error-prone in others – along with the more abstract reasoning skills described by logic. What is key here is that the heuristic responses are typically spontaneous and immediate; "quick and dirty," as the saying goes, rather than reflective and deliberative. As Tallis himself points out, many emotions and other behaviours, including laughter and yawning, are "contagious". Such behaviours are triggered beneath conscious intention, by the laughing and yawning of those around us. On one influential account, emotions in general are "gut reactions," rapid appraisals of the relevance for us of events that we encounter; appraisals which are then typically re-evaluated but which nonetheless constitute our initial response and form the baseline of any reappraisal.[25] All of these forms of affective and cognitive response are, in other words, evidence of our animal natures in precisely Tallis' sense: they demonstrate how we are, in many ways, precisely "wired into the world."
My aim so far has been to consider some of the worries raised by critics of contemporary neuroscience and to show that they are often groundless, overstated or at least in need of further elaboration and defence. I hope to have created some space for naturalism. If I have succeeded, we are now in a position to consider the relevance of a naturalistic perspective on human behaviour and experience for film; an approach informed by neuroscience and evolutionary theory. I will explore this perspective via an examination of the way in which filmmakers seek to elicit, and the way in which spectators experience, two particular forms of affective response: the *startle response* and *empathic mirroring*.

Startling Sounds and Sights

When we jump at a loud or unexpected noise or at a sudden, dramatic change in our field of vision, we are experiencing the startle response. Startling in this manner is a brainstem reflex: we cannot, at least under normal circumstances, exert significant control over it. We can no more stop ourselves startling at a loud, unanticipated gunshot than we can halt the shrinking of our pupils when we move into a field of bright light. The startle response depends on specific neural pathways – leading from the visual and acoustic systems through to the motor cortex.[26] Signals carried on this pathway cause the charac-

24) See José Luis B e r m ú d e z, *Thinking Without Words*. Oxford: Oxford University Press 2003; Susan H u r l e y, Animal Action in the Space of Reasons. *Mind and Language* 18, 2003, no. 3, pp. 231–256.
25) Jesse J. P r i n z, *Gut Reactions: A Perceptual Theory of Emotion* Oxford: Oxford University Press 2004.
26) For more detail, see Ronald C. S i m o n s, *Boo! Culture, Experience, and the Startle Reflex*. Oxford: Oxford University Press 1996, pp. 9–15; and Michael D a v i s, The Mammalian Startle Response. In: Robert C. E a t o n (ed.), *Neural Mechanisms of Startle Behavior*. New York: Plenum 1984, pp. 287–351.



Stills 1–6. IRON MAN (Jon Favreau, 2008).

teristic motor "jerk" of the torso and limbs, along with an eye blink and distinctive facial expression. Being evolutionarily ancient, the startle response is found in many species, and its evolutionary function is not hard to discern: in potentially threatening situations, the startle response propels us into a state of heightened attention.[27] In this sense, the startle response is very clear evidence of both "the continuity of species" – of the evolutionary continuity between humans and other animals – and of the way in which we are "wired into the world."

How have filmmakers drawn upon the startle response? In reading the paragraph above, many readers will doubtless have recalled examples from horror movies and from thrillers. The "startle effect" is a staple of such films, just as the crying human face is a key ingredient in the melodrama. Robert Baird suggests that the startle effect as an integral feature of the horror film can be traced to producer Val Lewton, who referred to such effects as "busses," named after his first use of the technique in CAT PEOPLE (Jacques Tourneur, 1942), where we are startled by the sudden and unexpected appearance of a bus from off-screen.[28] IRON MAN (Jon Favreau, 2008) furnishes us with a more recent

27) Juan M. C a s t e l l o t e – Hertice K u m r u – Ana Q u e r a l t – Josep V a l l s - S o l é, A Startle Speeds up the Execution of Externally Guided Saccades. *Experimental Brain Research* 177, 2007, no. 1, pp. 129–136.

28) Robert B a i r d, The Startle Effect: Implications for Spectator Cognition and Media Theory. *Film Quarterly* 53, 2000, no. 3, pp. 12–24.

but similar example. Tony Stark (Robert Downey Jnr.) is being escorted by a group of American soldiers in a Humvee across a desert landscape in Afghanistan. The scene begins with a shot framing in the centre of the vehicle a boom box on which plays the AC/DC song "Back in Black," first heard at high volume, before settling after a few seconds into its function as diegetic background music. The camera tilts up from the boom box to reveal, through the windscreen, two other Humvees in front of the one in which the camera is situated (still 1). Stark is a flamboyant character– a celebrated inventor who is equally well-known as a playboy. Incongruously, he cradles a cocktail (still 2), and, after a few seconds, he starts to banter in good-natured fashion with the soldiers.

The soldier sitting alongside Stark in the back of the vehicle asks if he can get a photo with him; Stark assents and strikes a pose with him, while the solider in the front passenger seat frames the shot. Cutting between Stark and the solider in the back seat (still 3), and the soldier taking the shot in the front seat (still 4), the action focuses on the framing and staging of the photo. Across the thirty or so seconds that have elapsed since the scene began, then, the film has worked to focus the spectator's attention on the initially tentative, but increasingly relaxed and humorous, interaction between Stark and the soldiers. The AC/DC song, Stark's cocktail, and his irreverent jesting create a sociable atmosphere within the Humvee; an atmosphere that stands at odds with and distracts us from the treacherous environment outside the vehicle. A micro-narrative is created around the taking of the photograph, which we expect to be completed. A complex but stable overall rhythm emerges from the blending of editing, figure movement, and the AC/DC song; the auditory dynamics of the scene are similarly stable. All of these factors set up the startle response cue – a sudden and tumultuous blast as the Humvee in front of Stark's vehicle is destroyed by a rocket-propelled grenade or a missile (an explosion that resonates through every speaker in a surround sound system). The explosion is rendered visually across three rapidly cut shots – beginning in the background behind the soldier taking the photo (still 5), continuing in a shot of the convoy (still 6),[29] and concluding with a return to the framing inside Stark's vehicle, as debris from the destroyed Humvee lands on top of it.

Now, it is obviously the case that our appreciation of this scene and the film as a whole depends upon a whole array of mental capacities that go far beyond the brief, involuntary, reflex-like reaction that is the startle response. In order to make basic sense of the action, viewers need to understand the dialogue, to interpret facial and vocal expressions, and to figure out the spatial relations among the agents and features of the setting. If their understanding is to go beyond very basic comprehension, spectators will in addition need to bring to bear a great deal of culturally-specific knowledge – including, for example, knowledge about Marvel Comics, about Robert Downey Jnr., and about the "war on terror,"– on the unfolding action. None of this knowledge, however, makes star-

29) In fact, the onset of the explosion is visible in both the first and second of these three shots. But this is not an instance of true "overlapping" editing, in the Eisensteinian sense, since the very brief overlap is not consciously perceptible under ordinary viewing conditions. It is nevertheless very likely that the overlap is registered non-consciously, and may play an indirect role in our conscious experience of the action as rapid, disjunctive and chaotic.

tle cues like the explosion in IRON MAN – and the primitive response that it triggers – any less significant, any less a designed feature of the film that exploits a real and important feature of human psychology. Here the startle cue performs a number of functions: it embodies a major narrative development (indeed, a plot point); it symbolizes in concrete form the danger posed by the Afghan insurgents; and it delivers a thrilling "whomp" – one of those powerful bodily sensations so characteristic of action and horror movies, very much akin to the visceral, stomach-in-mouth pleasures of fairground rides.

With such disreputable associations in mind, Baird notes that the startle effect has been "[m]aligned as mindless and a hallmark of B-movies and exploitation fare."[30] Such cultural prejudice, however, should not stop us from seeking a deeper understanding of such genres, nor of the dispositions and capacities upon which they depend. Tallis and other traditionalists might be inclined to agree that the startle response is, precisely, "mindless" – a reflex response of the body bereft of flexibility and variability. But such a stance is untenable – unless we are prepared to embrace dualism, human psychology cannot be regarded as dividing conveniently into a wholly mechanical, bodily dimension and an entirely voluntaristic mental dimension. Tallis' own adage regarding "affirmative action for the body" is ironically apt here. Tallis' point, recall, is that the brain cannot be understood properly in isolation from the body. But it is equally true that cognition itself cannot be understood properly when detached from its neural and bodily grounding.

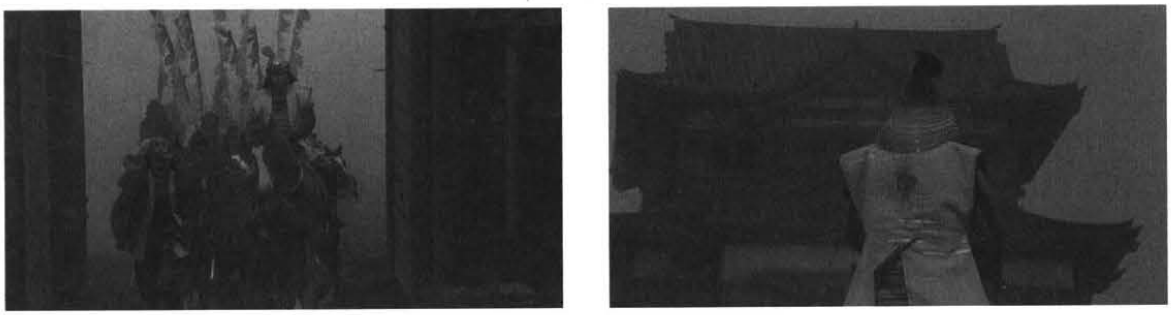
In any event, the startle effect is not uniquely associated with the horror film or with other popular genres even though it has certainly been exploited most frequently and routinely in these types of film. RAN (1985), Akira Kurosawa's free adaptation of *King Lear*, shows the effect at work in a much more "exalted" cultural context.[31] In the film, the Lear-figure Hidetora (Tatsuya Nakadai) has ceded effective leadership of the Ichimonji clan to his first son, Taro (Akira Terao), while Hidetora retains his role as titular leader of the clan. Initially in residence at Taro's castle, Hidetora leaves after arguing with him, eventually moving into the castle of his third son, Saburo (Daisuke Ryu). Taro and Jiro (Hidetora's second son, played by Jinpachi Nezu) together mount a sustained and bloody attack on Saburo's castle. Across a lengthy sequence, we witness the extraordinary carnage of battle, and the gradual progress of the attacking armies towards the capture of Saburo's castle (stills 7–10).

All diegetic sound from the battle – the clash of armour, the galloping of horses, the cries of injury and death – is suspended, however; in its stead, we hear only Toru Takemitsu's mournful, Mahler-inspired score. Until, that is, we see Taro, leading the offensive army and entering Saburo's castle on horseback – at which point he is shot in the back, a single, loud gunshot terminating the musical cue abruptly and marking the restoration of diegetic sound (stills 11 and 12).

30) R. B a i r d, The Startle Effect, p. 15.

31) In describing RAN as a "free" adaptation, I mean to indicate that the film borrows many elements from *King Lear* and seems designed to bring Shakespeare's play to mind, but it does not seem intended as a "faithful" adaptation, in which overall fidelity to the play is a primary goal. See Paisley L i v i n g s t o n, On the Appreciation of Cinematic Adaptations. *Projections* 4, 2010, no. 2, pp. 102–127. Livingston notes the use of the phrase "free adaptation" in the credits for FELLINI – SATYRICON (1969).

Stills 7–10. RAN (Akira Kurosawa, 1985).



Stills 11–12. RAN (Akira Kurosawa, 1985).

As in the IRON MAN sequence, a striking change in the overall rhythm of the scene, initiated by the occurrence of an unanticipated event, as well as a sudden loud sound, prompt the startle response. And here, the force of the startle is both to underline a dramatic turning point, and to remind us of the physical brutality of war. The startle effect begins a process of defamiliarization, whereby our appreciation of what is being represented is heightened by the shift in style. First, we witness slaughter on a mass scale, through the stylized, "operatic" phase of the sequence, when only the score is audible; then, with the re-entry of diegetic sound, the realistic potential of the visual imagery is drawn out. The startle generated by the gunshot marks the dividing line between the two styles; the effect of defamiliarization therefore turns on this moment.

Thus far in this discussion of the startle response, I have assumed that the response itself is an invariant feature of human physiology; what variation of function we see arises from the contexts in which it is spontaneously triggered or exploited by design, as in IRON MAN and RAN. In fact, to some extent, context may affect the form as well as the function of the startle response. "Unlike the knee-jerk, the sneeze, or the flinch," writes

Baird, "startle reflexes are modified by emotional and cognitive states." According to Peter Lang and his collaborators, "the vigor of the startle reflex varies systematically with an organism's emotional state [...] the startle response (an aversive reflex) is enhanced during a fear state and is diminished in a pleasant emotional context."[32] Baird points to the "threat scene" as evidence of horror filmmakers understanding, whether fully conscious or more intuitive, of this fact. In such a scene, a character is presented as fearful of a hidden, often indeterminate, off-screen threat; after depicting the character's anxiety for a period, the immediate space around the character is subjected to a sudden intrusion, typically from an unpredictable direction or in an unpredictable manner. The threat phase of the sequence primes us for the startle response; in an anxious and fearful state, we are more likely to be startled. (Baird suggests that this is why we find the startle effect much more frequently in horror and thriller films than in any other filmic context.) Threat scenes thus perform a balancing act between priming and misdirection: an unsettling, fearful mood is created but within that broad affective context, our attention is taken away at the critical moment from the precise spatial location of the threat.

Baird analyses the bus scene from CAT PEOPLE as an important historical exemplar. Alice (Jane Randolph) is seen making her way through the streets at night. She senses that she is being followed by someone or something, and glances several times to screen left. After this pattern has been sustained over some seconds, a bus abruptly and noisily enters from screen right. The sequence from IRON MAN is closer to this antecedent than the sequence from RAN: in the former case, general knowledge of war zones and particular knowledge about attacks on military convoys in Afghanistan puts us on alert. The relaxed social atmosphere in the Humvee – Stark's incongruous cocktail, AC/DC hammering away, the badinage and business around the taking of the photo – are designed to distract us from the possibility of an attack; our visual attention in particular is (mis-)directed to the right of the frame (where the photographer lines up the camera) and away from the centre of the frame (where the Humvee in front will explode). In the RAN sequence, the sense of threat is somewhat dampened and flattened by the suspended diegetic sound, and the fatal bullet is less visibly intrusive than the bus (in CAT PEOPLE) or the missile (in IRON MAN); even so, the basic constituents (character, implied threat, and sudden intrusion) are in place here as well.

There is also some evidence that the startle response may be subject to more idiosyncratic and elaborate cultural variations. Members of Malaysian, Indonesian, and some other Southeast Asian cultures recognize a condition called *latah*, which roughly translates as "jumpy."[33] Those suffering from the condition appear to have a strong innate predisposition towards being startled, but this predisposition is combined with some element of learned performance (playing up of the startle response) through "matching" (mimicry

32) Peter J. L a n g et al, Emotion, Attention, and the Startle Reflex. *Psychological Review* 97, 1990, no. 3, p. 377; quoted in R. B a i r d, The Startle Effect, p. 20.

33) According to Simons, versions of this "culture-bound syndrome" are scattered in other locations outside Asia as well – "in a most improbable set of other places around the globe – Siberia, Maine, Yemen, and the Island of Hokkaido, to name a few." R. C. S i m o n s, *Boo!*, p. vii.

of the startling event) and "automatic" obedience to a command following the startle. In an interview with anthropologist Ronald Simons, Cik Alimah binti Mamad gives the following account of the behaviour of a *latah*:

> When she's sitting quietly we can take a piece of wood and bang it, or we can poke her in the ribs over and over and she'll become *latah*. She gets startled! Then if we order her to hit or dance, she'll hit or dance. And she'll do whatever we tell her to do with what she's holding. Whoever is in front of her will be hit. That's what a *latah* does![34]

To some extent, latah resembles the practice of acting out and playing up startle and fear responses among Western horror movie audiences, especially among teenage female spectators; though in this context, the practice is not so elaborately developed, and appears to be restricted to the time and space of spectatorship.[35] On the one hand, then, latah appears to be grounded in the startle response; on the other hand, latah appears to be a cultural extension of the response, where the effects of learning and context are evident. "The nearer the onset of the original response (speaking of microseconds), the more innate, 'hard-wired' the response," Baird argues; "conversely, the further from onset, the more learning, context, and personality influenced behavior".[36] As with the film sequences discussed above, there is no difficulty, in principle or in practice, in recognizing both the invariant physiological basis and the variations achieved through particular uses and cultural elaborations of the startle response. For this reason, we can acknowledge that the response "wires us into the world" without denying that the response figures as just one part of the immensely complex and flexible cognitive and behavioural repertoire possessed by human beings.

Mirror Thrills

Another element in that repertoire is the set of interrelated capacities usually gathered under the label *empathy* – a term which is used to refer to a variety of phenomena, ranging from the conscious, imaginative effort to "perspective take" or put oneself in another's shoes, to affective mimicry and emotional contagion, whereby we "catch" the emotions of others through a process of low-level, non-conscious, involuntary mimicry.[37] This is one of the contexts in which the discovery of *mirror neurons* has been so signifi-

34) R. C. Simons, *Boo!*, p.162.

35) Thanks to the journal referee for this point.

36) R. B a i r d, The Startle Effect, p. 21. See also Carl P l a n t i n g a, *Moving Viewers: American Film and the Spectator's Experience*. Berkeley: University of California Press 2009, p. 119.

37) On the distinction between affective mimicry and contagion, see my Empathy, Expansionism, and the Extended Mind. In: Amy C o p l a n – Peter G o l d i e (eds.), *Empathy: Philosophical and Psychological Perspectives*. Oxford: Oxford University Press 2011, p. 101. In the case of contagion, we lack awareness of and control over not merely the mechanism by which we pick up the emotions of others, but awareness of even the fact that our emotional state derives from or has been triggered by the states of those around us.

cant. Mirror neurons are active both when subjects perform an action, and when they observe that same action being performed. There is evidence that a neural "mirror system" exists in humans for "somatosensory" experiences (tactile, proprioceptive, and pain-related sensations), basic actions (grasping objects, switching switches) and basic emotions (including disgust and sadness).[38] The mirror system, then, is the neural substrate that realizes our capacities for sensory, motor and affective mimicry – the modeling of the basic emotions and intended actions of others via simulation, that is, by running them on our own embodied minds. These abilities, in turn, appear to be central to the intensely social character of human existence: sensory and affective mimicry enable a rapid, almost seamless, grasp of the basic affective states of the individuals and groups with whom we interact, while motor mimicry enhances not only our ability to recognize with ease and facility the intentions of others (as these are embodied in basic actions), but also our ability to pick up new motor skills (such as those at stake in sporting activity or musical performance, as well as more in utilitarian tasks). In this context, as Margrethe Vaage has put it, seeing is feeling: the mirror system allows us to simulate the sensations, emotions, movements, and actions of those we observe.[39]

Mirror neurons are not unique to humans – indeed, they were first discovered in macaque monkeys, and research on mirror neurons in humans is still at an early (and in many ways controversial) stage. The passage of discovery, however – from macaques to humans – nevertheless underlines, and indeed encapsulates metaphorically, the continuity of species. No matter how massively humans may have evolved – biologically and culturally – in a distinctive direction, we share many ancient physiological, psychological and behavioural traits with other animal species, particularly primates (as Darwin stressed in *The Expression of the Emotions in Man and Animals*).[40] We have an important instance here of the fruitfulness of one of Cronin's ethological "explanatory principles" – that is, a principle setting human behaviour in the context of other animal behaviour: were neuroscientists not prepared to propose and test hypotheses about humans based on non-human characteristics or behaviour, no-one would even be exploring the existence and nature of the human mirror system. In the present context, however, the key point about mirror neurons, and the sensory, motor and affective mimicry that they implement and enable, is not so much that they tie us with our evolutionary ancestors and cousins, but that they *"wire" us into each other*. In the words of Gallese, Keysers, and Rizzolatti – key players in the discovery of mirror neurons – mirror neurons enable a "direct experiential" form of understanding the actions and emotions of our

38) See David F r e e d b e r g – Vittorio G a l l e s e, Motion, Emotion and Empathy in Esthetic Experience. *Trends in Cognitive Sciences* 11, 2007, no. 5, pp. 197–203; Christian K e y s e r s – Jon H. K a a s – Valeria G a z z o l a, Somatosensation in Social Perception. *Nature Reviews* 11, 2010, pp. 417–428; and Alison M o t l u k, Mirror Neurons Control Erection Response to Porn. *New Scientist* (16. 6. 2008). Online: <http://www.newscientist.com/article/dn14147-mirror-neurons-control-erection-response-to-porn.html>, [cited 19. 11. 2011].

39) Margrethe Bruun V a a g e, *Seeing is Feeling: Empathy and the Film Spectator*. PhD dissertation. Oslo: University of Oslo 2009.

40) Charles D a r w i n, *The Expression of the Emotions in Man and Animals*. London: John Murray 1872.

conspecifics.[41] Or in the words of Marco Iacoboni, another member of the circle of Italian mirror neuron researchers: "[w]e empathize effortlessly and automatically with each other because evolution has selected neural systems that blend self and other's actions, intentions, and emotions [...] Our neurobiology [...] puts us 'within each other.'"[42] And, as with the startle response, filmmakers have not been slow to exploit this capacity.

127 Hours (Danny Boyle, 2011) provides a recent and vivid example of the way in which filmmakers may draw upon our ability to mirror the experiences of others. The film relates the true story of Aaron Ralston (played by James Franco), a mountain climber who goes on a solo biking and climbing trip in the Utah desert. While climbing in a narrow canyon, a rock fall results in one of Ralston's arms becoming trapped beneath a boulder. From the outset, the film is intent on giving expression to Ralston's sensory experiences – the intense pace of his life, the rush of pleasure he takes in climbing and biking, the dry heat of the south-western desert landscape, and so on.

The credit sequence of the film is a montage of large-scale collective events, including sporting events such as a marathon, the Pamplona bull run, and a swimming gala; significantly, for our purposes, during these scenes of sporting spectacle almost as much emphasis is laid upon spectatorship of the events as on direct participation in them. The bold gestures and often extreme states engendered by sporting activity provide fertile ground for filmmakers and make our mirroring responses highly salient. The various forms of empathy – sensory, motor, and affective – are not, of course, prompted uniquely by witnessing sporting endeavours; any form of physical action, expression or sensory experience can act as a prompt to empathic mirroring. But it is no accident that many films generate drama around and through sporting encounters.[43] Along with the action film, the sports film is one of the major sites for the generation of what we might call "mirror thrills" – intense, bodily sensations triggered by and tracking those of the characters on screen.

Cues for such mirror thrills are present in concentrated form during the climax of 127 Hours. By this point in the plot, Ralston has been trapped in the canyon for approaching five days. His water supply has run out, delirium from exhaustion has set in, and there is no realistic prospect of his being discovered by other hikers or climbers, such is the remote and obscure nature of his location. Ralston faces a stark choice: either to die a lonely death from heat exhaustion and dehydration in the canyon or to find a way to release himself from the imprisoning boulder. Ralston chooses survival – by amputating his trapped arm using a blunt penknife. The film goes to great lengths to get

41) Vittorio Gallese – Christian Keysers – Giacomo Rizzolatti, A Unifying View of the Basis of Social Cognition. *Trends in Cognitive Science* 8, 2004, no. 9, p. 397.

42) Marco Iacoboni, Within Each Other: Neural Mechanisms for Empathy in the Primate Brain. In: A. Coplan – P. Goldie, p. 57.

43) I discuss one such encounter – a tennis match in Hitchcock's Strangers on a Train (1951) – in my Triangulating Aesthetic Experience. In: Steve Palmer – Art Shimamura (eds.), *Aesthetic Science*. Oxford: Oxford University Press 2011.

Stills 13–16. 127 Hours (Danny Boyle, 2011).

us to feel the excruciating quality of his situation – that is, both the literal pain of the trapped arm, and the larger anxiety connected to both his isolated entrapment and to his impending death in the canyon.

In the climactic scene of the amputation, all three types of mirroring come into play, because Ralston is both an agent and an object in this scene. That is, the film invites us to mirror the *sensations* of his trapped and dying arm (the constant weight of the boulder, the cutting and ripping of skin, and the breaking of bone); the strenuous efforts – *motor actions* – of Ralston as he contorts his body to break his arm and cut himself free; and his *facial* and *vocal expressions* of pain (stills 13–16).

What might Tallis make of my emphasis on the role of mirror neurons in explaining our experience of 127 Hours? Tallis' writings are curious because – as we might expect given his medical background – many of them are larded with discussions of human physiology, including neurophysiology, which run alongside his emphasis on the distance between humans and the rest of the animal kingdom. As a consequence of his emphasis on the most sophisticated aspects of human cognition however, Tallis is in danger of caricaturing human psychology and the place of human existence in the natural world. As we have seen, humans are "wired into the world" in the sense that a great many human reactions are spontaneous and unreflective; non-conscious, autonomous responses and literal reflexes represent an extreme on the spectrum of types of human response, but they can hardly be ignored. And more specifically, humans – like the members of many other species – are "wired into" the minds of their fellows by virtue of somatosensory, motor and affective mimicry, psychological capacities realized by mirror neurons. These capacities allow us to track, virtually effortlessly, the basic emotional states of those around us, and assist us in imitating and in learning new motor skills. Of course such capacities

do not describe the human mind exhaustively; neither can they be regarded as exemplars for all forms of human mental activity. But they cannot be written off as trivial or unreal facets of the human behaviourial repertoire.

So What?

Let me conclude by offering some thoughts in response to an inevitable, and good, question: what exactly is it that the neuroscientific elements of the analyses I've offered can be said to add to our understanding? What can we learn about the startle response and empathic mirroring that we didn't, or couldn't, know from the existing sources of knowledge at our disposal (including reflection on our experience, exploration of the practices and discussions of filmmakers, and psychological theories of these phenomena)?First and most basically we gain knowledge about the very existence of the phenomena. Empathy has been disputed for as long as it has been an object of speculation; evidence of a mirror system provides a new form of evidence in favour of its existence. The startle response might seem less fragile as a postulate, so robust is the evidence from ordinary experience. But what is not obvious from such experience, or from the reflections of practitioners, of critics or of viewers, is the *precise* nature of the startle with which we all have casual familiarity. How is the startle response realized physiologically and neurally? To what degree, and in what ways, is it affected by learning and by cultural context? How do these factors bear upon the role of the startle response in our experience of films? Experience and reflection are vital, but controlled observation and experimentation add a further, fine-grained level of detail to our understanding of the world. This fact points to the second way in which neuroscience adds something new to the sum of knowledge we possess about psychological phenomena like the startle response and empathic mirroring. Neural evidence sheds light on the nuances of the phenomena that elude ordinary experience and reflection.[44] In this respect, neuroscience is like any type of scientific observation that transcends the limits of ordinary human perception; the brain scanner joins the telescope, the microscope, stop motion and x–ray photography, and so on – all technologies which allows us to see new aspects of our world, or to see familiar aspects of it in greater detail.

We need to acknowledge a third way in which neuroscience may contribute to what we know. Even where neural evidence adds little detail to our picture of a phenomenon and only seems to confirm what we already knew, in reality it does or can do much more than that. It is important not to confuse here the *dramatic novelty* of some body of scientific knowledge with its strictly *epistemological value*. Scientific findings arising from controlled experiments that broadly confirm hypotheses derived from everyday experience and folk theory may not be very sexy, because they leave the landscape of ordinary belief and practice unchanged. From an epistemological point of view, however, such findings are

44) On the integration of phenomenological, psychological, and neurological evidence, see my Triangulating Aesthetic Experience.

significant, adding the kind of systematic and quantitative evidence provided by scientific methods to the looser, anecdotal, and experiential evidence already in our possession. The point here is not to denigrate these latter forms of evidence, but just to point up the limited sense in which we can be said to "already know" something based only upon them. Knowledge arises not only from the dazzling and unexpected finding, but also from the gradual accumulation and correction of detail, and the convergence among the different sources of knowledge upon which we draw.[45])

Murray Smith (1962)

Professor of Film Studies at the University of Kent, Canterbury, UK, where he has taught since 1992. Since 1995 he has been an advisory board member of the Society for Cognitive Studies of the Moving Image. His research focuses on the psychology and philosophy of film; his current projects include a work on the naturalized aesthetics of film. His publications include *Engaging Characters: Fiction, Emotion, and the Cinema* (Clarendon, 1995), *Film Theory and Philosophy* (co-edited with Richard Allen) (Clarendon, 1998), *Contemporary Hollywood Cinema* (co-edited with Steve Neale) (Routledge, 1998), *Trainspotting* (British Film Institute, 2002), and *Thinking through Cinema* (co-edited with Tom Wartenberg) (Blackwell, 2006). (*Address*: mss@kent.ac.uk)

Cited Films and TV Series:

127 Hours (Danny Boyle, 2011), *Baywatch* (various directors, 1990–99), *Cat People* (Jacques Tourneur, 1942), *Iron Man* (Jon Favreau, 2008), *Ran* (Akira Kurosawa, 1985), *Fellini – Satyricon* (Federico Fellini, 1969), *Strangers on a Train* (Alfred Hitchcock, 1951).

45) My thanks to Tereza Hadravova for her support and helpful feedback, and an anonymous reviewer for their astute comments.

ILUMINACE
Volume 23, 2011, No. 4 (84)

SUMMARY

"THE PIT OF NATURALISM"

Neuroscience and the Naturalized Aesthetics of Film

Murray Smith

Neuroscience has become ubiquitous, venturing into domains well beyond the study of the brain *per se*. In this paper I provide an overview and provisional assessment of the impact that neuroscience might have on filmmaking and on the study of film. I begin by surveying some of the objections raised against contemporary neuroscience, with a particular focus on one of the most voluble neurosceptics, Raymond Tallis. I then propose some ways in which existing neuroscientific research can be mobilized to deepen and nuance our understanding of some aspects of film spectatorship, via two case studies – on the startle response, which I discuss in relation to CAT PEOPLE, IRON MAN, and RAN, and on empathy, explored through 127 HOURS. I conclude by seeking to make explicit the kinds of epistemological contribution that we might expect scientific knowledge, including neuroscientific knowledge, to make to our understanding of film.