

Durham Research Online

Deposited in DRO:

23 May 2008

Version of attached file:

Published Version

Peer-review status of attached file:

Peer-reviewed

Citation for published item:

Ratcliffe, M. J. (2003) 'Scientific naturalism and the neurology of religious experience.', *Religious studies.*, 39 (3). pp. 323-345.

Further information on publisher's website:

<http://dx.doi.org/10.1017/S0034412503006413>

Publisher's copyright statement:

2003 Cambridge University Press

Additional information:

Use policy

The full-text may be used and/or reproduced, and given to third parties in any format or medium, without prior permission or charge, for personal research or study, educational, or not-for-profit purposes provided that:

- a full bibliographic reference is made to the original source
- a [link](#) is made to the metadata record in DRO
- the full-text is not changed in any way

The full-text must not be sold in any format or medium without the formal permission of the copyright holders.

Please consult the [full DRO policy](#) for further details.

Durham Research Online

Deposited in DRO:
23 May 2008.

Version of attached file:
Published.

Peer-review status of attached file:
Peer-reviewed.

Citation for published item:
Ratcliffe, M. J. (2003) 'Scientific naturalism and the neurology of religious experience.' ,
Religious studies., 39 (3), pp. 323-345.

Further information on publisher's website:
<http://dx.doi.org/10.1017/S0034412503006413>

Use policy

The full-text may be used and/or reproduced, and given to third parties in any format or medium, without prior permission or charge, for personal research or study, educational, or not-for-profit purposes provided that :

- a full bibliographic reference is made to the original source
- a link is made to the metadata record in DRO
- the full-text is not changed in any way

The full-text must not be sold in any format or medium without the formal permission of the copyright holders.

Scientific naturalism and the neurology of religious experience

MATTHEW RATCLIFFE

Department of Philosophy, University of Durham, 50, Old Elvet, Durham DH1 3HN

Abstract: In this paper, I consider V. S. Ramachandran's in-principle agnosticism concerning whether neurological studies of religious experience can be taken as support for the claim that God really does communicate with people during religious experiences. *Contra* Ramachandran, I argue that it is by no means obvious that agnosticism is the proper *scientific* attitude to adopt in relation to this claim. I go on to show how the questions of whether it is (1) a scientifically testable claim and (2) a plausible hypothesis, serve to open up some important philosophical issues concerning interpretive backgrounds that are presupposed in the assessment of scientific hypotheses. More specifically, I argue that naturalism or scientific objectivism in its various forms is not simply a neutral or default methodological backdrop for empirical inquiry but involves acceptance of a specific ontology, which functions as an implicit and unargued constitutive commitment. Hence, these neurological studies can be employed as a lever with which to disclose something of the ways in which different frameworks of interpretation, both theistic and atheistic, serve differently to structure and give meaning to empirical findings.

Introduction

Following a talk entitled 'The neural basis of religious experience', presented by V. S. Ramachandran and colleagues at a conference of the Society for Neuroscience in October 1997, the alleged discovery of a 'God-spot' or 'God-module' in the brain has received much media attention, largely due to its potential ramifications for our understanding of religious belief.¹ In this essay, I will begin by briefly outlining what Ramachandran's study² purports to show. I will then examine its possible implications for the claim that God really does communicate with people during religious experiences. Contrary to Ramachandran's own view, I will argue that an in-principle agnosticism is not a sustainable position to adopt in relation to this claim. A refusal to entertain the possibility that God speaks to people during religious experiences as an aspect of

scientific deliberation does not amount to neutrality. In fact, it ultimately entails an ontological rather than merely methodological position, a position that implicitly rules out the possibility of certain coherent, theistic ontological claims.

Hence, my purpose here is not to decide whether such studies do or do not constitute evidence that religious experiences have veridical objects but rather to employ them as a specific illustration of how a supposedly neutral *methodological* standpoint can commit one to an *ontological* position antagonistic to a substantial body of religious beliefs. My argument complements concerns voiced by Alvin Plantinga on a number of occasions (e.g. 1991/1998) to the effect that *methodological* exclusion of theistic claims in science often amounts to an unwarranted *ontological* exclusion.

I will conclude by illustrating that the plausibility of claims such as there are neurological structures for communicating with God cannot be weighed up in a wholly empirical fashion. This is because pre-existent ontological commitments, whether theistic or atheistic, serve as backdrops for the interpretation and even individuation of biological structures, differently determining the kinds of biological entities whose being one is prepared to acknowledge as a possibility. Thus, if debate over the question is to be possible, it must involve an interplay between empirical and hermeneutic considerations.

Ramachandran on the neurology of religious experience

It has long been known that certain subjects affected by focal temporal-lobe epilepsy report profound religious feelings during seizures, feelings that may persist, with a lesser degree of intensity, after seizures have ceased.³ As Ramachandran notes, subjects with seizures ‘originating in this part of the brain can have intense, spiritual experiences during the seizures and sometimes become preoccupied with religious and moral issues even during seizure-free or interictal periods’ (1998, 175).⁴ But how can one explain ‘the flights of intense religious ecstasy experienced by patients with temporal lobe seizures or their claim that God speaks directly to them?’ (1998, 176). One might be tempted to dismiss such experiences as a pathological effect or malfunction specific to a certain neurological condition. However, experiments carried out by Michael Persinger with a transcranial magnetic stimulator (discussed by Ramachandran (1998, 174–175)) cast doubt upon this. Magnetic stimulation of parts of the brain can induce various psychological and behavioural effects, some of which are uniquely associated with stimulation of quite specific brain areas, thus providing clues about the possible localization of certain brain functions. When stimulating parts of his temporal lobes, Persinger apparently ‘found to his amazement that he experienced God for the first time in his life’ (Ramachandran, 1998, 175). This possibility of producing similar psychological effects in subjects with no history of temporal-lobe seizures suggests that the capacity for these experiences is not restricted to

certain epileptics but is much more general or even universal, even though it is considerably more pronounced in some people. So it seems that there is a common but variably active neurological structure involved in religious experience, whose activity might be explained in a number of different ways.

Ramachandran (1998, 181–182) entertains four possibilities:

- (1) God really does speak to people during focal temporal-lobe seizures.
- (2) Religious experiences are a misinterpretation or ad-hoc rationalization of emotional chaos.
- (3) Religious experiences are a result of general enhancement of neural pathways between the limbic system and temporal lobe, resulting in patients imbuing everything with excessive significance.⁵
- (4) Specialized neural circuitry mediates specifically *religious* experience.

Ramachandran dismisses (1) on the basis that it ‘can be neither proved nor ruled out on empirical grounds’ (1998, 182). He also dismisses (2), given that there are myriad cases of emotional chaos that aren’t interpreted religiously. Hence the two main contenders are (3) and (4). The media attention surrounding Ramachandran *et al.*’s 1997 presentation and 1998 report relates to the results of an experiment set up to test the relative plausibility of these two explanations. Ramachandran *et al.* measured galvanic skin responses of two temporal-lobe patients in order to monitor their emotional reactions to various words and icons, some with strong religious associations, some mundane, and others non-religious but generally perceived as emotive. Hypothesis (3) predicts enhanced emotional reactions across the board. However, Ramachandran *et al.* found a selectively enhanced response only to religious words and icons in temporal-lobe patients. In conjunction with this, compared with other subjects there was a diminished sensitivity to other emotive categories such as sexual imagery (see Ramachandran, 1998, 185–188). Selective response to religious words and imagery rules out (3), leaving only (4). Hence Ramachandran states that ‘the one clear conclusion that emerges from all this is that there are circuits in the human brain that are involved in religious experience and that these become hyperactive in some epileptics’ (1998, 188).

It is important to note that this is a very modest conclusion and fails to differentiate a number of more specific claims. For example, the involvement of common neurological structures does not entail that those structures have the *function* of sub-serving religious experience. Religious experience could just as well be a malfunction or a contingent side effect of a different function with which these structures are involved. It is also by no means certain that the neural pathways identified constitute a distinct and complete *circuit*, rather than a part of a larger system that cannot be fruitfully considered in isolation from that system.⁶ By analogy, a tennis player’s hands make a major contribution to her

tennis-playing ability, and their absence would probably put paid to her sporting career, but it would be a mistake to infer that the hands constitute a distinct and complete tennis system that can be studied in isolation from the rest of the organism. Furthermore, as Ramachandran (1998, 184) acknowledges, the experimental results do not imply that religious experience is in any illuminating sense *biological*. Specific biological structures are involved in writing books, kicking balls, and smoking cigarettes but this does not imply that such pastimes are written into our biology. So Ramachandran's results are still a long way from suggesting a 'God-module'; that is, a discrete neurological structure whose *function* is to produce or mediate religious experience.

Hence, a pressing goal for future research is to assess the many competing hypotheses that remain viable. However, Ramachandran explicitly states that one hypothesis not up for scientific debate is (1) that God really does speak to people during temporal-lobe seizures. He claims that 'this can be neither proved nor ruled out on empirical grounds' (1998, 182), and maintains that 'my goal as a scientist ... is to discover how and why religious sentiments originate in the brain, but this has no bearing one way or the other on whether God really exists or not' (1998, 185). Hence, the position advocated in respect of the theistic hypothesis is one of religious neutrality. Theistic claims are, it seems, excluded by definition from the scope of science, which can investigate the brain structures involved in religious experience without prejudicing one way or the other the claim that God really interacts with people during religious experiences.

Plantinga (e.g. 1991/1998, 1997) claims that this sort of *methodological naturalism* often, though not always, involves a kind of ontological commitment, a provisional atheism rather than religious neutrality:

We are sometimes told that natural science is *natural* science. So far it is hard to object: but how shall we take the term 'natural' here? It could mean that natural science is science devoted to the study of nature. Fair enough. But it is also taken to mean that natural science involves a *methodological naturalism* or provisional atheism: no hypothesis according to which God has done this or that can qualify as a *scientific* hypothesis. (1991/1998, 693)

According to Plantinga (1991/1998, 694), methodological naturalism slides into a 'sober [atheistic] metaphysical truth' which is 'settled and fundamental'. McMullin argues in response to Plantinga, that 'methodological naturalism does not restrict our study of nature; it just lays down which sort of study qualifies as "scientific"' (1993/1998, 702). He contends that scientific theorizing is simply not the kind of activity that can entertain claims concerning God's agency, but that this is just a methodological restriction that serves to determine the scope and limits of science. In other words, the restriction is part of the definition of science and does not entail any ontological claims. Though specific scientific hypotheses can come into conflict with religious doctrine, there is no sense in which methodological naturalism is itself a source of conflict. Science does not rule out

theistic claims a priori but leaves them outside its scope, to be legitimately entertained elsewhere:

Scientists have to proceed in this way; the methodology of natural science gives no purchase on the claim that a particular event or type of event is to be explained by invoking God's 'special' action or by calling on the testimony of Scripture. Calling this methodological naturalism is simply a way of drawing attention to the fact that it is a way of characterizing a particular methodology, no more. In particular, it is not an ontological claim about what sort of agency is or is not possible. (Plantinga (1993/1998, 702))

Ruse argues similarly that,

... the metaphysical naturalist is the person who is an atheist, who does deny that there is anything beyond blind law working on inert matter. The methodological naturalist, who may well be an ardent Darwinian, is one who states that for the purposes of doing science nothing but law will be entertained, but who recognizes that there might be more, in fact or meaning. (2001, 99)

The disagreement between Plantinga and McMullin is explicitly concerned with the question of Darwinian evolution versus Biblical Special Creation and whether, as Plantinga maintains, methodological naturalism functions as a background of ontological presuppositions relative to which Special Creation is rendered untenable. According to Plantinga, it is a background that the theist should not feel compelled to accept. Unlike Plantinga, I assume the truth of some account of biological evolution, and I also accept that natural selection is an important source of evolutionary change. However, I will argue in what follows that methodological naturalism, construed as a definitive refusal to entertain theistic possibilities in a scientific context, *itself* entails *ontological* claims that are antagonistic to theism. Hence, contrary to McMullin's claim that methodological naturalism does not amount to 'an ontological claim about what sort of agency is or is not possible', I will argue that it does sometimes entail such commitments. In what follows, I will focus on the claim that God communicates with people during religious experiences. I will show that refusal to entertain this theistic hypothesis as an integral aspect of scientific inquiry into the neural basis of religious experience ultimately entails a denial of the veridicality of religious experience.

The contents of religious experience

In order to argue that supposedly neutral, *methodological* naturalism in relation to the neurology of religious experience actually involves the denial of the ontological claim that God communicates with people through religious experience, one must first give some indication of what this claim involves. What is meant by a 'religious experience' and by the 'object' of such an experience? What common experience can be said to unify the category 'religious' and what elements, if any, do all religious experiences incorporate? Reports of religious

experiences are culturally and historically extremely diverse. Not only do religious experiences involve a vast diversity of elements but many of these elements are exclusive to only certain doctrines and may be incompatible with the central tenets of other doctrines. Hence in order to extract elements common to all, many features must be regarded as inessential.

In addressing the question of whether there is a *common core* underlying all religious experiences, it is instructive to turn to William James's classic discussion in *The Varieties of Religious Experience*. James surveys a plethora of different kinds of religious experience and argues that, in order to extract that which is shared by and essential to all, one has to subordinate the intellectual aspect of the experience to a more basic *feeling*:

Individuality is founded in feeling; and the recesses of feeling, the darker, blinder strata of character, are the only places in the world in which we catch real fact in the making, and directly perceive how events happen, and how work is actually done. Compared with this world of living, individualized feelings, the world of generalized objects which the intellect contemplates is in fact without solidity or life. (1902, 501–502)

Cultural and historical variation in the contents of religious experiences arises, according to James, from the secondary imposition of *over-beliefs*, culturally diverse intellectualizations that differently interpret a common experience (1902, 504). The underlying feelings, however, constitute a universal experiential 'nucleus'. This nucleus takes the form of an initial sense of general unease, or un-homeliness, that is subsequently resolved through the feeling of a higher power with which one comes to connect or bond (1902, 507). The contents of this core experience do not conform exclusively to any specific religious doctrine. In fact, as James admits, they are so generic as to accommodate the imposition of either monotheistic or polytheistic over-beliefs. However, he qualifies this by saying that 'God is the natural appellation, for us Christians at least, for the supreme reality, so I will call this higher part of the universe by the name of God' (1902, 516). James's discussion thus suggests a common content of religious experiences that can be described as a feeling of some higher power which infuses one's world with meaning. This core experience does not conform exclusively to the specifics of any one religious doctrine. As Mackie (1982, 183) puts it, the most that such experiences can assure us of is 'the existence of some greater friendly power, whose precise identity and character are left wholly indeterminate'.

But should the feeling of communion with a higher being be regarded as real or illusory? James contends that religious experience does indeed point to a genuine reality beyond the mundane, physical, objective world, to a higher power with which the experiencer really does communicate. But his argument in support of this, that the world of religious experience affects our actions and anything that affects our actions must be real (1902, 516), is implausible, given that illusions and

hallucinations can also have a real influence upon our actions.⁷ However, James's description of the *content* of the experience does constitute a plausible account of the essential elements of religious experience, if not a compelling argument for the reality of its object. And this account fits in very nicely with the experiences reported by Ramachandran's subjects. Ramachandran describes how focal temporal-lobe seizures can induce 'deeply moving spiritual experiences, including a feeling of divine presence and the sense that they are in direct communion with God. Everything around them is imbued with cosmic significance' (1998, 179). The experience, as with James's descriptions, seems to involve two elements, a feeling of communion with a higher being and an infusion of life with a new sense of meaning. James and Ramachandran also agree with respect to the centrality of emotion to religious experience. James not only acknowledges the primacy of emotion but also accepts that feelings can constitute a legitimate guide to aspects of reality that are missed by commonplace intellectualizations. The importance of emotion as a constituent of one's cognition of and basic orientation towards the world is readily apparent in Ramachandran's work (see 1998, chs 7, 8, 9). It is also explicit in Damasio's recent neurological studies of emotion (1995, 2000). On the basis of such studies, it is not implausible to maintain that emotions can play an important role in revealing the world rather than merely obfuscating our intellectualization of things. Thus, the emotional foundation of religious experience does not in itself amount to a compelling reason for dismissing its object as illusory.⁸

So, in considering the veridicality of religious experience, the possibility one is required to entertain is that God is communicating with the subject in some broad sense. According to James, this generic feeling is the source of all religion. Hence a denial of its object, in conjunction with a realist understanding of religious belief, would amount to atheism. However, it is clear that, even if such experiences are not the sole source of and motivation for religious belief, they play a major role in many, if not all, religions. So a global denial of their veridicality would amount to an ontological claim that is, if not synonymous with atheism, at least antagonistic to theism. In the next section I will show that 'methodological' naturalism entails just such a denial.

Explaining the neurology of religious experience: methodology and ontology

In postulating a common neural basis for religious experience, Ramachandran's studies support James's claim that it is a unitary phenomenon, rather than an arbitrary categorization of disparate, culturally diverse, and ultimately dissimilar experiences. If methodological naturalism or scientific agnosticism concerning the experiential object is defensible and sustainable, then there is no subsequent *scientific* question of whether these experiences have a genuine

object or whether they are illusory or mistaken. But how might one obtain a more specific scientific explanation of how, and why, certain parts of the brain are involved in the production of religious experience? Ramachandran emphasizes the importance of an evolutionary explanation and states that, in order to obtain a comprehensive understanding of the mechanisms involved, the question one has to address is ‘what sorts of Darwinian selection pressures could lead to such a mechanism?’ (1998, 183).

One conceivable evolutionary explanation of the capacity for religious experience is that a specific neural structure (A) has the function of producing religious experiences (x). ‘A has function x ’ is generally taken to mean something like (1) A consistently has effect x , and (2) A came to exist or continues to exist in its current form because it does x . In other words, selection pressures that favoured the ability to do x have shaped the development of A.⁹ A broadly functional or adaptationist account of any A’s capacity to x can accommodate a number of different historical scenarios.

(1) A exists in its current form as a result of long-term selection pressures that incrementally shaped it so as to better perform x and only x . Hence x is currently the sole function of A and has been for some considerable time.

(2) A originally arose due to selection pressures that shaped it to perform task y . However, the way it performed task y also made it coincidentally able to aid the accomplishment of task x . During its more recent evolutionary history, ability to perform task x took over as the primary selection pressure shaping development of A. Hence, the current function of A is x , though its function was previously y and, in order to understand its structure, we must appreciate the role of both x and y in shaping its evolution. To apply a term coined by Gould and Vrba (1982), A’s performance of x is an *exaptation*, a role that it was not originally selected for but which has more recently become the primary focus of selection pressures on A.¹⁰

(3) A once had function x but its function is now y .

(4) A evolved as a result of its ability to perform task x or y and was then shaped by natural selection as a result of its ability to perform the other task too. It retains both functions.

(5) x is a current function of A but A had and still has a number of other functions which have to be taken into consideration in order to understand why A has its current form.

(6) x is a current function of structure B. A is part of B and is integral to B’s capacity to x .¹¹

All of the above involve some kind of adaptationist claim in respect of A’s capacity to x . That is, selection pressures favouring the production of x have or once had an influence on the genesis or persistence of structures of type A. However, a number of other historical scenarios are also possible. That structure A and effect x are in some broad sense a *product of selection* does not imply

that either A or x were themselves *selected for*. It is possible that (a) x is not and never was a function of A, or even (b) that A itself has no function and never had a function. The following accounts all incorporate either (a) or (b) or both.

(1) y is a function of A but x is a malfunction to which A is disposed as a consequence of its ability to perform y . In other words, x is not something A was selected to do and x impairs either A's or some other organismic structure's ability to perform its function.

(2) x is not and never was a function of A. It is a contingent effect arising from A's being shaped by natural selection to carry out function y . For example, the heart has the effect of making a thumping noise, which is not a function of the heart but a consequence of its pumping function. In such scenarios, x is not a malfunction but a non-functional side effect of another function. To adopt Gould and Lewontin's (1979) well-known term, x is a *spandrel*, a non-functional effect arising from selection pressures acting on a different capacity.

(3) A has no function. A is itself a spandrel, entailing that any effect x of A is also a spandrel. Natural selection never acted directly upon A, and its genesis and persistence can only be explained by treating it as a non-adaptive structural side effect of a greater adapted system.

(4) A facilitates x but x is not a *biological* capacity of A. Consider, for example, using a knife and fork, doing crossword puzzles, and watching films. For convenience, I treat ' x is not a biological capacity of A' as a subcategory of ' x is a spandrel'. Within this more general category, some spandrels are more suited to biological explanations than others.

The above comprise a fairly comprehensive but highly simplified list of the various possible evolutionary explanations of how a biological structure A and one of its effects x came about. They can be grouped into three more general categories:

- (1) x is or was a function of A.
- (2) x is a malfunction of A.
- (3) A/ x has no function and never has had.

If this explanatory framework is applied to the neural pathways associated with religious experience, it would seem that one of many possible coherent explanations is (1) that certain structures in the temporal-lobe and limbic system (A) have the function of facilitating religious experience (x), and that religious experience is functional because it allows communication with God.¹² (This is more specific than 'God communicates with people during religious experiences', as it is not inconceivable that God communicates with people, even though they do not have specialized structures whose function is to facilitate such communication.) Given that such an explanation seems perfectly coherent, why,

one might ask, should it not be entertained as a scientific possibility? As Joseph (2001, 132) notes of religious experiences and their various objects:

Why would the limbic system evolve specialized neurons or neural networks that subservise the capacity to experience or hallucinate spirits, angels, and the souls of the departed if these entities had no basis in reality? ... Perhaps under the guiding influence of 'God', or perhaps after repeated experiences with gods, spirits, demons, angels, and lost souls, *homo sapiens* evolved these neurons, which enabled them to better cope with the unknown as well as to perceive and respond to spiritual messages that increased likelihood of survival. A true scientist would not rule out such a possibility.

Why is 'the function of certain structures is to aid communication with God' not a respectable hypothesis? Ramachandran claims that it 'can neither be proved nor ruled out on empirical grounds' (1998, 182), implying that empirical findings can have no bearing whatsoever on whether religious experience has a genuine object or not. Whichever explanation of A and its effect *x* we settle on, evolutionary explanation of religious experience will, according to Ramachandran, have no implications so far as the reality of its object is concerned.

However, a cursory glance at the possible evolutionary explanations of A and *x* suggests that this is not the case at all. For example, suppose one claims (2) that structure A evolved due to its ability to perform task *y* and that its current structure can be comprehensively accounted for in relation to task *y*. When structure A is involved in religious experience (*x*), its ability to perform *y* is detrimentally affected. It is also apparent from further study that *any* structure able to perform *y* will as a consequence be susceptible to certain forms of disturbance, damage, or developmental anomaly that will result in effect *x*. It turns out that *x* has no biologically advantageous effect and is almost invariably damaging to the organism. Thus, it seems reasonable to infer that *x* is a malfunction of A. If *x* is a malfunction of A, then this automatically rules out the possibility that *x* is a function of A. And if scientific explanations can rule out a hypothesis, it is surely mistaken to claim that they can have no bearing on the probability of that hypothesis.

A malfunction explanation not only rules out the claim that religious experience is a function of A, but also casts doubt on the more general claim that such experiences have a real object. If the experience is a malfunction then it is something that has *gone wrong* and any experiential object arising from cognitive malfunction is presumably to be treated with incredulity, just as the objects of experiences resulting from the ingestion of drugs that distort normal cortical function are generally taken not to exist. There is no reason for anyone, including the experiential subject, to assume the veridicality of an experience that results from cognitive processes that are by definition unreliable.

When it comes to empirical assessment of a malfunction hypothesis, the matter is less than clear. Ramachandran considers the question of whether religious experience is a result of a malfunction, noting of one subject that 'he was intense

and self-absorbed and had the arrogance of a believer but none of the humility of the deeply religious' (1998, 180). However, he also observes that these experiences are not obviously detrimental to a subject's wellbeing. Indeed, the subject herself often finds the experience highly desirable. Hence, Ramachandran remarks that 'the physician has no right, really, to attribute a value label to such esoteric embellishments of personality. On what basis does one decide whether a mystical experience is normal or abnormal?' (1998, 184). But such ambiguity does not amount to a sufficient reason for claiming in-principle undecidability. After all, many evolutionary explanations are to some extent speculative and, despite the ambiguity as to whether religious experience amounts to an obvious impairment, appeal to historical selection processes could conceivably help to resolve the issue in respect of malfunction.

So we can see how the malfunction hypothesis excludes the possibility that the function of A is to communicate with God and also how this would in turn cast doubt upon the more general claim that God is really present during religious experiences. A similar argument can be played out in relation to versions of claim (3) that religious experience is a spandrel, as opposed to a malfunction. Suppose that neural structure A is a part of a greater structure B, which historically evolved to perform a complex and intricate set of functions. It turns out that an unavoidable structural consequence of B's ability to perform functions v , w , y , and z is A, which is not itself and never has been the object of selection pressures. However, it turns out that B couldn't arise without producing A as a side effect. An unavoidable consequence of A's structure is that it sometimes induces a certain kind of experience that is neither obviously advantageous nor disadvantageous to the organism. Again, such a hypothesis is difficult to corroborate convincingly, but concerns about the availability and adequacy of evidence plague many such evolutionary explanations and it is not clear that this case is qualitatively different.

As in the malfunction case, a spandrel explanation rules out the possibility that the structure's *function* is to talk to God, as spandrels are, by definition, structures that don't have functions. And like the malfunction explanation, a spandrel scenario casts doubt upon the more general claim that religious experience has a real object. If A is a spandrel, then its genesis, persistence, and various effects, such as x , can be wholly accounted for independent of any environmental influences that directly influenced the tendency to x . Spandrels do not *systematically* relate to the environment in any way that has historically had adaptive consequences for the organism. Otherwise, selection pressures would no doubt have influenced their genesis, persistence, and causal properties, and so an adaptationist account would constitute a partial explanation of their being, implying that they were not spandrels at all. If religious experience is an effect x of a spandrel A, any reference to an environmental cause that has shaped A's tendency to produce effect x is ruled out, whether that cause be the communicative

acts of God or anything else. A's disposition to x is wholly explicable in terms of selection pressures acting on some other organismic capacity, with A and x emerging as contingent side effects of functional capacities to which they make no contribution. So, if religious experience is a spandrel in the strictest sense, its having a genuine object is ruled out by definition, as no such object has played a historical role in the causal genesis of the experience, and if it plays no such role, it cannot be in communion with the experiencer.

These examples show that empirical considerations are relevant to an assessment of the claim that the function of A is to talk to God and also to the more general question of the veridicality of religious experience. However, one might object that methodological naturalism does not deny the possibility of conflict between *specific* scientific hypotheses and certain theistic claims, so, *contra* Ramachandran, perhaps properly *methodological* agnosticism only arises in the first type of case, where religious experience is taken to be a function of A. Any adaptive effects of religious experience could arguably be explained just as well without invoking the presence of God as a contributing factor as, whether its object is real or illusory, the effects of religious experience will be the same and the following two hypotheses will be scientifically indistinguishable:

- (1) Structure A has the function of inducing a feeling of God's presence and this has adaptive consequences.
- (2) Structure A has the function of inducing a feeling of God's presence and this has adaptive consequences *and* God exists.

Scientific agnosticism is unavoidably entailed if there is no way that (1) and (2) can be empirically distinguished, and it might seem that 'God exists' is a spurious additional proposition that can, in the context of scientific inquiry, be removed for simplicity's sake without any empirical ramifications. However, this is misleading. Consider as an analogy 'Perceptual systems have the function of producing a mental map of the world and the world exists'. An evolutionary explanation of the function of perceptual systems that did not presuppose the existence of the world would have to do an awful lot more work in order to explain the function of perceptual systems, even though there is no absolutely conclusive way of deciding between the two alternatives, as several hundred years of philosophical scepticism concerning the external world illustrates. Surely the same reasoning applies to religious experience, thus allowing for the possibility that the most plausible evolutionary explanation is one that actually invokes God as a being with whom communication carries some evolutionary advantage. Why not, as James suggests, take religious experiences to be veridical? Indeed, why not take a biological adaptation for talking with God as one's initial hypothesis rather than exclude it a priori from consideration?

However, even if this hypothesis is, for some reason, excluded from scientific consideration, it could still be argued that a scientific functional explanation of

A's capacity to x might involve assigning a function that is at least compatible with the claims that (a) God is present during certain experiences, and (b) a function of certain neural structures is to facilitate such communication. And if there is no unavoidable ontological incompatibility between methodological naturalism and such theistic claims, then naturalism is agnostic rather than atheistic in its refusal to address the question. Contrary to such a position, I suggest that even this minimal compatibility is illusory. In other words, refusal to entertain (b) as a possible scientific explanation ultimately rules out both (a) and (b).

Consider 'Structure A has the function of inducing experience of God and this has adaptive consequences *because* "God exists"'. By replacing 'and' with 'because', we can see how God's existence constitutes not a spurious additional proposition but an explanation of why A's doing x has an adaptive effect. God is singled out as the environmental *cause* of the experience, the environmental influence that was instrumental in the historical shaping of structure A's capacity to produce effect x , just as light is causally instrumental in the evolution of eyes. Refusal to entertain the possibility that the function of a structure really is to communicate with God effectively amounts to a refusal to consider the possibility that God, as part of the *selective environment* in which organisms evolve, could at any time have had any causal influence on the genesis of a structure or upon its tendency to produce certain effects. Thus, God could have no influence on the evolution of a capacity for religious experience. If an explanation of religious experience rules out the causal efficacy of God in producing the experience, this immediately denies any warrant for claiming that God, as the object of religious experience, is real. If God has no causal efficacy in relation to religious experience then communion with God is simply not a real part of the experience. What may at first seem like agnosticism ultimately amounts to denial.

Consider the following:

- (1) Structure A has the function of producing religious experiences and this has adaptive consequences *because* such experiences strengthen social bonding.
- (2) Structure A has the function of facilitating religious experiences and this has adaptive consequences *because* God exists.

These could be rendered compatible by maintaining that communication with God enables social bonding. However, if one refuses to consider (2) as a *scientific* possibility, then such compatibilism is by implication also ruled out as a *scientific* possibility. If (1) without (2) is an incomplete explanation, in the same sense that 'the function of the visual system is to produce the experience of a visual world' is incomplete without the additional claim that this function is efficacious because the world exists, then there can be no justification for excluding (2) and settling for an incomplete explanation. If God is the primary historical environmental

cause of the evolution of structure A and its effect x , then functional explanation of A and x should refer to God, just as water must be invoked in order to explain the development of fins, their function being to ‘flap’ constituting a horribly uninformative explanation. The alternative is to maintain that something like (1) amounts to a comprehensive scientific explanation of the causal forces operating in the selective environment of A and thus a comprehensive account of all causes relevant to A’s performance of function x , with the result that God is allocated no causal role whatsoever and so any sense of communion with God is illusory. Of course, one might contend that God’s influence is not necessarily ‘causal’, in the usual sense of the term, but may involve a very different medium to that of physical causation. However, insofar as such an influence would still produce a genuine *effect* in the subject, denial of physical causation could just as well be construed as a reason not to reject God as a real feature of the selective environment, but to reconsider one’s ontology and embrace more than simply physical causation. A rejection of such influences would, in any case, constitute an ontological rather than a methodological restriction which, if there are non-causal influences resulting in organismic effects, amounts to an ontologically incomplete picture of the world.

Refusal to consider the possibility that the function of religious experience is to communicate with God is ultimately equivalent to a denial that God, as a part of the organismic environment in which natural selection operates, could in any way causally influence the genesis of biological structures and their effects. If religious experience is to be explained biologically, the result is a denial that such experiences have a real object, at least if one accepts an epistemology according to which an x ’s having some effect upon a subject is a necessary condition for that subject’s having any grounds for believing in the reality of x . One way out of this is to postulate a two-tier model of functions, where something can have function y in the context of biology but function x in the context of religious discussion, resulting in two distinct but somehow harmonious universes of discourse. However, if a biological account purports in any way to investigate or explain specifically *religious* experience, then the two universes have already collided. If everything belonging to the category of *religious experience* and *religion* more generally is excluded from science, then the problem can’t arise to begin with, as talk of a *neural* structure associated with *religious* experience would be disallowed. Though such a division of worlds might put paid to discussions like this one, it would also involve a strict compartmentalization of human life that would most likely be unacceptable to most and also almost impossible to sustain.

To summarize, methodological naturalism (construed as the refusal to consider any hypothesis that makes reference to God’s existence), coupled with the application of a fairly standard framework for evolutionary explanation, unavoidably translates into an ontological exclusion when applied to the

hypothesis: 'the function of A is to communicate with God'. Hence, it involves a form of ontological commitment that is antithetical to any religious doctrine ascribing some degree of importance to veridical religious experience.

Interpretation and constitutive commitment

In the preceding section I discussed the issue of the neural basis of religious experience as though it were in principle resolvable in a wholly empirical fashion, naturalism amounting to the exclusion of one empirical scenario. However, things are not so simple, and in this section I will argue that 'methodological' naturalism is an ontological commitment that is in an important sense *prior to* empirical considerations. That is, it serves as a pre-theoretical background of interpretation that determines the kinds of things one is prepared to admit into being.

My reason for focusing specifically on the neurology of religious experience as a philosophical case study is that it serves to illustrate a robust ontological assumption that would pass unnoticed in the majority of selectionist explanations. Thus my argument is not an extended tirade against a few remarks made by Ramachandran, but an attempt to bring to the foreground a much more general point concerning ontological presuppositions underlying any so-called *methodological* naturalism. In order to develop this point more fully, it is important to understand why the neurology of religious experience is of special interest.

In many circumstances, assignment of function does seem religiously neutral. Darwin replaced instantaneous special creation by God with evolution via natural selection as the proximal mechanism of biological adaptation. However, this does not rule out God as the ultimate source, acting through the various evolutionary mechanisms to create organisms. Such a simplistic conception of compatibility is not without its problems (see e.g. Ruse (2001)). However, the crucial point is that the function of a biological structure can be the same whether or not one chooses to invoke God as the ultimate source of biological 'design'. Consider a simple case such as 'the function of the eye is to see', or 'the function of the hand is to grasp objects'. Whether God exists or not will not, it would seem, affect function assignments in such cases and, similarly, assigned functions will have no bearing on the claim that God exists. Thus, though it is by no means clear that science should remain neutral on the question of whether God is the ultimate agency *behind* the genesis of the biological world, it does appear that agnosticism is a generally tenable position so far as the ultimate source of biological adaptation is concerned.

However, in the case of the neurology of religious experience, the situation is very different and this is because we are not being asked to consider whether God is the ultimate agency *behind* the evolutionary process but whether God can be

taken as part of the selective environment in relation to which that process operates upon organisms. If God is not a part of the selective environment to which organisms are adapted by natural selection, then no part of any organism can have a function involving God, as the kinds of function one is prepared to assign depend on the kinds of thing one is prepared to admit as possible constituents of the selective environment. For example, if fish were not part of any organismic environment, no biological structure could have the function of perceiving, evading, luring, catching, dismembering, digesting, or parasitizing fish. Thus, in the case of the organismic environment in which selection acts, refusal to entertain the possibility of God as an active part of the environment, able to affect organisms, results in an ontological restriction in relation to possible characteristics of the biological world. Hence, the neurology of religious experience serves as a thought-experiment with which to reveal a metaphysical commitment attached to any exclusion of God from biological inquiry. This commitment involves rejection of God as a part of the causally efficacious environment in which organisms evolve. If God exists, then God is not a part of the world in which we live and act.

Such restrictions not only serve to constrain the kinds of *functions* one is prepared to admit as a possibility but also the kinds of *beings* one is prepared to allow as possible constituents of reality. This is because there are many cases where functions are not just properties that are assigned to pre-given entities but rather constitute those entities, making them what they are. This is readily apparent in the case of artifacts such as can openers, screwdrivers and chairs. As Heidegger remarks, 'the functionality that goes with chair, table, window is exactly that which makes the thing what it is', (1982, §15, 164). And it is equally true of many biological entities. Consider a structure such as a wing, a hand, or a claw. The individuation of such a structure makes essential reference to its function. Wings, for instance, are individuated in terms of their functional role in relation to flight. Indeed Millikan (1984) and Neander (1991) have argued that biological categories are invariably functional categories, a biological structure's function making it the thing that it is. However, this strong claim may well need to be deflated. As Amundson and Lauder (1994) note, in criticizing Neander and Millikan, biological structures are often classified phylogenetically, in terms of anatomical homology, and it is by no means clear that such classifications make essential reference to functions. For example, a pentadactyl limb is still a pentadactyl limb, whatever its function may be. Nevertheless, it is safe to say that a substantial proportion of biological entities are functionally individuated. Thus, preconceptions concerning the nature of the environment that restrict the range of possible functions one is prepared to entertain also restrict the range of possible beings.

One consequence of this is that refusal to consider the claim that God is or was an influential part of the selective environment entails a denial of the possibility

of a 'God module', taken literally. This is because modules, as conceived by evolutionary psychologists, are individuated functionally rather than anatomically. As Pinker vividly puts it:

Mental modules are not likely to be visible to the naked eye as circumscribed territories on the surface of the brain, like the flank steak and the rump roast on the supermarket cow display. A mental module probably looks more like a roadkill, sprawling messily over the bulges and crevasses of the brain (1998, 30).

But if function x isn't possible, then any structure whose individuation presupposes the possibility of function x is also not possible. Thus a God module, a functionally individuated structure whose function is to communicate in some way with God, is impossible. Refusal to entertain the possibility of God as an environmental influence, relative to which different organismic responses have a differential effect in relation to organismic survival and reproduction, will similarly rule out a whole range of entities. Preconceptions concerning what the organismic environment contains act as an interpretive background relative to which only certain entities and functions are deemed possible. So exclusion of God as a part of that environment amounts to an ontological exclusion of myriad conceivable beings.

In stark contrast to this Godless environment is Alvin Plantinga's claim that belief in God is properly basic for the believer. According to Plantinga, (e.g. 1981, 46–47), beliefs such as 'God is speaking to me', 'God disapproves of what I have done', and 'God forgives me' are basic in the sense that 'I see a tree' is basic. That is, the contents of such beliefs reflect an everyday experiential environment in which God is always present for the believer and taken for granted in an analogous sense to the majority of everyday perceptual beliefs.

Such radically different basic conceptions of what the world is like are clearly not methodological constraints but contrasting ways of interpreting the world that determine the kinds of beings one is willing to entertain as possible constituents of reality. One's conception of the environment serves as a background from which one interprets the biological world so as to assign functions and individuate structures. Different background commitments concerning what the world is like will thus result in different ontologies. The naturalist assumes that God is in no way tangible. In so doing, she rules out God as a possible part of the environment, an environment that serves as a presuppositional interpretive background for the understanding of biological structures.

One might object that it is simply the case that we describe the environment as carefully as we can and discover that God is not an efficacious part of it. Hence the methodological naturalist does not rule out God a priori but, after careful empirical investigation, concludes that there is no evidence of such an environmental influence, which is why it is not the subject of any empirically based inquiry.

A problem with this is that the nature of the selection-relevant environment is not always readily apparent in the case of any given organism or organ. Adaptationist inquiries can go either of two ways:

- (1) One lists some salient features of the environment in which x evolved and considers whether x might have evolved as an adaptive response to one or more of these features.¹³
- (2) One hypothesizes that structure x is an adaptation and considers the kind of environment that x might be or have been an adaptive response to.¹⁴

In the case of (1), a description of the relevant environment is taken for granted. However, in (2) the nature of the environment is itself a matter of debate, the question being ‘what kinds of possible environmental influences are the most plausible evolutionary causes of a structure like A?’ In practice, these two strands of inquiry are often likely to be intertwined. Absolute inflexibility with respect to the nature of the environment in which any structure evolved is likely to obfuscate inquiry by ruling out investigation of various possible functions, structures, and historical scenarios.

So one might maintain that, in the case of religious experience, inflexible pre-suppositions concerning the environment rule out the possibility of the very thing that could constitute evidence of a novel environmental influence. That is, unless we at least *entertain* the possibility that God is a part of the environment in which evolution occurs, we will deny the possibility of any biological structure whose existence might constitute evidence for such a claim. However, our naturalist might reply that, although the selective environment relevant to any specific example of biological adaptation is a matter of debate, there is a common taxonomy of causally efficacious environmental features from which the environment relevant to any specific example of organismic adaptation is comprised. As God is not a part of this taxonomy, God cannot be plausibly maintained as a possible environmental influence on the genesis of biological structures.

But the contention that we have such a description of the environment is dubious at best. When one tries to describe the objective way in which the world most absolutely, fundamentally is, it becomes readily apparent that this is an extremely difficult undertaking. Nowhere is this better illustrated than in Husserl’s (1970, II§9h, IIIA) discussion of the ‘life-world’; a tacit background of taken-for-granted reality that is presupposed by naive objective conceptions of the way things are; the ‘forgotten meaning-fundament of natural science’ (1970, §9h, 48). As Gurwitsch (1974, 17) explains, the concept of the life-world, as put forward by Husserl and elaborated by Schutz, ‘the life-world is defined as comprising all items and objects which present themselves in pre-scientific experience and as they present themselves prior to their scientific interpretation in the modern sense’. It is a world-disclosing foundation that has ‘been obscured, obfuscated,

and forgotten' and is consequently very difficult to describe; a background presupposed by all scientific abstractions, 'whose simple acceptance proves an essential precondition of every activity' (1974, 144).

Husserl's account of the life-world suggests that scientific conceptions of the objective world presuppose various constitutive methods which abstract from the pre-given life-world and, in so doing, differently determine the kinds of beings one is prepared to admit as elements of theoretical, scientific ontologies.¹⁵ And this is precisely the constitutive capacity in which naturalism seems to function. As certain biological entities presuppose a naturalistic interpretive background for their sense, it cannot be argued that such a background can simply be empirically described, given that empirical conceptions of the way things are presuppose rather than entail it. So, as naturalism is an a priori restriction that determines the kinds of things that are admitted into being, it cannot itself be legitimated via appeal to those very beings. Thus, in order to begin to consider whether God is a plausible constituent of the evolutionary environment, one is required to suspend acceptance of biological objectivities that have already been constituted naturalistically, and contemplate the possibility of alternative interpretive stances that integrate God as a possible experiential object and environmental influence.

'Methodological' naturalism ultimately amounts to an interpretive background that determines the kinds of things one is prepared to admit as possible constituents of reality. If this background is taken as an inflexible conception of what the objective world can contain, then any conception of the world that involves God as an active part of experienced reality is excluded. Thus, the naturalism in question translates into a substantial ontological commitment that is antagonistic to a large body of religious doctrine. What's more, it is arguably impossible to refute *empirically*, as the possibility of any phenomenon that could possibly refute it is denied. And this is because any biological phenomenon can in principle be interpreted so as to fit in with it if one tries hard enough. Consider the following, where A presupposes an atheistic interpretive background and B a theistic background:

- (A) x is a malfunction of a structure A that performs y .
- (B) A ordinarily performs y but it has also evolved the capacity for x , which is the privilege of the spiritually enlightened.
- (A) A used to have a function x but doesn't any more.
- (B) A is functional but not in our individualistic, atheistic society.
- (A) A is a spandrel that resulted as a contingent consequence of B's development of function y .
- (B) B's y 'ing only persists because it now supports A's x 'ing.

I suspect that these sorts of contrasting interpretations can be formulated in relation to just about any biological phenomenon and that there is no wholly

empirical way of deciding between them, given that one's understanding of what the world contains is itself differently carved out by different interpretive backgrounds. What may look to someone like an adaptation for *x* can be reinterpreted as a structural constraint by someone else who doesn't want to find an adaptation for *x*. If it looks too intricate to be a structural constraint, various complex evolutionary contingencies can be invoked until the story starts to look plausible. It is not possible to *see* functions, malfunctions, and contingent effects in the biological world. They are interpretations that presuppose a view of how things are. If these presuppositions are set in stone, then anything can be made to fit in with them.

To illustrate this point, consider an analogy. Gould and Lewontin famously argued that the adaptationist programme prevalent in biology during the 1970s amounted to a collection of 'speculative tales' (1979/1994, 73). Every effect of every structure was assumed a priori to be an adaptation and all other alternatives were implicitly ruled out. A story could always be strung together to support some adaptationist interpretation; 'since the range of adaptive stories is as wide as our minds are fertile, new stories can always be postulated' (1979/1994, 79). Thus, according to Gould and Lewontin, adaptationist methodology amounted to a self-perpetuating way of thinking that refused to entertain contrary possibilities.

I suggest that the same is true of naturalism, construed as an unwavering commitment to what the world is like that determines the domain of *acceptable* phenomena. Even though naturalistic explanations, unlike the adaptationism satirized by Gould and Lewontin, incorporate all manner of different evolutionary explanations, naturalism places a limit on the range of acceptable phenomena and it can reinterpret and accommodate anything that doesn't at first seem to fit. Thus naturalism constitutes a broader, more embracing narrative than adaptationism but, if held inflexibly, it amounts to dogmatic enforcement of a metaphysical lens through which the world is interpreted. Gould and Lewontin list four criteria for bad adaptationist story-telling (1979/1994, 79). Below I have listed the first three,¹⁶ replacing the word 'adaptive' with the term 'naturalistic'. As you can see, it works pretty well:

- (1) If one [naturalistic] argument fails, try another.
- (2) If one [naturalistic] argument fails, assume that another must exist; a weaker version of the first argument.
- (3) In the absence of a good [naturalistic] argument in the first place, attribute failure to imperfect understanding of where an organism lives and what it does.

Naturalism is a constitutive commitment that delimits possible objects of inquiry. It is not itself empirically vindicated but, rather, has become a framework for vindication. And if both theism and naturalism are taken to be inflexible, pre-theoretical interpretive backgrounds, then the result, I suggest, is ontological

and epistemological relativism. However, there is no in-principle reason why a background of interpretation cannot be questioned. Why not see what happens to your interpretations of the biological world when you lower the naturalistic defences and entertain God as a *possible* constituent of the experienceable world? Hence, anybody who does not explicitly admit to operating wholly from within a metaphysically atheistic research framework should open up the arena of debate to embrace the complex cycle of mutual illumination between empirical investigation of worldly entities and different constitutive presuppositions concerning what the world is like. I do not champion the claim that God really speaks to people during religious experiences, and neither do I recommend the adoption of a theistic interpretive framework over an atheistic one. But I do think that both possibilities are worth investigating and that to do so will involve not merely empirical work but also acknowledgement of the hermeneutic dimensions of science, of how scientific ontologies are constituted by interpretive stances.¹⁷

References

- ALBRIGHT, C. R. (2000) 'The "God module" and the complexifying brain', *Zygon: Journal of Religion and Science*, **35**, 735–744.
- ALLEN, C., M. BECKOFF, and G. LAUDER (eds) (1998) *Nature's Purposes: Analyses of Function and Design in Biology* (Cambridge MA and London: MIT Press).
- AMUNDSON, R. and G. LAUDER (1994) 'Function without purpose: the uses of causal role function in evolutionary biology', *Biology and Philosophy*, **9**, 443–469.
- BARKOW, J. H., L. COSMIDES, and J. TOOBY (eds) (1992) *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (Oxford: Oxford University Press).
- COSMIDES, L. and J. TOOBY (1992) 'The psychological foundations of culture', in Barkow, Cosmides, and Tooby (1992).
- DAMASIO, A. (1995) *Descartes' Error: Emotion, Reason and the Human Brain* (London: Picador).
- (2000) *The Feeling of What Happens: Body, Emotion and the Making of Consciousness* (London: Vintage).
- DENNETT, D. C. (1990) 'The interpretation of texts, people and other artifacts', *Philosophy and Phenomenological Research*, **L** (Supplement), 177–194.
- DEWHURST, K. and A. W. BEARD (1970) 'Sudden religious conversion in temporal lobe epilepsy', *British Journal of Psychiatry*, **117**, 497–507.
- GOULD, S. J. and R. LEWONTIN (1979) 'The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme', *Proceedings of the Royal Society of London*, **B20**, 581–598. Reprinted in Sober (1984), 73–90.
- GOULD, S. J. and E. VRBA (1982) 'Exaptation – a missing term in the science of form', *Paleobiology*, **8**, 4–15.
- GRIFFITHS, P. (1992) 'Adaptive explanation and the concept of a vestige', in *idem* (ed.) *Trees of Life* (Dordrecht: Kluwer).
- GURWITSCH, A. (1974) *Phenomenology and the Theory of Science*, L. Embree (ed.) (Evanston IL: Northwestern University Press).
- HEIDEGGER, M. (1982) *The Basic Problems of Phenomenology*, (transl. and intro. by A. Hofstadter) (Bloomington IN: Indiana University Press).
- HULL, D. and M. RUSE (eds) (1998) *Philosophy of Biology* (Oxford: Oxford University Press).
- HUSSERL, E. (1970) *The Crisis of European Sciences and Transcendental Phenomenology*, (transl. D. Carr) (Evanston IL: Northwestern University Press).
- JAMES, W. (1902) *The Varieties of Religious Experience: A Study in Human Nature* (New York NY and Bombay: Longmans, Green, and Co.).
- JOSEPH, R. (2001) 'The limbic system and the soul: evolution and the neuroanatomy of religious experience', *Zygon: Journal of Religion and Science*, **36**, 105–136.

- MACKIE, J. L. (1982) *The Miracle of Theism: Arguments for and against the Existence of God* (Oxford: Oxford University Press).
- McMULLIN, E. (1993) 'Evolution and Special Creation', *Zygon: Journal of Religion and Science*, 28, 299–335. Reprinted in Hull and Ruse (1998), 698–733.
- MILLIKAN, R. (1984) *Language, Thought and Other Biological Categories* (Cambridge MA and London: MIT Press).
- NEANDER, K. (1991) 'Functions as selected effects: the conceptual analyst's defense', *Philosophy of Science*, 58, 168–184.
- PINKER, S. (1997) *How the Mind Works* (Harmondsworth: Penguin).
- PLANTINGA, A. (1991) 'When faith and reason clash: evolution and the Bible', *Christian Scholars' Review*, 21, 8–32. Reprinted in Hull and Ruse (1998), 674–697.
- (1997) 'Methodological naturalism?', *Perspectives on Science and Christian Faith*, 49, 143–154.
- (1981) 'Is belief in God properly basic?', *Nous*, 15, 41–51.
- RAMACHANDRAN, V. S. and S. BLAKESLEE (1998) *Phantoms in the Brain* (London: Fourth Estate).
- RAMACHANDRAN, V. S., W. HIRSTEIN, K. C. ARMEL, E. TECOMA, and V. IRAGUI (1998) 'The neural basis of religious experience', *Society for Neuroscience Abstracts*, 23, 519.1.
- RATCLIFFE, M. (2002) 'Heidegger's attunement and the neuropsychology of emotion', *Phenomenology and the Cognitive Sciences*, 1, 287–312.
- (forthcoming) 'World-making emotions'.
- RUSE, M. (2001) *Can a Darwinian be a Christian? The Relationship between Science and Religion* (Cambridge: Cambridge University Press).
- SLATER, E. and A. W. BEARD (1963) 'The schizophrenia-like psychoses of epilepsy', *British Journal of Psychiatry*, 109, 95–150.
- SOBER, E. (ed.) (1994) *Conceptual Issues in Evolutionary Biology*, 2nd edn (Cambridge MA and London: MIT Press).
- TRIMBLE, M. R. (1992) 'The Gestalt-Geschwind syndrome', in M. R. Trimble and T. G. Bolwig (eds) *The Temporal Lobes and the Limbic System* (Petersfield: Wrightson Biomedical).

Notes

1. For two of the many reports, see Steve Connor "'God spot" is found in brain', *Los Angeles Times*, 29 October 1997 and *Sunday Times*, 2 November 1997; Robert Lee Holtz 'Brain's "God module" may affect religious intensity', broadcast on BIC News, 31 October 1997.
2. As reported in Ramachandran *et al.* (1998), and Ramachandran and Blakeslee (1998).
3. Ramachandran cites Slater and Beard (1963), Dewhurst and Beard (1970) and Trimble (1992) amongst others.
4. The reference cited is co-authored with Sandra Blakeslee. However, as the book is generally written in the first person singular, referring to work that Ramachandran has carried out, I refer exclusively to Ramachandran when citing it in the text.
5. As the limbic system is involved with production and regulation of emotional responses, generally enhanced activation of these pathways is likely to result in more pronounced emotional reactions to all stimuli, which are consequently perceived by the subject as imbued with significance.
6. Albright (2000) criticizes Ramachandran's premature commitment to a specialized neural structure that can be identified independent of a broader context of cortical activity. Albright emphasizes a more holistic, developmental perspective on the brain, challenging the assumptions that it is comprised of a 'collection of unrelated modules' and that experience of God can 'be confined to a single sort of experience, or to a module of the brain' (2000, 737).
7. It may however make more sense from a thoroughgoing pragmatist point of view.
8. See Ratcliffe (2002) for the view that emotions and moods are a pre-theoretical, world-disclosing cradle within which explicit, propositional cognition rests, disclosing a sense of reality that is more basic than the objective world that the sciences take for granted. See also Ratcliffe (forthcoming) for a discussion of William James and the emotions.
9. Selectionist accounts of function are surprisingly technical, distinguishing between a variety of different scenarios in order to insulate themselves against counter-examples. See for instance the essays by

Wright, Millikan, Neander, Griffiths, Godfrey-Smith, and Kitcher in Allen, Beckoff, and Lauder (eds) (1998). I do not agree with any such account. However, for current purposes, I assume that 'the function of A is x ' is generally coincident with some variant along the lines of 'A exists/persists because of selective factors favouring an ability to x '.

10. Gould and Vrba (1982) refer to a structure that was originally adapted to perform task y but was subsequently adapted for x and now performs x but not y as an exaptation. There are plenty of other, similar terms referring to the same or similar historical scenarios floating around in the current literature (e.g. Griffiths (1992) discusses 'exadaptation'). Gould and Vrba restrict the term 'function' to the structure's original role. However, it is more usual to regard the task that is currently the focus of selection pressures as the structure's function.
11. Explanations (2)–(5) can also be rephrased with A as part of B, as can (1)–(4) below.
12. This would be analogous to 'the function of the heart (A) is to pump the blood (x) and the reason that x is functional is that pumping the blood supplies the body with oxygen'.
13. As Dennett (1990, 188) puts it, 'one starts off with a naive understanding of the "problem" faced by some organism, and in terms of that naive understanding works out how the organism ought to be designed'.
14. This is evident in the writings of evolutionary psychologists such as Cosmides and Tooby (1992), who look at what the mind currently does in order to extrapolate about the nature selection pressures with which we were confronted in the Pleistocene environment in which the mind evolved.
15. See e.g. Husserl's (1970, Part 2) historical discussion of the origins of modern scientific objectivism. According to Husserl, the sense of modern objectivism rests on a sedimented and forgotten history of accomplishments, culminating in the achievements of Galileo and Descartes. These accomplishments take the form of methodological innovations, which at the same time constitute their objects of study. All draw their sense from the tacit, pre-given life-world.
16. The fourth criterion, 'emphasize immediate utility and exclude other attributes of form', cannot be made to apply here.
17. I am grateful to Brian Garvey, Joan McCarthy, Norman Sieroka, and an audience at the University of Ulster, Coleraine for helpful comments on an earlier version of this article.