

SPECIAL DIVINE ACTION AND NATURAL SCIENCE

THOMAS TRACY

Bates College

Abstract. A number of modern theologians have concluded that the rise of natural science makes it necessary to give up the idea that God acts in particular ways to affect the course of events in the world. I reply to this claim, taking up the challenge to explain what might be meant by a 'special' act of God. There are several ways to conceive of such acts, including the possibility that God might determine what is left determinable in the structures of nature, e.g., at the quantum level. I address objections to this view, and consider metaphysical puzzles that it presents.

How can we conceive of special, or particular, divine action in the world described by the contemporary natural sciences?

Anxiety over this question has played an important role in forming (and, arguably, deforming) a great deal of modern theological reflection, often providing the rationale for fundamental revisions of what had been core teachings in mainstream belief and practice. Theists in the Abrahamic traditions have classically affirmed that God acts not only at the foundation of the world as its creative ground, but also within its ongoing history as the providential guarantor that the divine purposes will be achieved. If the findings or methods of the sciences are somehow incompatible with the idea that God acts in particular ways to affect the course of events in the world, then religious thought and practice in the theistic traditions will have to change.

These dynamics are vividly illustrated in the struggles of the biblical theology movement. In the 1950s thinkers like G. Ernest Wright and Bernard Anderson called for a renewed recognition that the God of the Bible is an agent who acts at particular times and places to call, promise, judge, renew, and redeem (Wright 1952; Anderson 1957).

The proclamation of this *Heilsgeschichte*, they contended, is the primary content of the faith. In a now famous critique, Langdon Gilkey argued that the biblical theologians were caught in an awkward dilemma (Gilkey 1961). They insisted that narratives of divine action, such as the story of the Exodus from Egypt, constitute the core of Biblical revelation. But as informed participants in the scientific age they were committed to understanding events as occurring within a lawful continuum of natural causes, rather than as reflecting dramatic interventions by supernatural agents. So if God did not turn the Nile to blood or part the waters of the red sea, then what *did* God do to bring about the liberation of the Jewish people from captivity? In the absence of any account of God's role in the events of the Exodus, these theologians were left in the uncomfortable position of proclaiming that God is made known through 'mighty acts in history', yet being unable to say what God has done. Gilkey concluded that,

... in the shift of cosmology from ancient to modern, fundamental theological concepts have so changed their meaning as almost to have lost all reference ... It is no good repeating the abstract verbs 'to act' and 'to speak', if we have no intelligible referents with which to replace the vanished wonders and voices ... Unless we have some conception of how God acts in ordinary events, we can hardly know what our analogical words means when we say: 'He acts uniquely in this event' or 'this event is a special act of God'. (Gilkey 1961: 204)

In this paper I want to take up Gilkey's challenge, clarifying what might be meant by 'special' divine action, and sorting out the possible relations of such acts to 'ordinary events'. Gilkey decided that the ascendancy of modern (i.e., scientific) cosmology makes it necessary to give up the idea that God acts within the world's history to affect the course of events. I will argue that he is mistaken about this, and contend instead that a strong conception of special divine action remains a viable option in contemporary theology.¹

CREATION

If we are to think through God's relation to ordinary events, we need to begin with the doctrine of creation. The idea of creation has been elaborated in a number of different ways in the history of theology, but

¹ This discussion draws upon material from Tracy (2012), and Tracy (2010).

I will focus here on a view (or family of views) that came to occupy the mainstream of the tradition: the doctrine of creation out of nothing, *creatio ex nihilo*. God's creative act brings about the existence of all finite reality, and apart from this act nothing but God would exist. Creation is not a one-time event that generates a world which thereafter persists on its own. Created things exist from moment to moment in absolute dependence upon God; God empowers them to be, and if God were to cease doing so, they would return to nothingness. For creatures, therefore, relationship to God is essential; to be is to be in relation to God, and in this relation is found not only the creature's ground but also its highest good. God, on the other hand, does not require the existence of creatures in order to be God; God creates the world out of love because it is good for the world to be. Creation is a gift of the divine generosity.

It follows that God's relation to creatures as their creator is fundamentally different from any causal relation that holds among created things. Created things stand in causal relations by virtue of bringing about *changes* in other things. This is true even when the action brings something new into existence (the creation of a work of art) or causes something to cease to exist (as in causing the death of a living organism). God's creative act, by contrast, does not merely cause a change in the creature, but rather *produces the creature itself*. Apart from this act, there is 'no-thing' to change. God's creative activity, therefore, radically transcends the causal powers of creatures.

This understanding of creation provides the foundation for answering Gilkey's question about God's relation to events in the ordinary course of nature. God as creator acts in every moment of the world's history as its source and ground. There can be no event untouched by the divine agency, and it is seriously misleading to contrast 'extraordinary' events in which God acts and 'ordinary' ones in which God does not. God acts in every event, and the question about special divine action is whether and on what grounds some of these events might be singled out as distinctive or unique.

A further refinement is needed here, however. It might be thought that this strong understanding of God's universal creative action displaces created causes altogether, and makes God the only productive power at work in the world. If God is the immediate cause of the existence of each entity along with all its properties, this may appear to leave no role for the operation of created causes. Consider the paradigmatic causal event of billiard balls interacting on a pool table. We might suppose that

the doctrine of creation entails that God not only immediately sustains the existence of each entity involved in this event, but also causes them to possess their specific properties from moment to moment. So God causes there to be a cue ball with a particular trajectory and velocity, and an instant later God causes there to be a motionless cue ball and a target ball with a related trajectory and velocity. On this account, it appears that all the causal work is done by God, and created entities are merely 'occasions' for God's continuous activity of actualizing each new state of the universe. As long as this divine activity forms consistent patterns, the world will display a causal structure in the regularist sense, without any role for creaturely causal power or efficacy.

Roughly this position was embraced by thinkers who came to be known as 'occasionalists', but it has consistently been rejected by most Christian theologians. Thomas Aquinas described the view of Muslim occasionalists in this way: 'Some have understood God to work in every agent in such a way that no created power has any effect in things, but that God alone is the immediate cause of everything wrought: for instance, that it is not fire that gives heat, but God in the fire, and so forth.' (Aquinas 1265-1272: I, 105,5) Aquinas energetically resisted this account, and insisted that 'God works in things in such a manner that things have also their proper operation.' No doubt God *could* operate as the occasionalists suggest, and directly cause all of the events that constitute the world's history. But Aquinas contended that God's creative power is more fully expressed by granting causal powers to created things, so that in their interactions they affect and are affected by each other. As Aquinas put it, 'there are certain intermediaries of God's providence, . . . not because of any defect in His power, but by reason of the abundance of His goodness; so that the dignity of causality is imparted even to creatures.' (Aquinas 1265-1272: I, 22,3)

God's generosity in creation, therefore, includes empowering creatures to bring about changes in the properties of other creatures in an ordered structure of causal relationships. Only God can cause being, but both God and creatures, if God so wills, cause change. This establishes the familiar scheme of primary and secondary causation, in which God acts on two levels. God acts directly without intermediaries in every event as the ground of the creature's existence. God also acts by means of the ordinary processes of nature to produce a vast range of particular effects, and these effects can properly be described as indirect divine acts. This pattern of action attribution is familiar to us in daily

life. We often do one thing (vote for our favoured candidate) by doing another (marking a ballot). These chains of indirect action can be quite extensive, though there are some important limits on action attribution to human agents, since we frequently fail to accomplish what we intend, and produce instead various outcomes we do not want. In the case of indirect *divine* action, however, these limitations do not apply. God could so arrange the network of created causes that all and only the effects intended by God come to pass. This would be the case, for example, in a perfectly deterministic natural order. By establishing a complete set of deterministic causal laws and setting the initial conditions, God could specify every event in the world's history, each of which would be an indirect divine act no matter how remote it might be from the initial state of the universe. The emergence of a new species and the fall of an individual sparrow would each be God's intentional act, though they are brought about through an inconceivably complex chain of intermediate events as means.

This story about divine action becomes more complex, of course, if we move away from a simple deterministic picture, and include underdetermined chance or libertarian free action in our account. I will say more about this in a moment, but it is worth observing that even in indeterministic worlds, God's creative choice will establish and delimit the range of possible developments and their relative probabilities. This guarantees that God has profound providential control over the world's history.

SPECIAL DIVINE ACTION

Given this account of God's action in ordinary events, how might we respond to Gilkey's challenge to explain what we mean by a 'special' divine act? There are at least three ways in which we might mark out some events as divine acts in a distinctive sense.

First, we can begin where Gilkey ends, with the familiar shift in liberal theology to a strictly epistemic interpretation of special divine action. On this account, the significance of the event consists solely in its role in prompting a new insight or revealing an important truth. What makes this event special is its effect *on us*; it need not entail any distinctive form of divine action in the world. Suppose, for example, that the escape from captivity in Egypt involved only the ordinary processes of nature without any supernatural divine intervention. This experience may nonetheless

play a crucial role for the Hebrew people in awakening a vivid recognition of God's liberating purposes and forming their understanding of their place in those purposes; the exodus is a *subjectively special* moment in Jewish religious self-understanding. As Gilkey pointed out, the Biblical theologians hesitated to make any stronger claim than this about special divine action, and this reluctance fatally undermined their proposals.

Second, an event might be special by virtue playing a distinctive role in the world's developing history. This can be the case even if this development results from ordinary processes at work in nature and human history. We have just seen that events built into the plan of creation from the outset can be attributed to God as indirect divine acts. It could happen that some of these events might make an especially important contribution to advancing God's purposes, e.g., as a turning point or a culmination. This will be a fact about the event in its relation to the overall course of the world's history, and not just an observation about our beliefs regarding it; indeed, we might often fail to recognize the actual importance of such events. On this view, the improbable escape of the Hebrew people from subjugation in Egypt not only reveals God's purposes, but also advances them in a special way; the exodus would be a *functionally special* indirect divine action.

Third, an event might be marked out as special because God acts directly within the world's history to bring it about. More precisely, God might act to ensure the occurrence of this event even though created causes alone, given the world's actual history to date, would not be sufficient to produce it. This would be an *objectively special* divine action, distinguished from other events by the *way* God brings it about – its causal history will include, along with all its natural antecedents, a specific divine input. This takes a step beyond the idea of functionally special divine action, because in this case God produces an effect in the world not by writing this outcome into the program of history at the outset, but rather by acting within the world once its history is underway. If this is the mode of God's action in the Exodus, then in addition to acting indirectly through the order of created causes, God affects the course of events directly to ensure that the Jewish people escape from Egypt.

SCIENTIFIC VETOES

All three of these understandings of special divine action can be affirmed simultaneously of a single event. But it is useful to distinguish them

because they make claims of varying strength, and can be separately asserted or denied. It is, of course, the third way of conceiving of special divine action that has been so problematic in modern theology. There are multiple reasons for this, including historical-critical and interpretive considerations, but an overriding concern has been the alleged incompatibility of such claims with scientific understandings of the world. I have elsewhere called this the 'scientific veto argument' (Tracy 2012: 59-61), and variants of it have become a commonplace in contemporary theology. If we attempt to formulate this argument, however, its weaknesses quickly become apparent.

Consider, for example, a particularly adventurous version presented by Gordon Kaufman. He contends that the sciences have generated a 'modern conception of nature and history as a web of interrelated events that must be understood as a self-contained whole', and he concludes that 'in such a world acts of God (in the traditional sense) are not merely improbable or difficult to believe: they are literally inconceivable' (Kaufman 1972: 132, 135). In making his case, Kaufman observes that the sciences seek to explain events in terms of lawful causal relations to other events within the system of nature, and they exclude appeals to causes or agents that are not part of that structure. Suppose that we accept this claim about the methodological naturalism of the sciences. Objectively special divine action would be ruled out of *scientific* explanations (*contra* some forms of intelligent design hypothesis), but this does not entail an across the board rejection of this idea; it remains available for use in non-scientific contexts. Kaufman must defend a stronger claim: namely, that the sciences understand the web of natural events as 'self-contained' in the sense of being immune to outside influences. This *would* entail that there can be no objectively special divine action in the world described by the sciences. But why should we accept this view? Kaufman seems to think that this is a necessary presupposition of scientific inquiry. His argument here slides unselfconsciously from methodological to metaphysical naturalism. Although the sciences may be committed in principle to seeking explanations of a particular type (i.e., 'naturalistic' ones, whatever that might turn out to mean), they cannot themselves authorize the conclusion that there always are such explanations to be given. The program of scientific inquiry can be extended indefinitely, but there is no guarantee, from within that enterprise, that it will always be successful.

Kaufman's argument, then, overstates the case against objective divine action in the world. But thinkers like Kaufman and Gilkey are correct in recognizing that the natural sciences have profoundly affected the epistemic context within which theology now operates. We bring to our experience a strikingly different set of expectations than did, say, Gregory the Great when he wrote the *Life of St. Benedict*. Gregory tells us, for example, about a monastic graveyard that would not hold the body of a disobedient monk; the sacred ground spontaneously exhumed the corpse each time it was reburied until finally Benedict forgave the monk his misdeed (an unauthorized visit to his parent's home, during which he died outside the monastery). (Gregory the Great c. 590, 1895: Ch. 24) Many of us, I would venture to say, are not inclined to accept this story at face value as an accurate report of an historical episode. But, *contra* Kaufman, the problem is *not* that we share a scientific world view that rules out the possibility of such events. Rather the difficulty is epistemic; the story is at odds with our prevailing sense of how things go in the world, and so would require especially strong backing in order to become credible to us. This, of course, is the core idea developed by Hume's epistemic argument against miracles. But we can resist Hume's sweeping dismissal of all miracle claims while still acknowledging that such claims face special evidential burdens in our epistemic context, a context that includes background beliefs shaped by the modern sciences. The veto argument, I suggest, reflects an overreaction to this intellectual situation.

The background beliefs shaped by our scientific culture are, to be sure, a mixed bag. One problematic belief that has played a significant role in discussions of objective divine action has been the assumption that causal explanations in the sciences must not only be naturalistic but also deterministic, and that causal closure in a complete system of deterministic relations constitutes the scientific norm. Once again, we need to make a distinction between a (putative) methodological commitment to seeking explanations that provide causally sufficient conditions, and the metaphysical doctrine of universal determinism. Modern theologians have often overlooked this distinction, treating universal determinism as a concomitant of scientific inquiry. If this is our picture of the natural order, then there are just two ways in which God can shape the direction of the world's development. On the one hand, God's creative act can determine every event in cosmic history by specifying the laws of nature and a set of initial conditions. On the

other hand, God can intervene in the deterministic series to break the chain of natural causes and redirect the course of events. If intervention is rejected, then God's providential guidance of the world's history must, without remainder, be built into the act of creation. Deism responded in just this way to the triumphant determinism of eighteenth century mechanics, and the result was that the God who acts in history was replaced by Laplace's demon.

Given the failure of the scientific veto argument, the idea of divine intervention should not be ruled out as an option in contemporary theology. Indeed, if we affirm that God is the creator *ex nihilo* of the whole structure of finite causes, it would be odd to deny that God could act directly in the world. But given the epistemic challenges facing claims about intervention, the cautiousness of many modern theologians on this point is understandable.

DIVINE ACTION IN AN INDETERMINISTIC WORLD

Perhaps there is a way beyond this simple and unsatisfying juxtaposition of deism and interventionism. The conceptual options for thinking about direct divine action change in intriguing ways if we consider the possibility that God has created a world whose history does not constitute a rigidly complete causal system, but rather includes open alternatives for the future. In such a world, there will be at least some developments that are not precisely determined by their antecedents; in just these circumstances, any of some range of different outcomes will be possible. These events are not uncaused, but they are underdetermined, that is, they have necessary but not sufficient causal conditions in the world's prior history. If the natural order includes processes of this sort, then God could select among these alternative possibilities without disrupting any deterministic causal sequence. This would be an objective divine action that affects the world's unfolding history, but it would not be an intervention, if by this term we mean an action that interrupts an otherwise complete series of finite causes and effects.²

This represents a third way of thinking about special divine action. But this alternative will be available only if (1) it is plausible to understand the causal structures of our world as under-determined in some respects, and (2) these under-determined events can make the right sort of difference

² On difficulties in defining 'intervention' see Plantinga (2011: 108-113).

in the subsequent development of the world's history. The question about whether and how these two conditions might be met has led in recent years to a sustained engagement of theology with science, and a variety of possibilities have been explored³. One of the most promising has focused on indeterministic interpretations of quantum mechanics. Needless to say, this carries us well outside the home territory of theology, and the discussion must be exploratory and tentative in character. I want to suggest that whether or not this line of thought makes a contribution to a theology of divine action, it raises some puzzling wider questions about God's relation to nature in an indeterministic world.

The first thing to be said about quantum mechanics is that the theory can be interpreted in a fascinating variety of different ways, and it is a mistake to present any one of these interpretations as representing *the* findings of quantum theory. This interpretive pluralism reflects the challenge of trying to imagine a world that gives rise to the odd behaviour observed in the laboratory and described by the quantum formalism. The quantum realm lies at the foundation of our familiar world of discrete objects bearing determinate properties, and yet it defies description in these terms. Some of the properties of an electron, for example, have definite values; this is true of its mass, charge, and spin magnitude. But other properties stand in uncertainty relations such that if we gain information about one, we lose information about another; this is true of the electron's position and momentum, and its spin orientation on more than one axis. In order to describe the state of the electron, we must map a set of probabilities for the value that would be obtained for each property if we were to measure it, and before a measurement is made these properties remain indeterminate. Mutually exclusive outcome states for the position or momentum of the electron are conjoined in a 'superposition' described by the Schrödinger wave equation. This mathematical representation of the quantum object undergoes a continuous (i.e., deterministic) development over time. But when the right sort of interaction takes place, the wave function 'collapses' to a specific value for the measured property. It is here that we encounter underdetermination in quantum mechanics; the theory, at the level of its mathematical formalism, does not explain the selection of one of these possible outcomes rather than another.

³ For example, see the collections of essays from a series of conferences on divine action and natural science: Russell (1993-2007).

This peculiar situation has provoked interpretive disagreements right from the start. In an extended debate with Nils Bohr, Einstein insisted that quantum theory had to be incomplete, that there must be hidden variables that would make it possible in principle to provide a sufficient reason for the outcomes produced under various measurement conditions. The probabilistic character of quantum theory, he thought, ought to reflect the limits of our knowledge, and not the way the world works. Einstein, Podolsky, and Rosen generated the famous EPR thought experiment to show that if quantum theory is complete, it has various counter-intuitive consequences when applied to systems involving two-particles whose wave equations are entangled (*viz.*, 'spooky action at a distance') (Einstein, Podolsky, Rosen 1935: 777–780). J. S. Bell (1987) later demonstrated that quantum theory and deterministic local hidden variable theories of the sort Einstein envisioned produce different predictions for the correlation outcomes of EPR-type experiments (when the detectors are set at different angles). In the 1970's it became technically possible to conduct such experiments, and the quantum predictions were confirmed.

This does not mean that quantum theory cannot be interpreted deterministically. But it does mean that a quantum mechanical determinism will be a very different creature than the familiar macroscopic determinism of Laplace. David Bohm's reconstruction of quantum mechanics, for example, manages both to preserve classical particles with determinate properties and to provide these particles with complete deterministic trajectories. But in order to match the observed quantum statistics, he posits a 'quantum potential' that sustains instantaneous links between spatially distant regions (Bohm 1952: 166-193). When we make a measurement on an entangled two particle system, the orientation of the measuring device is registered by the pilot wave as a whole, and this fixes the state of the other particle even if the two are separated at 'space-like' distances, *i.e.*, distances great enough that no causal influence can be communicated within the signalling time permitted by the speed of light. This generates a deterministic hidden variable theory, but it does so by giving up the causal locality of classical determinism.

Bohm's interpretation has not been not widely embraced among physicists and philosophers of physics, though it certainly remains a live option. Many theorists profess a reluctant allegiance to the 'Copenhagen interpretation', but even this is actually a diverse family of related

views. For my purposes, it is enough to note what is generally shared among these approaches. First, they treat quantum theory as complete, rather than looking for hidden variables, and they therefore grant that properties held in superposition are indeterminate until measurement. Second, they accept that the transition from the superposition state to a determinate outcome is underdetermined; when a measurement occurs, the quantum system described by the wave equation undergoes a discontinuous collapse.

If quantum mechanics is interpreted this way, then the natural order at a deep level may provide a vast array of branching alternative pathways, all of which are available within its causal history. The structure of such a world weaves together law and chance, regularity and flexibility. But the presence of chance in nature is not enough by itself to provide for an open future. Chance transitions at the quantum level will need to have particular causal consequences over and above establishing the stable regularities of the macroscopic world. Unsettled scientific questions arise here, particularly with regard to the possible role of quantum events as triggers for chaotic amplification. But we know that quantum transitions can have specific effects at the macroscopic level – this happens in physics labs when measurements are made on quantum systems – and there are good reasons to think that some processes in nature function this way. A striking example can be found in evolutionary biology, where quantum effects play a role in some kinds of genetic mutation, and the results of these changes can then be amplified or extinguished by natural selection. (Russell 1998: 191-224)

An indeterministic interpretation of quantum mechanics, therefore, holds some promise of opening up fresh options in thinking about special divine action in the world. Of course, any theological proposal along these lines will be intimately tied to the current state of physical theory, and will be vulnerable both to new theoretical developments and to changing assessments of the relative plausibility of competing interpretations. As we have seen, modern theologians typically have fled from this kind of empirical exposure. But if theology is going to be relevant to the world in which we actually take ourselves to live, then it may need to run such risks, recognizing that this interpretive dialogue will be open-ended and that the ideas it generates will be tentative and revisable.

It is important not to overstate what is at stake in a proposal of this kind. Divine action through quantum (or any other) underdetermination

would be just one of the ways God might act in the world, and it will not be the most basic. We have already seen that, in the first place, God acts directly as creator *ex nihilo* in every event. Second, God acts indirectly by means of created causes as they operate according to natural law. Third, God can directly intervene in an otherwise deterministic secondary causal series. Fourth, we now add an additional possible mode of direct divine action in the world – namely, that God acts to determine some or all of what is left underdetermined by secondary causes.⁴ These ways of conceiving of divine action provide a rich set of resources that we can call upon in responding to Gilkey’s challenge to explain what we mean by an act of God in history.

THEOLOGICAL OBJECTIONS AND METAPHYSICAL CONUNDRUMS

Let me now turn briefly, first, to theological objections to the idea of non-interventionist direct divine action at the quantum level, and second, to some conceptual puzzles generated by this idea.

A number of objections are rooted in uneasiness with the idea that God would be so pervasively involved in the mundane business of moving the world along from one state to the next. This may seem excessively hands-on, over-involved, and quotidian – a kind of busywork that is beneath the dignity of the creator. It entails that God acts among or alongside secondary causes, and this purportedly treats God as one power among others, filling in where created causes are insufficient. This has the effect of demoting God from the position of transcendent creator *of* the world to being merely a formative power *in* the world, a cosmic demiurge.

These intuitive misgivings can be sharpened into at least two more precisely expressed objections. First, the idea that God acts at the quantum level might be criticized as a return to the discredited ‘God of the gaps’. Modern theology has not found it a winning strategy to seek out points at which scientific explanations are incomplete, and rush forward to insist that this is where God’s hand can be seen at work. The problem, of course, is that when these gaps are filled by expanded scientific understanding, God is once again pushed out of the world.

⁴ I hasten to add that these do not exhaust the range of possibilities. I have said nothing, for example, about divine action through the free intentional actions of created persons. I discuss this topic in Tracy (2010).

The reply, in brief, is that not all gaps are created equal; that is, they do not all arise in the same way. The gaps that give the God of the gaps a bad name are merely epistemic; they are a consequence of limitations in our current understanding of the way the world works. By contrast, the gaps identified by indeterministic interpretations of quantum mechanics reflect incompleteness in the causal structures of the world, i.e., they are ontological gaps (and therefore also epistemic gaps). The existence of these gaps is part of what quantum theory (so interpreted) has discovered about the world; they reflect what we currently think we know, rather than simply being artefacts of temporary ignorance. If our best current physical theory suggests that God has chosen to make a world with an objectively gappy structure, then this is an interesting fact that theology should take into account.

A second objection elaborates the worry that direct divine action at the quantum level (or finally at any level in the structure of nature) fails to appreciate appropriately the transcendent character of God's agency. The root problem, the objector claims, is contained in the very idea that God makes use of openings in the structures of nature in order to act without displacing secondary causes. This allegedly misunderstands the nature of divine agency, which as the creative ground of all finite things does not need to find a way into the world to act. Every activity of created things necessarily is an activity of the God who causes them to be. So there can be no trade-off, no juxtaposition, of God acting *or* creatures acting. The notion that there can be competition between divine and created agency, and that God must find 'room' in the world to act, represents God as one agent among others all of which operate on the same level.

This objection begins with a sound theological premise about creation, but the conclusion is a *non sequitur*. I noted earlier that the concept of creation out of nothing entails a fundamental distinction between God's act of causing being and creatures' acts of causing change. Nothing in the idea of direct divine action at the quantum level (or anywhere else in the structure of nature) denies this distinction. Rather, the idea is that the God who acts always and everywhere to give being to creatures, might also freely choose to act among them in their history. As Aquinas notes, God 'is not subject to the order of secondary causes, but, on the contrary, this order is subject to Him, ... Therefore God can do something outside this order created by Him, when He chooses, for instance, by producing the effects of secondary causes without them, or by producing certain effects to which secondary causes do not extend'

(Aquinas 1265-1272, 1945: I, 105, 6). If God chooses to act in this way, then there will be a trade-off between divine and created agency. *In these instances*, God rather than the creature produces the effect. But in acknowledging this possibility, we are not claiming that in general divine and created agencies are locked in a zero-sum game. Nor does direct divine action (whether interventionist or non-interventionist) among secondary causes reduce God to the status of a secondary cause. As sovereign creator *ex nihilo*, God may act directly in the world without being diminished; it would be strange to say otherwise in a religion with divine incarnation at its centre.

These particular theological objections, then, are misconceived. But significant conceptual puzzles certainly do arise in considering divine action at the quantum level. I want to suggest that some of these puzzles present difficulties not just for attempts to construct a non-interventionist account of divine action, but for theology generally in conceiving of God's relation to the created order. If God has chosen to make a world that includes ontological chance, then we must grapple with the question about God's relation to these underdetermined events. This question arises even if one has no interest in the kind of proposal I have sketched here, and it leads to some fascinating and fundamental metaphysical issues. There appear to be only two possibilities: events that are underdetermined by secondary causes must either be determined by God or by nothing at all.

Each of these alternatives brings with it further intriguing questions, though there is space here only to introduce them briefly. Consider the second possibility, namely, that God leaves quantum transitions 'up to chance'. How is this possible for the creator of the universe *ex nihilo*? Human beings can resort to chance (say, by rolling dice or flipping a coin) because we are unable to predict the outcome of the events in question; even if we understand the relevant causal laws, our knowledge of the initial conditions is insufficiently detailed to make possible an accurate calculation. But chance obviously cannot work this way for the Creator who brings about both the causal structures and the initial conditions under which they operate. Perhaps God might ordain that a creature shall instantiate any of some set of possible properties. The puzzle here is that God must cause there to be an entity or event whose content is not fully specified either by God in the act of giving it being nor by secondary causes. Peter van Inwagen (1988) has considered this possibility, and has suggested that God might leave even the initial state of the universe

undetermined. Perhaps God's creative decree takes the form: 'Let one of X or Y or Z come to be.' One of these possible worlds would then spring into existence without sufficient reason for doing so. This account of creation would no doubt disappoint defenders of the cosmological argument, since appeal to a self-existent creator of the world would not after all provide a sufficient reason for the existence of *this* universe.

Alternatively, we can hold that God determines the outcome of naturally underdetermined transitions in quantum systems. This preserves the principle of sufficient reason. But if God directly brings about the outcome of every quantum transition, then these phenomena are an immediate expression of God's activity, and so are the objects, properties, and relations built up on this base. Our familiar world consists of a vast aggregation of events actualizing God's choices between alternative possibilities. At this point, we may wonder whether we are witnessing the second coming of occasionalism.⁵

Recall that the traditional theological response to occasionalism contended that God's creative act endows creatures with causal powers of their own, capacities to cause change in other creatures and, in turn, to be changed by them. Historically, of course, the theory of causal powers developed as an analysis of the relations of macroscopic objects taken as discrete and determinate particular things. Causal powers are (or are linked to) intrinsic properties of particulars; to possess these properties is to be disposed under appropriate stimulus conditions to display characteristic behaviours and to produce characteristic effects. As we've seen, however, the quantum theory disrupts this metaphysical picture. An electron, like a macroscopic object, has a determinate mass that when observed is found at one location in space. Unlike a macroscopic object, however, the electron before we observe it does not have a determinate location, but somehow combines a mutually incompatible set of positions in a region of space. It hardly needs to be said that this is not the sort of entity envisioned by traditional accounts of created causes.

The first move in response to this strange new picture is to revise our account of causal powers so that it incorporates the stochastic properties of quantum entities, and allows for non-necessitating, probabilistic causality. The created bearer of causal powers would then be understood as an evolving structure of potentiality, an entity defined not only by various intrinsic determinate properties, but also by a set of well-defined

⁵ I draw here upon Tracy (2013).

probabilistic propensities. The causal powers of this entity include its capacity to generate with precise likelihoods this range of outcome states under the requisite measurement conditions.

So far, so good – but further puzzles immediately arise. Under many conditions ‘quantum entities’ cannot be individuated as separate bearers of stochastic properties. Consider a two electron system. According to the Pauli exclusion principle these electrons must be described by a single anti-symmetric wavefunction. Their joint state is not simply the sum of objective probabilities possessed by each electron considered individually; rather, they can only be described in relation to each other. In EPR-type experiments, physicists make separate measurements on two particles. But these particles cannot be regarded as *localized* bearers of causal powers. When a measurement is made on one electron, it collapses the wave function for its anti-correlated counterpart. Rather than there being a transmission of causal influence between discrete individuals, these particles appear to constitute a relational system, a whole that somehow maintains instantaneous correlations of its separated components. Current physical theory suggests that this is a ubiquitous feature of our world, and so the challenge is to develop an intelligible analysis of this situation in terms of causal powers.

It is tempting to sidestep these puzzles by regarding quantum theory strictly as a useful conceptual scheme for organizing experimental results and directing inquiry, but not as disclosing new classes of entities with causal powers. Talk about particles and their properties would have value not as a description of the quantum stuff we encounter in the lab (and elsewhere of course), but as a model that can incorporate current observational data, predict results, shape ongoing inquiry, and so on. What matters scientifically is that the object language of the theory (its description of the inhabitants of the ‘particle zoo’) is empirically adequate, i.e., able to account for current observations. But we would remain agnostic about whether this language correctly describes real items in the world, i.e., about whether it is literally true.

This metaphysical modesty is appealing. But if we adopt this cautious anti-realism, then we no longer have bearers of causal powers at the quantum level. Instead, we have patterns of events organized according to probabilistic laws that support complex counter-factual conditionals – causality in a strictly regularist sense. If we assert that all of these events are directly produced by God, then God is the only productive cause, and we are no longer in a position to reply to the

occasionalist by contending that God produces these effects by means of the operation of secondary causes.

Occasionalism has its advantages; it eliminates problems about how God can act in the order of nature without disrupting or displacing secondary causes, since there are no secondary causes. God is the cause of all change as well as of all finite beings, and natural laws simply identify recurring patterns in this divine action. Christian theologians have usually thought that this represents a loss of value in the world. In an occasionalist world, as Aquinas said, creatures do not 'have also their [own] proper operation.' They lack, we might say, a structure of active being that is their own, and in this respect the occasionalist's God stops short of positing the creature as a genuine other, differentiated from God's own activity.⁶

Quantum mechanics, then, may open the door to a non-interventionist account of objective divine action. But when we step through that door, we enter an unfamiliar world that leaves us facing fundamental metaphysical puzzles about God's relation to the world. In this context, it will not be enough simply to repeat classical claims about divine action through secondary causes; we need to grapple with some difficult underlying questions about how to conceive of such causes.

BIBLIOGRAPHY

- Anderson, Bernhard W. 1957. *Understanding the Old Testament* (Englewood Cliffs, NY: Prentice-Hall)
- Aquinas, Thomas. 1265-1272. *Summa Theologica*, Part I, Anthony C. Pegis (ed.), *Basic Writings of St. Thomas Aquinas* (New York: Random House, 1945)
- Bell, John S. 1987. *Speakable and Unspeakable in Quantum Mechanics* (New York: Cambridge University Press)
- Bohm, David. 1952. 'A Suggested Interpretation of Quantum Theory in Terms of Hidden Variables, I & II', *Physical Review*, 85: 166-193
- Burrell, David B., Carlo Cogliati, Janet Soskice & William R. Stoeger (eds). 2010. *Creation and the God of Abraham* (Cambridge: Cambridge University Press)
- Einstein, Albert, Boris Podolsky & Nathan Rosen. 1935. 'Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?', *Physical Review*, 47: 777-780
- Ellis, George, Michael Heller & Tadeusz Pabjan (eds). 2013. *The Causal Universe* (Krakow: Copernicus Center Press)

⁶ Bas van Fraassen argues that 'the language of science should be literally construed, but its theories need not be true to be good' (1976: 632).

- Gilkey, Langdon. 1961. 'Cosmology, Ontology, and the Travail of Biblical Theology', *The Journal of Religion*, 41: 194-205
- Gregory the Great. c.590, 1895. *Dialogues, Bk. II: The Life of Our Most Holy Father St. Benedict*. Available at: <http://www.ccel.org/ccel/gregory/life_rule> [accessed 6 Aug. 2015]
- Kaufman, Gordon D. 1972. *God the Problem* (Cambridge, MA: Harvard University Press)
- Morris, Thomas V. (ed.). 1988. *Divine and Human Action* (Ithaca, NY: Cornell University Press)
- Plantinga, Alvin. 2011. *Where the Conflict Really Lies* (Oxford: Oxford University Press)
- Russell, Robert John (ed.). 1993-2007. *Scientific Perspectives on Divine Action*, 6 vols. (Vatican City: Vatican Observatory, and Berkeley, CA: Center for Theology and the Natural Sciences)
- Russell, Robert John. 1998. 'Special Providence and Genetic Mutation', in Robert John Russell, William R. Stoeger & Francisco Jose Ayala (eds), *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action* (Vatican City: Vatican Observatory and Center for Theology and the Natural Sciences), pp. 191-223
- Russell, Robert John, William R. Stoeger & Francisco Jose Ayala (eds). 1998. *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action* (Vatican City: Vatican Observatory and Center for Theology and the Natural Sciences)
- Tracy, Thomas. 2010. 'God and Creatures Acting: The Idea of Double Agency', in David B. Burrell, Carlo Cogliati, Janet Soskice & William R. Stoeger (eds). *Creation and the God of Abraham* (Cambridge: Cambridge University Press), pp. 221-237
- Tracy, Thomas. 2012. 'Scientific Vetoes and the Hands-Off God: Can We Say that God Acts in History?', *Theology and Science*, 10 (1): 55-80
- Tracy, Thomas. 2013. 'God and the Causal Structures of Nature: Some Puzzles', in George Ellis, Michael Heller & Tadeusz Pabjan (eds), *The Causal Universe* (Krakow: Copernicus Center Press), pp. 269-290
- Van Fraassen, Bas C. 1976. 'To Save the Phenomena', *Journal of Philosophy*, 73 (18): 623-632
- Van Inwagen, Peter. 1988. 'The Place of Chance in a World Sustained by God', in Thomas V. Morris (ed.), *Divine and Human Action* (Ithaca, NY: Cornell University Press), pp. 211-235
- Wright, George Ernest. 1959. *God Who Acts: Biblical Theology as Recital* (Garden City, NY: Doubleday & Co.)