Emergence:

Using an Emergence Model of the Mind-Brain System to Construct an Emergence Model of the God-World System

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Fall/Winter 2003

"The essence of what a scientist does is to imagine and explain what lies behind phenomena, in other words to try to comprehend the natural world."

– John Eccles

"[Models] give us something to think about when we do not know what to think, a way of talking when we do not know how to talk."

– Sallie McFague

Table of Contents

Introduction 4
- My Experience of God
- Why Construct a Model?
- Why Construct an Emergence Model?

An Emergence Model of the Mind-Brain System 11
- Origins: Mind Emerges from Brain
  - Previous Models
  - Alternative Model: Emergence
- Integration: Primary Function of the Mind-Brain System
  - Construction of a Representation of Reality
  - Unique Cognitive Style: Cognitive Processing in a Meaningful Context
  - Self-Awareness and Imaginative Thinking
  - What Is the Self?
  - Ideas and Values
- Properties of the Mind-Brain System: Ongoing Relationship between Mind and Brain
  - Developmental Holistic Plasticity: How does change in one affect the other?
  - Causal Networks and Levels: How do they directly influence each other?
  - Self-Determining

An Emergence Model of the God-World System 31
and Its Theological Implications
- An Emergence Model of the God-World System
  - Origins: God Emerges from the World
  - Developmental Holistic Change: How does change in one affect the other?
  - Causality: How do they influence each other?
- Theological Implications
  - Origins and the Doctrine of Creation
  - Reciprocity, Development, and Change
  - God's Power and Human Suffering

Conclusion 42

Acknowledgments 43
Appendix 44
Bibliography 46

Introduction

I experience my relationship with God in every moment of my life.

Even to me, as I write those words, that sentence seems an odd way to begin a scholarly project. I do not appeal to any religious tradition, nor do I appeal to authoritative texts or doctrines. I simply begin with a statement of my own experience of the divine. In the following pages, I will take the reader on a journey to explore the nature of that experience, and I will attempt to establish a new way of thinking and talking about that experience. In so doing, I am approaching theology *a posteriori*, or based in experience, and I believe that a theology framed in terms of experience paves the way for deeper insights into the nature of the God that is experienced.[1] Furthermore, I argue that, even if the personal experience of God related below does not accord with the reader's own experience, the theological discussion that follows (founded on my personal experience) will open up new ways of imagining and speaking about God.

My Experience of God

In my relationship with God, God is *transcendent*. God is not a human being with human limitations, nor is God a living thing or a chemical element or a physical law with their accompanying limitations. God is more than I am, and God is more than the sum of the world's parts. In other words, God possesses unique properties of the highest order, interacting with the world in a way that no other being or force can. When I reflect on God's transcendence, I am reminded of all the moments in which I've felt that transcendence most poignantly. As a scientist contemplating nature, I am in awe of nature's enormity, but I am also in awe of that which unifies the enormity of nature

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1. Karl Rahner, Foundations of Christian Faith: An Introduction to the Idea of Christianity, trans. William V. Dych (New York: Seabury Press, 1978), 51-52.

into something greater than its parts. In studying the smallest details of life (the inner workings of a cell, or the minute changes in a strand of DNA), I am struck by the enormity of this thing called life. In these moments, I experience something greater than myself, greater than life itself, greater than the world I can see, hear, smell, taste, and touch. In these moments, God transcends me and transcends the world, and transcendence becomes an integral part of my relationship with the divine.

In my relationship with God, God is also *immanent*. True, God is not a human being or a chemical element or a physical law. However, God exists somehow in all of these things. As I described above, I often experience the enormity of the divine when I encounter the smallest details of the world around me. God is not equal to the cell or the DNA strand; God is more than these. Still, God is not absent from the cell or the DNA strand. When I see, hear, smell, taste, or touch, I am not encountering the enormity of God at once, but I am still encountering God. I feel God at work in the everyday miracles of thinking and feeling, of creating and growing, of moving and breathing.

Most importantly, my relationship with God does not end with my experience of God as transcendent and immanent. If I merely experience God in these ways, then my relationship with God is one-way: God affects me, but remains unaffected by me. Instead, I experience my relationship with God as reciprocal: God affects me, and I affect God. I do not wish to assert that the nature of our effect on each other is either exclusive or equivalent. That is, my experience tells me that I am not the only one affecting God, but that all things in the world do. Moreover, I do not affect God in the same way that God affects me, for such an equivalence would contradict God's transcendence (God is, after all, not a human being as I am). Still, reciprocity gives my relationship with God intense personal meaning.

To add precision to my original statement, I experience a reciprocal relationship with a simultaneously transcendent and immanent God. I am not the first to experience God this way, nor am I the first to entertain a discussion of the implications of this experience for theology. However, a simple discussion of the experience is not sufficient. After all, if God is both transcendent and immanent, and if God interacts with elements of the world as they would interact with each other, then precisely what *is* God? Many important questions are left unanswered by experience alone. Did God create the world? *How* does God influence the world, and *how* does the world influence God? Does God participate in evil and human suffering? These are important questions whose answers enrich any description of our relationship with God, and whose answers are not self-evident from a mere description of personal religious experience. To answer these questions, we need to bring personal experience into the realm of theological discourse, and for this we need to construct a concrete model of God based on our experience. The model uses imagery to make explicit our abstract notions of God and our relationship with God.

Why Construct a Model?

To construct a model, we must first find a powerful core metaphor upon which the model will be based. As explained by Sallie McFague, a metaphor uses a familiar object to explain a similar but less familiar object. Using McFague's language, unlike "symbolism" in which the inherent tension between the two objects has been resolved, "metaphor" maintains and even encourages the tension, harnessing the radical re-thinking necessary to process that tension and drawing our attention to a new way of imagining and talking about the less familiar object. According to McFague, "[G]ood metaphors shock, they bring unlikes together, they upset conventions, they involve tension, and they

are implicitly revolutionary."[2] The "tension" here refers to the dissimilarities between the two objects held to be similar by the metaphor. For example, the traditional metaphor "God the Father" relates the two objects "God" and "father" and draws attention to their similarity. Yes, God *is like* a father in that God cares for us, teaches us, disciplines us. However, we must also concede as part of this metaphor that God *is not equivalent to* a father. God is not human, does not conceive children with a mother, and does not die as fathers do. Within the metaphor "God the Father," there is both similarity and dissimilarity, both resonance and tension between the two objects. Both the resonance and the tension are useful for understanding what God really is, and both are necessary for the metaphor to work.

A model begins with a core metaphor and weaves around it a rich landscape of imagery that make explicit both the similarity and dissimilarity between the two objects in question. By exploring the similarity and dissimilarity, we can better understand the nature of the objects. After all, the purpose of constructing a model is to "give us something to think about when we do not know what to think, a way of talking when we do not know how to talk."[3] A model helps us understand an object or idea in terms of another object or idea that is either more familiar or more thoroughly understood already. For instance, a model of God based on the metaphor "God the Father" makes use of the rich imagery associated with our experiences of fathers as a starting point for our discussion of God (which we experience less directly and in less explicit detail). However, as discussed above, if this model is a good one, then the model will maintain both the similarity and the

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2. Sallie McFague, Metaphorical Theology: Models of God in Religious Language (Philadelphia: Fortress Press, 1982), 17.

3. McFague, 24.

dissimilarity between a father and God, and will indeed use the dissimilarity itself to further elucidate the nature of God.

Beginning with my experience of God, I construct a model that accomplishes the following. First, it metaphorically relates two ideas: "God's relationship to the world" and "the human mind's relationship to the brain." I argue that these two ideas relate to each other through the language of emergence, in that God *emerges* from the world as the human mind *emerges* from the brain. Second, my model of the relationship between mind and brain provides a rich matrix of imagery upon which I can draw, then, when discussing God's relationship with the world, including the notion of "system" and what this language implies about the relationship between two system components. In addition, the model maintains the dissimilarity between the two ideas in question: the world is not God's brain, nor is God a mind emergent from the world. Finally, using an emergence model of the God and world as system, I discuss how the model may be applied to theological issues such as creation and suffering, and I argue that my model provides more satisfying responses to these issues than those provided by other models of God.

Why Construct an Emergence Model?

If we model the relationship between two "objects" as emergence, one from the other, we maintain in tension two conventionally disparate perspectives. On the one hand, we see these two objects as fundamentally linked to one another, wrapped up in each other's properties and activities. On the other hand, simply by naming these two objects as *two objects*, we imagine, at least on a conventional level, that there are *two* things to be meaningfully discussed. In other words, we are holding in tension the idea of a single thing (a unity of two objects) and the idea of two things (distinct, separable objects). I propose a terminology of "system" to designate this perspectival

balancing act. To maintain this perspective, I remind the reader of the hermeneutics necessary to discuss *any* metaphor or model. We see two objects as similar enough to be meaningfully identified, but we also recognize that these two objects *are not* identical with one another, that they exist somehow outside of one another.

The language of emergence takes us a step further, however, and asserts that one of the objects emerged *from* the other. That is, in addition to the two objects being distinct but inseparable, one of the objects arises from the complexity of the other. In my model, the mind and brain are these distinct but inseparable objects, and the mind emerges from a complex brain. We may imagine the brain as existing prior to the mind in time, but this is not to say that the brain is somehow independent of the mind. In fact, once the mind has emerged, the brain and mind are related as part of a single system, and the mind and brain therefore become fundamentally interdependent. So, a brain can exist without a mind. But once a mind emerges, the fate of the brain becomes inextricably linked to the mind, and the brain cannot remain the same if the mind ceases to exist.

I will explain in detail an emergence model of the mind-brain system based on the findings of cognitive science. In so doing, I will establish imagery (most of which is directly experienced by us as human beings with minds and brain) in which two objects (mind and brain) are distinct and inseparable. This model forces us to hold in tension two more common perspectives (mind and brain as two objects; mind and brain as facets of a single object).

Then, I will construct a model of the God-world system based on my own experience of the divine, and I will depend upon the perspectival tension established in the mind-brain model to help us imagine a second set of objects (God and the world) as both distinct and inseparable. I will also explain how an emergence model of the relationship between the two objects in each case reinforces

the tension, as well provides a radical re-visioning of the relationship between God and the world.

An Emergence Model of the Mind-Brain System

Origins: Mind Emerges from Brain

Previous Models

In this study, I adopt Sperry's partial definition of mind as "dynamic, emergent (pattern[ed] or configurational) properties of the living brain in action."[4] By adopting this definition of mind, I reject the conclusions of another neuroscientific model of mind called the strong artificial intelligence model (AI). Strong AI neuroscientists model the mind-brain relationship after the relationship between software and hardware in a computer: if one possesses the appropriate software, the particularities of the hardware are next to irrelevant to the functioning of that software.[5] A strong AI model implies that the biology of the human brain is not necessary for the functioning of the human mind, that the human mind exists independently of the brain in that it does not require the unique properties of this biological system to exist.

Strong AI is a weak form of ontological dualism, a theoretical framework that draws a clear boundary between the stuff of the brain and of the mind. For an ontological dualist, once mental properties arise, they exist independent of the brain. This way of modeling the mind-brain relationship still finds voice in the scientific community. For example, neuroscientist Karl Popper espouses a version of ontological dualism. Popper consigns the mind and the brain to two separate "worlds" and

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4. Roger Sperry, Science and Moral Priority: Merging Mind, Brain, and Human Values (New York: Columbia University, 1983), 32.

5. John Searle, Minds, Brains, and Science (Cambridge, Massachusetts: Harvard University Press, 1984), 28.

argues that they only interact in the speech centers of the human brain.[6] In whatever form, ontological dualism argues that mind is an essentially different substance than brain or any other form of physical matter, and that mind therefore requires completely independent properties and laws to explain its behavior.

Ontological dualism does not satisfy me as a model for the mind-brain relationship for several reasons. First, we have no evidence that life forms without a biological brain do or can possess any attributes of mind. If a weak dualism, as that implicitly included in a strong AI approach, argues that the biology of the brain isn't necessary for the mind, then we would expect to find evidence of mental properties in non-biological systems. Although proponents of strong AI argue that computers are capable of mental properties, Searle argues quite convincingly that computers lack the "semantic content" necessary to differentiate between mental properties and simple information processing.[7] Second, a consideration of the mind and brain as two separate substances discourages modern efforts to probe the mind via brain research. After all, if the mind, once arisen, has little or nothing to do with the workings of the brain, how could neuroscientific discoveries aid us in our study of the mind? Finally, a dualistic model introduces a break in human evolution, a severing of the continuous threads linking the first organic compounds to the first living cells to the first multi-cellular organisms to modern humans. Dualism asks us to conceive of the introduction of a new non-material substance at some point in the course of human evolution, an event without precedence in our current understanding.

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6. Karl Popper, Knowledge and the Mind-Body Problem: In defence of interaction (London: Routledge, 1994), 133.

7. Searle, 31-33. See Appendix for a brief explanation of the Chinese room argument, used by Searle to argue that computers do not think in the same way that human beings think.

I believe that an alternative model can resolve these problems. This model asserts the fundamental interdependence between the mind and the biological brain. Furthermore, calling upon a rearrangement of matter (rather than the introduction of a new non-material substance) to explain the origins of mind, the alternative model allows us to maintain evolutionary continuity between ourselves and other forms of life. Finally, this model encourages rather than discourages explanatory continuity, in that neuroscientific study of brain mechanisms can provide insights into the nature of the mind.

Alternative Model: Emergence

Here I describe a more satisfying model of the mind-brain relationship: mind emerges from brain. By "emerge," I mean that the brain and its encounters with the world result in a system of such complexity that this system possesses what may be considered novel properties. This is not to say that a new substance arises from the old, but that a new level of organization and integration of the old substance arises. This means that the nature of the emergent mind depends upon the properties of the system from which it emerges: the human mind depends upon the properties of the human brain.

There is no dualistic separation into two realms, one mental and one physical, but an integral link between the mental and physical levels of a single continuous system. As Roger Sperry articulates, a monistic, holistic, system-based model of a mind emerging from brain "would eliminate the old dualistic confusions, the dichotomies and the paradoxes, proposing instead a single unified extending from sub-nuclear forces near the bottom up through the ideas at the top."[8] Mind is a new unity of matter, a novel arrangement of already existing forms to create novel and remarkable

8. Sperry, 36.

properties: "The transcendence [of mind] does not mean that a new force or energy has arrived from nowhere; it does mean that a new form of unity has come into existence."[9]

Integration: Primary Function of the Mind-Brain System

Once arise, the mind integrates vast amounts of information and creates a meaningful context for thought and action. Some integrative mental properties (including the ability to construct and process a representation of reality) have been found in other animals, although they appear to be particularly advanced in humans. Other integrative mental properties (such as self-awareness) appear to be unique to human beings, but may be described as emergent from and intimately related to other integrative mental functions.

Construction of a Representation of Reality

Perhaps the mind's primary function, especially from an evolutionary perspective, is to construct an internally coherent and consistent representation of reality that provides accurate, meaningful information about the way things are. Such a representation provides the foundation for action. In order to accomplish this objective, the mind must sort through abundant and sometimes disparate information from sources both internal and external to the body.

Imagine the amount of information reaching your nervous system at any given moment. As I sit writing, I hear music in the background, I feel the chill from the nearby window, I see letters appearing across the computer screen, and so forth. Although the brain, thanks to its enormous complexity, can process and integrate a large amount of information, it cannot give all available information equal processing attention. In fact, some of the information doesn't even reach the

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9. Theodosius Dobzhansky, The Biology of Ultimate Concern (New York: New American Library, 1967), 58.

central nervous system. Information filtering begins at the sensory organs, or periphery, and more filtering occurs as information from the periphery makes its way to the brain.[10]

Some of this filtering is the result of intrinsic properties of the sensory organs and their neural connections; some filtering results from top-down influences, in which the brain feeds back to alter peripheral filtering. This top-down processing often acts to create a "best fit" between information already present in the brain and new information, presumably to optimize internal consistency in the presence of disparate incoming information and to selectively attend to the most relevant information available. Choosing what novel information becomes part of the enduring system is important. If the mind mistakenly places too much emphasis on a new piece of information and consequently discards an older piece of the mental representation of reality, then the system is in a constant state of upheaval. Such constant upheaval hinders coherent, decisive action, which is necessary for survival. On the other hand, if the mind mistakenly ignores an important new piece of information, then the system becomes obsolete and does not adapt to changing circumstances, which is also necessary for survival. The mind's representation of reality is necessarily a probabilistic construction.[11] The mind constantly chooses which information to consider and which to ignore, and the decision is most often a matter of relative consistency than of fact.

Discerning consistency between sources of information is one important means for making such choices. For example, a strange odor alone may not be sufficient cause to mobilize the body's resources and leave the area. However, if the odor corresponds to a previously important odor, such

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10. See Appendix for a brief description of the progressive processing in the auditory system periphery, as evidence of how much processing occurs prior to entry into the cortex of our brain.

11. John C. Eccles, Facing Reality: Philosophical Adventures by a Brain Scientist (New York: Springer-Verlag, 1975), 48.

as smoke, the mind (via top-down processing) might signal the sensory periphery to investigate further without mobilizing an escape response. However, if the odor is initially accompanied by a bright light or heat, by consistent information from other sensory modalities (other sources of information), then the mind more quickly and decisively chooses to attend to the odor and to mobilize the body to avoid a possible fire in the area. This example illustrates, very simply, the kinds of information comparisons that the mind performs in order to decide which stimuli, both internal and external to the body, are *real* and *relevant*, amidst ambiguous and over-abundant information about the world.

Unique Cognitive Style: Cognitive Processing in a Meaningful Context

As the mind gains more experience over time, the top-down processing that influences information processing becomes more refined and personalized to the individual. Since the convergence of the information that reaches and influences each individual mind is unique, the cognitive decision-making capacities founded upon this information will also be unique. So, the mind's ability to construct a particular world view, tailored to the particular experiences of the individual, lays the foundation for the development of a unique cognitive style.

From a unique representation of reality emerges a unique cognitive style, a unique way of processing information about the world. Previous events provide not only the subjective context but, indeed, the biological framework for the consideration of future events, as top-down influences on information processing become incorporated into the neural activity of sensory systems. Which information we incorporate into our representation of reality early in our development influences which information will be selectively integrated later in development, as well as the way in which we will cognitively process that information.

According to Joseph LeDoux, working memory is the foundation of human cognition, particularly conscious cognition. "In order for the mind to think, it has to juggle fragments of its mental states," and the mind accomplishes this task by moving information, both previously integrated and newly encountered, in and out of a sort of cognitive "work-space."[12] If the underlying biological circuitry was not capable of nearly instantaneous change, of nearly instantaneous shuffling of patterns of neural activity, then cognitive functioning would be ponderous, and the time to move things into and out of the cognitive work-space would interfere with processing efficiency.

Human beings increase cognitive processing efficiency by linking mutually relevant information, such that a large amount of information may be cognitively accessed as a single unit. To do so, human beings have evolved an advanced mental ability: symbolic thinking. Language provides both an example and an evidence of symbolic thinking in humans.

LeDoux argues that the appearance of language from simpler forms of animal communication was a "revolution rather than an evolution of function."[13] Language catalyzed the development of other mental properties. Essentially, language is a powerful system of symbols, in which a single word may represent an array of information about previous experience, emotional reactions, and cognitive possibilities. For example, think of a simple word like "tree." Although this word does refer directly to a material object, I also think immediately of other objects indirectly related to "tree," such as leaves, birds, and grass. Furthermore, I think of more abstract concepts related to the word "tree," like having a picnic or taking a nap in a hammock. Even further, I remember how I felt

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12. Joseph LeDoux, Synaptic Self: How Our Brains Become Who We Are (New York: Viking, 2002), 175.

13. LeDoux, 198.

watching my brother climb a tree at my grandmother's house, and I imagine how scared I would feel if I were climbing a tree (as I have a terrible fear of heights, I imagine I would feel nauseous and terrified). Simply put, language enables the mind to integrate vast amounts of information, and to make this information readily available. Language acts as an integrating principle in the emergent mind, and the brain and mind have evolved to include and accommodate it. This "restructuralization" of mind explains in part why a "psychological abyss seems to separate *Homo sapiens* from all other animals."[14]

Self-Awareness and Imaginative Thinking

Another part of the explanation for the "psychological abyss" lies in the human experience of conscious self-awareness. Neuroscience has great difficulty pinpointing a mechanistic explanation of self-awareness, but we should require no evidence for its existence as a mental property. I experience myself as a subject, an entity distinct from the world around me. On the other hand, I can examine myself as an object, and I can consider my own properties and behavior as would an outsider observing me (or in a similar fashion).

Being able to at once consider myself and the world as objects of cognitive processing allows me to do several amazing things. I can observe my own flaws in action and deliberately correct them. I can observe others acting in particular ways, and I can deliberately imitate them and, furthermore, tailor the imitation to my own body and physical abilities. I can also imagine myself or others behaving in particular situations, and form a mental projection of what would occur under those circumstances without actually experiencing them.

Imaginative thinking, based on self-awareness, is important to cognitive efficiency and

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14. Dobzhansky, 130.

effectiveness. In addition to having a dynamic work-space, it is also important to have a diversified representation of reality. In other words, it is important that we can view information from many perspectives, and can process information in a variety of ways. The more perspectives from which we can view a particular cognitive problem, the more efficiently and accurately we can come to a decisive conclusion that will make sense in context. Our immense cognitive ability as human beings rests on the diversity of perspectives included in our representation of reality, in that we can combine our personal experience with our *imagined* experience.[15] For instance, I have several years of personal experience in driving a car, and I've only driven three types of automobile during that time. However, I can imagine what it would be like, based on my personal experiences, to drive a near-infinite number of different vehicles, and I can incorporate this information into my representation of reality. In so doing, I open myself up to a near-infinite landscape of information unavailable to animals without imaginative capacity.

Moreover, as a self-aware imaginative thinker, I possess the ability to solve problems imaginatively. I can "try out" behaviors mentally without wasting time or risking injury attempting them physically. For instance, using the example above, I don't need to drive a large truck across a slippery roadway in order to imagine what it would be like to attempt it. I can imagine that a larger vehicle is more difficult to drive, and I am aware that I do not have extensive experience in successfully driving in slippery conditions. Therefore, I decide not to attempt the feat (without having

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15. By "imagined," I mean those experiences we can cognitive process without personal physical participation. As a human being, my representation of reality includes not only my own personal experiences, but also those experiences of which I can conceive. The limits of my imagination, when used in this way, depend upon the same type of top-down filtering described previously, by which inconsistent information will be discarded (in this case, not imagined) in favor of consistent, relevant information.

to attempt it and injure myself before figuring out the correct course of action). The human ability to think imaginatively, based on self-awareness and a complex representation of reality, provides an evolutionary advantage in problem-solving and basic survival.

What Is the Self?

Both our unique internal representation of reality and our unique way of integrating information within this representation contribute to our unique "self." I define "self" here as "the totality of what an organism is physically, biologically, psychologically, socially, and culturally" as integrated within the mind.[16] What differentiates mind from self is that self refers directly and specifically to the individual, to the "I," while mind also encompasses those properties of the brain that are not distinct between individuals (such as basic cellular functioning).[17] Although neurophysiology does not determine self, it does form the foundation for self. The mental events necessary for the existence and maintenance of the self depend fundamentally on neural circuitry.[18] Furthermore, just as mind is unitary (integrated) and dynamic, self is unitary and dynamic.[19]

Our self integrates novelty, changing in response to new information and experiences. The integration of novelty occurs against a backdrop of restraint: not all new information will cause

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16. LeDoux, 31.

17. I should note here that even cellular functioning participates in the construction of a unique self, as will be evident in my discussion of networks and levels later in this essay. However, since the tenets of cellular functioning (including basic structure, organelle functioning, and so forth) do not differ greatly between individuals, I place a discussion of cellular functioning's contribution to mind as part of a theoretical treatment of system levels, rather than as part of the treatment of self given here.

18. LeDoux, 2.

19. LeDoux, 29.

drastic change. The self changes gradually, flexibly, but retains the memory of "who it was before." The mind dynamically integrates past and present. Although my self as a mental property changes constantly, I still retain an experience of continuity because the system *is* continuous. Change occurs gradually and only in congruence with past frameworks, against the backdrop of that internally coherent representation of reality described previously.

Here we begin to appreciate the complexity and interdependence of our human mental properties. A construction of reality necessitates a continuously refined cognitive style that decides which information will be processed and how it will be processed. As our cognitive style develops, it becomes unique and contributes to an internally consistent framework for maintaining system unity, associated with the self. However, our awareness of that self provides the foundation for imaginative thinking, increasing the necessity for more efficient and effective cognitive processing (to selectively and meaningfully integrate the near-infinite available information).

Ideas and Values

Ideas and values result from the activity of the human mind. Ideas are cognitive headings under which we classify information, and values are directional biases in the mind for a particular end. For example, religion and philosophy qualify as ideas, while an ethic of hard work in pursuing either of these qualifies as a value. Although the precise evolutionary origins of ideas and values remain a mystery, we can connect these concepts to previously mentioned emergent mental properties. First, as Searle describes, the primary distinguishing agent between a mental and a non-mental processing system is that a mental system contains semantic content. This semantic content, a meaningful contextualization surrounding a piece of information, may be the precursor for more complex contextualizations, like ideas and values. Furthermore, language functions as a high-level expression

of this contextualization, an information processing strategy that "increases the ability to categorize information."[20] Values similarly categorize biases in information processing when directed toward action. Ideas and beliefs capitalize upon the already powerful ability of language to integrate information, and provide *more* integrating power and cognitive efficiency to the mind.

Evolutionarily, both language and ideas (and the consequent emergent of culture) profoundly influenced biological history. As V.S. Ramachandran argues, "Once culture, language, and writing emerged ... human evolution became Lamarckian."[21] Similarly to the way in while self-awareness allows the individual to adapt to situations quickly (with a minimum of physical effort), language, ideas, and culture enhance the ability of the species to adapt and expand quickly. Ideas function as "exosomatic" tools; we allow our ideas to "die in our stead."[22] For example, while I am capable of imagining that if I jump from a high building I will injure or kill myself, I may not be capable of imagining, on my own, that if I eat too many fatty foods I will harm my health. The necessity of a balanced diet, as well as the content of that diet, is a culturally mediated idea, communicated to me by others. This idea could prolong my life considerably. Of course, other ideas influence my life without necessarily being tied to my survival. In any event, ideas allow minds to communicate with

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20. LeDoux, 177.

21. V.S. Ramachandran and Sandra Blakeslee, Phantoms in the Brain: Probing the Mysteries of the Human Mind (New York: Quill, 1998), 190. Lamarckian evolution refers to a pre-Darwinian theory formulated by the French biologist Jean-Baptiste Lamarck. According to this theory, species evolve by passing on acquired traits to their offspring. For example, if I become physically fit in my lifetime through exercise and diet, and if Lamarckian evolution applied to this trait, I would be able to pass physical fitness to my children. Cultural evolution (via communication) allows ideas and abilities acquired by parents to be passed on, not only to their own children but to people all over the world.

22. Popper, 12-13.

each other and to influence each other's development.[23]

Properties of the Mind-Brain System: Ongoing Relationship between Mind and Brain

I have described the original relationship between mind and brain as emergence: mind emerges from brain. I have also described the general trends in the functioning of mind and brain, including internal consistency and integration. I now describe the ongoing relationship between mind and brain as a "system." Reminiscent of my treatment of emergence, describing the mind-brain "system" asserts that the mind and brain do not exist or function as two separable entities. Nor do they exist as a single, indistinguishable whole, as evidenced by our ability to distinguish and describe mental properties (without reducing them to neural properties). Instead, mind and brain and the levels in between (such as neurons, neural circuits, and brain regions) exist somewhere in the tension between two and one: mind and brain are *distinct but inseparable*.[24] I will now examine how this relationship works, or how mind and brain relate to each other in practice.

Developmental Holistic Plasticity: How does change in one affect the other?

Neuroscientists define neural plasticity as the potential for change in a neural system as a result of experience, and they have demonstrated many mechanisms for neural plasticity, from

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23. Popper, 10.

24. I would like to thank Mary Solberg for her contribution of this terminology. After struggling to express this relationship using complicated language, her suggestion of "distinct but inseparable" seemed simple but rang true. I would also like to clarify what I mean by "levels." I use levels as an explanatory mechanism, not as an ontological statement. In much the same way that the mind and brain are distinct but inseparable, levels of the mind-brain system such as neurons and neural circuits are also distinct but inseparable: it is meaningful to speak of them in their distinctiveness, but also meaningful to speak of them as parts of a whole.

molecular to neural to behavioral.[25] Plasticity occurs at multiple levels, grounded in the basic biological changes in neural connectivity that arise from particular activities. Regardless of whether "nature" or "nurture" is responsible for the changes that occur, all changes in the brain and in the emergent mental properties evoke changes at the synapse, the biochemical junction between neurons.[26] Simple changes between individual synapses accumulate and coordinate to form memory. As the system encounters and selectively integrates new information, synapses continuously re-modulate and alter connectivity accordingly. Since mental events emerge from such neurophysiological events, mental plasticity emerges from synaptic plasticity.

Although the largest changes in the brain occur early in development, the brain (and, consequently, the mind) remains exceedingly plastic throughout development. Furthermore, although genetic inheritance dictates a basic neural framework instituted early in life, mechanisms of plasticity may alter this framework in response to adult experience, with often dramatic results. For example, Ramachandran describes experimentation in which the cortical somatosensory map can be re-mapped in response to experience.[27] Other examples of ways in which experience, including injury,

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25. See Appendix for a brief description of Dr. Eric Kandel's research in neural plasticity, and for other information concerning biological mechanisms of plasticity.

26. LeDoux, 262.

27. Ramachandran and Blakeslee, 27-28. The somatosensory cortex processes the sensation of touch. Each part of our body takes up computational space in the somatosensory cortex in proportion to the amount of sensation that body part relays. For example, the hands take up more space in the cortex than the arms because our hands are more sensitive than our arms to touch sensation. To explore the plasticity of somatosensory cortex, experimenters performed dorsal rhizotomies on adult monkeys, essentially disconnecting the sensory information in one arm from the somatosensory cortex. In a normal monkey, touching the arm or hand would cause heightened electrical activity in the place in the somatosensory cortex designated to arm and hand sensation. However, in experimental monkeys (post-dorsal rhizotomy), touching the animal's *face* caused heightened electrical activity in the portion of the somatosensory cortex originally designated for the

stimulation, and activity, alters brain structure abound in neuroscientific literature, implying that plasticity as a broad mechanism operates across time and across brain levels to enact change in the mind-brain system.

Furthermore, these examples should expand our conceptualization of "memory." Although we do consciously experience changes in the mind-brain system, we do not consciously access all change that occurs. And not all changes in the system relate directly to conscious experiences. For instance, our most personal images of "memory" relate to important events in our lives that have obviously changed us: our love for others, our education, places we've been. However, every piece of information that enters the brain has some effect on the system, however small and consciously unnoticeable. Most change is transitory, too fleeting to influence the system as a whole. Other change dramatically influences the system in the long-term, providing the framework for such mental events as the representation of reality, language, and learning.

In addition, we should re-imagine memory as a *distributed, holistic* property of the mind-brain system, rather than as a discrete brain function handled by a discrete brain structure. As already described, plasticity has been demonstrated in many brain areas and in response to many circumstances. Moreover, when a piece of information is "stored," it is not simply placed in a single compartment; even one piece of information is stored across sensory modalities, across brain structures. Indeed, the redundancy and richness of a particular memory trace provides assurance that

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hand and arm. Although the somatosensory cortex layout for a particular species is highly stereotyped (that is, the cortical space that processes information from the hands will be basically the same space across normal individuals), this cortical representation can still change dramatically in response to change in input. Since the paralyzed arm and hand were no longer transmitting information to their designated portion of cortex, nearby cortical areas (especially that area designated to face sensation), expanded and altered the electrochemical activity of the area to respond to other stimulation.

the information is internally consistent and therefore reliable.

Information stored in the system only makes sense in its *relatedness* to other parts of the system. So, in order to maintain internal consistency without hindering adaptation to experience, the system must be simultaneously able to store new information and "update" old information. LeDoux elaborates: "The only thing one brain area knows about another is the state of its synapses. Change the synapses in one area, and like dominoes in a line, synapses in others will be altered as well."[28] This parallel plasticity (the yoking of change due to novel circumstances to previously stored information) extends from the neural level to the level of the whole brain: "the brain that does the remembering is not the brain that formed the initial memory. In order for the old memory to make sense in the current brain, the memory has to be updated."[29] New research has begun to examine the nature of this parallel plasticity, positing brain systems called "convergence zones" that act as macro-level integraters across brain circuits.[30] These "zones" should not be understood as discrete loci of integration, but as broadly acting integrative processes localized most strongly in particular brain regions.

Our own conscious experience impresses upon us the importance of maintaining such yoking of parallel plasticity. In order to generate coherent and decisive action, we depend upon a conscious experience of a unitary self, of a single entity consistent over time and across circumstances. Although many things happen during my lifetime, I still experience them as happening to the same person, not as happening to a series of different people (one for each new change in the mind-brain

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28. LeDoux, 307.

29. LeDoux, 161.

30. LeDoux, 316.

system). As Eccles states, "because of memory, each of us links his life together into some kind of continuity of inner experience."[31] The unitary self includes both temporal constancy *and* continuous change across all system levels. This is the nature of change in a system: changes in one part of the system evoke changes in other parts of the system such that an internal system unity remains intact.

Causal Networks and Levels: How do they directly influence each other?

As human beings, we directly experience the result of our own intentional states, so we must include intention in any complete model of mind.[32] However, intention is not the only causal agent in the system. Our intentional causation, our experience of "will," acts as one cause among many. Each intention occurs against a backdrop of previous intentions, future plans, and mental properties, and all of these possess some degree of causal efficacy in the system.

Furthermore, although we have conscious access only to the mental level of causal agency, other system levels also possess causal efficacy, including the neurophysiological level. As Searle argues, to simplify our description, we may assert the "existence of two causally real levels of description in the brain, one a macro-level of mental processes and the other a micro-level of neuronal processes."[33] Each level may be explained in terms of its own properties, but the levels intimately interact with one another to produce change and action in the system. No level is "dominant," since all levels interact reciprocally and continuously in a multi-leveled network of causality. As Sperry describes, "The mental forces do not violate, disturb, or intervene in neuronal activity."[34] In other

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31. Eccles, 45.

32. Sperry, 64.

33. Searle, 26.

34. Sperry, 92.

words, mental forces do not break the laws or intervene in the relationships inherent in the brain's neurophysiology. Indeed, since the mental properties themselves emerge from these neurophysiological structures, they *could not* break these laws and relationships. However, broad directional influences may exist at the mental level (such as values) that guide the system toward particular ends. Once again, these directional mental influences do not themselves cause action, but they may provide a broad influence in the system by participating in networks of causality.

So, how do all of these causal agents in the mind-brain system become integrated to produce particular decisions or actions? We may gain an appreciation of just how complex are the causal networks and levels in the system by considering the following example. Imagine that you are standing on a soccer field in the middle of a game, pausing to get your bearings, and the soccer ball whizzes through the air towards you. How does your mind-brain system decide what to do? Otherwise stated, how does the system cause your action? At the mental level, your desire to be a hero in the game attempts to "cause" you to head-butt the ball and send it soaring into the opposing team's goal. However, also at the mental level, your desire to remain physically safe makes you afraid to head-butt the ball with the force required. At the neural level, your nervous system will be able to execute a head-butt only so quickly and with only so much force, limited by the speed of nerve conduction and the properties of your muscles. A compromise must be reached between all of these causal agents in the system. Although the outcome is not determined by any particular element, each element participates in the compromise to some degree. This is the nature of causality within a system: all elements contribute to the causation of system events, and no one element acts to "determine" those events.

Self-Determining

Humans experience free will, which I define as the experience of real causal agency in the world. In this model of the mind-brain system, free will becomes the experience that, although events outside of the system influence me, my thoughts and actions are ultimately dependent upon properties of that system. For instance, there are local, state, and federal laws dictating what I will be allowed to do under particular circumstances, and these laws may influence my thoughts and actions. However, in order to influence me, the laws must be *internalized* by my mind-brain system. As they are internalized, the laws (like all information from the world) are filtered and selectively integrated into the system depending on their consistency with the previously existing framework. Simply put, only those parts of the laws that are either particularly relevant or particularly consistent in terms of my previous experiences will be strongly influential in my mind-brain system. In this way, the system ultimately determines *how* external factors influence the system (even if the system itself cannot determine *if* external factors will exist).

Searle proposes a way of conceptualizing determinism in the mind-brain system so that it is compatible with human free will, and his description accords with the system model. He proposes the following: "Everything that happened was indeed determined. It's just that some things were determined by certain sorts of inner psychological causes (those which we call 'reasons for acting') and not by external forces or psychological compulsions."[35] Our thoughts and actions are indeed determined, but they are ultimately determined by events and properties *internal* to our own mind-brain system: by our internal representation of the environment, by our cognitive styles, by our development and memory (all of these properties grounded in our own neural connectivity and brain

35. Searle, 89.

anatomy). So, we are "self-determinant" or self-determining.[36]

Human beings are free, but the individual "is not free from the higher forces in his own decision-making machinery."[37] Indeed, just as my mind cannot independently determine the fate of the system from which it itself emerges, the conscious self or "I" cannot claim independence from the system from which it emerges. I cannot be free of my brain or my mind, for the system relating and including them *is* me.

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36. Sperry, 89.

37. Sperry, 40.

An Emergence Model of the God-World System and Its Theological Implications

Having described an emergence model of the mind-brain system, I will use the relationship between mind and brain in that model to construct analogically a model of the relationship between God and world, based on my experience of God as: 1) simultaneously transcendent and immanent in relation to the world; and 2) reciprocally influencing and influenced by the world. I will begin by outlining the God-world model itself, strictly in terms of its analogical relationship to the mind-brain model. Then, I will re-visit the God-world model in dialogue with several Christian doctrines of God. I have selected these doctrines in part to lay a backdrop against which my own model of God will stand in relief. I will also argue that my model provides provocative answers to important theological questions addressed by these Christian doctrines, and that my model provides helpful imagery for understanding some of these Christian doctrines in terms of the God-world relationship.

An Emergence Model of the God-World System

Origins: God Emerges from the World

A model of mind as an emergent integrating principle within the brain serves as the foundation for a provocative model of God and God's relationship with the world. Just as mental events emerge from brain events, God emerges from world events. This is not to imply that the rest of the world existed before God existed. Rather, in the moment that the world (space and time) came to be, God came to be. And just as mental events change and gain greater integrating power as the brain becomes more complex, God becomes more complex as existence becomes more complex (as universes form, as new elements form, as life emerges and evolves, and as mind emerges from living things).

This ever-increasing complexity of God is not an idea original to this model. Rahner describes the divine as the ever-transcendental experience, as the "infinite horizon" that remains incomprehensible (in the sense of pinning down its reality) even as we strive to comprehend.[38] The notion of this ever-receding horizon points to the experience of God's transcendence, in that God changes (increases complexity, to use the language of emergence) continuously with the result that God remains always above us or more than us. However, we also experience God as present within everything we do, grounding us in some measure. In other words, I do not ever comprehend the entirety of God, but I comprehend *something* of God in every moment, in every perception, in every thought. This points to the experience of God's immanence. By considering the relationship between mind and brain, how the mind can never be reduced to the brain (no matter how complex the brain becomes), how minds have evolved to be always more than the sum of the neural machinery underlying them while remaining fundamentally interdependent, we achieve the perspective from which it makes sense to construct a model of God as always more than the sum of the world's parts but also fundamentally interdependent (God as distinct and inseparable from the world).

Developmental Holistic Change: How does change in one affect the other?

Just as the mind-brain system exhibits continuous and integrated plasticity at all levels, both God and the world change continuously, and the change in each depends fundamentally upon the change in the other. No change occurs in any piece of the system without change in other parts, so that God and existence grow and develop *together*, forming a meaningful whole. This should remind us of the way in which the mind-brain system develops and changes. Change in one aspect of the system influences the whole system. For example, a change in neural connectivity in one brain region

38. Rahner, 61.

influences the neural connectivity all over the brain, and influences the functioning of individual cells in the brain, and influences the mental properties that arise from the brain. Change resonates in the mind-brain system, and change similarly resonates in the God-world system. For example, my actions obviously influence the people and things immediately surrounding me in space and time, but my actions also influence the *entire system*, including other people, other animals, and God. This points to the experience of my relationship with God as reciprocal: as I develop, God develops, and vice versa.

Development includes everyday changes that we can experience in daily human life, as the above example begins to illustrate. When I am joyful or sorrowful, when I grow as a person, when I develop a new idea or belief, God is changing as I am changing. This is not to say that the magnitude of the change in God equals the magnitude of the change I experience in me. Rather, in some measure, I can be assured that God experiences the change when I do, or when the world does. After all, God and the world are inseparable: the reality of God is wrapped up in the reality of the world, and vice versa.

Causality: How do they influence each other?

No piece of the system influences without being influenced, including God. God acts as one cause among many. God has the potential for the broadest or greatest influence because God integrates the system at the highest level. In the mind-brain system, mental properties have the ability to influence the system in the broadest way, nudging the activity of neurons, neural circuits, brain regions, and other mental properties in particular directions. Mental properties influence the system in this way because they integrate all other aspects of the system. For example, my values influence how I think, how I feel, how I act under particular circumstances and, consequently, influence how

the underlying neural circuitry supporting these activities behaves. My values don't intervene in these activities, as the values themselves depend upon the functioning of neural circuitry and other mental events for their existence. Rather, my values exact large-scale influence on these activities that would not be equivalent to the influence of a single cell, for instance. Similarly, God integrates all other aspects of the world, such that God can then influence the world's activities in a large-scale fashion (still without intervening in the world's activities, as the world and God are not separable).

As we model high-level mental events as broad directional influences (but not as intervening causal agents), we model God as having broad directional influence over the world. God does not intervene in the laws of physics and biochemistry, or in the relationships governing life and thought. Indeed, God emerges in part from these laws and relationships; changing them would change God-self. However, God may exert a subtle but powerful guiding influence on the world, and so participate in the immense web of world causality.

In this model, God is limited, in the sense that God is neither the sole nor the over-riding causal agent in the system. God does not get the final determining word, in the way that God has classically been imagined: God is not omnipotent. Rather, God is powerful, as we define power as having far-reaching causal influence in the system. And human beings are also powerful, insofar as we cannot shift responsibility for our actions and their consequences onto an omnipotent intervening God.

The God-world system (like the mind-brain system) is self-determining. God doesn't determine events any more than the laws of physics and biochemistry do. Rather, the whole of existence determines *itself*, because natural laws, relationships between beings, and even God are *internal* to the system. In this way, existence is a continuous coming-into-being, developing from

within, and integrated at the highest level by God as God reciprocally influences the world's unfolding. Once again, the language of "system" designates this relationship. Whereas two distinct and separable objects can determine each other, and whereas two non-distinct and inseparable objects carry no meaningful causal relationship between them, a system includes distinct but inseparable objects that, acting together, determine the fate of the system as a whole.

Theological Implications

Origins and the Doctrine of Creation

As described by Colin Gunton, the classical Christian doctrine of creation develops a view of God as creating the world out of nothing.[39] As a consequence, God takes on certain characteristics. According to this doctrine, God does not rely on anything beyond Godself, either to exist or to create, while the "universe, unlike God who is alone eternal and infinite, had a beginning in time and is limited in space."[40] God is omnipotent and not contingent on the world, while the world is completely contingent upon God. This reminds us of our experience of God as transcendent, though transcendence alone is an incomplete representation of the experience. To accord with that experience, God must also be immanent. According to this paradigmatic Christian doctrine, as Gunton discusses, God's immanence takes the form of the Trinity: while Godself remains transcendent, the Son and Holy Spirit enter the world and exist within it.[41]

In stark contrast to a Christian doctrine of God the creator *ex nihilo*, my model expresses the

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39. Colin Gunton, "The Doctrine of Creation." In The Cambridge Companion to Christian Doctrine, ed. Colin E. Gunton (Cambridge: Cambridge University Press, 1997), 141.

40. Gunton, 142.

41. Gunton, 142.

origin of God in terms of an emergence from the world. As I have briefly mentioned, this should not be understood as the world existing for some period of time after which God suddenly comes into existence. Instead, God *always* exists, but does not exist independently. Just as there can be no mind without a brain, there can be no God without a world. Moreover, once God exists (and God has always existed), the world cannot exist as such if God ceases to exist: upon God's emergence, the two become fundamentally interdependent. Rather than the one-way contingency of the classical Christian doctrine of creation, I imagine a two-way contingency. The nature of "creation" has much to do with a coming-into-being together, and less to do with a creat-or and creat-ed.

Reciprocity, Development, and Change

What do I mean by a "coming-into-being"? In other words, if the world does not depend completely on an independent God, then how do God and the world develop together as a system? Process theology provides a theological precedent for the conclusions of my own model in this regard, imagining the co-development of God and world as a "creative advance into novelty" during which "[n]either God, nor the World, reaches static completion."[42] Process theologian Alfred North Whitehead also rejects the classical Christian doctrine of tradition as described above, which he describes as a "transcendent creator, at whose fiat the world came into being, and whose imposed will it obeys."[43] Instead, God and the world develop together, as part of a process of actualization and unification. According to Whitehead, God exists first, infinite unity. Then, temporally bound, physical beings exist (are "actualized"). Their actualization is not complete, however, until these

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42. Alfred North Whitehead, Process and Reality: An Essay in Cosmology, ed. David Ray Griffin and Donald W. Sherburne (New York: Free Press, 1978), 349.

43. Whitehead, 342.

physical beings achieve perfect unity through God. The circle closes as God returns the perfectly actualization of the physical beings to the world.[44]

From process theology, then, we receive a philosophical discussion of the interaction between God and the world: God the infinite develops to include the finite world within Godself, and the finite world receives the echo of its own inclusion in Godself as an influence by God on the world. I argue that such philosophical discussion, though somewhat helpful, lacks a key element necessary for the discussion of such abstract, complicated imaginings: concrete imagery through which those abstract imaginings become explicit. Words such as "actualization" sum up complicated ideas into new language, but what does "actualization" mean? What does it look like? How does it work? To answer these questions, we need a model. A model gives us an explicit image or set of images that we may toss about, bend and break, compare and contrast as we refine our understanding of the abstract ideas upon which the model was based.

In this case, my model of the God-world system based on a concrete model of the mind-brain system provides the explicit imagery necessary to ground the ideas presented in process theology. Physical beings are indeed "actualized" into a greater unity in God, and "actualization" is similar to the process by which neural events (such as synaptic connectivity changes) accumulate and interact to influence mental events. The neural events become unified as part of the mental events, and the mental events in turn influence the neural events. Similarly, elements of the world become unified in God (which points once again to an experience of a transcendent God), and God in turn influences elements of the world and exists within these elements (which points to an experience of God's immanence).

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44. Whitehead, 350-351.

God's Power and Human Suffering

If God and the world exhibit two-way contingency, and if God and the world continuously and reciprocally influence each other, how does God respond specifically to human suffering? According to my model, God does not respond to suffering in the way that classical theism imagines. As described by Elizabeth Johnson, "Classical theism understands that at times suffering may be a punishment for sin ... [and is] also a sign of creaturely finitude, belonging to transitory moments of time; the eternal Creator cannot be marked by it. Pain, moreover, is an imperfection arising from a deficiency in one's being; hence it is incompatible with the greatness of God who is the source of all perfection."[45] Distancing God from human suffering solves the theological problem of theodicy by prioritizing God's absoluteness above God's personal relationship to the world, as it "seeks to preserve divine freedom from a dependency on creatures that would in fact render God finite."[46] Furthermore, classical theism as described by Johnson imagines God as deliberately willing only goodness into existence, but allowing suffering to persist towards some higher purpose, presumably incomprehensible to human beings in any detail.[47] Christianity adds to classical theistic theodicy the image of Jesus Christ as the representative of God or part of God that does participate in human suffering without threatening God's infinity or absoluteness. However, as Johnson points out, the human part of Jesus Christ suffers with us, *not* the divine part: Godself still does not suffer with us.[48]

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45. Elizabeth A. Johnson, She Who Is: The Mystery of God in Feminist Theological Discourse (New York: Crossroad Publishing, 1999), 246-247.

46. Johnson, 247.

47. Johnson, 248.

48. Johnson, 248.

So, the classical theistic imagining of God maintains God's omnipotence and keeps God separate from human suffering, as suffering implies finiteness and a passive state (or lack of power). Even the Christian image of Jesus Christ, who suffers with humanity, does not change God's ultimate separation from human suffering and, such as it is, does not accord with the experience of God I have described and used in this theological discourse. If God is truly immanent, and if God is truly affected by the world, then God must participate somehow in human suffering, must share in that suffering to some degree. However, if God is simultaneously transcendent, then God must not merely be a passive participant in our suffering. How do we strike this balance between God's power and God's caring, between God's suffering with us and God's ability to transcend that suffering in a way that gives the suffering meaning?

Once again, process theology provides some helpful discussion. As Whitehead asserts, based on a process understanding of God, "[w]hat is done in the world is transformed into a reality in heaven, and the reality in heaven passes back into the world ... In this sense, God is the great companion – the fellow-sufferer who understands."[49] This abstract imagining finds concrete expression in my model. In the mind-brain system, what happens at the neural level becomes a reality in the mental level, becomes unified with other realities, and passes back to the neural level. Similarly, in the God-world system, what happens in the world becomes incorporated into God, and this in turn returns to the world in some measure.

But this unification in God is not entirely passive on God's part; God has real power in the system, in terms of being the broadest directional influence therein. In this, my model agrees with the process theodicy of David Ray Griffin: "God's power is persuasive, not controlling ... the reason is

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49. Whitehead, 351.

metaphysical, not moral. God does not refrain from controlling the creatures simply because it is better for God to use persuasion, but because it is necessarily the case that God cannot completely control the creatures."[50] God's power *cannot* be coercive. Why not? According to my model (used here to extend the language of process theodicy), God *emerges* from the world, and exists in fundamental interdependence with the world. God cannot determine that from which it arises and upon which it is contingent (just as the mind cannot determine the brain from which it arises and upon which it is contingent). God *can and does* exert a broad directional influence on the world. In this way, God participates in our suffering (is affected by our suffering) and can act in response to our suffering (in a broad directional way).

An exploration of the nature of God's broad directional influence in the world is beyond the immediate scope of this paper, as it requires us to make explicit conscious or conscious-like intentionality part of God in a way that exceeds the imagery of the mind-brain model. For instance, I would like to model God as having benevolent intentions towards the world, but I cannot seriously entertain the idea of a human mind having benevolent intentions of the same sort towards neural circuits or brain regions. Having reached a boundary of the fruitfulness of my model, we are reminded of the essential nature of models, described by reference to McFague in the introduction to this piece. Models express both similarity and *dis*similarity. In this case, God's relationship with the world is similar to the mind's relationship with the brain, but God is not a mind, nor is the world a brain. There are theological concerns that will not be made explicit to our satisfaction in my model of God's relationship with the world. However, this model remains helpful in that the dissimilarity

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50. David Ray Griffin, God, Power, and Evil: A Process Theodicy (Philadelphia: Westminster Press, 1976), 276.

brings these theological concerns to the fore. My reaction against God as intentionless (as a mental event such as memory is intentionless, or lacking personal feelings towards neural circuitry and brain regions) makes clear that I experience God as having intentions (and benevolent ones at that). So, even when my model does not accord with all religious experience, it still helps make those experiences explicit.

Conclusion

In this project, I began with my own experience of God (an experience I believe I share with many others) as simultaneously transcendent and immanent in a reciprocal relationship with the world. I argued that a concrete model of God based on this experience would further its theological discussion. I described in detail an emergence model of the mind-brain system, and I used this model to construct analogically an emergence model of the God-world system. Finally, I discuss how my God model provides, in some cases, a more satisfying resolution to important theological questions than do previously constructed Christian imaginings of God. I also discuss how, in other cases, my model provides the imagery necessary to take previous theological discourse about a transcendent/ immanent God into a concrete and ultimately more fruitful discussion. My goal in undertaking this project was to make explicit, for myself and others, an experience of God that at once maintains God's power and ultimateness, and asserts a close, personal relationship with God. My hopes for the future of this project include further discussion of how this model compares to, contrasts with, and provides more satisfying answers than other God models and imaginings. I also hope that my model accomplishes the primary goal of any model: to provide us with a place to stand from which we can, through the similarities and dissimilarities in the model itself, elaborate upon our understanding of God and our relationship with God.

Acknowledgments

I would like to express my sincere thanks to the following persons for their inspiration and support in this work. I thank Dr. Michael Ferragamo for nurturing and actively engaging my enthusiasm for neuroscience and the philosophical questions surrounding it. I thank Dr. Garrett Paul for his guidance and encouragement in my initial pursuit of this project. I thank Dr. Deborah Goodwin for an attentive ear, for her constructive criticism, and for introducing me to the theology of Karl Rahner (which I intend to pursue further in my soon-to-be ample free time). I thank Aaltje Baumgart and Karen Martinson, my colleagues and friends during a frantic but productive semester. Finally, I thank Dr. Mary Solberg, who always manages to push and to challenge me while providing her unwavering support and faith (and humor – perhaps most important of all gifts). I hope that this work does justice to the amazing group of people who have contributed to its growth.

Appendix

7. John Searle's famous Chinese room argument provides the foundation for his assertion that computers do not think in the same way that humans think. The thought experiment begins with a human being who has neither heard nor spoken Chinese before. We lock this person in a room full of boxes and boxes of Chinese symbols, and we give this individual a rule book (written in their native language, of course) with incredibly detailed rules for manipulating the Chinese symbols to form Chinese responses to Chinese questions, which enter the room as strings of Chinese symbols. Now imagine that the rule book is detailed enough that the person in the room, when responding to the strings of Chinese symbols sent inside the room, responds to these with exactly the same strings of Chinese symbols as would a native Chinese speaker.

In other words, the Chinese room, with its symbol manipulator (the human being) and its rules for syntax (the rule book), can communicate fluently in Chinese. However, the room and its contents don't *understand* Chinese. For instance, we send a string of Chinese symbols into the room asking, "Do you enjoy eating hamburgers?" And the person in the room quite dutifully flips through the rule book, and answers and assembling the Chinese symbols for, "Yes, hamburgers are juicy and delicious." However, the person in the room doesn't have any idea what they're saying, has no idea that the squiggle for "juicy" actually means "juicy," or that the squoggle for "delicious" means "delicious." The person in the room lacks the *semantic* content necessary to actually understand Chinese – the syntactical manipulation of the symbols is not equivalent to semantics. Searle argues that computers, though able to process syntactical manipulation of symbols, possess no experience of the semantic content wrapped around those symbols, and therefore do not think in the way that humans do: semantic content distinguishes human cognition from computer cognition.[51]

10. Before auditory information reaches the cerebral cortex, it must travel through many peripheral nervous system structures. Auditory information in the environment exists as minute waves of differences in air pressure. In humans, these pressure waves first reach the external ears, where modification of auditory information begins. In the external ear, sound waves with a frequency near 3 kHz are selectively amplified (human speech sounds are produced at near this frequency), and certain high-frequency components are selectively filtered out of the signal depending on the elevation of their origin in relationship to the ear. Once sounds reach the middle ear, they vibrate the tympanic membrane. In the middle ear, the ossicles (small bones) mechanically transform the vibrations of the tympanic membrane to vibrations in the much smaller oval window, boosting the signal as it travels from the air medium of the environment to the fluid medium of the inner ear. The vibrations of the oval window produce fluid waves in the cochlea (inner ear), and these waves selectively vibrate the portion of the basilar membrane (along the length of the cochlea) corresponding to their frequency. In this way, the cochlear basilar membrane acts as a frequency analyzer,

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51. Searle, 32-33.

decomposing the total signal into its component parts before transmitting these parts to the central nervous system. Even this simplified explanation of the peripheral auditory system gives one an appreciation for the degree to which sensory information is processed prior to even reaching the brain.[52]

25. Eric Kandel and Alden Spencer (1968) conducted a series of experiments using *Aplysia californica*, a sea snail, to show neural correlates of behavioral plasticity.[53] For example, many animals (including *Aplysia*) exhibit "sensitization." *Aplysia* tend to withdraw their gill when touched on their siphon, but gentle touch will not elicit a strong response after repeated exposures. Kandel and his team paired a gentle touch to the siphon with an electric shock, teaching the animal to associate the noxious stimulus (the shock) with a previously sub-threshold stimulus (the gentle touch). After repeated pairings, the animals becomes "sensitized" to gentle touch and will withdraw the gill strongly in response. Kandel and his team outlined the neural events corresponding to the behavioral change, showing that stimulus pairings change the properties of the neural circuitry underlying behavior. Their experiments provided the foundation for modern research linking behavioral change with synaptic plasticity.[54]

Long term potentiation (LTP) is one general mechanism of synaptic plasticity that appears to be conserved across many animal species, although most LTP studies have been conducted using synaptic connections in the mammalian hippocampus. Hippocampal LTP exhibits several important properties: 1) state-dependency, in that whether or not the synapse changes depends on previous synaptic activity (linking present change to recent events in the system); 2) input specificity, in that LTP occurring at one synapse will not influence all synapses but rather will influence other active synapses nearby (providing integration, but not at random); and 3) associativity, as mentioned above (allows for information within a moment of experience to become associated in plasticity).[55]

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52. Dale Purves et al., eds., Neuroscience, 2nd ed. (Sunderland, Mass.: Sinauer Associate, 2001), 278-282.

53. LeDoux, 118.

54. Purves, 536-538.

55. Purves, 543-544.

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