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Dynamical Similarity and the Problem of Evil

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Discussions of evil commonly fault God for not "doing something." Defenders of God respond that God had good reasons for not "doing something." Detractors observe that if a human being can snatch the toddler from the path of the oncoming bus, why does not God snatch the bus from the path of the oncoming toddler? The underlying assumption in such discussions is that God's "doing something" is similar to humans' "doing something."[1]

If human beings bear the image of their Creator as the Abrahamic faiths maintain, it is natural to suppose that divine action is similar to human action. But what sort of similarity is in play? That more than one kind of similarity can be brought to bear is often overlooked.

The everyday garden variety of similarity may be illustrated by imagining two congruent triangles:
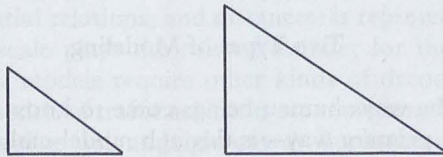
A glance will show that that the triangles are similar because their corresponding angles are the same. And though the sides are of different lengths, they are correspondingly proportional: if the bottom side of the smaller triangle is half that of the larger, then its other two sides will also be half the length of their counterparts. Here the simple scale is 1:2. The units of measurement are

unimportant. Whether one measures in inches or centimeters, the same ratio always holds. In other words, "4 in. to 8 in." constitutes a ratio of 1:2 as does "10.1 cm. to 20.2 cm." Because the units of dimension drop out when the scale is calculated, this kind of similarity has been called "dimensionless similarity."

When atheistic philosophers of religion complain that God failed to "do something" about instances of gratuitous evil,[2] they imagine the kind of divine agency being debated is a scaled-up version of human action: God's action (should God exist) is similar to human action only bigger, stronger, faster. The employment of dimensionless similarity is a bewitching conceptual mismove that perpetuates both theological and philosophical confusion.

At least as early as Augustine, Christians noted that there can be no proportion between God and creatures.[3] Of course, atheist philosophers of religion cannot be held to Christian dogmas. But the underlying confusion is also philosophical. The Christian notion of God cannot be arrived at by a strategy that presumes dimensionless similarity (i.e., numerical proportion) and then adjusts the scale to account for an "infinite" term. Fortunately, the kind of modeling that relies upon dimensionless similarity is not the only kind of modeling human beings can employ. Unfortunately, however, the notion that may assist in the problem of evil is not one that can simply be snipped out of one context and pasted into theodical discussion. It is a technical term, one on the same level of complexity as "partial differential equation" or "myocardial infarction." As such it must be seen against the backdrop of its use-in-practice to get the point.

Two Types of Modeling

One of the ways human beings come to know their world—perhaps the primary way—is through model-making. Modeling comes in all shapes and varieties, some linguistic, some mathematical, some mechanical, some conceptual. Despite the breadth of diversity, instances of modeling comprise two distinct families: *semantic* and *syntactical*. In the next section I will describe both kinds of modeling and contrast their attending concepts of similarity as found in Wittgenstein's thought.[4]

Semantic Modeling

Semantic models are definitional by nature; once the relevant definitions are learned, the model can be comprehended. The easiest illustration of a semantic model is a roadmap. Roadmaps are scale pictures of select features of the landscape: roads, rivers, some important buildings. What makes roadmaps useable is their dimensionless similarity. In the case of maps, this kind of similarity has four features. First, all the angles are preserved: a right-angle junction of two lines on the road map corresponds with a right-angle turn by the driver. Second, relative position is preserved: the four edges of the page correspond to four points of the compass (and not, say, its mirror image!). Third, the mapping is univocal: each point on the map correlates to a single location in the landscape. Finally, relative distances are preserved by means of a single rule of translation (e.g., 1 inch=1 mile). Importantly, the rule of translation can be transformed into a numerical scale. If one mile is 5,280 feet and one foot has twelve inches, then one inch on the map translates into 62,360 inches or a scale of 1:62,360. Because this ratio holds for whatever units of dimension are used (i.e., it is also true that 1 cm. on the map corresponds to 62,360 cm. in the landscape), the scale is again *dimensionless*. In this way the scale functions as a decoder or translator of distances.

Of course, not everything is replicated on the map. For example, a roadmap is a poor tool for finding shade trees. Conversely, not everything on the map corresponds to the landscape; roadways are not really red in color. Yet every property *relevant for travel* (geometry, spatial relations, and distances) is represented.

While the scale plays the role of decoder for the roadmap, other semantic models require other kinds of decoders. Three-dimensional models of traffic accidents are sometimes built to help jurors conceptualize fault and right of way. But in these models not everything is to scale (e.g., the cars might be monstrously large). Or to take another example, some people may utilize a secret code when entering their private thoughts into a diary. In this case, the direction of the letter's sequence is preserved as well as the number of letters and grouping into sets. But the whole thing is gibberish until the key is known (e.g., A=Z, B=Y, etc.).[5]

Syntactical Modeling

The second family of modeling is much larger than the first. Syntactical models differ from semantic models in at least two crucial ways. First, very often syntactical models are "that by which" an object is known.[6] Obviously, scale models are calibrated against an original. A juror can know truly relevant features of a traffic accident by studying a model, because the properties observed can be compared—at least in principle—with the original. But not every domain of knowledge has independent means for verification. This is particularly true at the edges of human experience: the very, very big,[7] the very, very small,[8] the very, very fast,[9] and the very, very unusual.[10] When the object cannot be experienced directly, the model becomes the very means by which the object is "known." "Knowing" under these circumstances is more like "making sense of" or "connecting with" everything else.[11] There may be indirect evidence of the object (be it qualitative phenomena, numerical data, and so on). But only by means of the model is all evidence hoped to fit together. Max Black supplies an example from atomic physics: "In using . . . models, they [physicists] were not comparing two domains from a position neutral to both. They used language appropriate to the model in thinking about the domain of application: they worked not *by* analogy, but *through* and by means of an underlying analogy."[12]

It is a mistake to imagine that someone might clean up these uncertainties at the edges and be done with them once and for all. For we are always at *some* edge of human experience, the temporal edge if no other. In other words, as human knowers move into the future, new edges of experience are uncovered that require modeling. For this reason, every civil engineering project—every bridge, dam, skyscraper—has yet-to-be-discovered properties peculiar to this context, properties that impinge on design. How much more, then, is this true for projects in politics or economics or education.[13] Consequently, human knowers are forever dependent on syntactical modeling.

The second feature of syntactical modeling that distinguishes it from semantic modeling is that human skill is not only handy, it is *required*. Not skill-in-general, mind you, but highly particu-

larized skill, the sort that sometimes requires years of training to get right. The dependence of syntactical modeling upon highly developed skill can be illustrated with a page from the history of European engineering.

In 1905, Boltzmann warned that a small-scale flying machine might bear its own weight but fail to fly when scaled up.[14] Although Boltzmann wrote three years before the Wright brothers brought manned flight to Europe, the children in France had for some years played with a toy helicopter (really more of a "flying screw") designed by Alphonse Pénaud.[15] A similar toy can still be purchased today. The helicopter's rotors generate enough speed for lift-off because of the ingenious rack-and-pinion gear arrangement: the child pulls the foot-long strap (rack gear) quickly, the rotor turns and lifts the toy, keeping it aloft for flights of thirty to forty feet, enough to clear the roof and get stuck in the neighbor's tree! The toy clearly shows that heavier-than-air flight was possible. Now, if engineers follow the rule by which roadmaps are contrived—dimensionless similarity—they might scale up the Pénaud flyer by a factor of, say, fifteen. This prototype will look identical to the Pénaud toy. *But it will not fly.*

While the strength of each part will have increased in proportion to the cross-section of the members (L^2), the weight has gone up by the *cube* of the linear dimensions (L^3). In other words, the propellers are 15 times longer and 225 times stronger (because they are both fifteen times wider and fifteen times thicker [in two directions] than the propellers on the toy). But the whole thing *weighs* more than 3,000 times (i.e., 15^3) more than the toy! Even if there were an energy source sufficient to offset the 3,000-fold increase in weight by pulling the strap 3,000 times faster than the toy, the thing *still* would not fly. In the first place, if *everything* relevant is scaled up in the replica, air density should have also been increased by the cube of the linear dimension. But since air density has not been scaled up, the large model has to compensate by some combination of *vastly* increased speed and pitch of the propeller. (A correlative problem faces real helicopters that at very high altitudes run into a ceiling above which they cannot climb because they cannot get enough lift out of the rarified atmosphere.) Friction also becomes an enemy here—high speed

props do in fact bind, bend, break, and even melt. In short, the simple scale, 1:15, will not produce the kind of similarity needed for manned flight.

In fact, *no* single dimensionless scale or parameter (e.g., "15") can regularize the functional differences that become enormously important when scaling up weight, strength, density, lift, and so on. To repeat, the large replica model is *dimensionlessly similar* to the Pénaud flyer, because it is geometrically congruent. But it is *dynamically dissimilar*. For while the toy flies, the big version cannot. In contrast, a real helicopter (which took until the 1940s to perfect) is *dynamically similar* to the Pénaud flyer, but it is *dimensionlessly dissimilar*. In other words, a real helicopter looks nothing like the toy, but it really does fly.

The point is that dynamic similarity functions in quite conceptually different ways than dimensionless similarity. Of course, engineers ordinarily do not stop to consider which concept of "similarity" they employ: as their skills for modeling increase, their use of dynamical similarity completely eclipses concern for dimensionless similitude.

Bewitched by a Model

Before I display the difference that dynamical similarity makes to discussions of evil, it is important to issue a warning: in our deep craving for explanation we forever tend toward reducing syntactical modeling to semantic modeling. This urge is apparent even in the empirical sciences. Take for example Clerk Maxwell's now classic attempt to understand an electric field by comparing it to a frictionless, non-compressible fluid as it were, moving through a sponge. He reports that his initial intentions were simply to come up with a pedagogical tool for more easily grasping the behavior of electric fields. He was well aware that his model "is not even a hypothetical fluid which was introduced to explain actual phenomena. It [the model] is merely a collection of imaginary properties which may be employed for establishing certain theorems in pure mathematics in a way more intelligible to many minds."[16]

But Maxwell's teaching tool was so convincing that he became bewitched. Before long, Maxwell began to think of electric fields not merely "as if" they were fluids but "*as being*" fluids.[17] In other

words, Maxwell came to regard his model as if it had a one-to-one correspondence of features like a scale model.

Maxwell was not the only scientist to surrender to the temptation of confusing a syntactical model with a semantic one. Lord Kelvin, who insisted on finding *mechanical* models to explain phenomena,[18] insisted that if light was a wave, then there *must* be a medium (called "the ether") through which light waves propagated themselves. Kelvin insisted, "We know the luminiferous ether better than we know any other kind of matter in some particulars. We know it for its elasticity; we know it in respect to the constancy of the velocity of propagation of light for different periods. . . . Luminiferous ether must be a substance of the most extreme simplicity."[19]

Kelvin's mistake—for there is not such a thing as "luminiferous ether"—began the moment he forgot that waves were syntactical models of light and not its semantic definition.

Were it possible to reduce syntactical modeling to semantic modeling the advantages would be obvious: semantic modeling is more accessible (and thus more persuasive to a wider audience) because it employs universal definitions and/or universally applicable translators (such as a scale). And sometimes the skill set required to do syntactical modeling becomes so widespread that it *seems* as though it were in fact semantic. Under these conditions the model strikes the majority as self-evident, while the unconvinced are chided for being obtuse. But when the difference between semantic and syntactical modeling is forgotten, a deep confusion threatens to enter the conversation.

Consider three pairs of statements. The first pair consists of a second-order partial differential equation: "$\partial^2(xe^y \sin\pi z)/\partial y^2$" and its non-obvious solution, "$xe^y \sin\pi z$."[20] The second set pairs a sentence in French with two in German:

[E]t les patriarches, et de qui est issu, selon la chair, le Christ, qui est au-dessus de toutes choses, Dieu béni eternellment.

Sie sind die Nachkommen von Abraham, Isaak, und Jakob, und sogar Christus, der versprochene Retter, zählt nach seiner menschlichen Herkunft su ihnen. Fur all dies sei Gott, der Herr über alle für immer und ewig gepriesen![21]

The third set is comprised of two identical sentences in English, one written using block letters in green ink, the second one using a cursive hand in red ink:

(in green) **Quick brown foxes jumped over the lazy dog**.
(in red) *Quick brown foxes jumped over the lazy dog.*

For each pair, estimation of "similarity" is a function of human skill: the ability to do calculus, fluency in French and German, and the ability to read at all.

Now, in the first case, the estimation of sameness is thought to have a correct answer. Those who can do calculus can tell us whether and within what boundary conditions the equivalence holds. In the third case, the question of sameness turns on the question of respect, "In which *respect* is sameness to be measured, color or font or meaning?" The respect at stake is related to the work the sentence is expected to do. If the purpose of the sentence is to detect color blindness, then the "correct" answer is that they are different. If the purpose is to test whether a youngster can yet read cursive handwriting (or read at all), the "correct" answer is that they are the same. Sighted adults possess the ability to estimate sameness with respect both to color and meaning, and so need clarification before answering.

The middle pair is more complicated and illustrates what is meant by dynamical similarity. Granted, fluency in both languages is required. But here "sameness" cannot be settled by phrase-by-phrase correspondence. After all, there are only twenty-two words used in the French sentence while the German uses thirty-six. In other words, there may be no objective measure of the sameness of the sentences. The question turns on *who* is speaking and to *what use* the sentences are being put. The question of similitude will have to be argued out. Such arguments can be done poorly or well according to the interlocutors' skill sets. We can imagine two multilingual speakers. The first insists that the two sentences are grammatically allowable translations of Romans 9:5 (originally composed in Greek). A wooden translation of the relevant bit of Greek is something like: "the Christ according to the flesh the one being above all God."[22]

The difference between the two versions is this: The French sentence virtually equates Christ and God. In contrast, the German version uses a period that functions to *bifurcate* the identity of Christ from the identity of God. Deciding between the two is not a matter of finding the correct decoder. Not only is there no punctuation in the Greek manuscript (ever!), the Greek is ambiguous as to whether it is speaking of two persons (Christ *and* God) or just one person (Christ, who is God). Thus the second reader may respond in horror, because to her lights the German translation is heretical! The second reader is not simply *preferring* the French as one of two grammatically allowable translations, but *judging* it to be superior, precisely because it more clearly *identifies* Christ and God as one person. For her the French text is *dynamically* similar to the Greek text as per her *doxastic* and exegetical skills. In other words, the Greek nominative of apposition that leans toward the identification of Christ and God is not a knock-down argument *proving* early Christians worshiped Christ as God. *But for those who have learned thus to worship, the French version is the expert's choice.*

But let me be clear. I am not claiming simply that the second reader has *more* skills than the first, making her the "expert." My point is that dynamical similarity is a function of *some skill or other* being in play. For her and her allies, the relevant practice-engendered skill is worship. Obviously, one can easily imagine a rival skill possessed by the equally pious first reader by which the *German* passage can be shown to be dynamically similar to Greek text. For example, perhaps the first reader is a missionary whose skill set includes cross-cultural communication. By his lights, the German passage is more easily accessible to a wider lay audience. Whichever direction the argument goes, *a case for dynamic similarity turns on the presence of an actual person in actual possession of some relevant skill.* For neither reader is the similarity in question dimensionless, making the modeling an "unskilled" enterprise.

Recalling the roadmap as an easy example of a scale model and dimensionless similarity, I'm not claiming that no skills whatever are employed in the affirmation of dimensionless similitude. Rather, my point is that shared skills often go unnoticed. This is readily apparent in the third case. Children who cannot read can only compare the string of colored shapes (i.e., the letters). Adults

who can read perform the act of *syntactical* modeling—which is to say they read both sentences so rapidly that the skill called "reading" is transparent. If no illiterate persons are in the room, readers tend to think that the meaning of each sentence is to be compared to the other in a dimensionless way and fail to notice other possible modes of comparison. But in point of fact, *syntactical* modeling *is* involved, albeit too rapidly to be noticed, unless a child is present to remind them of what they no longer notice.

For some of those who are fluent in calculus, type one comparisons may also be rapid enough for the skill to be overlooked. Anytime the skills are transparent to the subject, one may be bewitched into taking the comparison as straightforward one-to-one correspondence. Others who remember their calculus more dimly are painfully aware that the modeling involved is of the skill-based *syntactical* sort. If skilled judgment is necessary for these run of the mill examples, how much more in cases involving philosophical discernment? In other words, the activity of modeling is *ubiquitous*. Syntactical modeling is not unique to engineering or medicine or biblical studies but common to all practices and much of ordinary living.

Applying Dynamical Similarity to the Problem of Evil

It should be clear that conversations in philosophy of religion are themselves instances of modeling. Consequently, it is easy for skilled philosophers and theologians to lose sight of the role that specialized skills play in their conversations. What to them seems to be semantic modeling is in fact syntactical modeling. I raise this point to warn against the wrong sort of application of a new concept (here, dynamical similarity). In short, we cannot simply replace dimensionless similarity in standard theodicies. To make this kind of a swap is like putting down the AAA map and picking up the Thompson Guide. In reality, it is more like picking up a topographical map, because using dynamical similarity is more like orienteering than driving to Grandma's. If we are to make the switch successfully, we will have to attend to what Wittgenstein called the "grammar" of the term. And as we might expect, dynamic similarity functions in quite conceptually different ways than dimensionless similarity.

It is sometimes overlooked that as an engineer Wittgenstein would have been primarily interested in syntactical models.[23] Wittgenstein shows that he was primarily concerned with *syntactical* models and dynamical similarity (rather than mental models and dimensionless similarity) because like every other bright young engineer of the age, he wanted to solve the problems of manned air-flight![24] Only after the Wright brothers brought manned flight to Europe did Wittgenstein turn his attention from aeronautical engineering to the foundations of mathematics and then to the philosophy of language.

Here then is a crucial passage in the *Tractatus,* the book that he drafted while serving for the Austrian army on the front lines of World War I as a 29-year-old. He wrote:

> In the fact that there is a general rule by means of which the musician can obtain the symphony out of the score, and that there is a rule by which one could reconstruct the symphony from the line on a gramophone record and from this again—by means of the first rule—construct the score, herein lies the *internal similarity* between these things which at first sight seem to be entirely different [i.e., dissimilar]. And that rule is the law of projection which projects the symphony into the language of musical notation. It is the rule of transmission [*Übersetzung*] of this language into the language of the gramophone record. (4.0141)[25]

What sort of similarity does Wittgenstein mean? And what kind of modeling does he have in mind when he talks about the "law of projection"? Surely the relationship of symphonic performance to musical score and again between symphonic performance and groove in the old-fashioned long-play (LP) vinyl record are problems much more like the problem of scaling up the Pénaud flyer into a real helicopter than the roadmap replica. The difference is in the sort of modeling involved. In moving from performance to score, and performance to LP groove, *the model is varied according to conditions of the problem by means of the skills of the modeler.*[26]

This method of projection is not a simple correspondence between models that share logical multiplicity only. Nor is this

the sort of translation that can be understood by the average car owner. Rather, this method of projection is a function of highly developed experience, savvy, and know-how. In short, the "projection" of the played symphony onto a newly transcribed score is *internally related to the actual skill of the particular musician* who is doing the transcription. Or again, if *experior* (a term used here to capture together the three notions of *experiment, experience,* and *expertise*) rather than mental models are involved, then the "pictorial internal relation"[27] does not describe the one-to-one correspondence of dimensionless similarity that can be traced between a city neighborhood and its two-dimensional reduction. Rather, the "pictorial relation" is internal to the conceptual world of the expert modeler. It refers to functional or *dynamical similarity*. This kind of similarity cannot be assessed by mere spectators, because its prerequisite is actual human skill. Only *through* the fingers and ears of skilled musicians may the symphony be said to be "similar" to the score. The rest of us have to take the musician's word for it. (In Wittgenstein's case, the skilled musician may very well have been Johannes Brahms, who was a frequent visitor to the keyboard in Karl Wittgenstein's parlor! Then again it may have been Ludwig's brother Paul, for whom Maurice Ravel composed music!)

How then does Wittgenstein call this projection a "law"? Does "law" refer to a nomological pattern that holds whether or not anyone is looking? No. The "law" involved is not so much an objective regularity as an inter-subjective one; not so much a descriptive law as a prescriptive one. In other words, "law" connotes the fact that musical convention is regularized, for the practice of music is conventional and inter-subjective by nature. The skilled musician has been progressively trained—by intensive participation in the cooperative practice under the watchful eye of expert mentors over a long course of time—into a particular set of conventions surrounding musical notation and performance that can be discerned in the play of the experts. This training amounts to habituation in both tacit and verbal know-how.

How then is this a "general rule"? It may be illuminating to read this phrase as an expression of the regularized training that musicians receive. The rule in view, therefore, is not a one-size-fits-all

fiat (as in "rules are made to be broken"), but rather an *iterative training regimen*, again akin to the rigors of medical residency or the forming of expert engineers.[28] If the training regimens of doctors and engineers and musical virtuosi are flat-out grueling, the kind of life-formation involved indicates that the "rule" in view is best thought of as a law governing the formation of novices as in, for example, "The Rule of St. Benedict." If skill is involved in projecting audio performance onto a musical score, a parallel claim can be made regarding the projection of a performance onto an LP groove. The projection from performance to LP passes through the skills, not of the musician this time, but that of a team of engineers.[29]

In light of Wittgenstein's later philosophy of language, the "grammar" of a term relates to its skillful use within a form of life. This skill-in-context attunes the user to meaning and significance lost on others. To take a poignant example, hockey players and rabid fans are attuned through repetition of the respective bodily activities associated with playing and rooting. Both players' and fans' brains "light up" when presented with ordinary sentences in English that make particular sense in the context of a hockey game (such as "The shot hit the post."). The bodies of players and fans are in a ready state for action. In sharp contrast, people unfamiliar with hockey are far less disposed to attend to such sentences and often miss them entirely. To borrow a metaphor, players and fans have "ears to hear."[30]

What holds for hockey holds for other skill-intensive practices. To extend the engineering example, the notion of dynamical similarity is a way of saying that skilled engineers "light up" when engaged in modeling; they pick up on significance lost to the rest of us. While the general population understands scale models (and semantic modeling in general), Wittgenstein observed that the skilled practitioner sees not only the semantic similarity between, say, a technical drawing of a mechanism and a built prototype; the skilled engineer is also attuned to other conditions crucial to the achievement of dynamical similarity such as the play between socket and pin, that is, the pin not fitting "too tight" (how tight is that?), and the possibility of the parts binding, bending, melting, breaking, and so on.[31]

Wittgenstein associated the skilled participation in a form of life that is prerequisite for right usage of concepts with the "grammar" of the word. Of course, Wittgenstein did not reserve grammatical treatment for only technical terms. Even the most mundane concept is bound up with human activity: "It is part of the grammar of the word 'chair' that *this* [spoken while sitting down] is what we call 'to sit on a chair.' "[32] Nevertheless, it is the particularized skills that interest me in the use of "dynamical similarity" in theology.

Negatively put, the usefulness of "dynamical similarity" in discussions of evil is to trumpet a resounding "No!" to the temptation to compare divine agency to human agency in merely *semantic* terms. If it makes sense to appeal instead to dynamical similarity, then it is reasonable to say that God's action is *not* like human action albeit bigger, stronger, faster. Recall that even in the provenance of engineering per se, the difficulty of extrapolating from what we know in the center to the margins of human experience cannot be done by simple scale expansion, because the rules change at the margins. Engineers cannot say with absolute certainty whether the next "tallest building," "longest bridge," or "biggest cannon" will not fail. If it does fail, its failing reveals some previously undetected ceiling to our knowledge requiring syntactical modeling to make the next breakthrough. If engineers must be cautions at the margins, I claim that philosophers and theologians ought to be more so.

Positively speaking, dynamical similarity has widespread precedence. Clearly drama, poetry, and story-telling are examples of syntactical modeling (as is evident by the plight of desperate sophomores who think Cliff Notes are a short-cut to expertise!). But perhaps a more relevant theological example is hinted at by Aquinas. As is well known, Aquinas was loath to fall into the trap of "onto-theology"—the mistake Duns Scotus later made in claiming a univocity of being shared by God and the world (effectively making God a piece of furniture in the universe, only bigger, stronger, smarter, and faster than anyone else).[33] Thus Aquinas, together with a sizeable portion of the Christian writers who preceded him, vehemently denied the possibility of a scale model of God.[34] This seems like it should be a no-brainer. But

as David Burrell notes, both sides of the contemporary theodicy debate are tacitly committed to this very error.[35]

In contrast to modern theodicists, Aquinas follows the hints of Augustine and Pseudo-Dionysius and suggests that we understand a categorical difference between proportion (*proportio*, i.e., scale) and "proportionateness" (*proportionalitem*). This latter term is a sort of second-order analogy of analogy represented by A:B::C:D.[36] Aquinas's example is that the relationship of the sun to the physical world is akin to the relationship of God to the spiritual world. No proportion or scales can be set up between the sun and God (for there is no shared property enabling direct comparison, such as heat). Nevertheless, the analogy is intelligible. I concur with Ian Ramsey's conclusion that the model both *discloses* something about God's relationship to the world *and* that the model we employ to think this is itself inherently limited.[37] (And perhaps only the very skilled may be attuned to the limits of the model.) As a tentative example, I offer the work of Arthur Peacocke.

Since his 1978 Bampton Lectures, Arthur Peacocke has proposed that divine agency be compared with top-down causality exercised by a higher rung on a mereological order upon a lower rung.[38] It is well known that in the mereological hierarchy that stretches from the sub-atomic to the planet as a whole, lower rungs exert bottom-up influence on higher rungs of organization (for example, a chemical imbalance affects the operation of the organ). The biochemist-become-theologian Peacocke observed that it is equally true that non-reductive properties, which emerge at each level of complexity, exercise downward influence on lower levels in the hierarchy.[39]

Peacocke's model may be taken as syntactical in that he proposes that God's relation to creation is dynamically similar to the causal relation between emergent properties and their constituent parts. One advantage of this kind of comparison is that emergent properties are unpredictable, even "chaotic."[40] One might think that this fact would spare human modelers the temptation to press the model in a semantic direction in hopes of getting a bead on the mechanism of divine agency. Despite the unpredictability, the semantic temptation can still get a grip if God's "top-down" influence is taken to be "upon" something "external" to the divine

action. The problem is that the classical theological grammar of "simplicity" and "necessity" means that it makes no sense to speak of *anything* being external to divine activity.[41] While champions of Peacocke's model sometimes drift in a semantic direction,[42] the syntactical nature of modeling means that what is really needed is greater skill in attending to the limits of modeling. Thus my appeal to the syntactical nature of modeling is meant both to eschew the errors of "scale model" thinking and throw up a cautionary reminder that modelers attend to the inherent limits of analogical reasoning. Admittedly, this caution may be a grave disappointment to theodicists who want advance guarantees that models achieve the sought-for similarity. But their disappointment does not make syntactical modeling any less demanding.

To recap my main contention, as an instance of syntactical modeling analogical reasoning in theology has inherent limits that are not fixable flaws in the model *qua* model. Rather the limits are internally related to ever-imperfect human skills. Whether we are considering engineering, music, or theology, modeling happens only where there have been modelers, plural. Those who have gone before put the novices through the training paces. As could be seen in Wittgenstein's case, dynamical similarity became attainable by engineering modelers who had undergone extensive bodily training (technical drawing, building prototypes, lab work, on-site visits, and so on). Theology is no different. Progress in the art of modeling comes at a price.[43] In a recent interchange, theologian David Burrell expresses exasperation at the tin ear of the philosopher with whom he debates. The philosopher insists that God "exists" in precisely the same univocal way that creatures do, while Burrell has been trying to show that such an existent could not then be whom we mean by "God." At the end of the day, Burrell suggests that what his interlocutor needs is not more evidence, arguments, or facts but more (syntactical modeling) skills:

> How do we gain such adeptness? There is only one answer: through practice; but it must also be acknowledged that some never do! That suggests that we are in the realm of *judgment* here, for judgment gives some the ability to direct an inadequate concept to its target, whereas others will simply allow it to mislead them. Yet with such practices we are

entering that way of doing philosophy . . . which modernity, preoccupied with finding adequate [dimensionlessly similar] concepts, has simply overlooked.[44]

Notes

[1]My deepest thanks to my friends Terry Tilley, Kelly Johnson, Ethan Smith, Michael Cox, and Justus Hunter for their insightful comments on earlier drafts of this paper.

[2]Clearly large-scale disasters such as Hurricane Katrina or the 2004 tsunami pose problems for theodicists. But the most devastating critique asks whether the world could have done with one less raped child, or burned fawn, or disease-carrying mosquito. See William L. Rowe, "The Evidential Argument from Evil: A Second Look," in *The Evidential Argument from Evil* (Bloomington and Indianapolis: Indiana University Press, 1996); and Brad J. Kallenberg, "Some Things Are Worth Dying For," *New Blackfriars* 87, no. 1007 (2006): 50-71.

[3]St. Augustine, "Sermon 117," in *Part III—Sermons, Volume 4: Sermons 94a-147a*, ed. John E. Rotelle, O.S.A., *The Works of Saint Augustine: A Translation for the 21st Century* (Brooklyn: New City Press, 1990), 209-23.

[4]Wittgenstein's early comments on similarity, analogy, mapping, picturing, and modeling take on a new cast when read through the lens of his training in turn-of-the-century German engineering. For an outstandingly helpful overview of the Wittgenstein-as-engineer school of thought, see Alfred Nordmann, "Another New Wittgenstein: The Scientific and Engineering Background of the *Tractatus*," *Perspectives on Science* 10, no. 3 (2002): 356-84.

[5]Both courtroom models and private codes made an impression on Wittgenstein. See Georg Henrik von Wright, *Wittgenstein* (Minneapolis: University of Minnesota Press, 1974), 20f; Ludwig Wittgenstein, *Notebooks, 1914-1916*, ed. G. H. von Wright and G. E. M. Anscombe (Chicago: University of Chicago Press, 1961), 29.9.14 p. 7e; *Philosophische Betrachtungen, Philosophische Bemerkungen*, vol. 2, Wiener Ausgabe (Vienna: Springer, 1994), 279. For examples of Wittgenstein's own use of private code see manuscript number MS 183, which has now been translated in James Carl Klagge and Alfred Nordmann, eds., *Ludwig Wittgenstein: Public and Private Occasions* (Lanham, MD: Rowman & Littlefield, 2003), 227.

[6]The phrase "that by which" was used by Aquinas to describe how ideas directly grasp reality, thus precluding the problem of skepticism that faced Cartesian thinkers (St. Thomas Aquinas, *Summa Theologica*, trans. Fathers of the English Dominican Province [New York: Christian Classics, 1981], I.85.2).

[7]Small-scale models of wave action on ships must consider the role that surface tension plays on the action of waves. However, surface tension completely disappears on the open sea! Susan Sterrett cites Froude: "the diagram

which exhibits to scale the resistance of a model at various successive veloci-ties [i.e., dimensionally homogenous mental model similarity], will express equally the resistance of a ship similar to it, but of (n) times the dimension, at various successive velocities, if in applying the diagram to the case of the ship we interpret all the velocities as ($\sqrt{n}$) times, and the corresponding resistances as (n^3) times as great as on the diagram." In other words, sur-face tension greatly reduces the impact of model waves on model ships but disappears as a force on the open sea. Cited in Susan G. Sterrett, "Physical Pictures: Engineering Models Circa 1914 and in Wittgenstein's *Tractatus*," in *History of Philosophy of Science: New Trends and Perspectives*, ed. Michael Heidelberger and Friedrich Stadler (Dordrecht, Holland: Kluwer Academic Publishers, 2002), 131. See also the engineering failures such as bridges and skyscrapers as detailed by Henry Petroski. Most recently: Henry Petroski, "Tower Cranes," *American Scientist* 96, no. 6 (2008): 458-61.

[8]For example, microscopic particles for which weak bonding displaces gravity for significance.

[9]For example, near-light-speed particles.

[10]For example, gravity, electro-magnetism, or other "spooky" action at a distance.

[11]For an epistemological holism that encompasses science, see W. V. O. Quine and J. S. Ullian, *The Web of Belief*, 2d ed. (New York: Random House, 1978).

[12]Max Black, "Models and Archetypes," in *Models and Metaphors* (Ithaca, NY: Cornell University Press, 1962), 229.

[13]For interesting accounts of engineering at the margins, see the writings of Henry Petroski. For an example of a dam that failed when it was sup-posed to stand, see Henry Petroski, "St. Francis Dam," *American Scientist* 91(2003): 114-18.

[14]Boltzmann explains: "A distinction must be observed between the [mental] models which have been described and those experimental models which present on a small scale a machine that is subsequently to be completed on a larger, so as to afford a trial of its capabilities. Here it must be noted that a mere alteration in dimensions is often sufficient to cause a material alteration in the action, since the various capabilities depend in various ways on the linear dimensions. Thus the weight varies as the cube of the linear dimensions, the surface of any single part and the phenomena that depend on such surfaces are proportionate to the square, while other effects—such as friction, expansion and condition of heat, etc. vary according to other laws. Hence a flying-machine, which when made on a small scale is able to support its own weight, loses its power when its dimensions are increased" (Ludwig Boltzmann, "Model," in *Theoretical Physics and Philosophical Problems: Selected Writings*, ed. Brian McGuiness [Dordrecht, Holland: D. Reidel Publishing, 1974], 219-20).

[15]See Susan G. Sterrett, *Wittgenstein Flies a Kite: A Story of Models of Wings and Models of the World* (New York: Pi Press, 2006). Pénaud's drawings can be found in the 1897 edition of Encyclopedia Britannica and are reproduced at http://www.uh.edu/engines/epi1129.htm.

[16]Cited in Black, "Models and Archetypes," 227.

[17]Ibid.

[18]"I never satisfy myself . . . until I can make a mechanical model of a thing. If I can make a mechanical model, I can understand it. As long as I cannot make a mechanical model all the way through, I cannot understand it." Cited in Ian Thomas Ramsey, *Models and Mystery*, The Whidden Lectures for 1963 (London: Oxford University Press, 1964), 2.

[19]Black, "Models and Archetypes," 228.

[20]I estimate that less than 0.5 percent of the general population was, for the sake of college coursework, able to understand this equation. Of course my projection is likely flawed since I am using the University of Dayton's rate of completion of MTH218 as sole basis for extrapolation into the general college graduate population, and then for comparison with the general population.

[21]German text from *Die Gute Nachricht; Das Neue Testament in Heutigen Deutsche* (Stuttgart: Deutsche Bibelgesellschaft, 1967). French text from *La Sainte Bible*, trans. Louis Segond (Villiers-le-Bel: Alliance Biblique Universelle, 1992).

[22]"*ho Christos to kata sarka ho on epi panton theos. . . .*"

[23]A better term might be "experior" modeling, since the Latin term *experior* connotes all three notions of experiment, experience, and expertise.

[24]Brian McGuinness, ed., *Wittgenstein: A Life. Young Ludwig 1889-1921*, vol. 1 (Berkeley: University of California Press, 1988), 53-72.

[25]Emphasis added. Here I use "transmission" for *Übersetzung* in order to avoid connotations of one-to-one correspondence that seem to haunt current notions of "translation."

[26]I concede that the *Tractatus* itself possesses a serious spirit of generalization for which I blame the influence of Hertz and other mental modelers. After all, in the passage immediately preceding the one cited, Wittgenstein claims that the "pictorial internal relation" holds between language and the world! There he describes a plain one-to-one isomorphism, like in Grimm's fairy tale of the "The Golden Lads," "the two youths, their two horses and their lilies" (4.014). See Inge Ackermann, Robert Ackermann, and Betty Hendricks, "Wittgenstein's Fairy Tale," *Analysis* 38, no. 3 (1978): 159-60. However, in the *Big Typescript*, he makes explicit that "pictorial" is an adverb that describes an instance of skillful modeling. See Ludwig Wittgenstein, *Philosophical Grammar*, ed. Rush Rhees, trans. Anthony Kenny (Berkeley and Los Angeles: University of California Press, 1974), 113. For my discussion of this see Brad J. Kallenberg, *Ethics as Grammar: Changing the Postmodern Subject* (Notre Dame: University of Notre Dame Press, 2001), 101-12.

[27]*abbildenden internen Beziehung*; *Tractatus* 4.014.

[28]For an entertaining account of the way novice engineers become experts, see the biographical account of nineteenth-century John Jervis: Elting Morison, "The Works of John B. Jervis," in *From Knowhow to Nowhere* (New York: Basic Books, 1974), 40-71.

[29]A whole host of disparate engineers is involved: one team designs the recording equipment and another the playback system (turntable, amplifier, etc.) Other teams manufacture the equipment. While still others—sound

engineers, production engineers, and so on—work to skillfully mesh the performance and its recording.

[30]Fenella Saunders, "The Language Playing Field," *American Scientist* 96, no. 6 (2008): 462-63.

[31]The illustration belongs to Wittgenstein-the-engineer (Ludwig Wittgenstein, *Philosophical Investigations*, ed. G. E. M. Anscombe and Rush Rhees, trans. G. E. M. Anscombe [New York: Macmillan, 1953], §§193-94).

[32]*The Blue and Brown Books* (New York: Harper and Brothers, 1958), 24.

[33]For an account of "THE Distinction" (between God and creatures) see David B. Burrell, "Creator/Creatures Relation: "The Distinction" vs. "Onto-Theology," *Faith and Philosophy* 25, no. 2 (2008): 177-89.

[34]See Aquinas, *Summa Theologica*, I.12.1; Augustine, "Sermon 117," 209-23.

[35]For his most recent account see Burrell, "Creator/Creatures Relation," 177-89. On this view, Burrell is joined by a growing school of Thomistic thinkers who have also learned from Wittgenstein. For a description of this group of thinkers see Brian Davies, "Is God a Moral Agent?" in *Whose God? Which Tradition?*, ed. D. Z. Phillips (Hampshire, UK & Burlington, VT: Ashgate, 2009), 97-122.

[36]See Aquinas's *Commentary on the Sentences of Peter Lombard*, IV.49.2.1 ad 6. Latin text is available at http://www.corpusthomisticum.org/snp40492.html: "*Ad sextum dicendum, quod quamvis finiti ad infinitum non possit esse proportio, quia excessus infiniti supra finitum non est determinatus; potest tamen esse inter ea proportionalitas quae est similitudo proportionum; sicut enim finitum aequatur alicui finito, ita infinito infinitum.*"

[37]Ian Thomas Ramsey, "Talking of God: Models Ancient and Modern," in *Christian Empiricism*, ed. Jeffrey H. Gill, Studies in Philosophy of Religion (London: Sheldon Press, 1974), 120-40. See also Ramsey, *Models and Mystery*.

[38]See Arthur R. Peacocke, *Creation and the World of Science* (Bampton Lecture Series; 1978) (Oxford: Oxford University Press, 1979). For a recent example of this theory see Philip Clayton, "Natural Law and Divine Action: The Search for an Expanded Theory of Causation," *Zygon* 39, no. 3 (2004): 615-36. See also Nancey Murphy and George F. R. Ellis, *On the Moral Nature of the Universe: Theology, Cosmology and Ethics* (Minneapolis: Fortress Press, 1996).

[39]Scientific examples of downward causation such as the Bénard phenomena are detailed in Arthur R. Peacocke, *The Physical Chemistry of Biological Organization* (Oxford: Clarendon Press, 1983). Social facts, like one's being Protestant, have influence on individual members of the social group. As Durkheim famously showed, being Protestant causally contributes to a higher suicide rate among Protestants than Catholic counterparts. This explanation is an example of top-down causality. For other examples, see Daniel Little, *Varieties of Social Explanation: An Introduction to the Philosophy of Social Science* (Boulder, CO: Westview Press, 1991).

[40]See the essays in Robert John Russell, Nancey Murphy, and Arthur R.

Peacocke, *Chaos and Complexity: Scientific Perspectives on Divine Action* (Vatican City State & Berkeley: Vatican Observatory and The Center of Theology and the Natural Sciences, 1995).

[41] I am grateful to Ethan Smith for making this implication of Peacocke's model clear to me. This is a repeated theme in Burrell's work. For a recent example, see David Burrell, "Distinguishing God from the World," in *Faith and Freedom: An Interfaith Perspective* (Malden, MA: Blackwell, 2004), 3-19.

[42] Alas! I have succumbed to this temptation in my own writing. See Brad J. Kallenberg, "Unstuck from Yale: Theological Method after Lindbeck," *The Scottish Journal of Theology* 50, no. 2 (1997): 191-218.

[43] The personal demands of enterprises like philosophy and theology are made poignantly by Hadot (Pierre Hadot, *Philosophy as a Way of Life*, ed. with an introduction by Arnold I. Davidson, trans. Michael Chase [Oxford & Cambridge, MA: Blackwell, 1995]).

[44] David B. Burrell, "Response to Cross and Hasker," *Faith and Philosophy* 25, no. 2 (2008): 207. Emphasis added. Burrell's response is the last of a series of exchanges in this volume of *Faith and Philosophy*.