Research Article

Ryder Dale Walton*

"… God Said": Toward a Quantum Theology of Creation

https://doi.org/10.1515/opth-2022-0244
received October 06, 2023; accepted January 11, 2024

Abstract: This work argues that because Quantum Mechanics (QM) is superb at simulating natural, physical phenomena, so-called quantum-native phenomena, and that Quantum Natural Language Processing (QNLP), its child, is also quantum-native, God's generative language of physical creation is native to a quantum world; therefore, it is now possible to postulate an argument for God's creation of the world through language without requiring divine revelation. This argument is, in essence, an extension of the Augustinian argument – the baseline argument from mathematics and abstract objects – for the existence of God that accounts for contemporary advances in QM. Additionally, this work invites further research and investigation into applying category theory to model the theistic universe thereby allowing both modeling and simulations of the symbolic world.

Keywords: quantum computing, theology, QNLP, category theory, DisCoCat, Genesis, John, creation, cosmology, symbolism

1 And Now, We See More

There have been things to see – things worth seeing – longer than there have been eyes, but ever since the dawn of vision the perplexing problem of making sense out of what is seen has plagued the eyes, and the minds, of the beholders. It is a trivial matter to see the fact of a lion eating a lamb, or that the rain falls on everyone when it comes. It is an entirely different matter to see into the events and understand their underlying mechanisms and causes – how they work. Still further beyond this is the bottomless depth of what these things *mean*. One man sees a flying bird and knows it means good luck. A woman, instead, sees the same bird and knows the change of the season will soon be upon her. What is more, it is not as if the observable world – the seen – has remained static through the course of time. A contemporary mind riddled with *paranoia* might observe the flying bird and fear with a deep sense of dread that it is a camera, which means that the observer may actually be the observed and that the world may be more Orwellian than it feared. While that may sound ludicrous, in the contemporary world, robotic birds and cameras, at the very least, exist. Perhaps, the idea is not so ludicrous after all. Stranger still, infinitesimally small particles, invisible to the naked eye, are visible with the help of advanced optical tooling and computers. When one accounts for the passage of time, the state of the contemporary Cartesian mind – the *zeitgeist* – of the beholders, and the state of the various arts and sciences, it is no wonder that, for many, the search for meaning is fruitless or altogether abandoned.

Yet, this lurking despair and gradual retreat into nihilism is far from inevitable. The secret to seeing well is to remain firmly based on observable reality via science and the time-tested tradition encapsulated in the Logos simultaneously. Advances in contemporary physics, *quantum mechanics* (QM) in particular, and computer technology have made it possible to see more of the world – have made more of the world observable –

* **Corresponding author: Ryder Dale Walton,** Capitol Technology University, Doctoral Programs, Laurel, Maryland, United States, e-mail: rdwalton@captechu.edu, rdnotlaw91@gmail.com, rdnotlaw91@outlook.com

than ever before. Therefore, to honor the Logos, it is worth revisiting what was known and juxtaposing it with what now can be seen in nature via QM in hopes of discovering a richer, clearer conception of the truth.

1.1 Purpose

In the search for truth, the present work considers creation in light of new advances in QM and computer science (CS). The intersection of these two disciplines is often known as *quantum computing* (QC). The signature boon that QC provides over classical computing is performing and solving problems related to large-scale simulation of natural, physical phenomena.[1] Such problems are called *quantum-native*.[2] It is no stretch of the imagination that simulation of particles using computers built with particles would be quantum-native.

There is a much more surprising quantum-native problem domain known as *quantum natural language processing* (QNLP) that is the focus of the present work. QNLP is the quantum version of *natural language processing* (NLP), which is responsible for technologies such as text-to-speech, speech-to-text, autocorrect, auto-complete, personal assistants, AI chatbots, Chat-GPT, and more. NLP on classical computers has brought an immense number of advancements in technology using machine learning techniques and statistics over large corpora of texts. These techniques are often conglomerated into a single concept known as the *bag-of-words* approach.[3] In essence, this means that classical computers are excellent at guessing the next words by performing sophisticated mathematics on a stored vector of word counts. QNLP is different because quantum computers can know grammar and syntax because they have sufficient computational space to compute grammar and syntax.[4] This is precisely what is so surprising about QNLP: that language is quantum-native.

It is certainly unexpected that QNLP is quantum-native since it implies a mathematical connection between language and physical reality. We find this same connection expressed in the creative language of God in the Abrahamic faiths. In particular, the Hebrew Bible chronicles that God speaks, and the cosmos – structurally and materially – comes into being.[5] When God speaks words, he speaks elementary particles. In a world where God creates with speech, grammar is analogous to the laws of physics. In that analogy, the words are matter and energy,[6] and the building-blocks of language, then, are the building-blocks of reality. Figure 1 presents this observation graphically.

It all starts with the elementary particles, such as electrons and quarks, which would be nothing more than a pixel in Figure 1. The action really starts with the 36 marks.[7] The sub-atomic marks assemble into atomic letters. The atomic letters then combine into compounds called words. Finally, the word-compounds are arranged according to grammatical law to form viable sentences capable of expressing an ordered cosmology. The parallel between this vision of language and that of the physical world is perfect. Therefore, while it once seemed that the Abrahamic idea that creation through speech is obscure and discernible through divine revelation alone, in the quantum era where language and physical interactions can be visualized pictorially, such a notion ought to be revisited, examined, and updated to align with the observable world as it can be seen now. Certainly, the creation of the world through the speech of God will always require faith, but there is no need for that faith to be blind given contemporary tools.[8]

---

1 Feynman, "Simulating Physics;" Aaronson, *Quantum*.

2 Coecke et al., "Foundations."

3 Ibid.; Coecke, "Text Structure."

4 Coecke, "Text Structure."

5 *New Revised Standard Version*, Genesis 1-2:3.

6 Because it is now known that mass and energy are interconvertible via special relativity's $E = mc^2$ equation, then the analogy between words also extends to energy.

7 The number 36 is derived teleologically, meaning that the number is determined by the end of the figure. The sentence "There was light" requires 36 marks in these shapes to be constructed.

8 Hebrews 11:3.

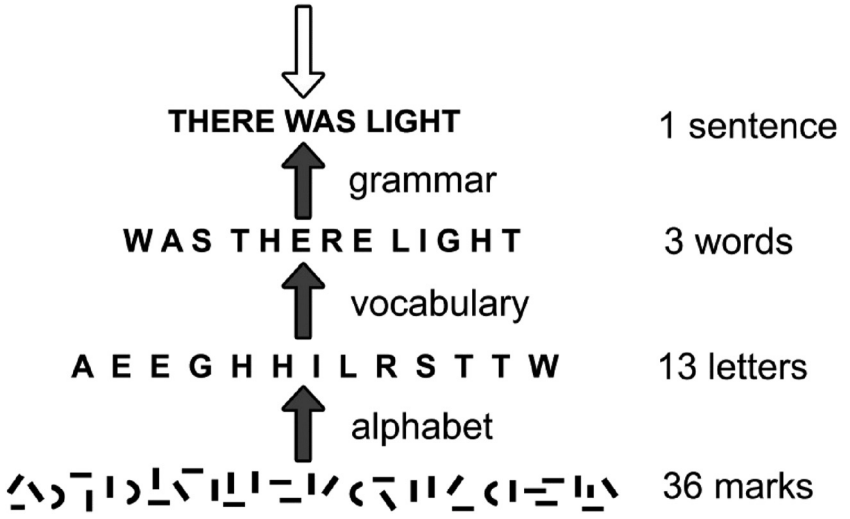

Figure 1: Building blocks of language: the metaphysical analogue to a physical world. This figure comes from Pageau's *Language of Creation*, which discusses the cosmology and symbolism of the ancient mind as expressed in Genesis. It is used with the author's permission.

1.2 Contributions and Avenues for Further Research

In agreement with that thesis, this speculative enterprise provides two novel contributions. First, it presents and explores an initial formulation of an argument for creation via speech without necessarily relying on divine revelation. Stated explicitly, there is an argument for the existence of QNLP in a creation narrative akin to Genesis 1-2 or John 1, though not necessarily those accounts precisely, that relies solely on observing quantum computing experiments. This argument, then, abductively implies that theism is a possible explanation for the quantum-native nature of language and that further development of a quantum theistic interpretive framework is an avenue for further research toward which this endeavor merely points. Additionally, as a necessary consequence of the first contribution, a second novel contribution presents an initial step toward a *category theory*-based representation of theistic cosmology – a universe created out of *heaven-stuff* and *earth-stuff*.[9] This initial step can be expanded to fuller representations that account for specific theological nuances, such as sacraments and sacramentals, effects of sin or baptism on the soul, and so on, in future works.

2 Background

The journey from QNLP to a proper cosmogony is clearly a long and interdisciplinary one. Before embarking, it is necessary to review the most relevant background knowledge that makes an observation as bizarre as the creation of the cosmos by a higher power's metaphysical tongue even possible in the first place. This knowledge includes diverse disciplines such as category theory, *mathematical linguistics*, quantum computing, theology, and philosophy. A full representation of all these topics would require a bulky tome filled with pages of technical writing and lofty jargon. For this exploration, brief introductions and only the brightest highlights must suffice. First, the physical disciplines are explored before proceeding to the metaphysical disciplines.

9 Augustine, *Confessions*.

2.1 Category Theory

2.1.1 Defined

The first noteworthy background discipline is category theory, which is the branch of mathematics concerned with maximizing abstraction by seeking unifying formal structures so that findings apply to the broadest possible range of disciplines and problems. Category theory is key because it provides a foundational mathematical and abstract unity between physics and grammar. This is achieved by creating a definition of a category and then applying different rules and stipulations to the said category until it adequately represents observable phenomena or correctly describes the behavior of a system. Due to their flexibility, there are a wide variety of categories.[10] Only the most basic type must be considered here.

All categories are constructed of *objects* and *morphisms*.[11] Objects look like dots or circles and are the nouns of a category. They can be thought of the things inside the category. Morphisms, on the other hand, look like *arrows* and are the verbs – the transformations an object can undergo to, for example, change it into a different object – within the category. Mathematically speaking, morphisms have a *domain* and a *co-domain*, which are objects within the category. Simply put, the domain is the input – like a vertex in a graph – into a morphism, and the co-domain is the corresponding output – another vertex.[12] Aside from objects and morphisms, it is crucial that categories allow *composition*, meaning that morphisms within a category can be nested.[13] This nesting of morphisms is roughly equivalent to function composition in algebra in that the nested function is calculated first with its output being provided as the input into the next function – i.e., $f(g(x))$. In category theory notation, the most basic composition equivalent to the prior example is typically represented as $f \circ g$ – read as "f after g."[14] This composition is required to be *associative* – the order of computation is irrelevant – and there must be an *identity* morphism that maps an object onto itself – a vertex with an arrow circling back on itself.[15] Formally, associativity is defined by the following equation: $(f \circ g) \circ h = f \circ (g \circ h)$, and identity is defined as $f = f \circ Iw = Ix \circ f$. Figure 2 provides a visual aid with a graph and labels to aid understanding. While it is possible to add additional rules and restrictions – more structure – to categories, only objects, morphisms, and compositionality with associativity and identity are required; therefore, those elements are the basic definition of a category.

The core of Figure 2 is the graph with its four vertices – objects – and seven edges – morphisms. The edges are more correctly described as three directed edges, which are morphisms between objects, and four loops that represent the identity morphisms. The object W is the starting point of the graph's flow. The morphisms f, g, and h move one along the graph toward its terminal point – object Z. The identity morphisms are, again, represented by loops, which circle back onto the vertices from which they originate. This means the origin vertex and terminus vertex are the same for each identity morphism. Thus, the identity morphisms are labeled with an I that has a unique subscript to specify the object to which it is the identity. For example, I_w is the identity morphism that originates from and terminates on object W. The rest of the image is layered and uses brackets to illustrate the symbolic mathematical expressions' referents. For example, the associativity equation – the topmost equation – states that the path from W to Z is the same path regardless of whether $f \circ g$ or $g \circ f$ is calculated first.

2.1.2 Category of Creation

The highly abstract nature of category theory allows it to represent many different things, including the *theistic universe*. The theistic universe is based on ancient cosmology and contains two types of substances:

10 Coecke and Paquette, "Categories."
11 Ibid.; van de Wetering, "ZX-Calculus."
12 de Felice, "Categorical Tools."
13 Coecke and Kissinger, *Picturing Quantum.*
14 Ibid.
15 Coecke and Paquette, "Categories;" van de Wetering, "ZX-Calculus."

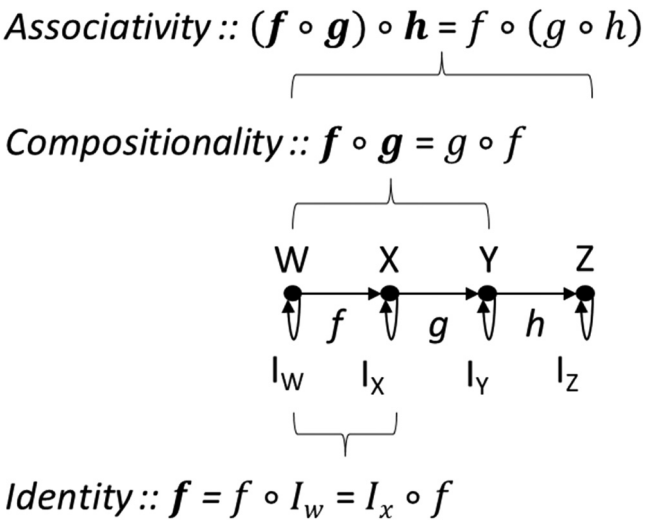

Figure 2: Example category theory graph and compositional equations.

heaven-stuff and earth-stuff.[16] The heaven-stuff makes up the spiritual aspect of life, such as souls, wisdom, the breath of life, consciousness, angels, demons, and so forth. Heaven-stuff provides meaning, hierarchical causality, and life among other things. On the other hand, earth-stuff provides the material aspects of life, like flesh, metals, dirt, water, fire, and air. Any categorical representation of the theistic universe must have objects that represent these two distinct kinds. Beyond these two objects, a wider diversity of possible representations begins to emerge depending on one's particular theological preferences. In particular, the theistic universe has a third object to describe where heaven-stuff and earth-stuff meet: *symbol*.[17] Symbols, then, are the third kind that holds the intersection of heaven-stuff and earth-stuff. In Christian theology, this would include human beings themselves as they are made from earth-stuff and filled with the breath of God.[18] In sacramental theologies that recognize transubstantiation, this would also include, among other things, the Eucharistic Host. Figure 3 shows a pictorial depiction of the theistic universe that will serve as the starting point for building a notional categorical representation.

Figure 3 comes from Pageau's 2018 work.[19] The left-hand side of the image shows the meeting of heaven-stuff and earth-stuff in Adam, which is elaborated below. The heaven-stuff and earth-stuff are depicted in semicircles that, when combined, form a whole circle that represents all of creation. Intuitively, heaven would be the upper portion of the circle, and earth would be the lower portion. Next, inward-facing directed edges are used throughout Pageau's work to graphically depict the formation of symbols – the items depicted in the center – out of their heavenly and earthly elements. A second important observation is shown on the right-hand side. The theistic universe is multi-tiered and recursively depicts the same cosmic structure at different levels of granularity, which are called macrocosms and microcosms. This is represented in the figure by zooming into the center of the macrocosm circle to see the microcosm as if looking through a microscope. The current level of granularity being discussed can be discerned by the topmost directed edge. On the left, the granularity is that of the divine. On the right, it is that of humanity.

Figure 4 takes the next step, providing a simple abstraction of the theistic universe as a *proto-category* – a nascent, potential category lacking full definition – with three objects and morphisms between them. Before viewing the figure, the morphisms require definition. There are four in total: *I, R, E,* and *S.* Borrowing from computer science, each of these morphisms has been assigned a meaningful name with the single character

16 Augustine, *Confessions*; Pageau, *Language of Creation.*
17 Pageau, *Language of Creation.*
18 Genesis 2:7.
19 Figure 3 is used with Pageau's permission.

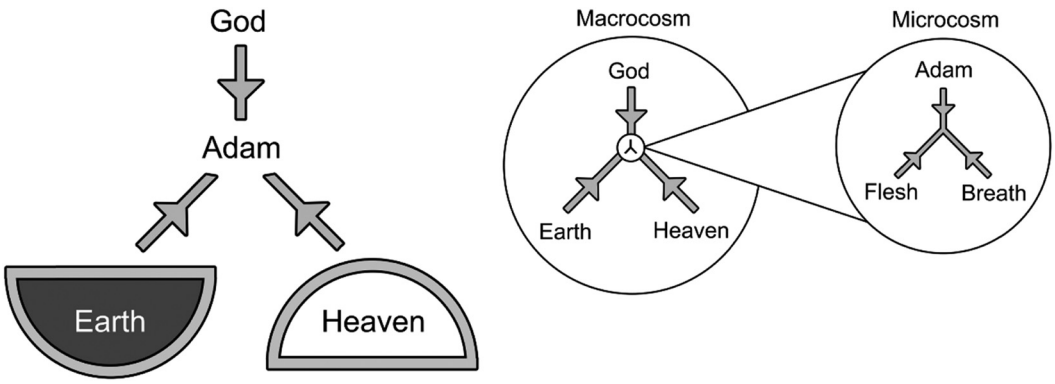

Figure 3: Recursive structure of the theistic universe.

designations functioning as helpful shorthand. *I* stands for "informs;" *R* for "returns;" *E* for "embodies;" and finally, *S* stands for "supports." The rationale behind the names is simple enough to ascertain. Beginning from the lower right-hand portion of the image and proceeding counterclockwise, the earth supports the symbol. It provides the material element that gives the symbol form, supporting the meaning in a weighty, tangible vessel. The symbol, then embodies the ideal – the wisdom, the breath – of heaven. This also implies, third, that heaven is informing the symbol with a higher principle or meaning; otherwise, the symbol would have nothing to embody. Lastly, now on the bottom-left, the symbol can return to the earth. This would signify the departure of heaven – the desacralization or desecration – from the symbol, rendering the symbol nothing more than an empty vessel – an object devoid of heaven-stuff.

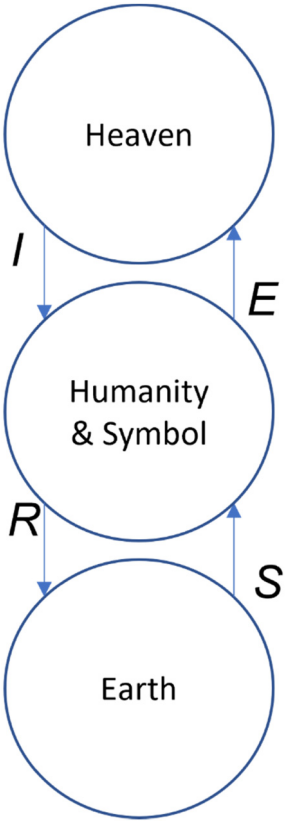

Figure 4: Proto-category for the theistic universe.

Figure 4 is nothing more than the conceptual starting point for the formation of a category proper, hence the use of the term proto-category. It is worth noting that the four morphisms break down into two sets and that identity morphisms are not yet considered here. There are only those morphisms that pair heaven with the symbol and those that pair earth with the symbol. These two sets can be envisioned as two circular cycles: heaven-symbol and earth-symbol. Envisioning these groups this way can be helpful when considering mathematical representations of these abstract concepts. For example, it is possible to represent each cycle with an isomorphic invertible function so that the heaven-symbol and earth-symbol sets use the same function. Implementation details like this are simply notional as fully defining the optimal categorical representation of the theistic universe is beyond the scope of this introduction to the concept; however, it is important to recognize that this sort of representation can be formalized mathematically.

Notice that the word "humanity" is also included in the symbol object's circle. This is not an accident. It is the prototypical example! Human beings, as represented by Adam in Figure 2, are the primordial[20] blend of heaven-stuff – breath of life – and earth-stuff – dust – because humans are a unity of body and soul.[21] Adam is formed out of the dust of the earth and the breath of God from heaven enters Adam's nostrils. He is, therefore and clearly, a symbol – the combination of heaven and earth – in the category of the theistic universe. Humanity, then, through Adam is the symbol of the unity of heaven with earth more broadly. So, when living righteously, the human being is properly functioning in the theistic universe as the embodiment of heaven on earth. When living wickedly, the human being fails to properly instantiate heaven as a symbol and, therefore, sins. It follows then that the very structure of the theistic universe defines sin as the botched embodiment of heaven on the earth.

The human being's physical and spiritual lifecycle illumines how the morphisms move the human between the objects in the category. At the moment of death, the breath leaves the body and returns to heaven. The breath, then, no longer informs the meaning of the body. This is the great tragedy of death. The soul of the loved one is now gone back to its Maker, and the bereaved have nothing left to do but await their own turns to join their loved one's soul in heaven as well.[22] Meanwhile, the soulless body slowly turns back to dust, returning to the earth, after burial.[23] Each of these categorical changes can be mapped as a morphism from the domain of symbol to the co-domain of earth or heaven, respectively. Figure 5 provides a notional, graphical example of such a mapping from a sacramental theology's perspective.

A full exploration of domains and codomains must be left to a future work. There are certainly multiple ways to implement this mapping, so this is only a notional example to aid comprehension. The arrows are precisely those morphisms that are indicated in Figure 4. Additionally, BBSD is an abbreviation meaning "Body, Blood, Soul, and Divinity," which is the view of transubstantiation regarding the Eucharist. There are other theological positions, but the underlying framework represented here still functions regardless of theological preference. Sacramental theologies tend to have more symbols to consider.

With the logical considerations for how the theistic universe is constructed now prototyped, it is time to formalize those considerations into a category proper. The first step to doing this is to convert the logical proto-category of Figure 4 into a process theoretic representation. Such a representation automatically provides a formalized mathematical structure that lends itself to implementation on a quantum computer.[24] This includes composition structured with associativity and identity. Figure 6 shows the necessary conversion.

Figure 4 here is split into two sections representing cycles of heaven-stuff to symbol – top – and earth-stuff to symbol – bottom. These sections are then juxtaposed with the equivalent process diagram. This is done to illustrate the conversion to process theory in steps. The two processes will be composed again in Figure 7.

The convention employed here is for the processes to be read from top to bottom; therefore, time is labeled with an arrow pointing downward to remove any ambiguity as to the direction of the flow. In that same spirit, the top conversion will be considered first. The abstract morphisms I and E have been collapsed into a single

20 Prior to the Fall, Adam and Eve lived in a state of Original Justice that pre-dates Original Sin. During this time, the adjective "perfect" could be ascribed to the symbol of humanity. See Paul II's *Theology of the Body* for more thoughts on this topic.

21 Genesis 2:7; Aquinas, *Summa*, part 1, question 76, article 1.

22 2 Samuel 12:23.

23 Genesis 3:19.

24 Coecke and Paquette, "Categories;" Coecke and Kissinger, *Picturing Quantum*.

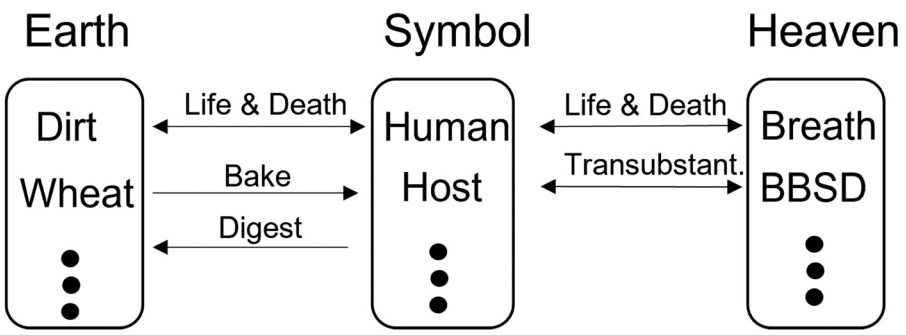

Figure 5: Prototype morphism mapping for a sacramental theology.

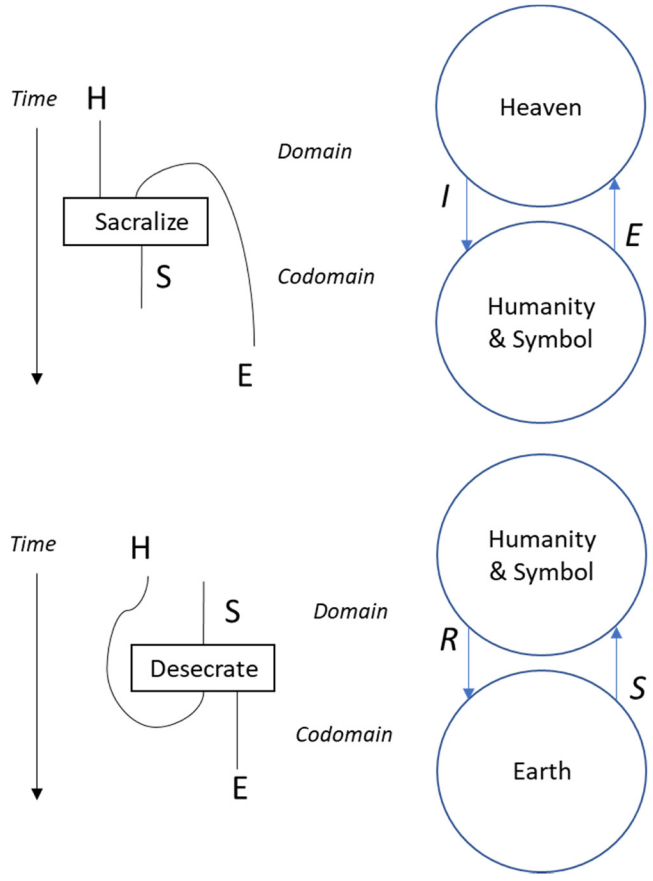

Figure 6: Converting proto-category into process theoretic representation.

process – a proper morphism – called *sacralize*. The inputs into this process are the proper objects H – heaven-stuff – and E – earth-stuff. Here, notice that the structure, both physical and logical, of heaven-stuff and earth-stuff is preserved. Heaven-stuff is above the earth. However, it is crucial to realize that connectivity is the key to interpreting these diagrams. Even though E is written in the place of earth-stuff, it connects to the process box on the top, meaning it is an input and not an output. Therefore, attention must be paid to the wires and their connection points rather than the relative positions of the labels. The inputs into – the domain of – the *sacralize* morphism, then, are the objects H and E. The output – the codomain – is S, meaning a symbol. The same logic is used to create the diagram for the *desecrate* process, which collapses the notions of the S and R proto-morphisms into a proper morphism. In this case, the symbol S is the domain, and the codomain is H and E. Again, the logical location of H's label is preserved in this image, but that is not necessary.

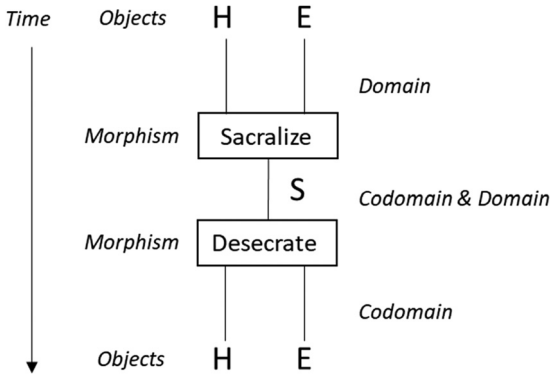

Figure 7: Composition of the theistic universe as a process diagram.

Next, the composition is demonstrated in Figure 7. Associativity is included in the composition without needing any diagrammatic amendments or annotations. This is because the top portion of the diagram or the bottom portion of the diagram is calculated first. As long as both portions are composed and calculated, the result is the same and the image will look the same. Therefore, the composition is associative in process diagrams representative of category theory by default. Identity is shown for objects in the same manner as *time*. For an object, it is simply an arrow that does not go through a process. The identity morphism is different. It is not depicted here because it is simply an empty diagram. A process that makes no change to objects has no need to be represented. Therefore, the composition here perfectly meets the definition of a category.

For ease of understanding the objects, morphisms, domains, and codomains are labeled in this figure. Domain and codomain are from the perspective of time in this example. So, the inputs are always entering the top of the process box, and outputs are always flowing out of the bottom. Objects are always represented by wires, and morphisms are always represented by boxes and are synonymous with processes.

In Figure 7, the labels for objects are no longer bound by the logical structure of Figure 4. That structure can be simplified because the bends in the wire can be straightened out. Again, so long as the connection point is preserved, only connectivity matters. The image here is now a formalized graph of a category-theoretic process and inherits all the structure and benefits implied.

Lastly, it remains to consider which underlying implementation could be used to concretize this category. There is not one simple answer as more than one category is a candidate. The optimal match or best candidate is an area for further research as that is beyond the scope of this contribution, which aims only to invite further research into the intersection of category theory and theology. Therefore, a simple implementation is offered here. Namely, the category of relations known as **Rel**, which is defined rigorously in Coecke and Paquette and used often to model conceptual spaces among other things.[25] Using **Rel**, the objects in Figure 7 become mathematical sets. The morphisms become mathematical relations, which map sets onto sets. The composition is defined by two relations that relate three sets preserving the same structure found in Figure 2. Formally, if there is a relation $R_1 : X \to Y$ and a second relation $R_2 : Y \to Z$, then the composition $R_2 \circ R_1 \subseteq X \times Z \coloneqq \{(x, z) | \text{there exists a} y \in Y \text{ such that } x\ R_1 y \text{ and } y\ R_2 z\}$ holds.[26] Effectively, this is saying that when two relations are composed using the Cartesian product – represented by the multiplication sign – the left-hand side of the relation is populated by an element of the leftmost set, and the right-hand side of the relation is populated by an element of the rightmost set. Again, this structure is exactly that found in the composition defined in Figure 2. Since these properties all hold, then **Rel** provides a feasible implementation of the theistic universe where the category of earth-stuff is defined as $E \coloneqq \{(e, 0)\ | e \in E\}$; heaven-stuff is defined as $H \coloneqq \{(0, h)\ | h \in H\}$; symbol is defined as $S \coloneqq \{(e, h)\ | e \in E, h \in H\}$. Symbol, then, is the Cartesian product of earth-stuff and heaven-stuff, which takes e from earth-stuff and the h from heaven stuff and creates

25 Coecke and Paquette, "Categories;" Hefford et al., "Semantic Concepts."
26 Coecke and Paquette, "Categories."

Table 1: The minimal type alphabet for English

Type	Part of Speech (Po5)
n	Noun
s	Sentence

The partial ordering here is not of grave importance since the example to follow is simple enough. Should this alphabet be expanded to account for differences in sentence tense, etc., additional could be required. In such a case, the partial orders ought to be specified.

a tuple from them. This structure is a good starting point since it mandates that symbols be constituted by both heaven-stuff and earth-stuff, which fits the abstract proto-categorical model of Figure 4. Further, the use of integers $\mathbb{Z}$ for values allows for a gradation of sacredness – positive values – and profanity – negative values. 0, obviously, would reflect neutrality, which would at the very least be useful as an initial value. Such a gradation makes sense as it could model differences in sanctity between marks on the soul – baptism, ordination, consecration, priests, bishops, and the like – and the relative sacredness of religious objects – bibles, crosses, holy water, rosaries, prayer ropes, and so on. **Rel**, then, seems like a good starting point for the implementation of the theistic universe as conceived here and in Pageau's work.[27]

Now, it may seem like this discussion is a rabbit hole, but it is certainly not. The categorical understanding of the theistic universe postulated here is the spiritual twin of the physical world, and necessarily follows from the main argument of this article as it is a requirement of QNLP that such a unifying, abstract, and mathematical structure exists. Therefore, this portion points toward and lays the foundation for the category theoretical understanding of spiritual realities and, by extension, abstract objects – the first contribution of this work. It is already documented that category theory can be used for philosophical considerations.[28] It is time to apply it theologically, develop it, and put it to the test.

2.2 Mathematical Linguistics

The second background principle of importance is mathematical linguistics, which is necessary to unpack as it formalizes grammar as mathematics. As the name implies, mathematical linguistics is a field of research and inquiry where mathematical methods are applied to linguistic phenomena. The field is broad, and there exist numerous approaches to represent natural language as mathematics; therefore, the discussion here must necessarily be limited to *pregroup grammar*, one of the most common approaches used in contemporary QNLP research. Pregroups are a particular kind of category called a *monoid* that is partially ordered.[29] This, in essence, means that there is an order to the relationship of the objects akin to an inequality – the order only flows in one direction. Additionally, for each *type*, *n* for example, that is a member of the pregroup *P*, there are left-adjoints, n^l, and right-adjoints, n^r, so that *expansion* and *contraction* multiplications are possible. As the names imply, expansion is breaking a 1 into its constituent parts. Contraction is combining those same parts, reducing them to a 1. These inequalities are defined as $n^l n \to 1 \to n n^l$ and $n n^r \to 1 \to n^r n$, where the arrow is equivalent to a less than or equal to inequality ($\leq$).[30] Before continuing, the pregroup *P* must have an explicitly defined alphabet, or dictionary, of types. Table 1 provides the minimum alphabet necessary to render a grammatical sentence in the English language.

Since the minimal alphabet shown in Table 1 contains only *n* and *s*, it is simple enough to comprehend. This is perhaps unsurprising since English contains sentences as simple as "Peter jumped up," which contains

27 Pageau, *Language of Creation*.
28 Lawvere, "Unity and Identity."
29 Lambek, "Type Grammar;" de Felice, "Categorical Tools."
30 Lambek, "Type Grammar;" Cardinal, "Japanese Causatives."

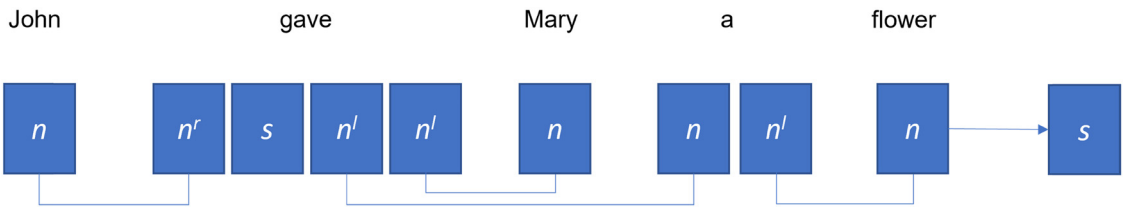

Figure 8: Pregroup grammar with underwires.

only two nouns and one verb and is still grammatically complete. Figure 8 shows a slightly more complicated example to demonstrate both the simplicity and flexibility of the *n* type. The diagramed sentence is "John gave Mary a flower."[31]

The sentence in question is shown above the type groupings. Each grouping relies on whitespace to associate the types with the word that they represent. Notice also that the *n* type is also capable of representing adjectives by carrying the nn^l encoding. Oftentimes, article adjectives are simplified out of the calculation before generating a quantum circuit. This minimizes the number of qubits needed, which is necessary on *noisy intermediate scale quantum (NISQ)* computers because these computers are limited to low qubit counts and incapable of error correction.[32] The fact that QNLP is possible on NISQ devices is itself proof of the quantum-native nature of language.

Figure 8 warrants some explanation. The pairing of types with adjoints via *underwires* effectively cancels them out of the calculation. Whatever type remains is yielded on the right side of the arrow. If the yielded type is *s*, in this simple example, then the collection of words is a grammatically correct sentence.

2.3 DisCoCat

Until now, in the spirit of just-in-time learning, it has been left unsaid that a partially ordered monoid with the adjoints and expansion and contraction equations – again, a pregroup grammar – is also precisely a *compact closed category*, which includes an additional operation for parallel composition that allows the boxes to be lined up horizontally instead of vertically as in Figure 7.[33] This operation is written as $f \otimes g$ and is read as "f while g" and provides the capability to account for multiple processes on disparate objects occurring simultaneously.[34] For example, with a while operator, it becomes possible to represent multiple symbols simultaneously so that a potentially infinite number of Figure 7s could be lined up horizontally. It is also true that boxes arranged in a horizontal line can represent words in sentences. Further, compact closed categories can leverage a special and elegant graphical representation known as *string diagrams*, which are closely related to the process diagrams of Figures 6 and 7.[35] It turns out this is incredibly fortunate as string diagrams can be drawn to look remarkably like the graphs of mathematical linguistics. This makes the leap from linguistics to quantum very intuitive. Consider Figure 9 as the quantum form of Figure 8 that leverages a *DisCoCat*[36] diagram, which is a specific type of string diagram commonly associated with QNLP research.[37]

31 Kartsaklis et al., "Lambeq."
32 Coecke et al., "Foundations;" Coecke et al., "Qubits Speak."
33 Coecke, "Text Structure."
34 Coecke and Kissinger, *Picturing Quantum*.
35 Ibid.
36 DisCoCat is a portmanteau of three words: *Categorical Compositional Distributional*. It is a rather clever portmanteau since the order of reading composition is why the terms are reversed (think Cat $\circ$ Co $\circ$ Dis).
37 Coecke et al., "Foundations;" Coecke, "Text Structure."

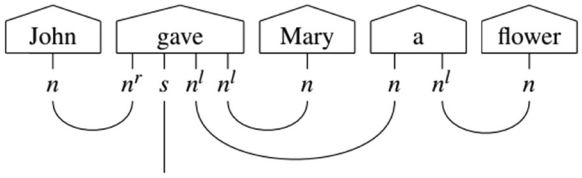

Figure 9: A DisCoCat diagram.

First, this image comes from Karsaklis et al.[38] Second, DisCoCat earned its name because these diagrams were developed by using category theory to unify *distributional semantics* – the linguistics and statistical research approach asserting that words used in the same contexts have similar meanings – and composition into one graphical tool.[39]

Notice how Figure 9 looks nearly identical to Figure 8. The primary differences are two-fold: First, the words are written in pentagons; and second, the underwires are curved. Both differences are significant. The pentagons mark a departure from algebraic grammar in as much as they represent processes like those in Figure 7 instead of Figure 8's types. Regarding the latter difference, the wires in the diagram are no longer underwires that pair up types with their adjoints. Instead, they are *cups*. Cups and *caps*, a cup that is mirrored across the horizontal axis, produce the identity when they are composed, which is the same principle – one of the *snake equations* – used to transform the processes of Figure 6 into those of Figure 7.[40] The use of a cup allows for the output processes to mimic underwires, which reduces the number of intermediary steps and allows for the eventual emergence of simpler quantum circuits.[41] Cups and caps, then, are very powerful graphical calculation tools.

Having reviewed the mathematic and scientific background up to the creation of DisCoCat diagrams, there remains only to convert DisCoCat diagrams into quantum circuits using software tools like *lambeq* and *discopy*.[42] That last step enters the heart of the argument, so it is reserved for the main body of this work. First, there are some theological and philosophical loose ends to tie.

2.4 Theology and Philosophy

Theology and philosophy provide the second half of the necessary background information for the present argument. Of course, theology and philosophy are large fields with millennia of history to consider; therefore, a full treatment on this topic is best left for a much larger work. The present discussion will graft QNLP to the metaphysical tradition by reflecting on necessary presuppositions that prepare the mind and the eye to see creation in the circuits. Theology and philosophy will agree that realism and the Logos are indispensable for this preparation, though they will come to terms in their own unique ways.

2.4.1 Theology

Within the realm of theology, it is crucial to consider the epistemic priority of Christ, natural theology, and scholastic realism. It is, furthermore, helpful to consider the parallels between quantum philosophy and the mystic tradition. All these parts, perhaps seemingly disjointed to some, all play a role in observing

38 Kartsaklis et al., "Lambeq."
39 Harris, "Distributional Structure;" Coecke, "Text Structure."
40 Coecke and Kissinger, *Picturing Quantum*.
41 Ibid.; Coecke, "Text Structure."
42 Kartsaklis et al., "Lambeq;" Toumi, "Quantum Natural Language."

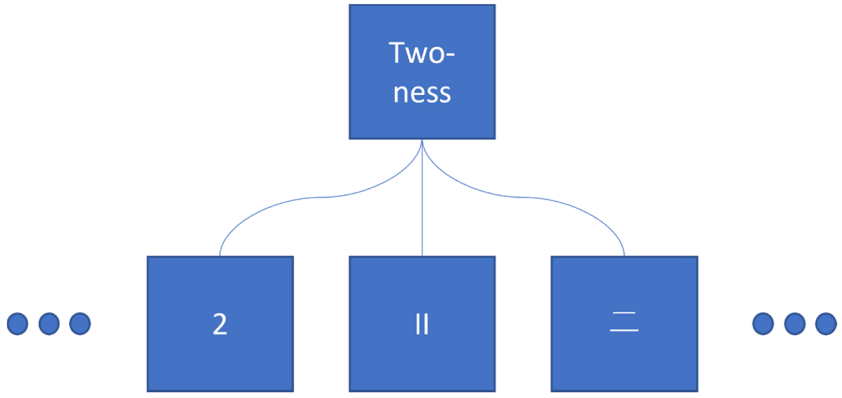

Figure 10: The principle of abstraction or the hierarchy of eternal truths.

the spoken cosmos in a quantum circuit. When taken together, they are the first ingredients to a quantum theistic interpretive framework. The investigation begins with an abbreviated journey to scholastic realism. Epistemology and natural theology will emerge on the way.

2.4.1.1 The Augustinian Argument

Saint Augustine, and those in his thought tradition, have argued for the existence of God on the grounds that *abstract objects*, also known as *eternal truths*, exist in the mind of a divine intellect – a notion commonly known as *scholastic realism*.[43] While the present work does not aim to provide an argument for the existence of God, the Augustinian proof presupposes much of the metaphysical background needed to buttress this work's primary contribution. In fact, the extension of this theological proof is the spine of this work. An abbreviated gloss of the argument, a distillation of Feser's much more complete formulation, is as follows:[44]

1. Abstract objects like propositions, universal truths, mathematical numbers and concepts, and possible worlds all exist. Figure 10 provides one such example.
2. *Realism*, *nominalism*, and *conceptualism* are the three possible explanations for the existence of abstract objects. Realism holds that abstract objects have a real existence and are not reducible to anything material. Nominalism denies that abstract objects are real instead asserting that they are phantasms of language. Lastly, conceptualism asserts that abstract objects are real but are nothing more than constructs of the human mind. Of these three explanations, there are strong arguments in favor of realism. Additionally, there are insurmountable arguments against nominalism and conceptualism. Therefore, realism must be true.
3. There are, however, multiple flavors of realism from which to choose such as *Platonic realism*, *Aristotelian realism*, and scholastic realism. Platonic realism is the belief that abstract objects exist in a third world – neither the world of the intellect nor the material world. This third world would be that of *ideal forms*. Aristotelian realism states that abstract objects exist both outside the mind in the essence of material objects as well as inside the mind performing abstract thought, making the existence of abstract object contingent on the existence of the material world and human minds. Scholastic realism holds that abstract objects exist inside the eternal, divine intellect. Of these three options, Scholastic realism has strong arguments in its favor. There are insurmountable arguments against Platonic realism and Aristotelian realism. Therefore, Scholastic realism is true.
4. There are strong arguments that the necessarily existing intellect in which abstract objects themselves exist is God's own intellect. Therefore, God exists.

43 Augustine, *Choice of the Will*.
44 Feser, *Five Proofs*.

The notion of two-ness, duality, or the pair has many different physical representations. All of which are accidental. The substance of two has no physical form itself, but it is still very real from the perspective of scholastic realism as it exists inside the mind of God – it is not contingent on the existence of human minds to any degree. It is, therefore, an abstract object.

Rather than delve into the intricacies of the Augustinian argument, it suffices to state that the proof is relevant here insofar as it asserts and supports the real existence of abstract objects, and that these abstract objects are physically instantiated into the material world from the divine intellect – the Logos and the basis of being itself. In other words, scholastic realism is a prerequisite for seeing the created world in quantum circuits. Now, there are two points to clarify here. First, grammar is an abstract object because grammar is mathematical. Second and therefore, the eeriness of mathematics – the interplay of abstract objects, to model, represent, and describe the workings of the material world to such a degree that they must be conceived of as real – also applies to grammar. This is significant because it allows one to swap the word "grammar" for the word "math" in all theological arguments from mathematics without compromising said arguments. Grammar and mathematics are equally abstract, equally eerie, and equally real. Therefore, the grand insight of the Augustinian argument that abstraction tends heavenward and that abstract objects are real firmly undergirds this work's primary contribution.

2.4.1.2 Quantum Theology and the Mystic Tradition

Quantum theory has made impacts on theology in the past. Though no previous major work has observed any implications of QNLP on theology, there have been meaningful insights that inform, at least indirectly, the present discussion. What follows is by no means an exhaustive treatment. Perhaps, the greatest exploration of quantum theology is that of O'Murchu, where he insists that the quantum era is marked by *participation*.[45] It is essential to quantum theory that any observation of a quantum process substantively affects the said process. While it is still hotly debated as to what the precise ramifications of this are, they are undoubtedly revolutionary.[46] At the very least, nothing exists in isolation; therefore, it is impossible to observe in the sense of classical physics. It is, then, impossible by necessity for there to be any such thing as an observer or an observed. In the macroscopic world, it seems counter-intuitive that there are no observers or observed things, yet the realities of the quantum world, such as entanglement, not only validate O'Murchu's claim but, in fact, necessitate it: "In the quantum worldview, nothing makes sense in isolation; basically, there are no boundaries, and influences can emerge from several sources."[47] These liminal influences of which O'Murchu speaks cast doubt on the classical view of physics and, indeed other sciences as well, to the point that the validity of experiments conducted in tightly controlled environments comes into question. Alternatively, understanding must begin with totality rather than subdivision – isolated, distinct parts. In other words, understanding begins with the whole, which is greater – unknowable strictly by – the sum of its parts.[48]

Robert Barron notes that the participatory nature of reality is also found elsewhere in the theological tradition, so quantum theology is not strictly unique in this regard.[49] Namely, participation is recognized by the greatest mystics throughout the millennia of recorded history. For example, John of the Cross truly understood the end of mysticism to be spousal union – the most intimate form of participation – with the Trinity.[50] Indeed, insofar as creation reveals its trinitarian Creator, as asserted by natural theology and based on Paul's rhetoric in Romans 1:18-20, creation's parts must be inextricably linked and interconnected in relationship. Further, that relationship must exist irrevocably since it is the eternal Godhead who creates and the Godhead who declares the creation good.[51] For anything to be good, it must exhibit the invisible

45 O'Murchu, *Quantum Theology*.
46 Aaronson, *Quantum Computing*.
47 O'Murchu, *Quantum Theology*, 33.
48 O'Murchu, *Quantum Theology*.
49 Barron, *Christ*.
50 John of the Cross, *Spritual Canticle, stanzas 22-24*; Barron, *Christ*.
51 Genesis 1:31.

qualities of the one good God, who is the indivisible ground of being itself. Quantum mechanics, then, is a way of understanding physical reality's participation in the metaphysical reality of the triune creator God's interconnected, relational, and eternal existence of love.

The essential end of any spirituality is to change minds – metanoia.[52] In the great Christian spiritual tradition, this is Christ's proclamation that "The time is fulfilled, and the kingdom of God is at hand; repent and believe in the gospel."[53] In a quantum theology, this change of mind is an invitation to recognize the divine energy "impregnating" creation and to participate sacramentally and ecclesiastically in God's relationship with all of creation.[54] Furthermore, it is the call to right personal relationships at every cosmic level of being: people with people; people with animals; people with the earth; and ultimately, people with God. It ought to be emphasized that the quantum view of spirituality elevates relationships within the created order that are often understated. Indeed, O'Murchu's view subverts the traditional view of humanity as the master of the created order. Instead, "Creation itself, and not we humans, is the primary narrator of the sacred story; we humans are invited to be the supreme listeners."[55] Insofar as quantum theology elevates the created order, it is not unlike primordial shamanism in its pursuit of the divine in the patterns and energy of nature. For better or worse, quantum theology's tendency to observe scientific phenomena and subsume them into contemporary metaphysics is a necessary precursor to observing any theological ramifications of QNLP. Without the changing of the mind to see that the underlying mathematics of language and physical processes reduce to quantum circuits – abstractions of quantum interactions – it would be difficult to make the case that the created order is spoken into existence. Yet, quantum theology invites its hearers to precisely that metanoia – the elevation of the mind.

2.4.2 Philosophy

Apart from quantum theology, there also exists a branch of quantum philosophy, which seeks to reinvigorate classical philosophy given the discoveries of quantum mechanics. Quantum philosophical thought, as with its theological counterpart, also begins with "togetherness," another word synonymous with participation, as Coecke aptly observes.[56] Branching out from the root of togetherness, Omnès seeks to harmonize quantum mechanics with the philosophical discipline to inspire further inquiry into the nature of reality and its interplay with the Logos.[57] Even from an atheistic worldview, there is still a metaphysical urge to reevaluate the way humanity has come to understand philosophy, religion, and the scientific disciplines in light of quantum mechanics. This urge often manifests itself in a search for what is universal, be it in grammar, a theory of everything, or the unifying structures of category theory.[58] It is also noteworthy that even in secular quantum philosophy, "realism is unassailable."[59] Abstract objects must exist in some real way because, even in the shadow of quantum mechanics, the observations, conclusions, and abstractions of common-sense perception will continue to hold true. It is these observations that constitute reality. Yet there is a wider and deeper reality available to the contemporary thinker who deigns to dive into the subatomic precisely because there is more to observe than meets the naked eye. There are still more abstractions to discover precisely because when there is more to see, there is more to infer and learn.

Indeed, observation is the lynchpin of science, and science is, therefore, the discipline that studies reality. The Logos is defined distinctly from reality in that it is the underlying rational principle through which all things operate; further, it is the epistemic reality through which all things ought to be interpreted. It is itself,

52 This word comes from the Greek word *μετανοια*, meaning beyond or over the mind. See Barron, *Now I See*.
53 Mark 1:15.
54 O'Murchu, *Quantum Theology*, 99.
55 Ibid., 211.
56 Coecke, "Theory of Everything," 1.
57 Omnès, *Quantum Philosophy*.
58 Wang-Máscianica et al., "Distilling Text;" Coecke, "Theory of Everything;" Coecke and Paquette, "Categories."
59 Omnès, *Quantum Philosophy*, 233.

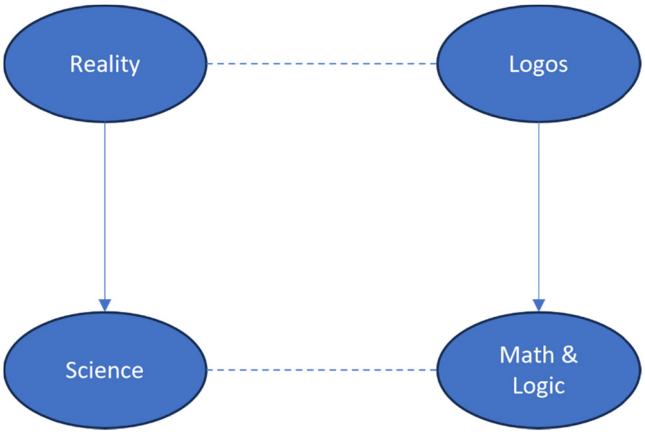

Figure 11: Reality and logos. Image is reconstructed based on Omnès, *Quantum Philosophy*, 268.

seemingly, abstract, and unobservable. It must, therefore, be within the realm of mathematics and logic. In quantum philosophy, the Logos exists in the abstract and permeates, or impregnates, reality. It is, thus, observable only insofar as its principles are embodied by a scientific object which is subject to some scientific discipline and study. Figure 11 provides a graphical depiction of this relationship.

2.4.2.1 The Epistemic Priority of Christ

The Christian mind holds that the Logos is Christ Himself.[60] There is nothing created, interpretable, or even knowable apart from the mind of Christ.[61] He, therefore, provides the epistemological basis for reality as described by Omnès in Figure 11. From the atheistic perspective, the Logos is fleeting. Like a leaf blown on the wind, it is difficult to grasp but, once seen, draws the gaze. The horizontal lines in Figure 8 demonstrate the parallelism between reality and the Logos, yet the lines are dashed because to the atheistic mind, the relationship is hazy and illy defined. Still, it is important to acknowledge that the search for order is not simply a theistic drive and that realism is not simply a theistic apologist position. There are real parallels between reality and the Logos that beg further investigation. One such parallel is the reducibility of speech to quantum circuits as implemented by contemporary QNLP methods.

3 The Observation of the Participation

With the preceding background laid as a foundation, it is time to participate in the scientific observation in three stages. First, a quantum circuit of a natural phenomenon is shown. Second, a couple of quantum circuits of grammar – linguistic phenomena – are also shown. The first circuit depicts the opening words of Genesis, and the second depicts the opening words of the Gospel of John. Sentences from both Genesis and John's Gospel are depicted because either one is ignored at peril. It is simply not fitting to ignore the creation or the Logos. Third, and finally, the physical phenomenon is juxtaposed and compared with the simpler linguistic phenomenon, which is that from John. The journey through the next series of images on the foundation laid above terminates in the scientific observation of the metaphysical participation of the creation of the natural world through word.

60 John 1:1-5.
61 Colossians 1:15-18; Barron, *Christ*.

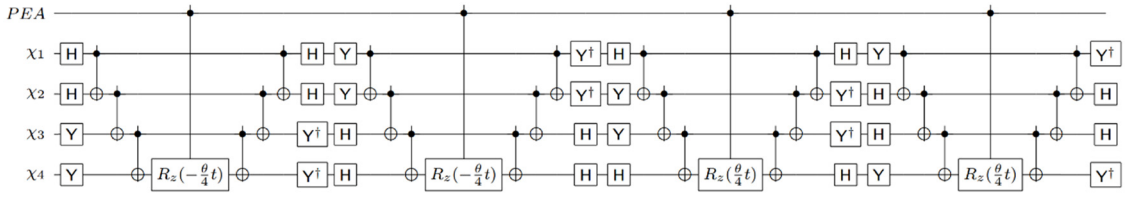

Figure 12: Quantum circuit for electron interaction. This image is taken from Whitfield, Biamonte, and Aspuru-Guzik's "Electronic structure Hamiltonians" and is presented with no formatting alterations to preserve the integrity of their original work.

3.1 Stage One: Quantum Simulation of Natural Phenomena

The most natural application of quantum circuits is, not surprisingly, in quantum simulation.[62] It is, also unsurprisingly, the area where the largest amount of scholarly research is being conducted as it is of great interest to companies that deal in chemicals, materials, heavy industry, and stock market finance. From that body of research, a single example has been chosen for illustration. There are numerous other examples that could have been selected and are equally appropriate. Figure 12 depicts a quantum circuit that represents a real, physical interaction between two electrons. The exact nature of the interaction is unimportant for the present discussion, but is elaborated in Whitfield, Biamonte, and Aspuru-Guzik.[63]

Before proceeding, a word should be offered about the contents of Figure 12. Quantum circuits are based on simple logic circuits, which use the traditional logic gates – AND, OR, XOR, and so on. Most horizontal lines – wires – represent a qubit, though some are used to represent a register of classical binary bits. This classical register is either the bottommost or topmost wire depending on one's preferred convention. The circuit is read from the left to the right with the state of the qubit being updated by passing through boxes as it goes. These boxes represent quantum gates, which are mathematical operations on unitary matrices. In short, this simply means that the boxes perform reversible – undoable – matrix operations on the qubits. They must be reversible because, in part, qubit states cannot be copied or cloned.[64] This works perfectly well because matrices are nothing more than large collections of numbers used to represent the state of an object or system with the different numbers representing different values for attributes. The specific meaning of each gate in the circuits is well beyond the scope of the present discussion. Inquiring minds ought to reference the Qiskit Textbook for a structured approach to learning the specifics of quantum circuits and their gates.[65]

3.2 Stage Two: Quantum Simulation of Grammar and Syntax

Having now seen an example quantum circuit depicting a natural phenomenon and discussed its basic structure, the abstraction known as a quantum circuit is now something readily identifiable on sight. Next, then, DisCoCat diagrams for sentences from the opening portions of Genesis and John will be used to generate quantum circuits from grammar. These too will become a feast for the eyes.

The first DisCoCat diagram is introduced in Figure 13. It depicts the sentence "God said, 'Let there be light'," which is found in Genesis 1:3. Any discussion of creation through speech would certainly be remiss for not considering this grand utterance. Figure 13 takes the same basic form as that of Figure 9, and the explanation for DisCoCat diagrams provided in Figure 9 is equally applicable for Figure 13. For now, recall that the remaining wire that is unassociated between types written beneath two distinct boxes must be an *s* type

62 Feynman, "Simulating Physics;" Aaronson, *Quantum Computing*.
63 Whitfield et al., "Electronic Structure Hamiltonians."
64 Coecke and Kissenger, *Picturing Quantum*.
65 Qiskit, *Textbook*.

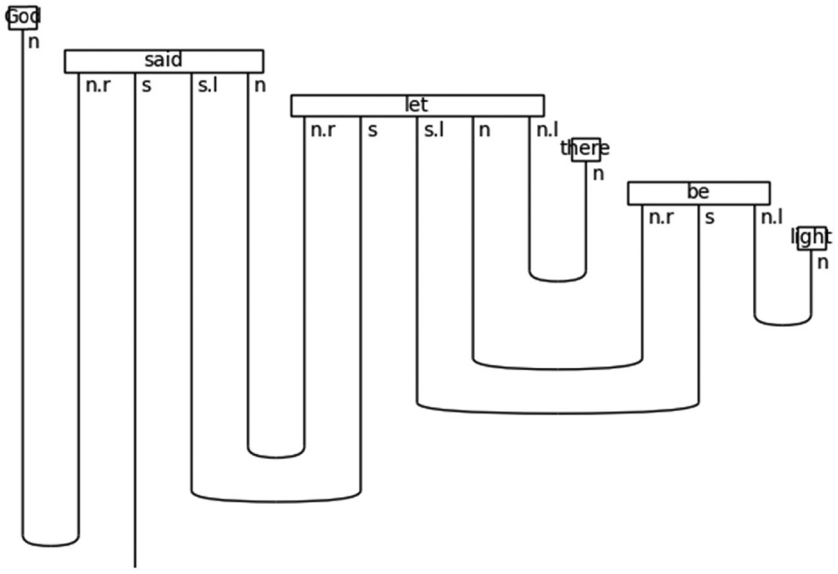

Figure 13: DisCoCat diagram for the sentence "God said, 'Let There Be Light'". This image is an original creation of the author using the python packages discopy and lambeq. For more information on these software tools, consult Toumi's and Kartsaklis et al. (2022; 2021).

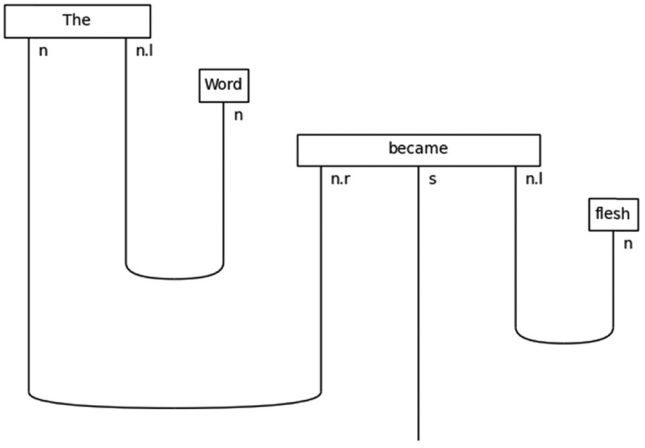

Figure 14: DisCoCat diagram for the sentence "The Word Became Flesh." This image too is an original creation of the author using discopy and lambeq. Again, for more information on these software tools, consult Toumi's, "Quantum Natural Language;" and Kartsaklis et al.'s, "Lambeq." It is also noteworthy that this diagram can be simplified in preprocessing to drop the article adjective "The." It is presented in this form so that the diagram maintains the exact structure of the biblical text.

for the sentence to be grammatical. Figure 13, therefore, represents a grammatical utterance that is fit for generating a quantum circuit.

Figure 14 is included as an additional example for two reasons. First, it is from the opening lines of John's Gospel, "The Word became flesh," which is the section that essentially functions as the creation account – the Genesis – of the New Testament.[66] These two accounts are, then, meant to be contemplated together with the John account explicitly describing the creation through the lens of the real embodiment of the Logos, which is pertinent relative to the prior discussion of quantum philosophy. Second, this sentence produces a simpler quantum circuit, which is more instructive in stage three of the observation.

66 (1:14)

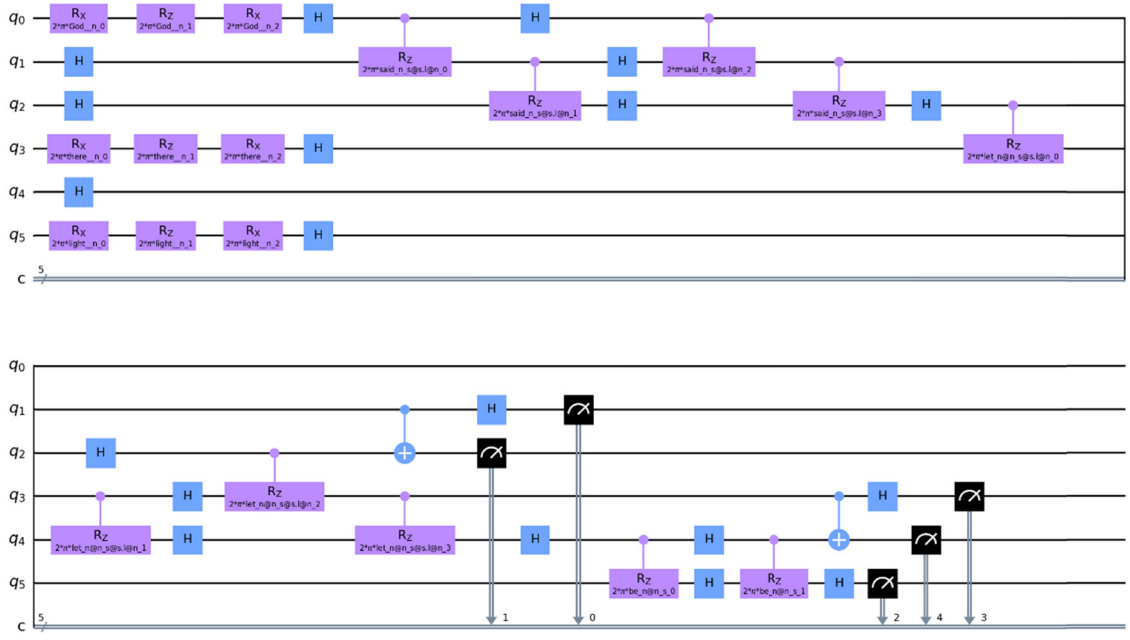

Figure 15: "Light" as a quantum circuit. This image is original to the author. The format presented here is that of Qiskit, which admittedly looks different from Figure 12; however, the differences are strictly limited to formatting conventions. In this representation, the classical bit register is the wire drawn across the bottom. Note also that the diagram is long enough that it is drawn across two rows.

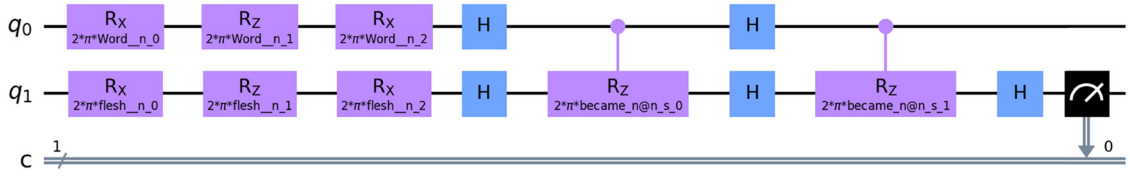

Figure 16: "The Word" as a quantum circuit. This image is original to the author. Because this sentence is radically simpler, it is better for juxtaposition in with Figure 12 in Figure 17.

Having introduced Figures 13 and 14, it is time to convert them into quantum circuits and examine them anew. Figures 15 and 16 are the quantum circuit forms of the DisCoCat diagrams found in Figures 13 and 14, respectively. Both Figures 15 and 16 are introduced and discussed as a pair.

Here, it is crucial to observe that while quantum circuits may have varying degrees of complexity – some require more qubits, so they grow taller vertically, and others require a greater gate depth so that they grow wider horizontally – some subset of the same mathematical building blocks are used in all quantum circuits regardless of complexity. Specifically, Figures 15 and 16 contain the familiar rotational gate, R, and the Hadamard gate, H, that first appeared in Figure 12.[67]

3.3 Stage Three: The Juxtaposition

What remains now is to juxtapose Figure 12 with Figure 16 to make a quick comparison of their content. Figure 17 shows the result.

67 Qiskit, *Textbook*.

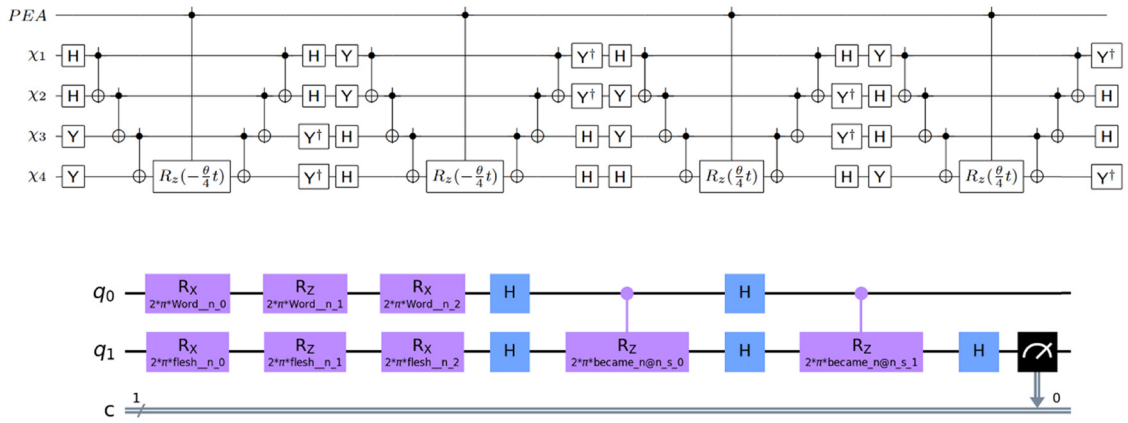

Figure 17: The juxtaposition of physical and grammatical phenomena.

Ignoring the formatting differences, which is strictly a difference in the technology used in Whitefield, Biamonte, and Aspuru-Guzik and the present work, the graphical, material resemblance is uncanny.[68] Now, the question remains: What is it about the juxtaposition of these two images that leads the metaphysically inclined mind to conjecture that the physical, ordered world is created by word? Certainly, both images are made up of lines and squares, and many of the squares have the same letters in them, but it is more than that. It is the line and the square as a depiction of abstract mathematical objects that inspire the connection of grammar to creation. Both grammar and creation share an abstraction – a metaphysical super-structure – like that of duality in Figure 10. Namely, that abstraction is *quantum-ness* or *quantum-native-ness* itself represented by the unifying abstractor of the quantum circuit. That speech – the Word – is both Logos and quantum should be no surprise given that which was spoken – reality and the cosmos itself – is quantum. Because of this quantum-native-ness, discoverable only through the scientific advancements of QNLP, creation through speech is observable – meaning visible – by the participation of the naked eye in graphical format for the first time with no divine revelation required.

4 Conclusion

From the outset, this work has endeavored to show primarily that QNLP has a unique theological and philosophical ramification in that it allows the concept of creation through speech in accordance with the Logos, divinely revealed in Genesis 1 and John 1, to be inferred – even observed and participated with – visibly from the discipline of quantum computing alone. No divine revelation is required. This is the principal contribution of this work. There is, however, a great deal of background and prior research required to substantiate this contribution.

It starts, in the strictly scientific sense, with the fact that the world is not classical. It is instead quantum mechanical, which brings with it a certain set of metaphysical claims as to the nature of reality and the fact that the very act of observation itself is a participation in the experiment. There are no longer subjects or objects, only participants. Further, since the world is quantum mechanical, the underlying mathematics of the universe are also quantum. This mathematics can be described in two camps: quantum mechanics itself – the nuts and bolts of matrix mathematics, Kronecker products, and other approaches – and category theory. The former leads to the development of quantum simulation and circuits and the latter to an abstraction fit for describing many disciplines and realities within a singular, higher-order mathematical abstraction. Category theory is itself strong enough to model the theistic universe insofar as it provides a framework for

68 Whitfield et al., “Electronic Structure Hamiltonians.”

mathematically representing symbols and rituals to instantiate them from the materials of heaven-stuff and earth-stuff. This is particularly appropriate for sacramental theologies but can represent any symbolic worldview so long as the structure of the cosmos in that worldview is sufficiently understood. An introduction to this potential avenue of research and an invitation to explore it is the secondary contribution of this work.

Given the quantum nature of creation, it remained to establish the quantum nature of language. This begins by establishing a mathematical system to model grammar, which firmly roots language in the reality of mathematics using types that represent something akin to matrices. The simplest choice for this is that of pregroups. Once this has been established it is a small step to add boxes, wires, and a few postulates to add structure and form DisCoCat diagrams. These diagrams, then, can be processed via software to create quantum circuits. With that development, it is now plainly visible that the natural world and grammar both share the abstraction of the quantum circuit.

Next theology and philosophy enter the picture. First, assuming natural theology – the idea that the natural world reveals the characteristics of the Creator – is a given. If the qualities of the Creator cannot be seen in the creation, any enterprise searching for truth through scientific means, or simply the senses in general is doomed to failure. Next, if the natural world reveals the qualities of the Creator, then abstraction is the process by which the qualities of the Creator may be ascertained. By examining the Augustinian proof for the existence of God, it becomes evident that a form of scholastic realism provides the best explanation for the existence of abstract objects – the outputs of the abstraction process – and their independence from created minds. There must be a supreme mind that holds these abstract objects in existence apart from the existence and experience of human consciousness. Whether that is the God of Christianity, another religion, or consciousness itself is immaterial for this portion of the argument. All that matters is that abstract objects have some kind of real existence.

A specific quantum theology begins to emerge at this point. Theoretical quantum physics demonstrates the interconnectedness of the world so that everything is a participant in the ongoing unfolding of reality. The implication here is that classical experimentation is quite limited in its explanatory power, and is, certainly, metaphysically useless when it comes to discerning the nature of the world since it neither accurately reflects the nature of the world nor its structure. Furthermore, classical experimentation creates the great sin of separation. Creation exists as a great orchestra of resounding unity, and any attempt to dissect it into its individual parts creates a skewed view of the world. Unity is where the world is seen as functioning in its true state, and in this unity is where understanding becomes possible. The forest can no longer be lost for the trees. The great mystics of all traditions were aware of this shamanic truth. Christian mystics are chief among these as contemplation of the eternal relationship of the Trinity has led them to the understanding that all of creation exists in relationship with itself, with the Creator, and with humanity. To be, whether abstract objects or material objects, is to be in a relationship. Because it is now wrestling with the quantum realm, science is now beginning to catch up to the Christian mystical tradition.

Finally, the inquisitive mind returns to the quantum circuits and takes a moment to contemplate a couple of examples: one representing a physical process, and another representing grammatical, human language. It is at this point that the Christian account of the Creator begins to be the most fitting, for the Christian God is one that exists in eternal relationship – perhaps eternal entanglement – and creates through the spoken word, that is the Word – the Logos. Any secular philosopher and any theologian alike seeks to understand the structure of reality and the underlying principle – the Logos – that makes it understandable. It is the very fact that the material order and the spoken order are really the same order that one observes – really participates in – in the quantum circuits with no divine revelation required. This is that principle. It is in this counterintuitive space, opened by viewing the outputs of a scientific experiment with a metaphysical mind, that the creation of the material and the creation of the grammatical as ascended into the same abstraction become interchangeable: "Were you there when I laid the foundation of grammar?".[69] It is in this space that the continued speech of God creates and holds all lovingly in being even now, where the dancing of our electrons and the beats of our hearts answer Him.

---

69 Entrustedtothedirt, "Wonder of Language;" Job 38:4.

Conflict of interest: Author states no conflict of interest.

References

Aaronson, Scott. *Quantum Computing Since Democritus*. Cambridge: Cambridge University Press, 2013.

Aquinas, T. *The Summa Theologica (Fathers of the English Dominican Province, Trans.)*. New York: Benziger Brothers, 1274/1911.

Augustine. *The Confessions of St. Augustine* (M. K. Minerd, Trans.). 397, Newark: Ascension Press, 2023.

Augustine. *On Free Choice of the Will*, translated by T. Williams, 387–391, Indianapolis: Hackett Publishing Company, 1993.

Barron, Robert. *And Now I See...: A Theology of Transformation*. New York: Crossroad Publishing Company, 1998.

Barron, Robert. *The Priority of Christ: Toward a postliberal Catholicism*. Ada: Baker Academic, 2007.

Cardinal, Kumi. "A Pregroup Analysis of Japanese Causatives." *Pacific Asia Conference on Language, Information and Computation* (2007), 96–104. https://aclanthology.org/Y07-1009.

Coecke, Bob, Giovanni de Felice, Konstantinos Meichanetzidis, and Alexis Toumi. "Foundations for Near-Term Quantum Natural Language Processing." *arXiv* (2020). doi: 10.48550/arXiv.2012.03755.

Coecke, Bob, Giovanni de Felice, Konstantinos Meichanetzidis, and Alexis Toumi. "How to Make Qubits Speak." *arXiv* (2021). doi: 10.48550/arXiv.2107.06776.

Coecke, Bob and Alex Kissinger. *Picturing Quantum Processes: A First Course in Quantum Theory and Diagrammatic Reasoning*. Cambridge: Cambridge University Press, 2017.

Coecke, Bob and Eric Oliver Paquette. "Categories for the Practising Physicist." *arXiv*. (2009, October 12). doi: 10.48550/arXiv.0905.3010.

Coecke, Bob. "From Quantum Foundations via Natural Language Meaning to a Theory of Everything." *arXiv* (2016). doi: 10.48550/arXiv.1602.07618.

Coecke, Bob. "The Mathematics of Text Structure." *arXiv* (2020). doi: 10.48550/ARXIV.1904.03478.

de Felice, Giovanni. "Categorical Tools for Natural Language Processing." *arXiv.* (2022, December 13). doi: 10.48550/arXiv.2212.06636.

Entrustedtothedirt. "The Image of God and the Wonder of Language." *Entrusted to the Dirt*. (2020, August 21). https://entrustedtothedirt.com/2020/08/21/the-image-of-god-and-the-wonder-of-language/.

Feser, Ed. *Five Proofs of the Existence of God*. San Francisco: Ignatius Press, 2017.

Feynman, Richard. "Simulating Physics with Computers." *International Journal of Theoretical Physics* 21 (1982), 467–488. https://web.archive.org/web/20190824203534/https://people.eecs.berkeley.edu/~christos/classics/Feynman.pdf.

Harris, Zellig S. "Distributional Structure." *WORD* 10:2–3 (1954), 146–162. doi: 10.1080/00437956.1954.11659520.

Hefford, James, Vincent Wang, and Matthew Wilson. "Categories of Semantic Concepts." *arXiv* (2020, August 5) doi: 10.48550/arXiv.2004.10741.

John of the Cross. *Spiritual Canticle*, translated by E. Allison Peers. Garden City: Doubleday Image Books, 1622/1975.

Kartsaklis, Dimitri, Ian Fan, Richie Yeung, Anna Pearson, Robin Lorenz, Alexis Toumi, Giovanni de Felice, Konstantinos Meichanetzidis, Stephen Clark, and Bob Coecke. "Lambeq: An Efficient High-Level Python Library for Quantum NLP." *ArXiv* (2021). https://arxiv.org/abs/2110.04236.

Lambek, Jim. "Type Grammar Revisited." *LACL '97: Selected Papers from the Second International Conference on Logical Aspects of Computational Linguistics*, 1–27. Springer-Verlag, 1997. doi: 10.5555/645666.665029a.

Lawvere, Francis William. "Unity and Identity of Opposites in Calculus and Physics." *Applied Categorical Structures* 4 (1996), 167–174.

Omnès, Roland. *Quantum Philosophy: Understanding and Interpreting Contemporary Science*. Princeton University Press, 2002.

O'Murchu, Diarmuid. *Quantum Theology: Spiritual Implications of the New Physics*. Crossroad Publishing Company, 2004.

Pageau, Matthieu. *The Language of Creation: Cosmic Symbolism in Genesis: A Commentary*. Scotts Valley, California, US: CreateSpace Independent Publishing Platform, 2018.

Paul II, John. *Man and Woman He Created Them: A Theology of the Body*, translated by Michael Waldstein, Boston: Pauline Books and Media, 2006.

Qiskit. *Qiskit Textbook*. 2021 Retrieved August 15, 2023, from https://qiskit.org/learn.

Toumi, Alexis. "Category Theory for Quantum Natural Language Processing." *arXiv* (2022). https://arxiv.org/abs/2212.06615.

van de Wetering, John. "ZX-Calculus for the Working Quantum Computer Scientist." *arXiv* (2020) doi: 10.48550/arXiv.2012.13966.

Wang-Máscianica, Vincent, Jonathon Liu, and Bob Coecke. "Distilling Text Into Circuits." *arXiv*. (2023, January 26). doi: 10.48550/arXiv.2301.10595.

Whitfield, James D., Jacob Biamonte, and Alán Aspuru-Guzik. "Simulation of Electronic Structure Hamiltonians using Quantum Computers." *Molecular Physics* 109:5 (2011), 735–750. doi: 10.1080/00268976.2011.552441.