Claiming Infinity: Tokens and spells in the foundations of the Moscow Mathematical School

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Abstract

The Moscow Mathematical School, led by Dmitri Egorov, made tremendous strides in the development of set theory in the period around the Russian Revolutions. The concepts of transfinite sets and absolute infinity have long had a controversial association with religion, namely in the explicit theological statements of the founder of set theory, Georg Cantor. However, several recent studies have argued that the Moscow School was instrumentally shaped by a sect called the "Name Worshippers". Here we examine more precisely what the Name Worshippers meant by naming, and how their semantics might have, and might have not, shaped the views of the Moscow School. This paper is a review and severe corrective of the book *Naming Infinity* by Loren Graham and Jean-Michel Kantor, yet we also have our own analysis. Examining the Name Worshippers' semantics as defined by themselves and their opponents argues for the greater theological influence being Cantor's. However some aspects of their beliefs indicate that they tended to treat names as tokens, objects of incantation and instantiation. Finally, we show how this fascinating chapter in the history of theology and mathematics contributes to realistic versions of what contemporary neurologically-based semantics calls "meaning externalism" and a science of essences.

Keywords: History of mathematics; Theology; Transfinite sets; Absolute infinity; Name Worshippers; Georg Cantor; Dmitri Egorov; Pavel Florensky; Nikolai Luzin

Аннотация

Московская философско-математическая школа, возглавляемая Д.Ф. Егоровым, в первой четверти XX века добилась огромных успехов в развитии теории множеств. Споры относительно взаимосвязи религии и концепции трансфинитных множеств и абсолютной бесконечности не угасают до сих пор, несмотря на явно богословские утверждения основателя теории множеств Георга Кантора. Более того, в нескольких недавних исследованиях утверждается, что взгляды Московской школы были существенным образом сформированы сектой имяславцев. В данной статье мы уточняем, что имяславцы имели в виду, говоря об именах, и могли ли их семантические теории повлиять на позиции Московской математической школы. Статья содержит обзор и серьезную критику книги "Именование бесконечности" (Л. Грэхэм, Ж.-М. Кантор), а также наш собственный анализ проблемы. Изучение семантических концепций имяславцев, определенных ими самими и их оппонентами, убеждает в том, что Кантор оказал на Московскую школу большее теологическое влияние, нежели имяславие. Помимо этого, некоторые аспекты их воззрений указывают на то, что они были склонны рассматривать имена как токены, заклинания и инстанцирование. Наконец, мы покажем, как эта значительная глава в истории теологии и математики поддерживает создание версий реализма, которые современная неврологическая семантика называет семантическим экстернализмом, и научного подхода к сущностям.

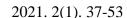# Claiming Infinity: Tokens and Spells in the Foundations of the Moscow Mathematical School

1.1 Introduction: Faithful Mathematics

The relationship between religion and mathematics is one of the most fantastic in the history of science – from the calculation of the movements of heavenly bodies – which were also gods – to the geometry of temples, the timing of sacrifices, the deification of 'one'. Since Laplace's famous (and apocryphal) answer to Napoleon's question about God ("I have no need to subscribe to such a hypothesis."), encounters between the present queen of the sciences and the former one have been far more furtive. Rather, what is surprising is that they happen at all.

Of all the sciences, mathematics carries with it some of the temple (see Wertheim, 1997). Gödel believed in a personal God and attempted to prove His existence, and many mathematicians continue to believe that numbers have a real, individual existence … somewhere, often to the chagrin of the philosophers.

One of the more significant trysts in this recent history came with the theological grounds for the birth of set theory. The classical, Aristotelian, definition of infinity as potential (if it is infinite, it must always encompass something more or other to itself) was contrasted in scholastic philosophy with actual infinity, which was identified as an attribute of God, simple and complete. Potential infinity was resolved by Georg Cantor (1845–1918) in the formulation of transfinite sets. As a realist, Cantor, held that all his transfinities were dependent upon an actual infinity. He appealed to the Catholic Church to confirm the orthodoxy of his doctrine and to be assured that the statement of 'multiple infinities' would not compromise the fundamental simplicity of divine nature. There seems to be no cynicism in this appeal, rather Cantor regarded the actual infinite to be *theoretically* essential and regarded engagement with Thomistic thinkers as important (Thomas-Bolduc, 2016; Tapp, 2014). Recent efforts to suggest that Cantor later rejected these approaches have not been supported by his letters and diaries. For many historians, there is something distasteful about such brilliant figures as Cantor, or Gödel, whose work has had such a great influence on science, relying on dusty proofs of God's existence – let alone that those proofs might have been essential to their progress.

The intellectual and religious confluence at the birth of the Moscow School of mathematics received a great deal of attention with the publication of *Naming Infinity* by the Harvard historian of science and Russian expert Loren Graham and the mathematician Jean-Michel Kantor at the Institut de Mathématique de Jussieu in Paris (Graham & Kantor, 2009). There modest questions and claims first posed by Russian scholars (Demidov, 1999; Ilarion, 2007a, 2007b) received geometric expansion. Unfortunately, Western reviewers have submitted these claims to neither Voltarian nor Torquemadan criticism. Just as Cantor's realism, *Naming Infinity's* claims are significant in the sense to which they relate to fundamental developments and have a bearing on the philosophy of language and on language as an algorithmic generator of signs. For the claims of *Naming Infinity* are not that, like ancient astronomy/astrology, maths can tell us something about the divine, or, like calculating calendars, they can help us fulfil religious

duties. The claims are that a religious sect, called the Name Worshippers,[1] dominated the founders of the Moscow School and that adherents of the sect believed they were creating God by naming him in prayerful incantations, some of which were carried out in a corner of the mathematics faculty chapel. Progress was made because Name Worshipping mathematicians believed that to name a set was not just to define it but to create it. Since the names had to do with the divine, naming absolute infinity was creating God.

I do not just intend to put the English reader right by the error of these claims and the false reading of Eastern theology which lies at their foundation, but to better define what the Moscow school hierophants were doing when they named sets – was it magic, setting semantic extensions, creating tokens, or some or all of these. Furthermore, what did the authorities of the Russian Orthodox Church think the Name Worshippers were doing? Can they tell us something about what the mathematicians' philosophy of denotation actually was in their condemnation of Name Worshipping? To this we will turn to a heuristic semiotic definition of a bare token to help us along. Finally, we will see how recent research in 'externalist' – which point to realist – notions of meaning can help explain a version of creativity that is both mathematical and theological. Despite the muddled and bloody history, heresy, and all too oft-encountered madness – there is still something divine about this debate – tokens jingling in the pockets of God.
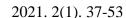
1.2 Truth-content and Rationality

Cantor's realism was avidly Platonic, or Plotinian: "Every extension of our insight into what is possible in creation leads necessarily to an extended cognition of God." (Thomas-Bolduc, 2016, p. 141) Naming sets is not a creation of them, but a definition of them. This bears comparison with the ancient notion of *apeiron* as that which was at once infinite and undefined. Realism allows one to find new things. Henri Lebesgue's (1927) statement that certain functions which cannot be analysed can be named does not conflict with this view unless you hold that what cannot be analysed cannot exist.

The most fruitful claim of *Naming Infinity* is that the members of what the authors call the "French Trio" – Émile Borel (1871–1956), Henri Lebesgue (1875–1941), and René Baire (1874–1932) – came to a certain impasse in their development of set theory precisely because they were beholden to a Cartesian, rationalist view of the world that sat ill at ease with multiple infinities (Graham & Kantor, 2009, pp. 60–63). Deifying Lebesgue's names allowed the Russian trio of Dmitri Egorov (1869–1931), Nikolai Luzin (1883–1950) and Fr. Pavel Florensky (1882–1937) to find errors in the French trio's work and move theory forward for the whole field.

The figures of both the French and Russian trios were emblematic of their extraordinary times. Borel was a local mayor, radical politician, and sometime Minister of the Navy. Florensky's fervid mysticism was matched by equally radical scientific breadth and intensity. The confluence of the two in his case led to a life of imprisonment and execution under the Stalinist régime. Cantor's prevarications with religion resemble those of Schoenberg, or Mahler. From Theosophy to Neo-Byzantine architecture, this was a time of inner and outer spiritual turmoil.

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[1] Though the Russian term *'Imiaslavtsy'* more correctly means 'Name Glorifiers', I will stick to previous convention and translate it as above. This preserves the contrast between 'worship' (Gk. *latreia*) and 'veneration' (*proskunēsis*) that was crucial in the anti-pantheism arguments of the iconoclast debate. 'Glorification' is the standard translation of *doxalogia* and when applied to the name of God is controversial to no one.

Naming Infinity begins with an especially dramatic eruption of this tension on the monastic republic of Athos in August 1913. Russian soldiers with rifles and water cannon stormed the St. Panteleimon Skete and demanded monks repudiate the confession of the "Name Worshippers". Some of those beaten, soaked and arrested continued to cry "*Imia Bozhie Sam Bog*" – "The Name of God is God Himself" – the central doctrine of the group condemned by the Patriarch in Constantinople and the Russian Synod earlier that year (Ilarion, 2007a, p. 545).
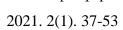
The Name Worshipping movement had three stages of development from roughly 1907 to the 1920s. In the first stage, the reception of the book of schemamonk Ilarion (1907/2018) (Domrachev, 1845–1916) *On the Mountains of the Caucasus* introduced the identity of the name of God with God. This was taken up by defenders of hesychasm of different stripes as well as intellectuals of a mystical bent, even the poet Osip Mandelstam later wrote a verse mentioning the Name Worshippers. The second stage begins with the categorical rejection of the sect by a judgement of the Holy Synod and their repression on Mt. Athos in 1913. Around this period the theological and philosophical apologetics of the movement were defined with an emphasis on naming being an act and referring to divine energies ([3] below). The final stage saw the conflict continue within and without the church as figures such as Florensky, Sergei Bulgakov (1871–1944), and Alexei Losev (1893–1988) expanded arguments to general ones regarding semantics, aesthetics and ontology in general. When the Church was to make a final decision on the issue between 1917 and 1918, the Revolution itself had transformed the Church from judge to co-defendant.

This episode was one of the last gasps in Russian philosophy before communism imposed Comtian naturalism and its unflinching service to progress and the party. From at least before Vladimir Soloviev's *Crisis in Western Philosophy* (1874), many Russian philosophers had regarded what he called "rationalism" and Florensky called 'positivism' as cardinal barriers to spiritual, moral, and even scientific, progress. While Soloviev (1989) put the blame on early Western mediaeval philosophy, (p. 3) Florensky faulted nominalism (Florensky, 1994a, p. 126).[2] In the first case, human reason is pitted in a Faustian bargain against traditional authority, in the second Platonic realism is pitted against an arbitrary (in the Saussurian sense) association of names and appearances. For Florensky nominalism and positivism were rejections of any coherence to reality. For him, in turn, the opposition to Name Worshipping was "a symptom of grave mental illness, close to that of neurasthenia or hysteria. It is a particular functional disorder of the nervous system" (Florensky, 1994b, p. 318). [3]

The Name Worshippers believed themselves to be an integral of the Church's tradition of constant prayer. The Jesus Prayer, which in its standard version reads: 'Lord Jesus Christ, son of God, have mercy on me,' is part of the Eastern Orthodox ascetic tradition devoted to the suppression of the bodily and spiritual passions and the cultivation of stillness, or quietness ('*hesychia*'). Under proper direction, faithful repetition of the Jesus Prayer, also called the Prayer of the Heart, promotes that stillness. With the help of the Holy Spirit, following the natural paths of divinely created reason that lead one to conquer the passions and cultivate the virtues, one is able to see what practitioners call

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[2] In this his views resemble those of John Milbank and the Radical Orthodoxy movement.

[3] Unless otherwise indicated, all translations from non-English sources by W. T.

the uncreated light, a great step along the way to salvation. Hesychasm, as articulated by Sts. Gregory of Palamas and Symeon the New Theologian, was accepted as Church doctrine in the 14th century by an ecumenical council.

In their account, Graham and Kantor conflate the hesychastic tradition as a whole with the Name Worshippers. This is possibly because *Naming Infinity* discusses theology only from the perspective of the movement itself and betrays no general knowledge of Orthodox theology. The Jesus Prayer and the practice of its repetition under appropriate spiritual direction is utterly uncontroversial (see Gillet, 1987; Ilarion, 2007a), though actual engagement of laypeople and monastics, even on Mt. Athos, with the Jesus Prayer has been rather inconsistent. The Name Worshipper movement came at a low point in a revival of hesychasm that had already begun toward the end of the 18th century. The Name Worshippers claimed to represent the *true* hesychastic tradition, but they were continually forced to shift and alter their original positions respective to it. In fact, it may well be that their final position ([3b]) would have been acceptable in some form had it been articulated as such from the start, so long as the name itself were regarded as part of creation.

The difference between the debates over the hesychastic tradition and those around Name Worshippers is that the former concentrate on the action of the prayer in the practitioner and the nature of revelation that results from it and the latter in the nature of the name itself.

Graham and Kantor maintain that

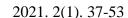[1] $[\![God]\!] \rightarrow God \wedge [\![God]\!] = God.$[4]

is the position of both the Name Worshippers and the Cantor school. Uttering names was not an act of definition of already undefined entities, it was an act of creation *ex nihilo*. That the left-hand part of the formula generates the right-hand part. This is a dramatic claim put in prevaricating language:

> Georg Cantor suggested these new infinities and made them seem real by assigning them different names. For some people the very act of naming these infinities seemed to create them. And here the Russian Name Worshippers had their opening: they believed they made God real by worshipping his name, and the mathematicians among them thought they made infinities real by similarly centering on their names (Graham & Kantor, 2009, p. 96).

As V. N. Katasonov (2009) says in one of the few critical reviews of *Naming Infinity*, "this sounds a rather vulgar assertion" (p. 137). The book's subtitle is: "a true story of religion, mysticism, and mathematical creativity". For them, mysticism names things and creates them. This analogy gets repeated very often in the book, along with a great deal of emphasis put on mundane acts of naming.[5] Katasonov justly asserts that the

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[4] Here I use the semantic notation in Rabern (2017), where double brackets refer to that which is to be denoted; in most cases this means "the word itself". So [1] means: "God" denotes the semantic extension of "God", and "God" and that extension are an identity. As Nizhnikov (2011) argues, Florensky (1994b) would not accept this type of notation for identities, though he does use proper subsets for his ontological arguments. As we shall see, the movement from identity to presence to inherence with shared properties is part of the development of the Name Worshippers' semiotics.
[5] For example, when Arnaud Denjoy proposed that Luzin be the godfather of his son, Luzin suggested a name (Graham & Kantor, 2009, p. 99). This is noted portentously, despite the fact that nearly all Christians are given a new name at baptism. Furthermore, name-giving is part of monastic practise. When figures such as Losev were secretly tonsured during repression of the Church, receiving a new name was one few, then secret, emblems of monasticism they could preserve.

Name Worshippers never associated acts of naming with creation. The analogy is false. Furthermore, it is clear Cantor and members of the Moscow School were realists – they believed the mathematical objects they described were real entities. If they believed their infinities were real entities rather than a nominal ones, it is unlikely they thought they did not exist before mathematicians created them.

The literary source of the Name Worshippers, *On the Mountains of the Caucasus* can also be seen as a source of divergence from hesychastic doctrine. Its statement "*V imeni Bozhiem prisutstvuet Sam Bog – vsem Svoim Suschestvom i (vsemi) Svoimi beskonechnymi svoistvami*" (Ilarion (Domrachev), 1907/2018, p. 210) "God Himself is present in the name of God – all of His essence and all of His eternal attributes."– thus

[3] ⟦God⟧ → God ^ ⟦God⟧ ⊃ God

To give an idea of the naiveté of this argument, we are required to use the proper superset symbol to express the relationship of the name to God because ⟦God⟧ has the letters ⟦G⟧, ⟦o⟧, ⟦d⟧, and anything else proper to the name (script, font size, sonogram, intonation) which means that there are more tokens comprising the name of God than God Himself. Though *On the Mountains of the Caucasus* is regarded by all parties as representing the Name Worshippers, its more sophisticated followers did not claim that the essence was identical to the name, i.e., God = ⟦God⟧. They also, as we shall see, did their best to refine what "is present" means in the above statement to avoid outright heresy and absurdity.

Our concept of semantics has gone through so many centuries of nominalism that the realism of figures such as Florensky adheres to seems to us intensely radical. He rejects any distinction between signs and appearances. Peter's shadow is not Peter, he writes, but it is no figment of the mind. It is a manifestation (*yavlenie*) of Peter, it bears some the power of the original, as St. Peter was able to heal those on whom his shadow fell (Florensky, 1994b, pp. 314–315). Florensky's realism means signs partake in the ontology of their referents. The act of naming can, then, be a creative act of invocation. Magical, and thus heretical, aspects of naming were not absent from Pavel Florensky's thought.[6] In magic, invoking a name, as a spell, can manifest its referent. [1] itself can make utterances and repetitions of the name theurgic. What Graham and Kantor claim is that it is not only theurgic, but *theopoetic*, that the Name Worshippers believed they were *creating* God. This calls to mind the hermetic tradition where magic spells and rituals create and bind the god to the hierophant or to a sacred image. Indeed it would follow that if the tokens of a name (letters, sonograms, scraps of paper on which it is written) are greater than the referent itself (as in Ilarion's [2b]), those who know the name have power over its referent.

Naming Infinity's own description of the rather conventional religious lives of Egorov and Luzin, with bible readings and icons, belies such Faustian insufflation. As Katasonov (2009) writes, Graham and Kantor declare their rationalistic views "with great pageantry" (p. 140). It is bible reading and icons that are vulgar to the contemporary intellectual. Surely Cantor could not *really* believe his sets of absolute infinity had a content. Such clearly brilliant men and women could not actually believe they were

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[6] This is especially the case in his early works, his interest in semiotics, and his magnum opus *The Pillar and Ground of Truth* (1914). Later, perhaps under the influence of priestly life and the tutelage of Elder Isidore, Fr. Florensky moved toward more orthodox positions.

describing external reality. Like much in the history of science, let the fairytale be the nursemaid to the truth. Troublingly for the authors, the ground set by theology did indeed yield creative results. The discoveries of set theory loudly attest to the strange nature of creativity itself, which in this case clearly means venturing into the deep and unknown, much like the extended uses of set theory in tropology, game theory, and artificial intelligence.

Just like most mathematicians, these figures believed the what they professed were reflections of reality. We might need to make room for a little less Comtian pageantry.

2. THE NAME WORSHIPPERS' SEMANTICS

The formal semantics of the Name Worshippers has not received due attention.[7] Let us state their identities in simple semantic notation:

[1] ⟦God⟧ → God ^ ⟦God⟧ = God.

  [2(a)] ⟦God⟧ → God ^ ⟦God⟧ ⇔ God.[8]

  [2(b)] ⟦God⟧ → God ^ ⟦God⟧ ⊃ God

  [3(a)] ⟦God⟧ → God ^ ⟦God⟧ = God's divine energies.

  [3(b)] ⟦God⟧ → God ^ ⟦God⟧ ⊂ God's divine energies

[4] ⟦God⟧ → God ^ ⟦God⟧ = a human-created convention.

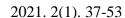 [5] ⟦God⟧ → God ^ ⟦God⟧ = a human convention made with a God-created and   inspired mind.

  [6] ⟦God⟧ → God ^ ⟦God⟧ ∪ [divine energies] by means of [5].

The slogan's status required that all hold [1], but the intellectual Name Worshippers rejected [2] and asserted that [1] actually meant only [3]. Florensky and Losev went on to argue that the semantics of [1] meant [3a] which meant [3b]. Florensky considered this to be the part of an ontological process which was the way all semantics worked in a movement of essence through energy. However, it is clear that Florensky's ontology considers [3b] to mean that the name as a sign bears the presence of its referent. In the system of late Name Worshippers, [3b] would not accommodate [6] as the signs are a full part of creation. The opponents to the Name Worshippers held [4], while [5] is the traditional view of the Church Fathers regarding names in general, and [6] is an adaptation of [5] which applies more properly to their view of the names of God. [6] means that God can imbue divine names, like any aspect of creation, with divine energy, but the name is not energy (no version of [3a] is correct), nor is energy the name. The semiotics behind ⟦God⟧ are not different from that of any other name. [4] allows for the operation of prayer to work, just as a message should work when sent to the addressee, and no differently. [3], [5], and [6] all allow for the operation of prayer based on a special property of names, and/or divine names in particular. Put differently, all but [4] have something about the second part of the formula that affects the way the first, the denotation ⟦God⟧ → God, operates. To be clear within the context of these arguments: [1–3] need not be in contradiction, [4–6] are not in contradiction. However, many would consider [4] not to represent the reverence given to the names of God by the faithful of any tradition. [4] was

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[7] A Russian survey of Name Worshippers and philosophy is worth mention: Nizhnikov (2011).

[8] I.e., ⟦God⟧ = God ^ God = ⟦God⟧. Both domains are co-extensional.

the statement of the synod in 1913 and was taken by many to be an extreme and politically-motivated position. [4] served more to vitrify differences than to resolve them.

Graham and Kantor's view can be accommodated by both [1] and [3], though they only mention [1]. Perhaps as a model for their understanding of it, they describe the priestly magic of Pythagoras and ancient Egypt (Graham & Kantor, 2009, pp. 21–22), but they do not understand the significance of denotation for Orthodox theology. They presume that the condemnation of Name Worshipping as 'pantheism' was mistaking that term for 'polytheism' (Graham & Kantor, 2009, p. 15). Rather it was part of the argument that that [1] means each synonym and instance of God's name must have a different extension. Thus ⟦God⟧, ⟦Jesus⟧, ⟦All-Mighty⟧, ⟦Yahweh⟧ would all be different gods. This is polytheism, but that is not the point.[9] We see different instances of signifiers, tokens, as we shall call them, but creating an identity means that the extension shares the nature of the referent. Since words are objects in the world, part of creation, [1] implies that God is a created thing. When God is taken to be part of creation the Church calls this pantheism, the charge levelled against Spinoza's monism. Since a name is an obviously identifiable element of creation, followers of [1–2] are pantheists.

The defenders of Name Worshipping did everything in their power to refute the charge of pantheism and emanationism, and [3] is their most concerted response with [3b] coming closest to traditional orthodoxy. Divine energies helped them account for the operation of repeating the Jesus Prayer. Furthermore, the activity of divine energies and their relationship to essence is an important part of the theology of St. Gregory Palamas, and so provides links to the hesychastic tradition. Yet, the debates of the 14th century surrounded the nature of the experience of the divine and not the essence of names. In fact, if names are created things, [3a] can also mean that the divine energies are created. That, the Name Worshippers' critics noted, is exactly the position of Barlaam of Calabria, St. Gregory's opponent. Barlaamism was a heresy both sides hurled at one another (Ilarion, 2007a, pp. 424, 521–22).

The most important discussion of names in Orthodox theology came in the late 4th century Eunomian debate. Two lengthy treatises by the Cappadocian theologians St. Basil the Great and St. Gregory of Nyssa involved refuting the claim that a name accounts for the full extension of its referent. These complicated arguments have received two excellent studies (Radde-Gallwitz, 2009; DelCogliano, 2010) worthy of examination by historians of linguistics. If we put the jist of these arguments in Classical terms, the Church takes Hermogenes' position in Plato's dialogue *Cratylus*: names are conventions made by men. But, of course, Socrates' solution to the issue was that God, the nomothete, gave good names that suited the referents. In the arguments against Eunomius, this gets a significant twist. Man created signifiers (as Adam named the animals in the Garden of Eden), but he did a good job of it because his rational capacity was created by God, made in the image of God. The Stoic and Aristotelian-influenced arguments, synthesized with biblical anthropology and the incarnational understanding of human nature, all make for a reading of the name quite a bit meatier than that of Plato. For it examines naming not just as something to do with words, but as a human faculty enabled by the divine. Gregory discusses at length the purposes of the human faculty of invention (*epinoia*), making

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[9] Furthermore, Fr. Antony (Bulatovich), speaking for the Name Worshippers, flatly rejects this claim and regards all names for God as the same (see Ilarion, 2007a, p. 607). The practice of the Name Worshippers only included references to ⟦Jesus⟧ and ⟦God⟧.

name-giving something akin to what many would call a 'technology', like medicine, boat-building, or statecraft.[10] [4] represents the statements of Arbp. Antony (Kharpovitsky), and the more Hermogenean position (Ilarion, 2007a, p. 486). ⟦Jesus⟧ → Son of Sirach, ⟦Jesus⟧ → the Greek name for Joshua the son of Nun, ⟦Jesus⟧ → the Son of God are all the same denotative operation. It is the referents of each iteration which are different. Bulgakov in his defence of Name Worshipping declared this the height of "rationalism" (Ilarion, 2007a, p. 542). [4] is clearly rejected by the Name Worshippers, and I have yet to see any particular versions of [5] or [6]. For them the name of God was prior to all human naming.
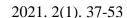
Indeed, the lack of concern over the intention behind the utterance, its context or medium, suggests the central place of the name matters much more than the worshipful habitus that enfolds it. Florensky and Losev's later work on names suggests as much. And this is indeed part of what troubled theologians. A repetition is that many more instances, that many more names, their invocation has a power of itself. All this smacked of magic, Kabbalism, and the theurgy of Iambilichus or Giordano Bruno.

Another concern for theologians are the rather unique and selective readings given to the great deal of patristic theology devoted to the symbol. The Greek notion of the symbol (*syn-bole*) as a sign with content allows for a doctrine where the bread and wine of the liturgy are both symbols of the Body and Blood of Christ, and also are identical with it; where the Creed is called the 'Symbol of Faith', though it is at once a *statement* of faith. Similarly, icons are equivalent to the Gospel as the Word of God, and the Word of God is an icon.[11] The theology of the symbol is richly intertwined with the all-important theology of the incarnation as the symbol is, in part, a product of *epinoia*. It is, indeed, the incarnational aspect of the Name Worshippers' thought that is sorely lacking. In the eyes of contemporary Orthodox theology, at least as this author views it, the incarnation is a resolution of the fundamental question as to how God interacts with the world, as well as how essences and appearances are related. For Florensky, Bulgakov, and Losev, the formulation of their opposition to Western positivism – be it in semiotics or Sophiology – has resulted in giving inordinate power to signs over the person of the Incarnate God. While a full semiotics of Name Worshipping must await its own study, we shall see what the above results might tell us about the founders of the Moscow School.

Among the list of heresies liberally applied to Name Worshippers was 'Platonism'. The implication of [3] is that creation issues forth from God as part of His essence. This is more precisely defined as emanationism which is a subtype of pantheism. The Orthodox hesychastic theologians are not pantheists because the God's energies, or activities, are, firstly, not created things and, secondly, distinct from God's essence. This was part of middle and later Name Worshippers' arguments supporting [3]. However, Florensky, Losev, and the rest of the Moscow School had a great enthusiasm for Plotinus, (see Graham & Kantor, 2009, pp. 93–94). An emanentist understanding of [3] would mean that naming and uttering the names of God was fundamentally different from that of [5] and [6]. Platonism and Florensky's ontology of signs tend to lead toward emanentism.

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[10] See Gregory of Nyssa, *Contra Eunomium* 2.1.182-184 (*PG*).
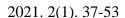[11] See St. John of Damascus (2003), first treatise.

As a strange and interesting 1907 article by Florensky on infinity suggests, Cantor's power to grant descriptions of the indescribable was sufficient ground for theological speculation on its own (Florensky, 1994a, p. 79–145), though Florensky's direct contributions to set theory itself were minimal. Florensky gave Cantorian infinities philosophical and theological weight and introduced them to a more general readership (Troitsky, 1997, p. 538), the cause was then taken up by Losev. In a comment on pseudo-Dionysus the Areopagite's text *On the Divine Names*, (c. 6th century), Losev wrote that apophatic theology of names alone was

> ...completely impossible. This is not only agnosticism, but *atheism*. It is the rejection of revelation, of theophany, not to speak of the Church, sacraments and prayer. Thus it is necessary that this supra-essential abyss, in some sense *existed*. That *it is* means that it has a boundary, a position [*stanovlenie*]. The mathematicians have a good understanding of this – the differential, integral – this position takes place in the depths of essences [*v nedrakh suschnosti*], without passing into some other form of being. (Losev, 1997, p. 75, emphasis in original)

Human freedom and the divine were only accessible when they had a name. The ability of advanced calculus to supply names to functions that could not be completely described provided an answer to determinism, apophaticism, and agnosticism. Not only was Name Worshipping cataphatic, it was *mathematical* – the most rigorous type of thinking there is. Losev planned to give a full account of the science of Name Worshipping in an elaboration of his project. His repression and imprisonment in the GULAG redirected his interests for the rest of his very long and productive life.

The semantics of the mathematical Name Worshippers seem then to regard the right side of the equation in [1] to comprise the unbound and unlimited properties of functions, especially those of mathematical theory – plots of imaginary and rational numbers on a graph, for instance. The left-hand side, the name, is not an arbitrary signifier, but an manifestation of the right-hand side, a shadow that carries some of the power and operation of its referent. Mathematics, and science in general, define names and their referents in a dialectical fashion with one adjusting the other. At the source of the dialectic, the *causus primus*, is a predicate by nature impossible to define and a subject fixed as the name of God. Where as German and French mathematicians were willing at different levels to engage with this equation, the ontological lustre across the boundary between signifier and signified seems to be a Russian innovation expressed by, or prompted by, Florensky's ontology. A useful avenue for further research would be to see whether this non-arbitrary understanding of names influenced the development of description set theory and its further contribution to topology. There names greatly proliferated and expanded into network and communication theory. These were uniquely Russian/Soviet contributions.

Thus though most of what Name Worshipping takes from mathematics comes from Cantor's absolute infinities, the understanding of a name as something non-arbitrary, bearing some of the power of its referent, would have been ascribed to by both Egorov and Luzin as fervent admirers of Florensky's philosophy (see Graham and Cantor, 2009, p. 83). A name that has its own power is a magic one and this aspect of the Name Worshippers' semantics requires more than a historical approach.
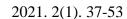
3. TOKEN AND INVOCATION

An appendix to *Naming Infinity* reproduces some interesting remarks from Luzin's notebook, along with illuminating comments. On several occasions, Luzin prefers to use the French verb *'nommer'* rather than the Russian '*imenovat'*'. He seems to prefer to keep Lebesgue's concept of naming as delimiting the unanalyzable separate from the connotations of the Russian. Mapping the French and Russian terms related to the semantic fields of MARK/SIGN/WORD and MEANING would clearly indicate why Lebesgue and Luzin and would prefer *nom* over many other comparable terms. The name as that which can be applied to a individual over a class, as it is in both Russian and French, is certainly a far more convincing reason than any Adamic power of naming. In sympathy with this inadequacy, I would like to stir the cauldron with an English term that has no French or Russian equivalent: 'token'. The Russian word '*znak*' – 'sign/mark' – has as its abstract form '*znachenie'* which means 'meaning, intention'. Other derivatives are much closer to 'significance' or 'value'. A token in corpus linguistics is translated by the term '*sluchai*', instance. However not all instances are tokens. Here we will define a token as: 'a heuristically-delimited entity that can call forth a possible referent, including an indistinguishable instance of itself'. The only thing controversial about such a definition is that it does not seem to be particularly indicative, but it will serve our purposes here.

Note that this definition is also included in other tokens: locks of hair, evidence from the scene of a crime, private currency, all meanings given for the term in the *Oxford English Dictionary*. Nor does it require that a token be an instance of a type. In fact, as we will see, the lack of referential understanding of tokens means that it can replace other signs when its referent is mysterious. For example, we may identify a particular instance of a sign as a sign without understanding what about it makes it a sign, like the secretary inside Searle's Chinese Room. A mark in an undeciphered script on a tablet may itself be a sign, but we, as Wittgenstein shows, may not be able to identify what it is about the object that is a sign. Perhaps the colour of the tablet, the material of which it is made is part of the sign. If we have successfully identified the object as bearing a sign (and that itself may not be determinable), then we certainly know that some part of that object must be a token, though we may only have a general impression of what that is before we have determined the type.

Thus the tablet with the unknown token can be taken to someone who can decipher it. They say it means "God". You may believe it was the markings on the tablet and not know it was also the colour and the type of clay which were the decipherable marks. The fact that the token can exist independent of the type makes it similar to names, or signifiers, with signified entities that are unknown. Note also that a token is still different from a name: "Socrates!" screamed three times by his wife, "Socrates" written on a tablet, and a sonogram of the utterance of his name are together five tokens.

To isolate the technical nature of naming and granting tokens, I am going to employ a simple, primitive example of an electronic lock and key as a form of denotation and recognition. The economics of server space dictate that a cypher is to be difficult enough so that the effort it would take to crack the code, the security threshold, would be greater than that to obtain it legitimately. In the traditional terminology: Alice holds a key and Bob holds the locks. In a symmetric key system, the form of Alice and Bob's codes are identical except for the fact that Bob's is connected to a command that provides entry.
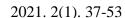
Alice's key and Bob's lock could be exchanged and there would be no telling the difference. Two things aid security: the number of keys and the complexity of a single key. In an asymmetric system, Bob has an algorithm which allows him to decipher the key and match it to his lock. This permits issuing many fewer keys ('public keys') with much less security while Bob keeps private keys that process the public keys to open the lock. The layer of encryption aids security while the reduced number of keys aids efficiency. The cost of complexity is either born by Alice (recall the 30 or 40 character-long software licence keys of a decade or so ago), or is inherent to the algorithm itself. In a symmetric key system, Alice's keys can have only one form and that form must also be represented by Bob's locks. In an asymmetrical system, Alice's keys contain cyphers that have to be processed by Bob.

Now we apply this simple communication model to a simple model of computational cognition where Alice sends a key and Bob cognizes it. A key passed in a symmetrical system is only cognized because it is doubled in the cognizer. The characteristics of the key are not dependent upon those of the lock in any sense other than identity. The symmetrical key is a name with no difference between its private language and non-private one, in any cognitive sense it *means* nothing. In the asymmetrical model, both the key and the process of cognition are important for decryption and, thus, cognition. The decryption algorithm determines the characteristics of the key. Without having the process of encryption apparent (and in advanced encryption systems it is mathematically impossible for a private key to be derived by the private one), we have a cognitive model that accounts for token and type, or of particulars (in Aristotle's system primary substances – 'Socrates') and universals (secondary substances – 'a man'). As in *Cratylus*, names are well-formed because someone who "knows the nature of things" has determined them.

Note that instances of both types of keys are tokens. Only one is needed to open the lock, no more. The asymmetrical one however, can refer to a generalised entity even if the algorithm is merely based on relations between elements of the key. The symmetrical key system has two tokens – lock and key – identical with no other form of reference.

The symmetric key heuristically calls forth its referent even if that referent is nothing other than the token itself. These systems are particular and non-analysable. It is in this sense that the token – a bare token – permits us to have a form of signification without typification. The software key can be off by a single letter, the name for 'harpoon' misspelled in the only known glossary of an extinct language, "aba*bra*cada" instead of "abacadabra" and the token will not refer to type even if there is one. Suchness and non-arbitrariness of tokens is what associates them with spells, curses, and incantations (see Flahault, 2010).

This is clearly what the Name Worshippers and, in part, Graham and Kantor are pointing to in their formulation of the creative power of names. There was a great deal of creative symbolism within the Russian school, beyond Florensky. *Naming Infinity* relates the story of Alexander Yessenin-Volpin, who answered the question as to whether he believed each sequential power of 2 was real by answering 'yes' just slightly later for the subsequent power than for the previous (Graham & Kantor, 2009, p. 23). Symbols for paradoxes could be rhythmic, choreographic, ritualized, satirized. It is possible that the services practiced by Name Worshippers in the faculty of mathematics were indeed incantations meant to create an "instantiation of the energies of God" as proponents of

the name givers were said to have done. In this case, the Jesus Prayer under the semantics of [3b] was indeed a spell meant to make the spirit incarnate in the hearts of believers. The incantation of the name in, according to Graham and Kantor (2009), the basement of the Moscow University Chapel (p. 3) would be a ceremony iterating tokens of God that call down the fundamental reality of the absolute infinite set upon the Moscow collective. *Naming Infinity* movingly describes the repression, pain, hunger, and privation of the Moscow School between the Revolutions – Egorov sharing his food rations and students rubbing the frostbite on one another's faces during lectures. Perhaps the Name Worshipping cult instilled a brotherhood and sisterhood, a set of common aims, foundations, and courage in collective spirit.

The Name Worshippers would have taken the name of God as an identity and an elaboration of [1–2] that is a manifest reality articulable but with a referent inherently and supremely beyond analysis. This required believing in the ontological status of a fixed sign on the left side of an equation that had the characteristics of our bare token because the ontological status of what was on the right side of the equation was by its nature indeterminable. This fascination with advanced calculus and number theory alluded to by Losev suggests that the very fixedness of that on the left side was necessitated by the very interminability of that on the right. A reasonable question is whether the necessity holds as much for their theory of free will as it does about statements of the absolute infinite.
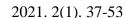
4. NAMING CREATIVITY – EXTERNALISM AND ABSOLUTES

It deserves note that Cantor's statement: "Every extension of our insight into what is possible in creation leads necessarily to an extended cognition of God." more clearly resembles the synergetic description of human signs as a kind of inspired collaboration with the divine in [5] than it does the Name Worshippers in [1–3].

In parts, Losev and Florensky mentioned the synergetic element in the power of the name being matched with human striving (see Florensky, 1994b, pp. 358–359), but the Platonic power of the name itself often seems to overwhelm both God and humankind. Some of Losev's description of hesychasm read more like the theosophy of yoga than St. Gregory of Palamas.

This is a result the more philosophical of Name Worshippers did not intend. Florensky forcefully believed that set theory offered a means of introducing freedom into mathematics. And absolute infinity offered freedom from potential infinity, whose elements he compared to insatiable denizens of Buddhist hell (Florensky, 1994a, p. 82). Such are the aporias that are so common to Florensky's philosophy. A name for the infinite provides a semantic extension of it, but that extension binds it to a token and turns prayer into magic. The liberation of human will from the confines of deterministic rationality, or Neutonian positivism, as some of the Name Worshippers liked to put it, traps the human into a new type of rationality. As Lorraine Daston has shown, technology has aided humans in creating a form of algorithmic rationality that humans now regard as more essential than their own (Erickson et al., 2013). As we have seen, it is the technology of encryption which can give us a model for the type of tokens used to name the unnameable.

In a famous legend related by Iambilichus, when the mathematician Hippasus discovered the existence of irrational numbers, his rivals of the school of Pythagoras took

him out on a boat to sea and drowned him (Doxiadēs & Mazur, 2017, pp. 1–2). The waves of the inchoate deep were a suitable place for the father of irrationality. Little is known about Hippasus, but it was also said that, in contrast to Pythagoras, he and the members of his school were much less prone to creative innovation in the formulation of theorema and more inclined to rote instruction of fixed rules. It is in some sense a Faustian bargain. Those who sought to define the formless, the limitless, that which evaded all boundaries (the *apeiron*) became bound to the names they had given them, by tokens that could not be checked against their types. Those who argued complex differential calculus would account for free will became subject to the calculus of encryption systems.

A surprising contribution to creativity and mathematics comes in contemporary, cognitive science-based conceptions of meaning. Knowing the mind's "trillion handshakes" of neural connections, everything we can conceive should be able to fit between our ears without any external metaphysics. Creativity comes merely in neural recombination and progress in the acquisition of recombinations by self and others. But could it be possible that some meanings are actually external to the brain? This is the argument by so-called 'meaning' or 'vehicle externalists' who, though not necessarily realists, hold that merely mental representations are not enough. Though most arguments follow Putnam and Davidson's arguments about intention and causality, an excellent contribution to this position has come recently in the proposition of 'extended mathematical cognition' by Vold and Schlimm (2020).

They argue that "there are cases in mathematics where external symbols have content that is not derived either from conventional associations or from the representational states of a cognitive agent" (Vold & Schlimm, 2020, p. 18). We can prove this because mathematicians sometimes themselves do not know what the content is of the symbols they coin. For example, Giovanni Saccheri (1667–1733) attempted to demonstrate the Euclidian parallel postulate by disproving the contrary. Instead, he began to demonstrate that these contraries had unexpected content, content whose features began to be expanded by figures such as Gauss, Lobachevsky, and Bolyai. Finally, Beltrami, Klein, and Poincaré showed the relationship of non-Euclidean objects to Euclidian ones and, by the end of the 19th century, non-Euclidean geometry was normal science (Vold and Schlimm, 2020, p. 15–16). Similar examples could be taken from the mathematical subdisciplines we have been discussing – Reimann space, Lagrange's theorem, for example. Is this not the very nature of creativity itself – a search along a path with aims that often lead to uncharted destinations?[12]

Reading Vold and Schlimm's multiple sources with their Berkeleyian neuro-centrism one is struck by the poverty of the materials in comparison with omniverous Cantor, the Russian Trio, or Losev. The only way to get out of your own head is to find some predicate, any predicate, that might not have already been there in the first place. The list is short. Their aims are, apparently, very different from those of these thinkers. They are not trying to prove that the external nature of 'cognitive representation' is real, nor are they trying to prove it is infinity, or an absolute infinity as the ground of all other

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[12] Florensky (1994a) writes: "Cantor *does not know* where his work is leading. All raise their voices against the possibility of such reckonings, all nod their heads in mockery; but he does not set idols before him. Will he leave his work behind – the source of tradition and science that has nourished him, beyond all temptations, heading forward into the unknown, to the desert of pure thought? What is it he is striving toward? So as to build a temple, a church, a symbol for the Infinite. He wants to see the realisation of the Heavenly Powers, to be convinced that such is possible, and he needs it now" (p. 126) [emphasis in original].

infinities. These predicates could just as well be signs rattling around in social or scientific discourse without their descriptions fully captured, and no more real than any other set of signs.

When Vold and Schlimm make the argument that something cannot be in the mind because it is at some point indeterminate they inevitably argue that such an object is not *present* in the accessible world of appearances. If elliptic geometry were laying around somewhere in an 18th century Jesuit hostel, perhaps in a translation from the Persian, that would mean the solution was apparent. If it were apparent, then it was, or could have been in someone's mind (we are talking about history here and never know all the facts) and is no support for Vold and Schlimm's argument. Thus that these objects can be names without an account of their meaning not only means that the meaning (i.e., forming a predicate) is elsewhere, but that it is in the world of things that could *become present* but have not. Perhaps these predicates lurk in some Hegelian twilight waiting for consciousness to find them. Or perhaps it is no less feasible to conceive that they are real.

The arguments of the Name Worshipping mathematicians and 'meaning externalists' are in an interesting relationship. In the first, a bound name can denote an ever indefinable entity, in the second a particular, but merely heuristic, name can denote an entity perhaps definable but not present. These names are, in the sense we have seen, both token-like, though in the former that semiotics hypertrophises into the mystical. Both, in remarkably similar fashion – one from theology, the other from the history of mathematics – point to a realism making itself present or emanating into the world of appearances. They also point, as Socrates did in the *Cratylus*, to creativity and imagination where poets vie with the gods in the creation of names (391d). Along with visionaries, technology in the formulation of informatic ontologies, or varied systems of encryption, or 'rational' systems of choice, is more than just limitation. Technology is in some sense a fellow striver through human *epinoia*, through craft, along the concatenation of names.

Cantor's legacy points to a theory that is able to return to a scientific basis for essences over processes, after a long absence from the days of Roger Bacon. Cantor's, Lebesgue's, Losev's names denote essences that, like Vold and Schlimm's external vehicles, must exist as whole entities because they cannot be reduced, like a description of the location of an electron or Husserl's ideas – products of the same generation as the Russian Trio. Their realism and idealism was not so much a confessional choice as it was a reasonable deduction from their forward-thinking and dazzlingly synthetic work. Philosophy, in this neuroleptic, neurocentric age, with the aid of information science, might itself need to learn to intone the real by its names.

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