The Power of Names: In Culture and in Mathematics[1]

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A COMMON CONCEPT in history is that knowing the name of something or someone gives one power over that thing or person. This concept occurs in many different forms in numerous cultures—ancient and primitive tribes, Islam, and Judaism; and in Egyptian, Vedic, Hindu, and Christian traditions. Some writers find it embedded in the first verses of Genesis, written probably more than three thousand years ago; others believe it to be an intrinsic characteristic of classical Greek religion; still others find it a central feature in magic and folklore, and modern feminist writers often see it as the reason a woman is traditionally asked to take the name of her new husband. In all these cases, "naming" something or someone is seen as the exertion of dominion over that thing or person. I will give examples of some of these, and then I will proceed to the role of "naming" in twentieth-century mathematics and maintain that it has not only been central, but has also played an important role in the creation of the famous Moscow School of Mathematics.

In Genesis we hear in the first verses that "God said 'Let there be Light' and there was light." Think about that statement logically. God named the thing before he created it; the naming seemed to be a necessary first step toward creation. Then, according to Genesis, God gave Man the right to name all the animals and, at the same time, the right of dominion over them. Here again the act of naming carries with it a sense of power, of hegemony. The Egyptian god Ptah allegedly had the

[1] Read 18 November 2011. This article is drawn from Loren Graham and Jean-Michel Kantor, *Naming Infinity: A True Story of Religious Mysticism and Mathematical Creativity* (Harvard University Press, 2009). Different extracts and versions have appeared elsewhere, both in printed and oral form.

power to create anything he could name.[2] The ancient Egyptians similarly believed that one gained power over a god if one knew his name.[3] We are told that the name of the deity who cared for the city of Rome was a secret known only to the pontifices; if an enemy learned that name, he might use its power against the city. According to the Jewish religion, the name of God was so holy that it was not to be said out loud. A likely reason for this prohibition was that naming God might be seen as an attempt to assert dominion over him.

A specific use of names to bring religious power is that of the "Jesus Prayer." The practice of this prayer dates back to at least the fifth century, when certain Christian "Desert Fathers" in Egypt and the Middle East promoted the view that the ceaseless repetition of the names "Jesus" and "God" brings to the worshipper not only religious ecstasy, but also profound insight about the world.[4] The practice of the Jesus Prayer has continued down to the present day, but after the split between the eastern and western forms of Catholicism it was much stronger in Orthodoxy, especially Russian Orthodoxy, than it was in the Roman Catholic Church.[5] As we will see further on in my story, several of the most important Russian mathematicians of the twentieth century were practitioners of the Jesus Prayer and maintained that it had relevance to mathematics.

The status of "names" was a central issue in medieval philosophy, in the debates surrounding nominalism. Early nominalists such as Roscelin (1050–1125) denied that universal essences exist in reality; they are just *names*. Thus, according to the nominalists, while individual objects, such as a chair, certainly exist, the concept of "chairness" applied to all chairs does not. The most famous nominalist, William of Ockham (ca. 1287–1347), developed a more sophisticated position in holding that universal essences are concepts formed in our minds when we see similarities among the things in the world.[6] But by holding that such essences are only in our minds, Ockham, like Roscelin, denied that they are a part of reality itself. These arguments would have

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[2] Benedikt Rothöhler, *Neue Gedanken zum Denkmal memphitischer Theologie* (Heidelberg, 2006).

[3] "[A]n vielen Stellen gründet Osiris sein Ansprüche einfach auf seine Kenntnis der Namen der Götter" (P. L. Renouf, *Vorlesungen über Ursprung and Entwicklung der Religion, erläutert an der Religion der alten Ägypter* [Leipzig, 1881], 181).

[4] Antoine Guillaumont, "Une inscription copte sur la prière de Jesus," in his *Aux origines du monachisme chrétien, Pour une phénoménologie du monachisme* (Bégrolles en Mauges: Abbaye de Bellefontaine), 168–83.

[5] George A. Maloney, *Russian Hesychasm* (The Hague: Mouton, 1973).

[6] Forrest E. Baird and Walter Kaufmann, *From Plato to Derrida* (Upper Saddle River, N.J.: Pearson Prentice Hall, 2008).

relevance to debates much later among mathematicians about whether the sets they were creating and naming were "real."

The theme of the importance of names often appears in folklore. In the well-known story of Rumpelstiltskin, the origins of which are centuries old, the miller's daughter is bound to give her first-born child to the unnamed dwarf who taught her how to weave straw into gold.[7] She is helpless in his power until she learns his name. When she tells him what his name is—Rumpelstiltskin—she gains the ascendancy over him, and he either flees or is destroyed (in different versions of the tale, some more violent than others).

In modern mathematics the theme emerges in different ways. The great Russian-French mathematician Alexander Grothendieck, still alive but no longer active as a mathematician, put a heavy emphasis on "naming" as a way to gain cognitive power over mathematical objects even before they have been understood.[8] One observer of Grothendieck's work wrote, "Grothendieck had a flair for choosing striking evocative names for new concepts; indeed, he saw the act of naming mathematical objects as an integral part of their discovery, as a way to grasp them even before they have been entirely understood."[9] Mathematicians occasionally observe that, on the basis of intuition, they sometimes develop concepts that are at first ineffable and resist definition; these concepts must be named before they can be brought under control and properly enter the mathematical world. Naming can be the path toward that control.

In the late nineteenth and early twentieth centuries this topic became critical when mathematicians developed whole classes of "mathematical objects" of which no one had earlier conceived. Being totally unknown, they arrived unnamed. There was even serious doubt that they truly "existed." Maybe they did not deserve names.

Georg Cantor initiated this discussion when he promoted the view that there is more than one type of "infinity."[10] Until his time most mathematicians and philosophers had accepted Aristotle's view that infinity is a potentiality, a single abstraction, and not an actuality. Cantor radically broke with this Aristotelian tradition by suggesting that

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[7] Jacob Grimm and Wilhelm Grimm, *Household Stories by the Brothers Grimm*, trans. Lucy Crane (London and New York: Macmillan, 1893).

[8] Alexander Grothendieck, "Récoltes et Semailles, Réflexions et témoignages sur un passé de mathématicien" (1985–86), 24; to be published care of IHES. See http:/www.fermentmagazine.org/rands/recoltesI.html (accessed 30 December 2007; trans. Roy Lisker).

[9] A. Jackson, "Comme appelé du néant," *Notices of the American Mathematical Society* 29.5 (1974): 173–78.

[10] Joseph Dauben, *Georg Cantor: His Mathematics and Philosophy of the Infinite* (Cambridge, Mass.: Harvard University Press, 1979).

infinity is an actuality, not a potentiality, and that it not only exists, but exists in multiple forms. His first distinction was between "countable" and "uncountable" infinities. He noted that the series of integers 1, 2, 3, 4 . . . can be continued indefinitely, and therefore the set of all these integers is infinite. Obviously, the number of elements in the set of all points on a line segment is also infinite. But are these two "infinities" of the same type? Not at all, said Cantor, because with the set of all integers we can count elements (as we do when we say, "1, 2, 3, 4 . . ."), but with the set of points on a line segment we cannot count the elements. So, if these infinities are different, should they be given different "names"? Cantor's answer was in the affirmative, and he began the process of naming different infinities by different "Aleph numbers." Now the door was open to the creation, and the naming, of a whole gamut of infinities, in fact, an infinity of infinities. A new world of transfinite numbers was being created. But should we say "the creation and the naming" of transfinite numbers or "the naming and the creation" of them? Which comes first?

Not all mathematicians accepted this invitation to a new world. The French, who possessed a very powerful mathematical school in Paris, divided over the issue.

But while they were still wrestling with these questions, several Russian mathematicians, especially Dmitri Egorov and Nikolai Luzin came to Paris and learned the new mathematics from the French. Both of the Russians were under the heavy influence of a religious sect of the Russian Orthodox Church called "Name Worshippers," whose members put a heavy emphasis on the power of "naming."[11] They believed that we know that God exists because we can name him. For them, it was a short step to say that we know that transfinite numbers exist because we can name them. Intellectually and religiously, Egorov and Luzin were descendants of the Desert Fathers of the fifth century, who had such a strong influence in the Russian Orthodox Church.[12] Egorov and Luzin believed that if they named God, they assured his existence, and similarly they thought that by naming the new mathematical sets they could make them real. God cannot be defined, but he can be named. The new sets resist definition also, but they, too, can be named.

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[11] S. S. Demidov, "Professor Moskovskogo universiteta Dmitri Fedorovich Egorov i imeslavie v Rossii v pervoi treti XX stoletiia," *Istoriko-matematicheskie issledovaniia*, 2nd ser., 4 (39) (1999).

[12] This tradition was given a new emphasis in Russia in the late nineteenth and early twentieth centuries by the publication of two books: the folklore classic *The Way of the Pilgrim* (Kazan, 1884), and Ilarion, *In the Mountains of the Caucasus* (Kiev: Kievskaia Perchersskaia Lavra, 1907).

The Russians returned to Moscow and created there one of the most powerful mathematical schools of the twentieth century. They had no hesitation about creating new sets involving dozens of different kinds of infinities. It was as if sets, of kinds not known before, were emerging from a secret cavern, needing new names and notations. When skeptics such as the French mathematicians Henri Lebesgue and Emile Borel asked the Russians how they knew that these sets actually exist, that they are real, they replied that they knew they were real because they could name them, the same way they knew that God was real.

The Moscow School of Mathematics became one of the greatest concentrations, if not the greatest single concentration, of mathematicians in the world and had an international influence.[13] Despite recent massive losses to emigration, the school still exists, and its products today can be found on most of the mathematical faculties of the leading universities and research institutions on the globe.

One of the reasons that the role of name worshipping in the early history of Russian mathematics is so little known is that it has been condemned by two of the strongest institutions in Russian history in the last one hundred years: the Russian Orthodox Church and the Communist Party.[14] The Church censured the Name Worshippers for heretically "confusing the name of God with God Himself," and, indeed, when the Name Worshippers claimed, as they often did, that "the name of God *is* God" ("Imia Bozhie *est'* sam Bog"), they opened themselves up to this criticism. The Communists condemned all religious believers, both orthodox and heretical ones, and in the late 1920s and early 1930s they arrested and imprisoned many Name Worshippers, including the president of the Moscow Mathematical Society, Dmitri Egorov.[15] The Name Worshippers seemed to have few friends. Not only did the Church and the Communists rule against them, but most rationalists disagreed with them as well, seeing them as mystics. Thus, because of this widespread disapproval, the role of name worshipping in an important development of modern mathematics has been largely ignored.

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[13] Lipman Bers, former president of the American Mathematical Society, wrote in an official report of the U.S. National Academy of Sciences in 1977, "Moscow probably contains more great mathematicians than any other city in the world"; quoted in *Review of U.S.–USSR Interacademy Exchanges and Relations* (the "Kaysen Report") (Washington, D.C.: National Academy of Sciences, 1977).

[14] In October 1918, the Holy Synod of the Russian Orthodox Church ruled that Name Worshippers could not participate in church services unless they repented—something that many of them would not do; Dmitrii Leskin, *Spor ob imeni Bozhiem* (St. Petersburg: Aleteiia, 2004).

[15] M. Pol'skii, *The New Martyrs of Russia* (Montreal, 1972).

One time not long ago I gave a version of this talk to a group of colleagues. One of them in the question and answer period afterward said, "Loren, you do not really believe that 'naming' and 'creating' are the same, do you? Obviously, they are not. I can name unicorns, for example, but that does not make unicorns real."

This comment points to an important distinction between what is "real" in the physical world and what is "real" in the mathematical world. If one asks if unicorns are real, in the physical world we can go looking for them and come back with the report that we could not find unicorns, and no one else can, either, so they do not exist. But if one creates a concept in mathematics—such as irrational numbers, or imaginary numbers, or different types of infinities—mathematicians do not send out expeditions looking for these numbers to see if we can find them in the physical world. Instead, they ask, "Can these mathematical entities be usefully employed in our work?" If they find that they can be so employed and that they can be used in ways that are consistent and non-contradictory and that lead to interesting results, then the mathematicians treat the new mathematical entities as if they were "real." "Reality" thus means something different in the mathematical and physical worlds.