Mathematicians' Religious Affiliations and Professional Practices: The Case of Joseph

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The mathematics education community fosters discourse on a wide variety of personal and social factors influencing mathematical development in the individual and in the mathematics community. Some authors have focused on the issues of race and gender in mathematical learning (e.g. Moody, 1998; Fennema, 1990). Others have focused on the issue of social norms in classroom mathematical development (e.g. Cobb, Wood & Yackel, 1991; Lampert, 1990). Still others have tried to reveal the long history of insights that have determined the fate of mathematical development (e.g. Kline, 1980). Such work reveals the overlap between our lives as humans and our lives as teachers, researchers, and students of mathematics.

Throughout all of the discussion of humanizing mathematics, one facet of our lives is blatantly omitted: religion. Religion (and not politics) remains a taboo topic for us as researchers. It seems that separation of church and state has extended to research in mathematics education. I searched several library and Internet resources looking for studies on the relationship between religion and mathematics learning and teaching; I found none. What I did find were a couple of reports on policies of segregation for religion and science in our schools, and biographies that included theological confessions of historical figures in mathematics.

In "The Science and Religion Wars," Singham reported that 40% of scientists believe in a deity (2000, p. 430). However, he argued that faith in science might crumble under a God who intervenes in the world: "If the scientific community concedes even one miraculous event, then how can it credibly contest the view that the world (and all its fossilized relics) was created in one instant just 6,000 years ago?" (p. 428). Likewise, Warren Nord found that "as it is practiced, science assumes God is irrelevant to understanding nature" (1999, p. 29). The National Academy of Sciences seems to condone such practice: "Religion and science are separate and mutually exclusive realms of thought whose presentation in the same context leads to a misunderstanding of both scientific theory and religious belief" (p. 29). These statements might indicate there are no implications of religion to be found among scientists or mathematicians. Given the powerful roles that mathematics and religion can play in a person's life, I find this conclusion hard to believe. Nord suggests one possible resolution for religious scientists by noting that evolution and other scientifically defined processes may just be "God's way of doing things" (p. 30). Joseph's case introduces another resolution. By way of his story, the present study investigates the ways in which religion might influence mathematical research and teaching, views of mathematics, and one's decision to study mathematics in the first place.

Mathematics educators have looked to the practices of professional mathematicians in order to build metaphors for classroom learning (Cobb, Wood, & Yackel, 1991; Lampert, 1990; Nickson, 1992) under the assumption that understanding their motivations, perspectives and methods leads to a better understanding of mathematics itself and our practices as mathematics educators. I began my study of mathematics and religion under the same assumption. I feel that we can learn a great deal about the religious facet of mathematical development by examining professional mathematicians who hold strong religious convictions. With this assumption in mind, the purpose of my study was to investigate the implications of particular religious affiliations in the lives of professional mathematicians. How do strong religious convictions influence their mathematical practices (research and teaching) and their views of mathematics? Though my larger study includes Buddhist, Christian, and Jewish participants, I focus on the Jewish participant in this paper.

While the biographies I found in my initial search offer perspectives on personal relationships between mathematicians' views of mathematics and their religions, references to such perspectives are often spotty, and there is little or no mention of practice. Since these mathematicians are all dead (some for decades or centuries), the biographies do not engage us in the present state of mathematics. Therefore, these biographies do little to describe current mathematical practices, and they do not answer my research question. Instead, I use them as backdrops to set the stage for Joseph's story. I will reference these histories in building my discussion and conclusions.

The Histories

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In *Kepler's Tübingen: Stimulus to a Theological Mathematics*, Charlotte Methuen (1998) identified four historical relationships between mathematics and religion: conflict, independence, dialogue, and integration. She recounted the life and theory of the 16th century philosopher, Philip Melanchthon. Melanchthon clearly fell into the last category, claiming, "the study of mathematics offers a vehicle by which the human mind may transcend its restrictions and reach God" (p. 83). This rather bold statement relies on the certainty of mathematics and God's order of nature.

On the other hand, the 20th century mathematical logician, Bertrand Russell, relied solely on the certainty of mathematics. "For a period of his life his attitude towards mathematics made up a great part of his personal religion" (Anderson, 1994, p. 2). He had given up on trying to find truth in his Christian religion at a young age. He needed a new religion and sensed that he could find truth in mathematics. This led to a study of the foundations of mathematics and an attempt to ground it in logic - a project that culminated in his publication of *The Principles of Mathematics.* By age thirty-eight, however, he was discouraged by the problems with mathematical foundations (revealed in part by his own work) and was led to give up on the certainty of mathematics as well.

In *The Man Who Loved Only Numbers,* Paul Hoffman (1998) wrote about a brilliant mathematician who found truth in mathematics. Paul Erdös was a Hungarian man who traveled the world to work with other mathematicians on proving theorems, until he died a few years ago at age 83. Hoffman described him as "a mathematical monk… uncovering mathematical truth" (1998, p. 25). Erdös envisioned a God (known as SF, or the Supreme Fascist) who held a book of mathematical truths; "You don't have to believe in God, but you should believe in the book," said Erdös (p. 26). He cursed SF (in whom he himself hardly believed) for keeping this book of truths from him.

Concerning the existence of "the book," Hoffman (1998) claimed "if you believe in God, the answer is obvious. Mathematical truths are there in the SF's mind and you just rediscover them" (p. 26). To illustrate the position, Hoffman offered the story of Ramanujan, perhaps the brightest mathematician ever, who received mathematical knowledge in his dreams from the goddess Namagiri. Ramanujan believed in the truth of mathematics, but as a Hindu, he also believed in God: "an equation for me has no meaning unless it expresses a thought of God" (p. 85).

Einstein, on the other hand, did not believe in a personal god. Instead, in *The World as I See It* he wrote about a "cosmic religious feeling" (1990, I, p. 26). He claimed that Buddhism had a strong element of this feeling. Far from believing that science and religion were at odds with one another, he claimed, "in this materialistic age of ours the serious scientific workers are the only profoundly religious people" (p. 28) because they are able to think abstractly and universally. In *Out of My Later Years*, Einstein pointed out that "the realms of religion and science are clearly marked off from each other" in that they answer different questions (1990, II, p. 26). Still, he proclaimed, "science without religion is lame; religion without science is blind" (p. 26).

Methods

In order to study the implications of religious affiliations in the lives of professional mathematicians, I conducted interviews with three university mathematics professors. With the help of two professors in the mathematics department of a large, southern university, I identified three religious groups representing the diversity of religious beliefs in their mathematics department: Jewish, Christian and Buddhist. I knew the Jewish participant (the one described in this paper) better than the others because I have talked with him on several occasions at mathematical meetings and social gatherings with his department. As a Catholic, I was also somewhat familiar with his religious doctrine.

I conducted a single one-hour interview with each participant using these questions:

1. Describe your beliefs concerning religion.
2. How do these beliefs affect your lifestyle?
3. Tell me about your decision to study mathematics.
4. Tell me about your role as a professional mathematician.
5. Do you see any relationship between your professional practice and your religious beliefs?

For background information, I collected additional data from archival sources including vitas of the participants and a booklet describing the faculty of their department. I used memoing to develop codes from the data and then grouped codes into categories to identify concepts. I constructed narratives from the concepts, but I wanted to include something additional to capture the words and phrases of my participants. So I incorporated poetic transcription (Glesne, 1999, pp. 183-187), restructuring words from the

transcripts into poems. In forming the stanzas, I was careful to stay close to my interpretations of their meaning. While I used only the literal phrases and words of the participants in this section, their order and concatenation may be very different from the literal transcriptions. I hope that the end result gives the flavor of the participants' voice and language that is missing from the narratives.

Joseph's Story

Background.

Joseph is a Jewish man of about fifty-five years. He was raised in a conservative Jewish family; his mother was especially conservative in observing Jewish laws. His beliefs are mostly orthodox, which means that he believes that the Jewish Bible (the Torah) is the word of God handed down to Moses. He also recognizes the laws passed down through oral tradition and later recorded in the Talmud.

Study, both scriptural and worldly, is very important to Joseph. He studies the Talmud with a friend in the philosophy department. For his studies in mathematics, he received a doctorate from the University of Michigan. He is particularly interested in functional analysis, a subject in which he has a long list of publications.

Teaching is also important to Joseph. He has taught 68 different courses in mathematics at his university and has gained much respect in his 28 years of teaching there. In fact, he recently received a prestigious university award for his teaching. His students celebrate his patience, humor and dedication in the classroom. His services to students extend to various other activities as well: judging science fairs, sitting on the Academic Dishonesty Panel, and serving on many graduate student committees.

Learn, Obey, Teach.

Orthodox Jews believe that the Bible is the written word of God handed by Him to Moses on Mount Sinai. Therefore, "[their] primary responsibility is to learn, obey, and teach" the commandments written there, as well as those passed down through oral tradition and recorded in the Talmud. As part of his responsibility to learn, Joseph emphasized the importance of "study for its own sake." Studying the Torah and the Talmud is a way of "showing love for God," but there is also a religious value in studying other things, such as mathematics. He notes that mathematics too requires a respect for study. This value establishes one of many relations between Joseph's religion and his profession. "Doing what you can" and "the value of teaching others" also appear across domains for Joseph, as do many of his beliefs and practices. Though the relations are clear, it is not so evident that aspects from one domain influence the other. As Joseph put it, "I don't know whether that is [the] influence of my religious experience or just the way that I am."

The Talmud includes commentaries that explain the logic of some laws and clarify the meanings of some words. When Joseph is reading the laws in the Talmud, he first tries to figure out their meaning without the aid of the commentary. Often he is unsuccessful and has to look for hints in the commentary before returning to the law. However, this hermeneutic process of text interpretation helps him to understand the law better, and it is the same process he uses in reading mathematical proofs:

> I'll try to prove it myself, and then when I get stuck, I'll look at their proof and try to find the idea that I am missing. And then I'll try to do it myself—that process. Of course, that takes a very long time, and I can't do it for many papers, but whatever I do succeed in doing along the way really becomes mine. And I guess that's an influence of studying the Talmud. You read the text and then you try to figure out the reasoning for yourself.

Joseph feels that when he tries to figure things out for himself, he understands them better. He doesn't like to take things for granted, though he admits that in Judaism there are things that he must accept on faith, "the purest form of obeying God." Human understanding is limited; only God has perfect knowledge. To think that people can attain ultimate truth through mathematics is nothing more than "human chauvinism—the glorification of reason." Although logicians have tried to establish the certainty of mathematics on logical foundations, Joseph claims that "[mathematicians] are scared of them [logicians]." Rather than worry about foundations, he focuses on doing his job. "Just because you can't do something completely, doesn't mean you can't make some progress. That's certainly built into my religion—that attitude."

Joseph's practice of studying the Talmud and mathematics texts demonstrates another relationship between his religion and his profession. Passed down through oral tradition and later written in concise form, the Talmud is a center of ongoing discussion. Many of the laws are explained in a theorem-proof fashion in which reasons are given and then their necessity is justified logically. People voice different opinions as to

the meanings of laws and even individual words written there, and others raise objections to those opinions. In this way, the laws are sort of flexible and debatable. The objective of interpretation is to try to establish a consistent opinion from which to understand the laws.

This objective is similar to debate in mathematics. While the results of mathematics are published in "finely polished texts," the real, intuitive work of mathematicians that lies behind the text is much less defined and is open to argument. Like the Talmud, mathematical theorems and proofs should be concise, and the meanings of the words it uses are crucial to understanding. Disagreement over the meaning of just one word in either domain causes confusion. Still, as Joseph sees it, "you never completely understand a definition." This conclusion highlights yet another common aspect of Joseph's religious and mathematical studies.

Joseph's interview responses are wrought with examples, which seem equally important to him in understanding Judaism and mathematics. Looking at examples in the Talmud helps him to refine the meanings of religious laws. Looking at examples in mathematics helps him to establish the boundaries of theorems and definitions. In fact, Joseph like the way Halmos put things in saying that "theorems are the afterthoughts of examples."

As an Orthodox Jew, Joseph tries to do the things God wants for him to do and apply the Jewish law in his life each day. He tries to understand the reasons for God's law in order to understand its application in his life, rather than to establish why God made the law. "Our primary religious obligation is to obey the commandments that God gave us… and it's impossible to conjecture what God is like." This attitude applies to other philosophical speculations as well, such as the ones about the afterlife. There is certainly a belief in an afterlife in Judaism, but "there is little conjecture as to what the world to come will be like."

Joseph's attitude of doing his job with little concern for philosophical questions carries over to his mathematical practice. He thinks it is important for students and researchers alike to make as much progress as they can on mathematical problems. It's hard to say how much this attitude reflects Joseph's religious beliefs and how much of it is just part of his personality, but the idea of doing what you can is certainly an important value in both his religious and mathematical practice.

One can make a stronger argument that these relationships are actually influences of his religion upon his profession. Joseph perceives that "there are a disparate number of religious Jewish mathematicians" because of the "similarity of the activities and because there is no potential conflict with mathematics as in other sciences because mathematics is self-contained and built on our own axioms." Thus, Joseph identified logical grounds for his affinity for mathematics and his application of religious practices to that domain.

Aside from study, there is another religious value that is central to his profession. Joseph feels that "the value of teaching is ingrained [in me]… I'm sure it influences the way I look on the profession." When it comes to teaching, he seems keenly aware of the influences. One could even say that Joseph's dedication to teaching mathematics is religious.

Many aspects of Joseph's religious *practice* affect his teaching as well. For example, he finds it important to use a lot of examples in his classes. While students often view examples as models of solutions to a class of problems, Joseph uses them to help students understand concepts. He also thinks that students should get used to studying a good mathematical text, in much the same way he studies the Talmud. "[My teaching] is influenced by studying the Talmud...You read the text, but most of the time that you spend is trying to understand the logic of it and reconcile the different opinions." In fact, he feels that part of his responsibility to the students is to help them learn to read the text. Understanding the logic is at least as important to studying a mathematical text as it is to studying the Talmud. After all, "the rules of logic are pure and precise in mathematics as nowhere else."

Joseph doesn't like to lecture. He feels that it is more beneficial to the students if he answers their questions and shares perspectives with them. This seems to be related to his attitude toward authority; the students should be doing, rather than blindly following. They should be trying their own ideas and developing mathematics on their own as much as they can. Mathematics professors should help students to act more like researchers. "The idea is actually to get [students] to do some research themselves." In fact, Joseph talked about a grant received by his department to do just that.

In Joseph's case, we can be certain of many relationships that exist between his religion and his profession. Joseph himself noted the disproportionate number of religious Jews in his field. In the case of his religious values for study and teaching others, the influence seems clear. In the case of his religious practice, such as his method of studying the Talmud, the influence may be mutual or the result of a third cause ("just the way I am"). Still, influential or not, the many relationships described here go far beyond coincidence.

Meritorious Activity

How are we going to deal with the fact that we're all going to sin?
God knows we're not perfect, but that does not release you
From the responsibility of doing what you can. No matter where you are,
There is a right thing to do at this point.

God is the perfect everything. Showing love for God is primary
Religious obligation—to learn, obey, and teach the commandments He gave us.
A fanatic observes one more than you; A heretic observes one less.
But, doing the commandment that you don't understand is the purest form of obeying.

Just because you can't do it completely
Doesn't mean that you can't make some progress.
That's certainly built into my religion—that attitude—
Is very much like doing mathematics. It's not a spectator sport.

Mathematics is self-contained and built on our own axioms.
Not many of us are going to question the Law of the Excluded Middle.

Yet we all use the Axiom of Choice and we don't apologize for it.

We won't conjecture as to why is this really a good axiom.
It's the logicians who do this, and we're scared of them!
The same thing motivated the Greeks. They wanted something
To believe in: human chauvinism and the glorification of reason.

Uncertainty Principle, Incompleteness Theorem:
"There are limits to what we can know and what we can understand."
There's no point in conjecturing as to the afterlife. That doesn't help you
Do a better job of doing what He wants.

The Talmud is a commentary on the living portion of law.
In concise form, studying that is a lot like studying mathematics.
It was necessary to list all those reasons a person should not go into a ruin.
The hypotheses really were necessary—indispensable commentary.

I don't like taking things on authority. I can't read another person's proof.
We try to figure it out by ourselves. I try to prove it myself.
And then when we can't do it, and then when I get stuck,
We look at the commentary. I'll look at the author's proof.

Then it really becomes mine. Well, that's just the way I am.
You read the text and try to figure out the reasoning for yourself.
The idea of study for its own sake—that's something that is ingrained
I'm sure it influences the way I look on the mathematics profession.

Language poses some difficulties. You never completely understand
A definition: a word that is actually showing for you to learn this extra lesson.
There's nothing that doesn't have a purpose and I guess
That's really similar to my attitude towards learning mathematics.

You don't know what's true. You have to start looking at examples, and examples
Show the boundaries of a theorem. People have this attitude toward mathematics
That it's very well defined. Intuition goes on behind it, without which
The whole enterprise is meaningless.

The value of teaching, that’s built in. I don’t like to lecture.
Looking at examples all the time. For example,
20 ideas in 5 minutes, one will probably have some seed. There’s nothing wrong
With wild conjectures and making mistakes—this cyclical idea.

Working Toward Reconciliation

I recall one of my undergraduate mathematics professors telling me "mathematics is the only truth with the possible exception of theology." The histories recounted here along with Joseph's story offer illustrations of ways that mathematical truth and theological truth might co-exist. Hoffman (1998) questioned the existence of a mathematical bible ("the book") and presented the stories of Erdös and Ramanujan to exemplify two possible positions. While Ramanujan believed in a god who holds the book, Erdös believed in the book without holding a god. Melanchthon's story provides us with a Christian perspective similar to that of Ramanujan's Hindu perspective. Russell seemed to recede from a position similar to Erdös' into a third position that neither accepted a God nor the book. Joseph's story offers the fourth possible resolution—a god without a book—refuting Hoffman's claim that a belief in God necessarily implies a belief in the book.

Joseph's resolution depends upon the limits of human understanding and the boundaries between our mathematical knowledge as humans and God's Truth that cannot be known to us. Whereas Melanchthon pursued mathematical understanding as a means to understanding God, Joseph pursues mathematical knowledge as a meritorious activity within our restricted domain of understanding. He does not make any claims about the universal truth of mathematics. He warns against such claims as a product of the "glorification of reason." Instead, he views mathematics as a closed system, "built on its own axioms." In fact, Joseph says that the closure of mathematics distinguishes mathematics from other sciences that might conflict with his religious beliefs. This orientation fits Methuen's (1998) idea of an independent stance.

Though Joseph draws a distinction between his mathematical understanding and his understanding of God (thus making the two independent), it is important that he finds religious meaning for his activities as a mathematician. He believes it is important that he does what he can. This Jewish belief, along with the value for study, may have influenced his decision to enter his profession. In fact, these beliefs are the foundations for Joseph's Jewish practices, which he identified in explanation for the disproportionate number of Jewish mathematicians.

Whether or not his religion influenced his decision to become a professional mathematician, Joseph's religious values and practices certainly fit his profession. As noted earlier, Joseph's practice of studying the Talmud carries over to his mathematical practice. Looking at examples and struggling with definitions is important to both domains. In reading mathematical proofs, he tries to reproduce as much of the proof as he can on his own before looking at the original proof for hints. This approach is the same one he takes to studying the Talmud. In both activities he senses the responsibility to "do what you can." In addition, Joseph believes there is a religious value of teaching, and his religious practices of studying texts and looking at examples extends to that aspect of his profession. He feels that he should provide a good text for his students to study at home, while spending class time providing examples and perspectives on the reading.

Through his story, Joseph teaches the mathematics education community something as well. To understand the mathematics profession deeply, we must reconcile it with our deepest held beliefs and values. For those without strong religious convictions, these beliefs and values may stem from a philosophy of life (as they did for Russell and Erdös.) Without this reconciliation, our profession lacks meaning. For teachers, this absence of meaning would be disastrous. How are we to teach children mathematics when we cannot answer for ourselves what mathematics is and why it is important? Worse yet, how can we profess mathematics when there is unresolved conflict between our own mathematical beliefs and religious convictions? Though our answers to these questions will vary, each mathematician and mathematics educator must develop a philosophy of mathematics that can coexist with her philosophy of life. In Joseph's case, his mathematical beliefs might be considered independent of his religious beliefs, but there is harmony between his religious values and his professional practice, and his religion helps to define his professional practice as meritorious activity.

Teaching is also a meritorious activity for Joseph. Just as the value of religious study extends to his study of mathematics, the value of teaching the Talmud seems to extend to his mathematical teaching. For some mathematics teachers, the value of teaching may encompass the entire value of their profession. However, it is Joseph's value of mathematical study combined with his value of teaching that enables him to teach mathematics passionately. If we want our students to act as mathematicians, we need to convey the significance of the subject through our teaching. We need to know at a philosophical level what mathematics is and why we are teaching it.

As a final note, Joseph's story might awaken us to particular approaches our students take to mathematical study. We have seen that Joseph's

learning style is informed by his religious practice. We might expect similar influences for students who engage in ritual religious study. After all, many students have developed their styles to studying religious texts, such as the Koran or the Bible, over a period of many years. Joseph's story demonstrates that these learning styles and study habits can translate to secular studies as well.

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