A Vision for ACMS

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Introduction

In a recent book, Alistair McGrath articulates a new vision for natural theology [McG, 2008]. He quotes William Alston's definition of traditional natural theology, "the enterprise of providing support for religious beliefs by starting from premises that neither are nor presuppose any religious belief" [ibid., p.7] and rejects such an approach. His principal reason is that nature is not self-interpreting. For example, he quotes Jesus' words in the Sermon on the Mount,

> *See how the lilies of the field grow. They do not labor or spin. Yet I tell you that even Solomon in all his splendor was not dressed like one of these. If that is how God clothes the grass of the field, which is here today and tomorrow is thrown into the fire, will he not much more clothe you, o you of little faith?* [Matthew 6:28-30, NIV]

McGrath points out that to a person of faith, this passage speaks eloquently of God's providential care for his creation. But no amount of training in botany could lead one to such a conclusion. He writes,

> *…nature itself is conceptually and hermeneutically inarticulate. It is for us to interpret nature, knowing that those interpretations are of our own creation … the traditional Christian theological perspective … insists that we ultimately need to be told about the nature and purposes of God. We can get so far "on our own steam" – to use a characteristic turn of the phrase due to C.S. Lewis – but then stall, needing further help. The insight that nature has the capacity to disclose God is only given from the standpoint of knowing that God, and the attending realization that the Christian vision of God entails that the created order has a God-given potential to tell of its creator. A Christian natural theology rests on the premise that, although nature may be publicly observable, the key to its proper understanding is not given within the natural order itself…Yet when the specific content – as opposed to the mere act – of divine self-disclosure is considered, a conceptual framework emerges which has the potential to allow nature to be "read" in this highly significant manner.* [McG, p.139]

The "specific content" of "divine self-disclosure" is the content of Scripture.

Michael Heller adopts a similar approach [Hel, 2003]. He argues that there are three essential questions that science is intrinsically unable to address: Why is there anything? Given that the universe does exist, why does it have such an orderly, mathematical structure? How do we account for humanity's sense that the universe has meaning, purpose, and value? Answers to these questions necessarily involve interpretation. Nevertheless, Heller writes at some length about the risks of interpretation.

This paper applies McGrath's and Heller's approach to the consideration of mathematics. It assumes that mathematics is not self-interpreting, but that, looked at from a framework informed by the Christian scriptures, it can be seen as having significant meaning and value and a transcendent purpose. In particular, it presents a classical interpretation of mathematics broadly conceived, presents two approaches to providing warrant for such an interpretation, and explores some implications. It argues, by means of the example of the classical interpretation, that the relationship between mathematics and theology is a viable area of scholarly inquiry encompassing profound and fascinating questions. While it presents a case for the veracity of the classical interpretation, its primary goal is to establish the plausibility of that interpretation and the potential value of further study of the issues it raises. It concludes with a discussion of what role ACMS should play in the broader mathematical community.

The classical interpretation

Perhaps the clearest expression of the classical interpretation of mathematics is the following statement by Johannes Kepler.

> *In that geometry is part of the divine mind from the origins of time, even before the origins of time (for what is there in God that is not also from God) it has provided God with the patterns for the creation of the world, and has been transferred to humanity with the image of God.* [as quoted in McG, 2001, p.210]

Kepler expands on these ideas elsewhere:

> *geometry … is coeternal with God, and by shining forth in the divine mind, supplied patterns to God … for the furnishing of the world, so that it could become best and most beautiful and above almost like to the Creator. Indeed all spirits, souls, and minds are images of God the Creator if they have been put in command each of their own bodies, to govern, move, increase, preserve, and also particularly to propagate them. Then since they have embraced a certain pattern of the creation in their functions, they also observe the same laws along with the Creator in their operations, having derived them from geometry. Also they rejoice in the same proportions as God used, wherever they have found them.* [as quoted in Koe, p.369]

We can see the principal features of the classical interpretation in Kepler's statements:

- Mathematics consists of ideas that have existed in the mind of God from eternity.
- As such, it consists of eternal, unchanging truths that transcend human minds.
- God used mathematics as patterns in making the universe.

- We are able to understand the truths of mathematics because God created us with the capacity to do so.
- The mathematical orderliness of creation is an expression of God's rationality.

Other classical authors have expressed similar ideas. Plato believed that geometry existed before the creation. Augustine viewed numbers as ideas in the mind of God. Etienne Gilson summarizes Augustine's concept of divine ideas:

> *Since the ideas subsist in God's intellect, they must share in his essential attributes. Like God Himself, they are eternal, unchangeable, and necessary. Indeed they are not formed as creatures are: they are rather the forms of everything else. They have no beginning or end and are the causes of everything which does have a beginning and an end.* [Gil, p. 80]

Galileo was not as direct about the divine nature of mathematics but saw the structure of the universe as being mathematical:

> *Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the characters in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it; without these one is wandering in a dark labyrinth.* [as quoted in McG, 2001, p.210]

Herbert Breger describes Liebniz' perspective:

> *Liebniz argues that mathematical truths are not fictions; on the contrary they do exist in the region of ideas which is nothing other than God's reason. They do not depend upon his will; God would not be able to change the necessary truths without abolishing himself. One might interpret this as mathematics being autonomous. In finding mathematical truths, human beings discover part of God's reason. This is not only valid for mathematics and logic, but also for a number of truths in metaphysics, including some statements on goodness, justice, and perfection. Liebniz calls these truths necessary or eternal truths as opposed to contingent truths. Necessary truths are valid in every possible world, whereas contingent truths depend on the particular structure of this world which God created and which he could have created otherwise. So Kepler's laws, Galilei's law for bodies falling in a vacuum and the proposition "Caesar was murdered" are all contingent truths.* [Koe, p.488-9]

Note that if one accepts the classical interpretation, it addresses Heller's three critical gaps that science is unable to close: Things exists because God made them. They have mathematical order and structure because mathematical ideas existed in God's mind prior to creation and were used as patterns in creation. And it provides clear answers for the meaning, purpose, and value of mathematics:

- In doing mathematics, we are handling divine things. Its order and beauty should lead us to worship.
- God is purposeful and has given human beings the capacity to understand the patterns used in creation. Thus mathematics is deeply tied to our role as stewards of that creation.

Bases for the classical interpretation

The classical interpretation has enormous appeal for Christian believers. It gives significant meaning to mathematics – that in doing mathematics one is dealing with divine ideas many of which were used in creating the universe. As such, mathematics has enormous intrinsic value, not solely the value humans impute to it. And it gives mathematicians a great purpose – in dealing with divine ideas they are led to worship and they are helping to carry out the mission of stewardship of creation that God originally gave humanity.

The physicist Paul Dirac accounted for his success in the early years of quantum mechanics by saying that whenever he was faced with multiple plausible interpretations of data, he always pursued the one that was the most beautiful. The beauty of the classical interpretation in itself is an argument for its truthfulness; nevertheless, as an interpretation, it can only be scientifically or mathematically disconfirmed, never absolutely established as true by the methodologies of those disciplines. But there are two theological approaches to providing a measure of credibility for it – a doctrinal approach and a biblical approach. Let's examine each in turn.

Three fundamental Christian doctrines can be applied to argue for portions of the classical interpretation:

- *Creatio ex nihilo* – all that is comes from God,
- Omniscience – God knows (and has always known) all truth[i],
- *Imago Dei* – we are made in the image of God.

Creatio ex nihilo implies that mathematics originates in God, although it does not address the question of whether it is created or part of God's nature. Omniscience implies that mathematics has been eternally known by God and thus is transcendent; it doesn't address the issue of whether it is unchanging. The doctrine that humanity is created by God implies that our capacity to do mathematics originated in God. Kepler and others have asserted that this capacity is part of the *Imago Dei*, but there is nothing in that doctrine (or the other two) that necessarily implies this. The notions that God used mathematics as patterns in making the universe and that the mathematical orderliness of creation is an expression of God's rationality are consistent with the three doctrines, but again, there does not seem to be a deductive argument that would lead from the three doctrines (treated as axioms) to these conclusions.

A biblical basis for the classical interpretation begins with the concept of God's consistency. One place this is clearly expressed is in 2 Timothy 2: 11-13 (RSV):

The saying is sure:
If we have died with him, we shall also live with him;
If we endure we shall also reign with him;
If we deny him, he will also deny us;
If we are faithless, he remains faithful– for he cannot deny himself.

Note Paul's use of the word "cannot." God's omnipotence does not extend to acting inconsistently with his own nature, which is one of faithfulness. Also note that if we apply the law of non-contradiction

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with p being the proposition "God is faithful," we get a rewording of the last line in the previous biblical quotation – it cannot be the case that God can be both faithful and unfaithful.

One key concept in the work of Thomas Aquinas is the *analogia entis* – the "analogy of being." God is creator and infinite; we are creatures and finite. Thus the gap between us and God is infinite. Nevertheless, Aquinas argues, the gap is not so great that there isn't a meaningful analogy between our thinking and God's thinking.[ii] If we assume the analogy of being, it is reasonable to also assume that God's consistency can be reliably described by the law of non-contradiction.

But all of the basic laws of inference used in logic originate in the law of non-contradiction. Thus logic is rooted in God's consistency; this implies that the normative power of logic to define correct reasoning is rooted in God's consistency as well. Benedict XVI expressed this idea in his well-known Regensburg talk when he said, "To act inconsistently with reason is to act inconsistently with the nature of God." [Ben] Furthermore as Bertrand Russell has shown, the natural numbers can be constructed from logic and some elementary set theory (which God in his omniscience has always known). But from the natural numbers and the elementary operations of arithmetic, one can derive the integers, the rationals, the reals, the complex numbers – in fact, $\mathbf{R}^n$. The more abstract structures of mathematics – groups, rings, vector spaces, etc. – are abstractions of properties inherent in these numerical sets. Thus a reasonable argument can made that all of mathematics resides in the nature of God and hence has resided there from eternity.[iii]

Again, the first two aspects of the classical interpretation as outlined above follow directly from this; the other three cannot be deduced from it but are clearly consistent with it.

Secularization

As we have seen, a reasonable case for the classical interpretation can be made on both theological and biblical grounds. Nevertheless, the key issue here is not one of establishing the veracity of the classical interpretation but its viability. That is, given its staggering implications, it merits widespread consideration. However, over the past century and a half or so, the intellectual framework within which the mathematical community functions has become secularized to the point where public expression of ideas such as these is regarded as inappropriate to the point of being embarrassing. Contemporary reference to the classical interpretation is rare and when it does occur, is often dismissive or takes the form of ridicule. Daniel Cohen has done an excellent job of articulating the history of this secularization process. [Coh] Many factors entered; among them were the growing rigorization that made mathematics more technical thus creating distance between it and theological interpretations, the growing professionalization that separated it from non-specialists, the advent of non-Euclidean geometry that challenged the notion that geometry articulated transcendent truths, and both the logicism of Bertrand Russell and the formalism of David Hilbert that made mathematics seem increasingly like the product of human thought. Also some weak Christian apologetics based on mathematics convinced many mathematicians to distance themselves from religious ideas.

For example, one of the key figures in this secularization process is Augustus De Morgan, born in India in 1809 and brought up in a theologically conservative family. De Morgan founded the London Mathematical Society which was the model for the American Mathematical Society and, subsequently, many other such organizations. Cohen describes De Morgan's vision for the mathematical community:

> *Where religious sects constantly bickered, mathematicians would discuss matters peacefully; where polemical fanatics overstated their cases, mathematicians would be cautious in their proclamations; where amateur mathematicians and arrogant metaphysicians discussed grand notions, professional mathematicians would limit their purview; where the evils of dogma and religious establishment smothered nonconformity, mathematicians would be open to the new and different – as long as dogma and religion were not involved.* [Coh, p.107]

> *Mathematicians would have to sacrifice the age-old transcendental characterization of their discipline. They could no longer claim that mathematics was a divine language because it then became a proper subject for clergymen and mystics as well; they could no longer assert that mathematics was perfect and infallible because it then became a new dogmatic church like the one they had struggled against; no longer could they even flaunt the supreme precision of mathematics because that was just the sort of hubris they disparaged in contemporary intellectual discourse.* [Coh, p.108]

There is much that is laudable in De Morgan's views – he advocated humility, a deep commitment to truth and peaceful dialogue, and openness to new ideas. But he also identified religion as the opponent of these principles. The effect of this secularization process, to which

De Morgan made a large contribution, was to establish norms for professional conversation in the mathematics community that marginalized discussion of the classical interpretation of mathematics – in fact, it marginalized all discussion of possible connections between mathematics and theology.

ACMS' mission

The norm that excludes religious issues from mathematical discourse has severe consequences for Christians – it compels many believers to adopt a "Sunday – Monday" mentality in which their thinking is compartmentalized between their religious life and their professional life, it drives many able students who want a profession that is connected with their faith to avoid mathematical careers, and it poses a serious challenge for Christian college faculty members who are pressed by their institutions to "integrate faith and learning." Thus ACMS has the opportunity to fill a major gap in the mathematical community by helping to relieve these consequences.

Four subcommunities to which ACMS has much to offer are:

- Its members

ACMS is a professional community, a guild. But it is counter-cultural in that it rejects the compartmentalization of mathematics and religious belief. Many ACMS members teach at small colleges; they have limited opportunities to discuss mathematics with colleagues and even less opportunity to discuss the relationship between mathematics and their faith. ACMS can serve as a community within which such conversations are normal, that is, where Christian mathematicians have the freedom to present and explore integrative ideas and receive feedback. In short, ACMS can help its members integrate their professional and faith lives.

- The next generation

The norm in the mathematics community that marginalizes discussion of mathematics and theology has produced a widespread perception outside that community that there is no relationship between mathematics and religious thought. In particular, Christian students come to their study of mathematics with this mindset. ACMS can not only introduce these students to the larger conversation of which the classical interpretation is a part, but can empower the next generation to take further steps.

- All people of faith in the mathematics community

There are many people of faith in the larger mathematics community from various religious traditions. ACMS can provide resources such as worship services at larger mathematics meetings, fellowship gatherings such as dinners and talks, and literature that can support these believers as they seek to integrate mathematics with their own tradition.

- The mathematics community as a whole

John Paul II wrote in several places about the "evangelization of culture." By this he meant Christians working within social and/or professional cultures to move these cultures in directions in which they affirm fundamental principles and values also affirmed by Christian thought. Some of these that apply to the mathematics community are openness to truth from any source (including religion), the reality of transcendence, the dignity of persons, the priority of ethics over technology, the value of education and knowledge, and the importance of applying knowledge to serve human needs. ACMS members can work toward such ends by actively participating in the professional organizations of the mathematical community such as local chapters of the MAA.

Conclusions

How can ACMS best serve members of these subcommunities? Perhaps the single most valuable contribution it could make would be to revitalize a discussion of the relationship between mathematics and theology. Not many years ago, the literature on the relationship between science and religion was small; today there is an extensive literature and several journals dedicated solely to the subject. The relationship between mathematics and theology is a part of that larger conversation but a relatively neglected one. ACMS can help rectify this in many ways – the production of scholarly books and articles for both Christian and secular audiences, production of educational materials at all levels, the creation and teaching of courses in many different educational institutions, conducting workshops and conferences, scholarly presentations in suitable settings, personal study of the issues, and simply engaging in conversations with students and colleagues. Given the norms of the mathematical community, it is probably impossible to do this without occasionally giving offense. But the mathematical community is a scholarly community and if ACMS members respect that, needless offense can be avoided. An early nineteenth century work that claimed to prove the Athanasian Creed by a mathematical argument [Coh, p. 154-5]) provides a good example. This particular creed places a strong emphasis on God's infinitude and trinitarian nature. The "proof" is primarily based on the observation that $\infty + \infty + \infty = \infty$. If the author had treated his observations simply as a helpful metaphor, he would have been unlikely to give offense but by treating it as a proof, he contributed to secularization. One way to avoid such offenses is by being careful that any apologetics based on mathematics respect mathematical standards for rigor and logical transparency. Another is to be very careful not to introduce devotional content such as prayers or expressions of gratitude to God in settings that call solely for scholarly content.

The classical interpretation of mathematics offers a grand and inspiring vision and one worthy of respect and careful consideration. Insofar as ACMS can stimulate a broad engagement with such issues and introduce Christian perspectives broadly into the life of the mathematical community, it can provide an extraordinarily valuable service.

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[i] This doctrine can easily be misused. It does not suggest that God knows everything in some absolute sense but only that God knows everything that is knowable. Kepler illustrates this idea with the construction of a regular heptagon by straight edge and compass means – God cannot know how to do this as it is impossible. A more contemporary example is the halting problem in theoretical computing – God cannot know how to solve this problem by finitistic means as there is no such solution.

[ii] Some contemporary Reformed thinkers reject the *analogia entis* as presuming more about God than we can know. But the *imago dei* doctrine when combined with the incarnation and words of Jesus such as "If you have seen me, you have seen the father" argue strongly for the reasonableness of Aquinas' notion.

[iii] For a philosophical explication of an expanded version of this argument, see [Pla].