Mathematics, Beauty and Theology

History gives us some rather strong claims about the relationship between beauty and mathematics, particularly between beauty and *numbers*. That beauty is somehow fundamentally about numbers is an idea that goes back to Pythagoras, and one that was given forceful expression by Augustine: 'only beauty pleases; and in beauty, shapes; in shapes, proportions, and in proportions, numbers' . It is probably safe to say that such views are not widely accepted or influential in contemporary aesthetic theorizing, and it is not my object in this paper to propose a wholesale revival of this strand of what has been called 'The Great Theory of Beauty'. But I do want to propose a somewhat more modest claim about mathematics and beauty; whether or not all of beauty should be understood ultimately in terms of mathematics, it is quite clearly the case I think that mathematics, and especially pure mathematics as it has developed in the last 100 years or so, needs to be understood ultimately in terms of beauty. In other words, at a time when, philosophically, the ancient link between mathematics and beauty is almost completely ignored, mathematics itself has developed in such a way as to bring out more clearly than ever before the centrality of beauty to its own enterprise.

What I want to do in this paper then is to develop three theses. The first is that mathematics should be thought of as a sphere of beauty, as a realm to which we can turn, somewhere in addition to the realms of the arts or of the natural world, when we want to think about beauty. My second thesis is that mathematics can in fact prompt us to relate theology and beauty in a very particular way: not only can we ask about the beauty of God, or the beauty of God's dealings with the world, of God's revelation, but we can also ask about the beauty of theology itself. From mathematics we can learn, that is, to think about the beauty of arguments and of intellectual constructs, and this may not be a mere distraction. Finally, I will focus on one particular aspect of the beauty in mathematics, and suggest that it can help us distinguish among ways of talking about God, and in particular among ways of talking about God as unknown.

Now beauty is not always, I suspect, the first thing that comes to mind when one thinks about mathematics. Many theologians, together with most contemporary intellectuals with a literary-philosophical education, are more likely to think of mathematics, alongside science and engineering, as technical and pragmatic disciplines, or indeed as part of a way of knowing and interacting with the world which is fundamentally to do with control and manipulation, with measurement, mastery and domination.

If one considers mathematics, and in particular *pure* mathematics, as it is actually practiced by mathematicians, however, such a conception rapidly runs into difficulties. Pure mathematics is a project engaged in precisely *not* for the sake of any practical outcome, of any measurement, control or domination of nature. If a pure mathematician discovers that her work has applications, she may be vaguely pleased, but for at least the great majority, the work is not undertaken in the first place for the *sake* of such application.

Pure mathematics is, it should be said, a relatively recent term. It is only a little more than a century ago that mathematics split into pure and applied branches. So one might say the business of pursuing a mathematics that one does *not* take to be descriptive of the natural world is an innovation. But most pure mathematicians would conceive of what they do as in a strong form of continuity with the mathematics that was done before this divide took place, going back all the way to Euclid and perhaps beyond. What the development of a distinct field of pure mathematics does is to bring out more clearly some features of mathematics which were always present.

And one of these features is precisely the link between beauty and mathematics. I have distributed some relatively short pieces of mathematics in the hope that they may for some at least provide some concrete sense of what is meant by talking about beauty here, but in a 20 minute slot there is clearly no time to discuss these and so hope even to begin to *display* the beauty of mathematics, to induce an *experience* of the beauty of mathematics, directly. Instead I will try to get at this indirectly by saying something about mathematicians' practice.

The most obvious way in which mathematical work is judged is in terms of its validity. Does the proof in fact succeed in proving what it is supposed to prove? But it will not do to suppose that this is all that counts. Mathematicians make all kinds of judgments about the relative worth of equally valid mathematical proofs: from some of them one turns away in disgust, others are worth doing, others are particularly significant, and win a prize or promotion to a chair. Some mathematical papers are judged worthy of publication in prestigious journals, others only in journals lower in the hierarchy, and the difference cannot be measured in terms of how many new theorems are proven or how long and complicated the proofs are. To put the point in a slightly different way: there are infinitely many theorems a mathematician might in principle attempt to prove—how does he go about determining which of these are worth the trouble? How, in particular, is this choice made given that we are talking precisely about *pure* mathematics, where the decision will not be led by issues of what might be *useful* to the scientist or the engineer?

I do not want to go so far as to say that such judgements and such decisions are made *entirely* on the basis of aesthetic criteria. There are issues to do with how much a new piece of mathematics illuminates or extends or indeed unifies areas of mathematics in which an interest has already been established, and whether such considerations might ultimately be reducible to aesthetic ones I am not sure. But I think it is undeniable that at least *in large part* judgements about which mathematics to pursue, which mathematics to fund, and which mathematics to reward, are made on aesthetic grounds, on the basis of considerations which mathematicians typically articulate in terms of interest, simplicity and elegance.

Of course there is not absolute unanimity as regards judgements of beauty in mathematics. Members of the different mathematical subdisciplines tend to make somewhat different judgements about the relative merits of certain kinds of theorems. What seems a lovely theorem, or a lovely proof, to an algebraist, may seem less than inspiring to a topologist. But the disagreements and the ambiguities involved in aesthetic judgments in mathematics are no worse than those which can be found in others spheres of life in which we talk of beauty, and they ought to be taken as an indication that talk of beauty in mathematics is 'merely subjective' only if we also suppose this to be the case more generally.

What is the consequence, then, if the theologian reflecting on beauty allows her thinking to be informed not only by art, music and literature and natural beauty, but also by beauty as it can be found in a subject like mathematics? One thing that can happen, I want to propose, is that attention is directed to the possibility of beautiful arguments and beautiful intellectual constructions. Just as a mathematical argument can be beautiful, elegant, satisfying, or else clumsy and ugly, can a theological argument, or a theological system, also be beautiful or ugly? And should this affect our judgment of it?

The notion of theological beauty that I am introducing needs to be distinghished from questions about language. The aesthetic quality of the mathematical argument does not depend very closely on the linguistic abilities of its formulator, and the question about the beauty of a theological argument need not I think be reduced simply to a question about the theologian's prose style. One can convey an extremely elegant theological position in halting English, and if we find beauty in the theology of Aquinas, it is not necessarily because of any outstandingly mellifluous qualities of his Latin.

The analogy between mathematics and theology is particularly easy to make if one looks to a thinker such as Anselm of Bec. Just as mathematicians who have already proven a theorem may well seek, and then if they find it publish, a better proof—a simpler, more elegant way of establishing the same truth, so Anselm, in his best known work, the *Proslogion*, is not aiming to establish truths he previously thought uncertain, nor even primarily to rationally demonstrate for the first time truths he had previously held certain through faith. Rather, if we are to believe what he says in the preface, he is trying to find a more *elegant* way of demonstrating truths he had already, in a previous work, found arguments for. He became, he indicates, dissatisfied with his previous effort, the *Monologion*: 'when I reflected on this little book, and saw that it was put together as a long chain of arguments, I began to ask myself whether *one* argument might possibly be found, resting on no other argument for its proof, but sufficient in itself to prove that God truly exists, and that he is the supreme good, needing nothing outside himself, but needful for the being and well-being of all things'. And once he has, after much frustration, come upon his one argument, he writes it down because he thinks it might *please* some of his readers. What Anselm finds important about his phrase 'that than which nothing greater can be conceived,' then, is not so much that it makes possible his so-called ontological argument, but that it gives him a way of unifying many of the things he wants to be able to demonstrate about God, including, as it happens, that God exists. And because it introduces this unity and simplicity to his argument, it raises it to a new level of elegance.

Anselm, of course, is not to everyone's taste. Aquinas, for instance, was both unpersuaded by what has come to be known as the ontological argument, and often averse to the kinds of *necessary* reasons that Anselm thought he could provide to explain God's dealings with the world. From this I think we should conclude, not that intellectual beauty is to be sought *only* in those who work in the style of Anselm, and is dismissed by others, but that there is more than one style of beauty to be found in theological works. Anselm's hunt for simplicity, clarity, necessity and elegance is one, but it is presumably a very different *kind* of beauty than that which can be found in, say, Karl Barth's *Church Dogmatics* which is again different from the beauty that sometimes can be detected in Karl Rahner's often rather ugly and torturous writings.

On one level there is nothing new in what I am saying. We nearly all do, I suspect, respond to theologians and theological works at an aesthetic level, and whether we defend or criticise a theologian, whether we dismiss them or read on, is in significant part determined by whether in one way or another we find what they present us with beautiful. Mostly, however, this response remains implicit. Mostly we argue about whether Karl Barth has an adequate pneumatology, whether Schleiermacher's consignment of the Trinity to an appendix is acceptable, whether Balthasar's conception of the cross is orthodox, and so on. The aesthetic appraisal, which is one of the factors that determines our fundamental orientation towards a theology, is usually kept mute, and voiced only very indirectly. And when it does occur to us that theology should in some way make a connection with the aesthetic, we are most inclined to look for slides of paintings that we can talk about, or perhaps a bit of music.

Now it might be objected that if theology is to be concerned with beauty, it should be the divine beauty, and not its own, which it takes as its theme. To ask about the beauty of theology as such is for theology to become *incurvatus in se*, concerned with itself rather than its object. And ultimately this may be right. Ultimately perhaps any beauty of theology, if has no connection to the beauty of God, is simply distraction. But I think it is important not to move too quickly to this ultimate level, not too hastily to collapse the conversation about the one into a conversation about the other. To take whatever beauty one sees in a theological writer, whether it be Barth or von Balthasar or Aquinas, as quite straight-forwardly and without question the beauty of God as it is given to us through this theologian, is to become readers of the most sycophantic, uncritical and potentially dangerous kind. We need to be able to appreciate what is beautiful in a theological work, and yet still be able to ask, as a *further* question, what is the significance of this beauty?

It is well beyond the scope of a brief paper, and probably beyond the scope of my abilities, to carry through all the things that I am suggesting might be desirable: not only that our judgements of theologians should more explicitly bring out what is beautiful or ugly in their works, but also that we might attempt to classify and compare theologians in part by the *way* in which their works are beautiful, and that we might begin to reflect more carefully about the way in which theological beauty in general or theological beauty of various kinds does or does not relate to the beauty of God. So far I have suggested only that these are a kind of question we often don't think of raising, and that the raising of them might help illuminate an important dimension of theology and our relationship to it. Rather than trying for a very sketchy response to such questions *en masse*, what I want to do in my remaining few minutes is to turn again to mathematics for the help it can give us in a particular case of thinking about beauty in theology.

Though many think of mathematics in terms of control and mastery, one of the most striking features of some of the best of pure mathematics is the way in which it confronts us with that which exceeds our control, the way it opens up to us things which are beyond our ability to comprehend. Euclid's proof of the infinity of the primes, which I have given you, can be seen as a simple example of this. Prima facie it is not at all obvious how many primes there are or how one might go about establishing this. One might suppose one had to go on endlessly testing bigger and bigger numbers. But here, in a few lines, without any real calculations at all, a result is established that holds good no matter how big the numbers get, no matter how far along the list of numbers one goes. In the space of a few dozen words something is established about infinity. But what is established is precisely not any kind of mastery over numbers, but what can be interpreted as a proof of their unmasterability. We have discovered that we can never compile the complete list of the primes, never find the building blocks of all the numbers, never get a manageable set of numbers through which all the others can be understood.

There is a certain kind of dominance of the numbers which Euclid's proof tells us we can never have.

Some of the most interesting developments of the mathematics of the last 150 years can be seen in this light, I think: they have this quality of establishing with clarity and precision that which the mind cannot comprehend, or indeed of forcing it to confront the limits of its comprehension—and this, I think, is in large part what constitutes their elegance, their beauty. Cantor's work in the 19th century with infinite sets, for instance, brings a completely new kind of clarity to a set of questions that had been debated by philosophers and theologians for several thousand years—philosophical discussion of infinity cannot be the same after Cantor as it was before. After Cantor we have a precise language, set of concepts, even techniques of proof, with which cope with questions about what you might call the size of infinity – and yet what Cantor does is the very opposite of domesticating infinity. His new language and new proofs open up to us in a new way the uncontrollability of infinity: the more clear Cantor's analysis becomes to us, the more clearly we will understand the unimaginability of infinity.

This kind of point can be made most uncontroversially in connection with Godel's incompleteness theorems. Godel established that no finite set of axioms could be used to establish all the truths of arithmetic. Given any particular list of axioms, there will always be some true arithmetical proposition which cannot be proven from these axioms. What one has from Godel is a rigorous proof, carrying all the certainty that any mathematical proof does, of the absolute impossibility of ever developing what one might call a thoroughly satisfactory mathematical system. We have a mathematical proof of the ultimate limits of absolutely any system of mathematical proofs. It is unquestionably a very striking result.

One of the beauties of pure mathematics, then, is the way at its best it combines clarity with ungraspability, rigour and precision with uncontrollability, and this can also be, I want to suggest, one of the beauties of some theology—that it aims to advance our knowledge not by letting us comprehend God just a little bit more, but by making us more aware of the incomprehensibility of God. Theology is at its most elegant, I am suggesting, when the mystery of God and the clarity of the theology are directly, rather than inversely, related. Theology does not at its best, or at least at its most beautiful, acknowledge the mystery of God by vagueness in its formulations or half-heartedness in its assertions, nor does it achieve intellectual seriousness by in the end knowing quite a lot about God; at its most elegant, the more precise it is, the more effective it is in presenting us with the ungraspability of God. Part of the attraction of thinkers like Aquinas or Rahner, and perhaps the same could be said of Gregory of Nyssa or Karl Barth, is the way in which considerable intellectual resources and rigor are devoted to bringing to clarity the mysteriousness of God, a mysteriousness which is no way dissolved by the fact that revelation is given.

By contrast, part of what is in my judgement at least inelegant about much of the recent revival of Trinitarian theology, whatever one might say about its adequacy in other regards, is the way in which it aims to be robustly and distinctively Christian by knowing quite a lot about God and indeed God's inner life. Theology is conceived of as getting rid of much of the unknowness of God, or at least chipping away at it around the edges; it is conceived of as being true to revelation by having a very full description of God. The doctrine of the Trinity is very often conceived of not so much as deepening the mystery of God, but rather as giving the Christian a quite satisfyingly full picture of things.

What I am proposing is not a particular version of apophatic theology, but the suggestion that across a number of different and perhaps incompatible theologies, whether of the Cappadocians or of Thomas or of Barth or Rahner, one of the things that can make for intellectual elegance is that theological clarity aims to intensify, and not undermine, God's mystery, and that by contrast one of the things that makes for theological mediocrity is that a thinker construes God's mystery and their own success in a relation of competition.