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Music—A Life Not Chosen

I am a mathematician and not a musician. That is just a straightforward fact. However, it is a fact that I have never fully accepted: I am not a musician, but I nevertheless identify myself with that segment of the human race for which music is a way of life rather than just a form of entertainment. In this essay, I shall try to explain why. I do not plan to write about connections between mathematics and music or to theorize about music in a mathematical way. All I will do is write, as a mathematician, about some key moments in my musical life, hoping that there will be enough of a mathematical slant to my story to make it appropriate for this book.

My parents

My musical life started before I was born. My father read music at Cambridge, did a PhD (on Erik Satie), and could probably have had a career as an academic musician. Instead, he left Cambridge soon after I was born (in late 1963) and decided to try his luck as a composer. That decision led to many years of struggle: it was not until the late 70s that it was thoroughly vindicated and he started to get as much work as he wanted, mainly writing music for film and television. He also played the piano and organ, though not professionally, apart from a couple of years when he was the pianist for the a capella group Swingle II.

My mother went to the Royal College of Music, where her main instrument was the organ. After leaving, she became a piano teacher. For several years she was also the organist at our local church. At a certain point (also in the late 70s I think) she decided to switch from traditional piano teaching to the Suzuki method, about which more later.

Early memories

My earliest musical memory is not my own memory, but rather an anecdote that my father enjoyed telling. When I was very young—too young even to be talking—he noticed that I had a tendency to respond to music that I heard by singing, and that I always sang the same note: an E flat. So he would amaze his friends by setting up questions to which a sung E flat was the correct answer. For example, he played a D major chord on the piano and asked me to sing the minor ninth.

Another very early story is that some friends of my parents knew Nadia Boulanger, and my singing at the age of 3 was thought to be sufficiently good that she might be interested. Whether she actually would have been interested is open to question, but we will never know, because although a meeting was arranged, I absolutely refused to sing to her.

My father taught me tonic sol-fa at an early age—early enough that I cannot remember not knowing it. Another story that my parents tell me is that at some church service he noticed that I was singing along to a hymn, not using the words of the hymn, but (correctly) labelling each note do, re, mi, fa, so, la, or ti. I have a hazy memory of the occasion, but I do not know whether it is genuine. A more definite memory I have is of watching *The Sound of Music* in a cinema in the Isle of Wight. I was less interested in the film than in some kind ladies in the row behind who gave me sweets. Nevertheless, the song “Do—a deer, a female deer” is one that I have known all my life. And I have not lost the ability to sing tonic sol-fa: give me a tune that does not modulate too much and with no effort at all I can sing it using do, re, mi etc.

I have no memory of not understanding musical notation—that too my father taught me at an early age. I started the violin and piano at the age of 5, my lessons taking place on Saturday mornings at the Royal College of Music, where my mother taught. I would be there for quite a long time, during which I would have a piano lesson, a violin lesson and some kind of orchestral session. I would not be active for the entire morning, and during the breaks I would wander about, sometimes leaving the building and going to the Science Museum—a level of freedom that is hard to believe now (though Saturday mornings at the Royal College of Music continued until I was 9, so I was probably more like 7 or 8 when I did this).

In the infants at my first primary school, that is, when I was about 6, I had an early experience of getting to know a piece well. Each day we had assembly, and as we walked in there would be music playing through some speakers. As I remember it now, they only ever played two pieces, which I identified

much later as Bach's "Jesu Joy of Man's Desiring", and the F minor prelude from Book 2 of the *Well-Tempered Clavier*. Much later still, when I was in my late twenties, I decided to learn the F minor prelude. It felt like fulfilling my destiny.

Given what my father had taught me, and given that he was a composer, it is not surprising that I started composing. Another source of inspiration was a film I saw about Mozart. Apparently, soon after seeing the film I asked my mother, "How old was Mozart when he composed that piece?" and then, "Is there any manuscript paper I could have?"

At this age, I thought that questions such as "Who is the best composer ever?" had objective answers. My father did nothing to dispel this illusion, so I knew from him that the best composer was Bach. I also had two Ladybird books called *Lives of the Great Composers*, which added to the feeling of an objective pecking order. The first book was about Bach, Mozart and Beethoven and the second was about Handel, Haydn and Schubert. Even now Bach, Mozart and Beethoven have a one-two-three-ish feel in my brain, though Mozart is not in fact my second favourite composer. When I was about 8, it suddenly occurred to me to wonder who was the greatest *living* composer, so I asked my father. The answer was Stravinsky. Stravinsky died a year or two after my question, so I went back to my father and asked who was *now* the greatest living composer. To my surprise and disappointment, he didn't know, and I was forced to grow up a little.

When I was about 7, an uncle of mine got married, and asked whether I would write an organ piece for his wedding. I was very excited by this commission and readily accepted, only to realize later that I had bitten off more than I could chew. At around that time I had written a longish piece, but only the melody. When I played it in my head, what I heard was harmonized, but I was not at that time capable of writing down the harmonies I was hearing in my head. (At what level of precision I was hearing them it is impossible to say.) In the end, my father took my melody and harmonized it. At the wedding it was presented as my piece and I got a lot of compliments for it. My unease at getting those compliments under (mostly) false pretences was more than compensated for by my pleasure at all the attention (particularly as my sister was receiving even more attention as a bridesmaid).

Getting in to King's

When I had recently turned 7, my father took me to Cambridge to see David Willcocks, who was then the Director of Music at King's College and in charge of the famous choir there. I remember two things about the occasion: what it

felt like to see the choir in action (I don't know how to put this feeling into words—I have a picture of candles and cassocks and of everybody being older than me), and being in the organ loft with David Willcocks. According to my father, Willcocks gave me some aural tests and my father felt he had to intervene because they were much too easy. By that time, if my father played me a chord (or discord) on the piano with several notes in it, I could tell him what they all were.

The point of this meeting was to ask whether I had a chance of getting into the choir, and therefore whether it was worth making some effort to prepare for the auditions, which would take place a year later. We were told that it was, so I came back to Cambridge in January 1972 to give it a try. By that time I passionately wanted to get into the choir. I don't know why this was, since I knew very little about it and it would involve going to boarding school, but if I had known more, then I would have wanted it even more, not least because King's College School was far better academically than the state primary school I was then at.

Fifty boys were auditioning for five places in the choir. There was an initial round in the morning, which whittled the numbers down to twenty-five. I can't remember anything about it except that I made it through. I had come up to Cambridge (from London) with my entire family, and we were staying with an aunt who lived in Cambridge at the time. The plan had been that we would stay at King's College School, the choir school attached to King's College, where I would go if I got into the choir, until I had nothing more to do there, but my mother and I were so excited that I had got through the first round that we went back to my aunt's house to tell everybody. Of course, our appearance there initially made them think that I must have *not* made it through the first round.

The main thing I remember about the auditions is what happened during the second round. We were called into a room in groups of five, where David Willcocks was sitting at a piano. He had a hymnbook in front of him and he asked whether one of us would like to have a go at singing a verse of a hymn he had chosen. At that age (and, come to think of it, at pretty well every other age since) I felt very shy of singing in public, so part of me instinctively didn't want to volunteer. But another part was very calculating. My whole life depended on this moment, and I thought that I would look good if I volunteered, so I did. I sightread a verse of the hymn without making any mistakes. After that, the other four also read verses, and one after another they each made mistakes. So when we left the room, I was pretty sure it had gone well.

A little later in the day it was time for the results to be read out. They were read out in alphabetical order of surname. One of those chosen was called Timothy Amos, so I had a moment of great excitement followed instantly by an equally great letdown. But when the second “Timothy” was read out, I thought it just had to be me this time, and it was.

At King’s

The moment my name was read out in the assembly hall was indeed one that changed my life. A year later, when I had recently turned 9, I left the school I was at and went to King’s College School as a boarder. The reason I boarded was not just that my parents lived in London, but also that if you were in the choir then you had to board. The reason for that was that the timetable was extremely demanding. Choristers would go to all the lessons that non-choristers went to, but in addition to that they had about twenty hours of singing per week, as well as instrumental lessons and time for practising. A typical school day would start with a chorister practice straight after breakfast (in the room where I had volunteered to sing the verse of the hymn), followed by a normal day of lessons, followed by processing to King’s College Chapel for a practice with the choral scholars (the altos, tenors and basses, who were undergraduates at King’s College), followed by evensong, followed by supper, followed by time to do our prep (that is, our homework, except that we didn’t go home), followed by bed. There were variations to that timetable—for example, we did not sing at evensong on Mondays or Wednesdays and had two services on a Sunday—but that gives an idea of just how much singing was involved. The main things we missed out on were sports—we did some, but nothing like as much as the other boys—and free time.

For my first year at King’s I was what was called a probationer. That meant that I was not yet fully in the choir, and in particular not singing evensong, but was being trained in the necessary skills, such as music theory, sightsinging (which I was already pretty good at), the ability to watch the beat at the same time as singing, and specialized skills such as how to sing psalms (this involved understanding a notation known as pointing, which told one how the words of the psalm fitted the chant). One of my happiest memories of that year was of a day when the choir went to Ely Cathedral to sing Handel’s “Zadok The Priest”. Although I was just a probationer, I was the senior probationer, and something that David Willcocks said made me wonder whether I was supposed to go too. I wasn’t, but then he said, “Well, why not?” and I ended up going. I loved the piece, and the whole experience of travelling to that wonderful cathedral with those older boys I looked up to felt extremely glamorous.

Another memory from that year also involves my going and asking David Willcocks a question. At the end of a chorister practice, I asked him why we had been singing a piece a semitone higher (or perhaps it was lower—I can't remember now) than was written in the music. I think of that as the moment when it became official that I had perfect pitch. A couple of years later, my father, who as well as composing music liked to make electronic gadgets, made a tuner. It had a series of switches, which basically determined the binary expansion of the frequency of the note you could hear. So the first switch would move the note up and down a lot—I can't remember what the range was, but perhaps it was an octave and the first switch changed the note by half an octave. Then each succeeding switch changed the note by half the amount that the previous switch changed it. One Sunday, when my family had come up to Cambridge to see me and we were having a picnic lunch out in the countryside, he handed me the tuner and asked me how accurately I could set it to an A. I managed to do so to the limit of the accuracy of the tuner. To this day, I don't know how that happened, since I was not routinely exposed to the exact frequency of 440Hz. (The organ in King's College Chapel, for instance, was very slightly sharp.) When it came to the last couple of switches, I was not completely sure that I was making the right decisions, so perhaps the answer is that my perfect pitch was good enough to take me close to the right frequency, and after that I got lucky, though I have a vague memory that I repeated the feat on some other occasion.

Singing at King's had one not very surprising effect on my musical tastes: it left me with an enduring love of church music. However, there was slightly more to it than that. Initially, the pieces I liked the most tended to be from the late nineteenth and early twentieth centuries, whereas I found sixteenth-century music by the likes of Byrd, Tallis and Palestrina somewhat dull. I remember a kind of Borgesian fantasy I had at the time: that from the first few bars of a piece by Byrd it ought, with sufficient thought and sufficient familiarity with the general idiom, to be possible to reconstruct the rest of the piece.

My parents, who used to come to Cambridge every other Sunday and go to Evensong, made it clear from their remarks about what we sang that they had very much the opposite view. I remember being entranced by Mendelssohn's "Hear My Prayer" (with the famous "O for the wings of a dove" solo) and being shocked that my father didn't agree. His view of Mendelssohn was that he was quite brilliant when young and became gradually worse as he got older—another assessment whose simplicity appealed to my childish mind. I remember my mother telling my father to go easy on his criticisms of "Hear My Prayer", given how much I had clearly loved it.

It is hard to know how influential my parents' views were on the development of my musical tastes. If I had not had the feeling that they were somehow "right" and that I would come to understand why when I was older, would I have nevertheless come to see the glories of sixteenth-century choral music and the limitations of (at least some of) the later music that I initially liked? Whatever the answer to that, I had one or two epiphanies during my time as a chorister, when I realized that certain sixteenth-century pieces were quite wonderful. One I remember suddenly enjoying is an anthem called "Haec Dies" by Byrd. Another that has become one of my favourite pieces of any kind is "Ave Maria", by Robert Parsons. I can remember not wholly liking it, and cannot remember when that switched – quite possibly after I had left King's. It was not until I was in my thirties, and bought a CD that included it, that I noticed that the first six entries of the trebles make a very simple pattern: each entry is one note higher (in the A-flat major scale) than the one before, and stays mostly on that note. While this pattern lasts, it gives the piece a structure that is a perfect balance between freedom and constraint. One has an extraordinary impression of the trebles floating over everybody else, half ignoring what is going on beneath and half binding it all together.

One disappointment of my time at King's was that within a few months of my starting there, David Willcocks announced that he was leaving. He was a charming grandparental figure (it disturbs me a little to calculate that I am almost the age now that he was then) and I think that I would have been one of his favourites. He was replaced by the much younger Philip Ledger, who was less charming and who did not have any particular interest in me.

One of Willcocks's final decisions was to allow me to sing in the famous Nine Lessons and Carols service in 1973, even though I was still a probationer and strictly speaking not needed. It is difficult to convey just how extraordinary an experience singing in that service, which I did three times, was. Not only was the chapel packed, with people many of whom had queued overnight to get good seats, but the service was broadcast to millions round the world, which in those days meant more than it does now. The service opened with a single treble singing the first verse of the carol "Once in Royal David's City". It was my burning ambition to be that treble one day.

As things turned out, that ambition was not just not fulfilled—it was not even close to fulfilment. In fact, Philip Ledger almost never chose me to sing a solo—even a brief solo passage during some very ordinary service in the middle of an ordinary week. That puzzled me at the time, but perhaps if I could listen now to what I sounded like then I would understand why. I was good at getting the notes right, but it may be that the quality of my voice just wasn't what it felt

like to me as the one producing it. (I have often had the experience of listening to a recording of my speaking voice and finding it quite unlike what it sounds like to me when I am doing the speaking.)

There were two things that being a King's chorister gave me. One was the experience of performing music at a professional level at an unusually young age. I am talking not just about the services, but also about tours we went on, recordings we made, and concerts we gave. The recordings and concerts would often be with professional orchestras and soloists. Several people I knew then, both choristers and choral scholars, have gone on to successful musical careers.

The other thing it gave me was a perhaps not entirely healthy feeling of being special. This message was reinforced in many ways—by the numerous tourists who came to the services, eager to photograph us in our extraordinary uniforms (monkey jacket, waistcoat, pin-striped trousers, gown and top hat); by constantly being told that we were one of the best choirs in the world, if not *the* best (a verdict that many would have disputed even then, but they were not around to disabuse us); by being a somewhat different species within King's College School; by the many years of tradition that we were adding to; and so on.

Amongst the pieces of music I particularly love, there are many for which I can pinpoint the exact moment that that love started. One such is the alto aria "Erbarme dich, mein Gott" from Bach's *St Matthew Passion*, with its gorgeous violin solo. One year we gave two performances of the *St Matthew Passion* and that movement bowled me over. Not only that, but I liked the next aria, "Gebt mir meinen Jesum wieder", for bass, and also with a violin solo, almost as much. I hardly ever listen to them now, because I know that I am too familiar with the pieces to recapture the intense feelings I had then. My best chance of repeating the experience to some degree is to listen to them only very occasionally—for example, twice in the last ten years or so I have been to concerts of the *St Matthew Passion*.

On not becoming a composer

Towards the end of my time at King's, I had an unexpected further encounter with David Willcocks, who by that time was Director of the Royal College of Music. I entered a competition run by the Bach Choir, which he conducted, to compose a Christmas carol. They chose five winners, and I was one of them. The prize was a very small amount of money, probably something like five pounds, but what went with it was not small at all: a televised performance of the carol in the Royal Albert Hall, given by the Bach choir to a huge audience (it happened during a popular Christmas concert), as well as a televised

interview with David Willcocks in his office, and even a short film (maybe 90 seconds) made about me and my life as a King's chorister. I was 11 when I wrote the piece, and had just turned 12 when the concert took place, the broadcast going out a few days later. A friend of my parents agreed to video the programme (part of a series called *Songs of Praise* that used to be shown weekly) but unfortunately he later wiped it. My parents made enquiries many years later of the BBC but were told that they had not kept this programme in their archives. So it is almost certainly lost for ever.

One of the reasons my carol was chosen was that I had thought of a gimmick to make it stand out. The first verse was quite conventional (in fact, it was rather similar to a carol, "This Joyful Eastertide", which I had sung several times), but in subsequent verses the melody was sung in turn by the altos, tenors and basses, before returning to the trebles for the final verse. Once I had decided on this scheme, the rest was a bit like filling in the details of an attempted proof of a theorem: it was reduced to a series of smaller puzzles.

After this experience, I thought that I might well become a composer. But even then there were signs that I wouldn't. I had written this carol not because I was constantly writing pieces of music, but because there was a competition to go in for. And after the competition, I did not start composing more. I remember my father telling me something like, "You are ahead of the game now, but if you don't work at it, then others will catch up," and that is exactly what happened. I have written a handful of pieces since then. Hearing them performed is a very particular pleasure: the nearest equivalent I can think of is releasing a preprint with the solution of a previously unsolved problem. (There are many differences between the two, but the accompanying emotion is somewhat similar, including the rapidity with which the excitement fades.) I have not entirely given up on the idea of composing seriously, but I know that to do it properly would involve a lot of work, and that to write anything good I would have to write a number of lesser pieces first. At this stage, I may have to wait till retirement, though I suppose I could get started on some of the lesser pieces.

One of the things that has inhibited me is the difficulty of finding a true compositional voice: I think that with practice I would be good at writing pastiche, but music has developed and fragmented to the point where it is far from clear what one is supposed to do if one wants to write original pieces. My father faced this problem head on. He was masterful at writing pastiche. He wrote the music for every single episode of a well-known Sherlock Holmes series by Granada television (starring Jeremy Brett), and for each one he would arrange the main theme in a style that was suited to the subject matter of the episode. A particularly memorable sequence was a violin solo in the style of Bach that

accompanied the tumbling of Holmes and Moriarty into the Reichenbach falls. In general, he resolutely refused to follow the fashions of contemporary music. When he was not writing pastiche, he aimed to find what one might think of as “gaps in style space”—combinations of existing styles that had not previously been attempted. In my view, he succeeded in that aim, finding a style that builds on influences such as Bach, Debussy, Ravel and certain jazz arrangers, while also managing to be very characteristically his own.

Music at Eton

Towards the end of my time at King’s, I went in for a music scholarship at Eton, of which there were three awarded each year. I came fourth, which meant that I was offered a music exhibition, worth only a token amount, which I had to turn down because the school fees were way beyond what my parents could afford. (My father was still at the stage where he was earning hardly any money.) However, a few months later I tried for an academic scholarship, and this time I was successful, though only just. Then, as now, scholarships were means tested, so although mine was worth only half the fees, my parents were not required to pay the entirety of the other half, and that meant that I could go.

There were three main components to my musical life at Eton. From the start, I was a member of the College Chapel Choir, which, as its name suggests, sang in the Eton chapel, which is like a scaled-down version of King’s College Chapel (both having been founded by King Henry VI). The repertoire we sang was also similar to what I was already used to from my time at King’s, so in many respects my choral life just continued as it was. Of course, the standard was not as high, but it was pretty high nevertheless—there were many former choristers in its ranks, including a contemporary of mine, Jonathon Bond, who got one of the three music scholarships that I did not get. He had been the top soloist in the St John’s College choir (the main rival in Cambridge to King’s) and continued in that role for some time at Eton until his voice broke. My voice didn’t break suddenly, but it had started a downward slide by the time I got to Eton, so I sang alto, and continued singing alto all through my time there. I found it gradually harder and harder, and when I left, and stopped singing for a few months, I discovered to my surprise that I could no longer sing falsetto, something I inherited from my father. It was a disappointment as well as a surprise: I have had several dreams in which I am able to sing falsetto after all (usually much better than I was ever able to in real life), and waking up from those dreams I realize that there is still a part of me that deeply misses singing. What is left of my voice could be euphemistically described as “baritone”: that

is, not low enough to be a decent bass or high enough to be a decent tenor. More importantly, it just doesn't make a very nice noise.

The second component of my Eton musical life was playing the violin in the main school orchestra. I started at the back of the seconds and gradually worked my way up until in my final year I was in the front desk of the firsts (with my violin teacher leading). We would do a concert at the end of each term. There is nothing like rehearsing an orchestral piece for a term to become truly acquainted with it. I have often had the experience of hearing a piece on the radio, not knowing what it is, but knowing from the familiarity I have with it that I must at some stage have played in it.

Of course, some of the many pieces we played made a sufficient impression on me that I *was* left able to identify them. Each term somebody would play a concerto, and those were particularly memorable. Amongst the famous concertos I got to know that way were the piano concertos of Grieg, Tchaikovsky and Brahms (his first), as well as Gershwin's *Rhapsody in Blue*. Several of the soloists who played these and other concertos went on to become professional musicians.

Somewhere in the middle of the degree-of-recognition spectrum come Beethoven's symphonies. I have played in performances of most of these, and the result is that if I hear one (on the radio, say), I will instantly know that it is a Beethoven symphony, but unless I hear a very obvious cue (such as da-da-da-dum), I will not be able to say which one.

My best friend at Eton was a brilliant German viola player, Thomas Gaede, who was another of the three people who denied me a music scholarship. He had won national competitions in Germany and had two brothers, a violinist and a cellist, with whom he played in a trio that still performs now, and not just in Germany. He became a doctor, but he undoubtedly could have been a musician, as his two brothers are. The violinist, Daniel, was for a time the leader of the Vienna Philharmonic orchestra. Thomas, at his final school concert, played the Walton viola concerto. That was in 1981 and I have not listened to the piece since, but writing this makes me curious to know whether I will recognise it if I hear it again. A couple of minutes later, courtesy of YouTube, I have the answer, at least about the opening of the piece: I do not recognise it to the extent of being able to predict where it is just about to go, but the main melodic fragments are definitely familiar; I would not have known instantly that it was the Walton viola concerto, but would probably have been able to guess it (partly because there are not many viola concertos, and this may be the only one that would feel familiar). And a few minutes later I have a similar reaction to the second movement.

I also played in the school's chamber orchestra, so I got to know much of the string repertoire: pieces like Britten's simple symphony, and serenades by Elgar and Tchaikowsky. In my first year, we played Bach's first Brandenburg concerto, which became deeply embedded (in the sense that if you played me an arbitrary ten seconds of the piece, I would identify it easily). It was the first Brandenburg concerto I got to know apart from the third, which my parents had played me several times and which I loved. It is still one of my favourite pieces, and another that I have to be careful not to listen to too much. In my final year, we played the Bach double violin concerto. One of the soloists fell ill shortly before the concert, so I had the good fortune to be asked to step in. (I was fairly familiar with the piece, so I did not have to learn it from scratch.) That was not one of *the* concerto slots: it was at a more minor concert.

The third main component of my musical life was of course my music lessons on the violin and piano (and, very briefly, the organ, which I gave up after a term or so because I had too much else on my plate to do it justice). One abiding memory I have of my experience learning the violin is of playing to my parents one holiday, after I had been at Eton for a couple of years, and surprising them by being better than they thought I was. On the strength of that, my father decided to depart from his normal *laissez faire* policy of not pushing me to practise in the holidays, the natural result of which was that I did almost no practice in the holidays. We were staying with my grandparents, and he had a few sessions with me in which he took me right back to basics, concentrating especially on my bowing and on the tone I was making. I was at the level of maturity where what interested me was playing difficult right notes in the right places—I didn't really think much about my tone. The result of my father's input was that I went back to school with a complete technical overhaul: in a few sessions (consolidated with some practice on my own that he made me do), I probably improved more than I had over the previous couple of years. My violin teacher was astonished, and immediately took me more seriously, promoting me to higher desks in orchestras, and thinking of me as one of his better pupils, though never anywhere near as good as the likes of Thomas Gaede.

That taught me something about education more generally: that it is possible to make very rapid leaps forward. Probably one has to be ready for them, but it would be interesting to know what one could do in two weeks with an intelligent fifteen-year-old who had been taught mathematics badly. I think that many people are held back by an erroneous belief that significant self-improvement is virtually impossible. All it takes to correct that belief is an experience in one's own life that provides a clear counterexample. (An example in mathematics is the experience of solving a hard problem after thinking about

it for a long time.) Providing somebody with such an experience is one of the greatest services one can do for them.

The high point of my violin playing at Eton was probably a performance of the first movement of Bach's E major partita at the annual string competitions. I never had a chance of winning one of these competitions, but on this occasion I was highly commended. (The following year I played part of the first movement of Beethoven's violin concerto, but it was too ambitious—I could play the notes but not securely enough to make proper music of them—and I was not commended.) As for the piano, the high point, again at a competition, was Brahms's first rhapsody. My piano teacher was very pleased with me (though the judge of the competition was apparently less impressed), which had the unfortunate effect that the following year he set me a piece that was too hard: Chopin's ballade no. 3 in A flat. The final time I played it to him before the competition, it was clear that I had not managed to get fully to grips with the notes. In particular, I messed up the final flourish of the piece, at which my piano teacher was not at all pleased and said something he perhaps should not have said: "Whatever happens, don't mess up the very end." So it was more or less inevitable that when the end came, and I was already in quite a state after having only approximately played some of the earlier parts of the piece, I should mess up the final flourish again. It is not easy to take a bow to the polite applause that follows a disastrous performance like that. The following year I played an easier piece (Debussy's *Hommage à Rameau*) and it went well again.

A curious aspect of my musical capabilities was that I was very good at sightsinging and very good at sightreading on the violin, but very bad at sightreading on the piano. As soon as I had more than one line to cope with, the exercise was completely different somehow. I still find good keyboard sightreaders miraculous to watch. There was one boy in the year below me, Paul Richardson, who arrived at the school able to sightread anything one put in front of him, including pieces that it would have taken me weeks to learn. A beneficial effect of being bad at sightreading on the piano was that by the time I had learnt a piece, I could play it by heart: I think it probably meant that I became more intimately acquainted with the inner workings of the pieces that I played than I would have if I had been able to read them more easily.

It is probably not a coincidence that my inability to sightread on the piano was accompanied by an aptitude for improvisation. At some point in my mid-teens, my father played me a track called "Con Alma", from *The Jazz Soul* of Oscar Peterson. He did so to explain to me what swing was. The track starts slowly, though with an underlying 12-8 pulse in the drums. At a certain point

a faster rhythmic figure comes in, which creates a sort of half swing, but it is a bit regular. Then when Oscar Peterson's solo starts, the true swing starts with it: that unmistakable but hard-to-describe rhythmic quality that propels the music forward. Because this piece is in 12-8, it was perhaps not the best example to use to explain what swing is. If one plays in 4-4, then a first approximation to swing is that each pair of quavers should be "tripletized": that is, the first quaver should become two thirds of a triplet and the second quaver one third. However, unless the tempo is very slow, that does not in fact produce true swing: something that many a classical musician attempting to play in the jazz idiom has failed to understand. To a second approximation, the picture is more like this: at a slow tempo one plays triplets as just described, at a fast tempo one plays even quavers, and there is a gradual transition from one to the other in between. My father experimented with this idea with the help of a synthesizer he had, adjusting the ratios of the two notes in each quaver pair to see what the ideal ratio was at several different tempos.

Listening to "Con Alma" was one of the experiences that got me interested in jazz. I also used to listen to Humphrey Lyttleton's jazz programme on the radio. (Humphrey Lyttleton was a British national treasure: a jazz trumpeter, radio presenter, and host of a very popular send-up of panel games called *I'm Sorry I Haven't a Clue*. He had also, as it happens, gone to Eton.) Sometimes I would tape tracks from the radio and listen to them repeatedly afterwards: one that I got to know and love that way was "The Big Step", from a fairly late record by the Count Basie Band. (At least, I think that is what it was called, but I can find no mention of it online.) I played it to my father and he turned out to have the record. Much of the track consisted of the tune in the trumpets and just the bass and drums for accompaniment, which meant that when the entire band did come in with great big Basie chords, at one point unexpectedly interrupting a quiet piano solo by Basie himself, it was incredibly exhilarating. One of the many aspects of my musical taste that my father strongly influenced—it is probably not an exaggeration to say that he implanted it in me—is a love for sparse jazz arrangements. If one is sufficiently well-acquainted with jazz harmony and chord sequences, the chords can be implied by the bass and the melody (whether improvised or not), to the point where actually stating them becomes not just redundant but actually intrusive. My father introduced me to the Gerry Mulligan quartet, which did not even have a piano, and once I had got used to it, it was a bit like getting used to coffee without sugar and no longer liking coffee with sugar, though in the case of jazz there are later styles where the piano does much more than merely state harmony that could have been left unstated, and then it becomes palatable again.

The biggest thing my father did to transfer to me his love of jazz was to explain to me the rudiments of jazz harmony, with particular reference to the piano. He

had a piece of paper he was very proud of, on which he had typed his explanation, entitling it something like, "All of jazz harmony on one side of A4". I later realized that it didn't cover everything—for example, it did not deal with minor keys or the major seventh chord—but it was certainly all one needed to know to play a twelve-bar blues, and therefore enough to get started playing jazz. In addition, he created an ideal practice tape, in the form of a synthesized bass and drum track that I could play along to. The bass played a twelve-bar blues sequence, but every time it had gone through the sequence twice it went up a semitone. In addition, the speed gradually increased, so that every time one had gone through the entire octave twice, the speed had doubled. It started very slowly, and the more I practised with it, the longer I was able to last before I had to give up.

I did not list jazz as one of the three main components of my musical life at Eton. That is because at the time it was something of a sideline, though I was very interested in it and determined to get better at it. I set up a quintet there, but it was not very good, and for the bass player I had to write out parts because he couldn't improvise. (That statement is relative—some of the other players couldn't really improvise either, but they did.) One reason I was so keen to be able to play jazz piano was that my father could, and was very good at it. When he composed, he would work in a room at the top of the house, and one often heard him playing the piano to give himself ideas or to test ideas he had already had. But from time to time he would need to relax, and he would slip into jazz instead. I wish I had a recording of it, because I would be very curious to hear him again now that I know so much more about jazz than I did then.

One other school musical experience worth mentioning is my largest-scale composition, a setting of the *Agnus Dei* for choir, organ and a few other instruments, the particular combination being chosen because the piece was meant to involve everybody who would be going on a music tour that a group of us went on to Switzerland. I had recently been told about the diminished scale (also known as the octatonic scale) by my father, and I made very heavy use of it in the piece. When we were back at Eton, we gave a final performance of it and somebody recorded it. For some reason my father was unable to be at the concert, possibly because he had an urgent deadline (his deadlines always became urgent), but he listened to the tape and told me that while he liked it, he found the use of diminished harmony a little unrelenting. He said this in as positive a way as he could, by drawing attention to a place he liked where I moved from diminished harmony to a harmony based on fourths. Since then, I have been suspicious of any music that appears to be saying, "Wow, if I confine myself to the diminished scale then everything fits with everything else but sounds interestingly discordant at the same time." If everything fits

with everything else, then the harmonic tension is gone. In fact, I have at times even worried about this with some of my father's music, as he is certainly fond of the diminished scale. However, I usually find on repeated listening that he has used it as a means to a greater end, rather than as an end in itself, which is what I object to when I come across it.

Cambridge

I left Eton at the end of 1981, having taken the Oxbridge exam in November. That left me nine months to fill before I went to Cambridge. I spent most of them in South America, because my father thought it would be good for me to learn Spanish, and had a friend from university who lived in Santiago in Chile and would be able to help me settle there. The one thing to say about those six months from a musical point of view is that I took a cheap violin with me and busked in the streets of Santiago, playing unaccompanied Bach (the highlight being the E major partita I had learnt at Eton). Because the classical music tradition was much less developed in Chile than it was in England, I was, relatively speaking, a far better violinist, and attracted quite a bit of attention, including being interviewed by newspapers there. I even entered a talent competition called *¿Cuanto Vale El Show?* where contestants had about a minute to impress the judges, who would award money according to how impressed they were. I won about 100 pounds, which would normally have been enough to make it to the next round (and more money), but on this occasion it was not quite enough to stop me being beaten by someone else—a singer if I remember correctly. But I was pleased with the money, and the show was very popular so plenty of people came up to me in the street afterwards to say that they had seen it.

Once I started in Cambridge, the main changes to my musical life were that I no longer sang in a choir, that I played in significantly better orchestras, and that I started playing jazz more seriously. To the piano and violin I added the viola and double bass, for the same reason in both cases. My father had advised me that I would get into better jazz groups as a bassist, because there is always a shortage of good bass players, whereas however good one is at the piano, there is always someone better. At Eton, there was a room that had several double basses in it, and I would sometimes go there, pick up one of them, and have a go at it. The way I looked at it, I was applying a simple geometric transformation to my violin playing. In particular, what the left hand did was a rotation and enlargement of what I was used to, an attitude that led me to what I later discovered was rather unorthodox fingering. At Cambridge I played bass in a big band for a while, and also briefly in a small group. I found the latter frustrating because I didn't think the pianist was as good as I was. I realized that it really was jazz piano that I wanted to play: playing bass

just felt like being the servant of someone else who was doing what I wanted to do. I switched to piano in the big band, but in the end gave that up because there were not enough opportunities to improvise. My jazz life took off properly when I was in my fourth year (doing Cambridge's Part III course) and a pair of twin brothers, Phil and Tom Bancroft, one a tenor saxophonist and one a drummer and both extraordinarily good, arrived at Cambridge. By that time I was playing in a trio with a bassist and guitarist. The guitarist left and Phil and Tom joined us, and there followed a couple of years in a group that could actually get gigs outside the university. Perhaps our greatest triumph was to play twice at the 606 club in London. We were also selected by an organization called Eastern Arts for a tour, which meant about six gigs in various towns in Eastern England.

Unfortunately, no student band lasts for long, and when Phil and Tom left Cambridge after three years I did not manage to find anyone else of a similar calibre to play with. I also started to have the problem that my father had talked about: younger pianists arrived who were better than me. They have gone on to be jazz musicians, as have Phil and Tom. I am left with the feeling that perhaps if I had devoted myself single-mindedly to my jazz playing I could have become one too, though the life I might have led as a good but not top rank jazz musician would have been far less comfortable.

When I played in the band with Phil and Tom, we had disagreements about the kind of style we wanted to play in, which I mostly lost. That left me with the feeling that I had never quite achieved what I wanted to achieve musically. Many years later I spent two years in Princeton, where the standard of jazz was far higher than you would ever get in a British university. I managed to get into the second Princeton University Jazz Ensemble. (The pianist for PUJE1 was another mathematician, Adrian Banner, then a graduate student, and another example of there always being someone better—in his case much better.) The director, Tony Branker, insisted on a level of rhythmic precision that was quite new to me, and I came to realize how sloppy I had been rhythmically up to that point. One word sums up his approach: subdivide.

When I got back to Cambridge, I was given a chance by Peter Goddard, then the Master of St John's College, to perform in the Master's Lodge. I did so with a very good bass player, Chris Hill, yet another person who has gone on to become a professional jazz musician, and with a drummer he knew. While at Princeton, I had fulfilled a long-standing ambition of becoming comfortable with "Con Alma", the Oscar Peterson track my father had played me when I was a teenager (though the song itself is by Dizzy Gillespie), which has one or two transitions in its chord sequence that are tricky to improvise over convincingly. By "convincingly" I mean that one wants to play melodically rather than merely hitting notes that do not clash with the chord underneath. Often this

can be done by leading into the next chord before it arrives, but with certain transitions this creates constraints that are hard to satisfy. I listened carefully to how Oscar Peterson managed it, and eventually found a way of doing it myself. I gave a rendition of “Con Alma” to Tony Branker for my audition for PUJE, though I had to do it as a solo pianist—something I have never much enjoyed.

The recital at St John’s finally gave me a chance to be completely in charge of my programme. I also took on the challenge of John Coltrane’s “Countdown”, which is fast and has a ludicrously difficult chord sequence. I had a practice tape with a short and long version (not made by my father this time), and after a lot of practice I became reasonably fluent with the chords, though I didn’t quite get to the stage where I could forget about them and just play. A sign of that is that my “improvisations” tended to be very similar to one another: they were starting to become like mini-compositions.

That recital was recorded by the drummer, so I finally had a record of myself playing what I wanted to play, and doing so close to the limit of my ability. Unfortunately, there was much of it that I was not satisfied with—despite Tony Branker’s influence I still had a long way to go with my rhythmic precision (which matters a lot, since very small inaccuracies can kill swing stone dead). I have had one or two further chances to record myself since, of which the main one was a lecture/performance I gave as part of the Cambridge Music Festival in 2006, which had a music-and-maths theme that year. By then, I had developed my own ideas for how to present jazz harmony on a side of A4, which were of course heavily influenced by my father’s, but which generalized them somewhat and made a good topic for a popular lecture. A single rule that covers a huge amount of jazz harmony is this: assuming you leave the bass note to the bass, then whatever you play in your left hand, you should avoid notes that are a semitone above them in the right hand. This statement is to be interpreted modulo an octave. Vast amounts of traditional jazz theory can be condensed to almost nothing with the help of this rule. Naturally enough, there are exceptions to it, so the slightly subtler point I made was that these exceptions are discordant in a very particular way that is easy to distinguish from the usual “scrunchy” jazz discordance, which sounds gorgeous when you are used to it. This observation also helps to explain many effects of twentieth-century classical harmony as well.

I gave versions of this talk/performance a few more times, including at the Cheltenham Music Festival in 2011 (which again had a music-and-maths theme), and it has cured me of the feeling that I once had of never quite having fulfilled myself as a jazz pianist. I now know that to do something significantly

better than what I have done already would require me to take my playing to a new level, and that would need more work than I am ever likely to put in.

Returning to my undergraduate days, I played regularly in university orchestras and added several wonderful pieces to the list of pieces that I knew with the intimacy that is hard to achieve except by performing in them. Amongst the highlights were Brahms's fourth symphony, Stravinsky's Rite of Spring, Tippett's Double Orchestra Concerto, and Debussy's Prélude à l'Après-Midi d'un Faune. The last of these was another piece that my father introduced me to. I think he played it to me on two occasions, once to explain its historical significance as a completely new way of treating harmony, and once to test a theory that he had read and not believed. The test he did was to ask me to say what I thought the tonic was as the piece progressed (or as he and I would put it, to say what "do" was—that is, "do" pronounced "doh" rather than "doo"). I did the best I could, and afterwards he told me that the article he had read had suggested that there almost never was a clear "do", and that my response, which broadly agreed with his, appeared to disprove that by showing that there often was one. The piece joined my list of favourite pieces, but to play in it felt like an extraordinary privilege: it could so easily have not been programmed during the few years that I played in the orchestra.

The story behind Tippett's Double Orchestra Concerto is similar, but this time it was my violin teacher at Eton who introduced me to it. About once a year he would invite Thomas Gaede and me to Sunday lunch, which we greatly enjoyed because he was an excellent cook and amusing company. We would then stay around for the early afternoon, and two afternoons live particularly in my memory. On one of them, *The Glenn Miller Story* was showing on television and we ended up watching it. I was entranced, particularly by the music, though I stopped liking it when I started listening more serious jazz: I would now think of that development in my tastes as putting away childish things. On the other afternoon, my violin teacher decided to play us the Double Orchestra Concerto. I have no idea why he did that, but I do know that random acts of cultural instruction of that kind have often had a far greater effect on me than their perpetrators can possibly have expected. The style of the piece was very new to me at the time, but there was a hook: a melody in the second movement that was harmonized in a straightforwardly beautiful way, including a clash that quite deliberately violates my avoid-the-note-a-semitone-above rule to great effect. As I listened to the piece again over the years, I started to like other parts, until eventually I liked the whole piece—a process I have gone through with several other pieces.

The Rite of Spring I discovered for myself as an undergraduate, unless you count a failed attempt to sightread a piano duet version with my piano teacher

at school. I think everybody with a serious interest in music that does not stop in the nineteenth century has a time in their life when they come to grips with this piece. As with the Tippett, I was initially attracted by some of the more harmonically accessible parts—parts that could almost have been by Debussy or Ravel—but then became fascinated by the opening, wanting to know more precisely how it had the effect on me that it did. Analysing that properly is still on my to-do list, but when preparing for my talk in Cheltenham, I came to understand something about the opening of the second part. There is a kind of inhaling and exhaling that goes on, and I realized that the bitonal harmony for the exhaling part violates the no-semitone-above rule in a rather extreme way (one of the two alternating chords in the wind is E-flat minor over the held D-minor in the strings), whereas the harmony for the shorter inhaling part, though also discordant, is discordant in the semitone-*below* way that makes it jazzy, to today's listener at least. (One might question which of these is inhaling and which exhaling—I've gone for a slow exhalation and a more rapid inhalation.)

I mentioned earlier that I took up the viola at Cambridge. That allowed me to play in significantly better orchestras than I would have otherwise, including CUCO, the Cambridge University Chamber Orchestra. Of course, the price I had to pay was playing some fairly dull inner parts when the violinists were playing the interesting melodies. But that was not always the case, and one notable exception was yet another chance to play in one of my all-time favourite pieces: I scraped into a performance of Brandenburg III as the third viola. The small ensemble that played it was led by guest conductor/soloist Iona Brown, who was famous as the director of the Academy of St Martin in the Fields. That was the highest level I reached as a string player, but my memory of it is slightly soured by hearing someone else in the orchestra, who had not been involved in that item, describe it as the worst performance he had ever heard of the piece. Musicians can be like that sometimes.

One other highlight of my musical life at Cambridge was writing the music for a play. The play itself was a deservedly obscure one called *The Puppeteer*. I cannot remember the name of the author, but I think the play was French and written in the early twentieth century. My music was quite heavily influenced by Stravinsky, and in particular by *Petrushka*. In fact, I went with the director to watch a performance of *Petrushka* as part of my preparation for writing the music. The original intention had been to have live music during the play, but it became clear that that was simply not going to happen—Cambridge's musicians were far too busy—so I arranged for it to be recorded instead. I had a deadline crisis of a kind my father knew only too well, which included staying up all night to write out parts (this was before a computer could have done the

whole thing for me). We were very short of time during the recording session, so I had to make painful compromises such as accepting a take even though one of the musicians had missed a rather important entry. At one moment I thought the whole attempt had failed when a flautist, who played the main melody in two cues that we had not yet recorded, had to go. But a clarinetist said he would play the part instead, an octave lower than I had written it. I had no choice but to accept this, but fortunately a miracle occurred: it sounded better on the clarinet than I could possibly have imagined it sounding on the flute. That was not quite the last piece I ever wrote, but it was the last piece of anything like that level of ambition.

My classical piano playing took a back seat while I was an undergraduate, and I did not take it up again until a few years later when I was married and living in my own house for the first time. Then it became possible for me to own a piano, and although most of what I played on it was jazz, I also enjoyed sightreading classical pieces and even, just occasionally, learning a piece. My sightreading was still bad, but I improved it in the obvious way: by doing much more of it. I bought copies of both books of Bach's 48 preludes and fugues and worked my way through the whole lot several times. At first it was a tortuous process, but by the third or fourth time I knew them somewhat (previously I had known a few of them but now I had that intimate acquaintance that I have talked about several times already) and had become used to sightreading that particular style of music. That second point is important: I found that while my reading of Bach was noticeably better than it had once been, if I was given, say, a piano accompaniment to a violin piece by Mozart, my reading of it was as bad as ever. That led me to the theory (for which I claim no originality) that ability to sightread on the piano is not merely an ability to translate the symbols on the page very rapidly into appropriate physical movements, but something far more active: a kind of half improvisation where you have strong expectations about what you are going to do next and use the music to make minor adjustments as you go along.

The only time I have ever performed as a classical pianist, apart from the terrifying music competitions at school, was at a conference in Cambridge to celebrate Paul Erdős's 80th birthday. For the previous year or two I had been practising Chopin's *Fantaisie Impromptu*, which I first heard in an electrifying performance by the third person who had denied me a music scholarship: Philip Lurié, a pianist from Israel, who is now a performer and teacher there. My piano teacher, who was also his piano teacher, told me that he had learnt it in two weeks. Not too long after that, he suggested that I might like to learn it too. I made some progress with it but it was too difficult for me and eventually I abandoned it. (It was by no means the only piece to suffer that fate.) Years

later, I decided to try to take up where I had left off and finish the job. By the time the Erdős conference came round, I had got it just enough under control to dare to perform it in public, which I duly did. It was not the greatest performance ever—I was still too worried about the notes for that—but I avoided embarrassment of the kind that I had gone through with the third Ballade a little over a decade earlier.

On rehearing music

The phrase “On rehearing music” is the title of a wonderful article by Leonard Meyer, available online if you have access to JStor, which I read as an undergraduate. By that time I had become convinced that my musical pleasure was heavily based on how a piece managed to set up, and sometimes defy, my expectations. If there were no surprises, then the piece would give me no pleasure, but if there were too many surprises, then they would cease to be surprises because I would cease to have expectations. The best music would steer a careful course between these two extremes.

There are a number of difficulties with this general view. For example, it does not seem to explain what makes musical pleasure distinctively musical, since other art forms can set up expectations and provide interesting surprises. There are various answers to that particular objection. One is that nobody is suggesting that musical pleasure is *solely* a matter of managing expectations: merely that that is a very important component of the pleasure. The argument that underlies the objection could be phrased as follows: if you had some other structure that was isomorphic in a simple way to a piece of music, then the expectations would be set up in the same way, but the pleasure you would get from it would be completely different or perhaps even nonexistent. However, this argument is not obviously correct. Consider, for example, the effect of reflecting all the notes of a piece so that higher notes become lower notes and vice versa. The result would certainly be isomorphic in a simple way to the original piece, but, and this is the crucial point, *a piece does not exist in isolation*. Of course the upside-down piece would sound extraordinary and not give the same pleasure as the original, but that would be because its relationship to the rest of the musical canon would be completely different. Even if one brought a child up listening to every single piece upside-down (which might be quite an interesting experiment if it were not for the obvious practical and ethical objections), the relationship between the upside-down canon and the other noises that that child would hear, most notably human voices, would be importantly different.

There is, however, a more serious objection to the flow-of-information view of what makes music pleasurable. It would seem to be a consequence of that

view that if one listens to a piece several times, then one will stop enjoying it, since there will no longer be any surprises. Much of Meyer's essay is devoted to that objection. One of the points he makes is that sometimes you have to listen to a piece a few times in order to develop enough familiarity with its idiom to set up the expectations in the first place. So to begin with at least, the flow-of-information theory would suggest that repeated listening to a piece can *increase* the pleasure one derives from it, as indeed is often the case. But the part that impressed me most about the essay was when to my surprise he went on to suggest that it really is true that if one listens too often to a piece, one can no longer recapture the early pleasure, or at least not without some effort to refresh it, either by partially forgetting it or by listening to an interesting new interpretation.

This has fitted extremely well with my experience. A couple of times already I have mentioned pieces that I love but hardly ever listen to for fear that they will become over-familiar. Sometimes I am thrilled by a piece I know well and just happen to catch on the car radio, when I would never dream of putting on a CD of the same piece or listening to it on YouTube.

In general, a piece is "safer" in this respect if there is some aspect of the effect it has on me that I do not understand. I listen to such pieces as a (non-practising) composer, wanting to learn how to achieve the effect that has been achieved. (In a similar way, I listen to jazz pianists with an ear to adding ideas to my own playing.) If I have not yet worked it out, then the piece can remain interesting even if I have listened to it many times.

A third career in music that I have fantasized about (the other two being composing and playing jazz piano) is as a music theorist. As will be clear by now, my ideas have been strongly influenced by my father's. He always used to say that he wanted to write a book one day, based on what he had learnt about writing music through being a composer, which was very different from what he had been taught when reading music at university. He explained many of his ideas to me but unfortunately never got round to writing the book, and in 2001 had a stroke that put an end not just to his composing but to any thought that the book might one day be written. I have not completely given up the idea of writing a book myself. It would not be the one my father would have written, but it would be as close to it as the world is likely to get.

Towards the end of my father's composing life, he attempted to write more and more systematically. One of his best pieces, a trio sonata for organ, was written very carefully in a top-down fashion, with several levels of detail filled in one by one. The middle section of the piece is fugal. Initially it is based on the diminished scale, and is therefore a slight cheat in the sense I mentioned earlier: if you use that scale then there is no danger of the lines clashing, so one

of the sources of pleasure one can derive from a fugue—the way the counterpoint miraculously makes harmonic sense—is reduced. However, that applies just to the very opening of the section. Taken as a whole, it has an extraordinary Bach-like ingenuity after all. For example, one passage that sounds a bit like a jazz improvisation over a bass line, though using a different harmonic language so that it does not sound like a cheap imitation of jazz, is later repeated but with all the intervals stretched to approximately twice what they were before, creating a sound that works wonderfully well and that I have not heard in any other piece. His stroke was a terrible tragedy, not just for him, my mother, and the rest of the family, but also because it deprived everybody of the further music that his new compositional methods would have produced.

The tendency that drove my father to analyse and try to make systematic what he was doing when writing music is one that I have inherited, except that I apply it to mathematics. Recently I have worked on automatic theorem proving, which has required me to look very closely at the details of how I come up with (even quite simple) ideas. If I had become a music theorist, I think I would have ended up trying to write computer programs that could produce music in the styles of various composers. I have heard existing attempts in that direction, and while I am impressed by what some people have managed to achieve, I would not be impressed by the music if it were a pastiche written by a human composer. I am left with the feeling that, given sufficient time, I could do better. Of course, that is easy to say, but I still believe it.

Returning to the theme of rehearsing music, there is one other experience I have had a few times that is not completely explained by the information-flow theory. It is the experience of hearing a piece once, then not hearing it again for a long time, and then, on hearing it for a second time, absolutely loving it in a way that I did not the first time. The effect is particularly strong if the second time round I am not initially aware that I have heard the piece before, but then realize that I recognize it.

The clearest example of this was Schubert's string quintet in C major. One wet Sunday afternoon when I was probably about 11 or 12, my mother decided to play a record of it and get me (and probably my sisters too—I can't remember) to listen to it. I found it perfectly pleasant, but did not fall in love with it. Two or three years later, I was again made to listen to it, this time in a music class at Eton, and when the famous second subject came in in the first movement, I suddenly realized first that I knew the piece and almost immediately afterwards that I was mad about it. That quintet was another good example of a process I have already mentioned, where there is an initial hook—in this case that second subject—which to start with is the part that I particularly look forward to in the piece, but which is then joined by several other parts, until

eventually the pleasure is more uniformly spread over the whole piece. This particular piece has a quality that I always find extraordinary when I come across it: that all four of its movements are wonderful.

Oddly enough, another example was also a piece by Schubert: his G-flat impromptu. I do not know when I first heard it, but it is a sufficiently well-known piece that I probably heard it a few times during my childhood and adolescence, without necessarily knowing what it was. And then when I was about 30 the opening of the piece was used as background music at an appropriate moment in some TV programme I was watching and it had a magical effect on me. I still did not know what it was, but a few months later I was staying with an aunt of mine, whose husband played the piano and had a book of Schubert impromptus. I was still curious about the piece I had heard when watching the TV programme and had a hunch that this book might contain the answer, which it did. I have subsequently tried to learn the piece. That is another thing that is still on my to-do list—I'm sure I can manage it, but I have not put in the effort needed. With that particular piece, there is no point in playing it unless one plays it with complete control, so that the melody sings out over the rapid broken chords in the accompaniment.

A third example is an anthem, "Viri Galilaei", by my father, which was an Ascensiontide anthem written for the installation of Richard Harries as the Bishop of Oxford in 1987, which took place in St Paul's Cathedral. The first time I heard the piece, I found it pleasant but I was not grabbed by it. That was partly because I was comparing it with an anthem he wrote many years earlier, "Holy Holy Holy", which I *had* been grabbed by in the past, and there were certain similarities that made me see Viri Galilaei as a kind of pale imitation of the "real" piece. I do not for a moment want to suggest that there is anything rational about that thought: Viri Galilaei has established itself firmly in the canon of British church music and is sung in three or four cathedrals every Ascension Sunday, whereas "Holy Holy Holy" is almost never performed (which is, I think, wrong). In any case, several years later I went to hear the St Paul's Cathedral choir singing "Viri Galilaei" again. I think it was probably in 2003, and therefore a couple of years after my father had had his stroke. That may have amplified the powerful effect that the piece had on me when I heard it after not having heard it for many years. In fact, I was almost reduced to tears, which is the nearest I ever get to actually being reduced to tears. Since then, I have on a number of occasions had shivers up and down the spine when listening to the piece, though on any given occasion I do not know in advance how strong an effect it will have on me.

Another piece that played an important part in the development of my musical taste was Tippett's third piano sonata. When I first heard it, I was almost

annoyed with it, because I knew what wonderful pieces Tippett could write, whereas this one seemed to me to be gratuitously unpleasant. But there was one part, fairly early on, where there were little glimpses of tonality in amongst the cacophony (as I then perceived it), and those became the hook. After a few more listenings, the process I described earlier happened. My ears became accustomed to the harmonic language of the piece, and I started to like other parts, and to realize that there was much more system to the music than I had initially been able to perceive. That is another piece that I hope one day to find the leisure to analyse closely. Until I do, I will be able to listen to it as much as I like without getting tired of it.

I will end this section by quoting from the final paragraph of Leonard Meyer's article.

It is, at first blush, disturbing and disheartening to face the fact that treasured masterpieces can, with repeated hearings, become exhausted and lose their savor. But two considerations may save us from despair. We can forget. And by forgetting we can, enchanted by a great performance, again experience the vitality which a familiar work once had for us. Such rediscovery of the beauty of, say, a Beethoven symphony once cherished and then too well known, is not an uncommon experience. Second and more important: it is partly because familiar works and accustomed styles become exhausted that new compositions are needed and new styles are developed. And these, by changing us—our ears, our minds, and our habit responses—are paradoxically able to redeem and revitalize the very works and styles they were created to replace.

The Suzuki method

No description of my musical life would be complete without a mention of the Suzuki method, even though I did not learn by it. The main reason I did not learn by it was that it had not been introduced into this country when I was young enough. However, a short time later it was, by Helen Brunner, a friend of my mother's, and that was in time for the younger of my two sisters, Kathy, who is now a professional violinist. And a few years after that, encouraged by Helen Brunner, my mother switched to the Suzuki method for her piano teaching.

The Suzuki method is also called the mother tongue method. Suzuki's idea was that since being able to speak a language is a complex skill that children seem to have no trouble at all learning, one ought to try to teach music, another complex skill, in as similar a way as possible. This lies behind various distinctive features of the method: that children start to learn very young, that they begin playing by ear and only later start to read music, that there is a

large amount of parental input, and that it is important for children to listen many times to the pieces they are learning. This theory has not been scientifically tested, and there is a slightly cultish feel to the entire Suzuki set-up, but Suzuki achieved extraordinary results, and other teachers using the method, including Helen Brunner and my mother, have achieved remarkable results as well. Thus, there is fairly good evidence for the efficacy of the method. Where it becomes unscientific is in the lack of any control groups for its various features: for instance, is it important to listen to the pieces until one knows them well enough to be able to tell when one has made a mistake, or until one can remember every last detail of the performance, or more even than that? (The official answer is that you cannot listen too much.) Does the fact that listening to a piece of music is far more passive than being egged on to talk by one's parents matter? Should one try to have "conversations" at the piano? This is not discussed at all. However, certain features of the method—starting early, parental supervision of practice, and a very close attention to detail, both technical and musical—seem very likely to be ones that will produce good results, regardless of what one thinks about the theoretical underpinning.

I mention all this because although I am not a product of the method, it has had quite an impact on my life, starting with growing up with a younger sister who made much more rapid progress than I did on the violin. For a while that was easy to live with: she was far better for her age than I was, but I was six and a half years older than her so I was better than her in absolute terms. However, the inevitable happened and she caught up with me, when I was in my late teens. I sometimes used to wonder what my playing would have been like if my parents had put as much energy into it as they did into hers; the holiday when my father dramatically improved my playing was very much the exception. But I did not resent this difference in treatment, since it was quite clear that I had other interests, and my violin playing was good enough to give me great satisfaction at school and university. (After I started my PhD, I stopped playing in orchestras and, without really consciously deciding to, gave up the violin entirely.) My sister went to the Yehudi Menuhin school and then to the Guildhall. The Menuhin school gave me another precious musical memory: of watching their orchestra rehearsing Tippett's *Fantasia Concertante* on a theme of Corelli, with Tippett himself conducting.

The Suzuki method had a bigger impact later on, when my own children reached piano-learning age. My mother knew a Suzuki piano teacher, Stephen Power, in Cambridge and I decided that I would ask him to teach John, my eldest, and my other two, Richard and Madeline, when they too were old enough. Stephen Power was very particular about technique, even for a Suzuki teacher, and as a result I found myself becoming far more conscious of my own technique.

Perhaps more importantly, being a Suzuki parent taught me to listen far more carefully to the tone that the piano made, and to be aware of how the way one played the note affected it. To begin with I felt a certain scepticism about this, since it seemed as though there should be only one parameter of interest: the speed with which the hammer hits the strings. I'm not sure whether that is correct, but if it is, that does not alter the fact that a change in technique can have an important effect on the tone, since it can give one much more control. I find now that many pianists, even very good ones, are too percussive for my tastes. What I look for is a pianist who strokes the piano rather than hitting it, and a melodic line that sings as a result.

It often happens in Suzuki families that a second child does very well because of the example set by the older sibling. My second son, Richard, took a keen interest in music from a very early age (in fact, he appeared to be fascinated by it even as a newborn), and soon after he started at the piano, he began to teach himself several of the pieces in the book before he had been set them. He knew them by ear because he had heard John playing them and he had also heard them innumerable times on the CD we had of them. We were in Princeton for a couple of years at the time. When we got back to Cambridge, he and John went to King's College School, where I had been, and Richard came back one day telling us that he wanted to audition for the choir.

The background to this was that John had auditioned a year early and not got in, and then when it was his year we were in Princeton and he could not try again. So we had planned not to put Richard in for it. But there was something about the way he asked that made it clear that he knew what he was asking for and understood the implications, the main one of which was that he would have to board. The result was that in just over a week we went from assuming that he would not try for the choir to being rung up to be told that he had got in. A few months later he started there, and a couple of years after that he became a full chorister and I had a second spell at King's, this time as a parent. I even had a chance to fulfil, albeit vicariously, the dream I had had over thirty years earlier of singing the solo in *Once in Royal David's City*, when Richard was chosen to sing it in 2007.

I say that Richard understood the implications of his decision, but none of us understood at the time just how life-changing it would be for him. He took up the organ and became very good very quickly, continuing his organ studies at Eton, where he had a music scholarship. John went to Eton two years earlier, but with an academic scholarship and music exhibition, so he followed almost exactly in my footsteps. This summer Richard won an international competition in Northern Ireland and he has just won an organ scholarship back at

King's, where he will read music. So he appears to be set for a musical career, which leaves me with the feeling that even if I have not become a musician myself, at least I have successfully passed the torch to the next generation. I was helped in this by the fact that Richard is a phenomenal sightreader. What he can do is so far beyond what I can do that it feels completely miraculous. It may be, however, that I am the anomaly, since both my parents are also much better than I am at sightreading. A level I would have liked to reach, but never did, is to be able to sightread well enough to be a reliable accompanist. John, meanwhile, is once again more like me: he is reading mathematics at Cambridge and having a rich musical life at the same time: he is a choral scholar at Gonville and Caius College. He also still plays the piano, and occasionally conducts. They both enjoy composing.

Madeline, my daughter of 16, still has piano lessons, though no longer with Stephen Power. She is good at it, and could be better, but her interests lie elsewhere. The Suzuki approach to reading music served her rather badly, and she, like me, has ended up with a sightreading ability that is way behind her playing ability. I have recently started Octave, my five-year-old son, on the piano. I couldn't face the demands of the Suzuki method yet again, so he is learning with a traditional teacher, and in particular has been reading music from the very start. He appears to have a less good ear than Richard, but so far he is enjoying his piano lessons, and even his (short but regular) practice sessions with me. I think he is enjoying the piano in a rather mathematical way: he likes learning notes, understanding musical notation, spotting patterns in the fingering of scales, and so on. My other daughter, Esther, who is nearly 3, seemed to have something of Richard's interest in music when she was very young: it will be interesting to see what that and the second-child phenomenon will lead to.

Anybody who has taught mathematics knows that the exercise of teaching affects how one thinks about mathematics, though it is not always easy to say exactly how. Although I am not a piano teacher, my role as a parent supervising piano practice has been somewhat similar (particularly as my approach to practising with Octave is influenced by what I learned from the Suzuki method, so not everything I do with him has been requested by his teacher) and has affected my outlook on music in a similarly hard to describe way. At the time of writing, this semi-teaching is my main musical activity.

Conclusion

In his *Mathematician's Apology*, Hardy writes the following depressing words. (Given the time he was writing, perhaps we can forgive him for not considering the possibility that a woman might be a real mathematician.)

If a man is in any sense a real mathematician, then it is a hundred to one that his mathematics will be far better than anything else he can do, and that he would be silly if he surrendered any decent opportunity of exercising his one talent in order to do undistinguished work in other fields.

I have ended up following Hardy's advice, but certainly not because I agree with it. I incline to a view that is close to the exact opposite of Hardy's: if somebody is a real mathematician, then there is a good chance that they will be good at many other things as well, and they should take those other things seriously. Part of the reason I rebel against Hardy's view is that it threatens my fantasy that I could have had a different life as a musician and that it may not be too late even now. (It is far too late to be any kind of performing musician, but that was never what I thought I could have been. But I have not given up hope of composing a successful piece of music or of making a serious contribution to music theory.)

I entitled this essay "Music—a life not chosen." That suggests that at a certain point in my life my road forked into two and I chose mathematics rather than music. The reality was not like that at all: until I was well into my PhD I did a lot of both, but my "choice" was effectively made long before that because I would have had to do far more practice, either instrumental or at writing music, to become a musician, whereas I cleared the various hurdles I needed to clear to stay in mathematics. The life I have had (and am still having) as a result, the life of a mathematician with a strong side interest in music, has been ideal: to the extent that I made a choice, I made the right one.