Successful *memorising*

by Jenny Macmillan

Introduction

There are many advantages to memorising music. Knowing a piece really well allows a musician to concentrate on the performance, and an intense familiarity enhances the performer's ability to communicate the music to the audience. Indeed, according to research by Aaron Williamon, audiences prefer memorised performances. Playing from memory enables the performer to concentrate on the sound and to understand the whole composition more readily – the music transfers more fluently from conception to performance with no intermediate score. For the amateur there is the added bonus of giving impromptu performances to family and friends. However, there can also be disadvantages to performing from memory. The ability to play from memory varies, and a nervous performer may break down completely with no music. Early errors in learning the score may become reinforced and a particular interpretation may become fixed.

On balance, I believe all instrumentalists, particularly young ones, benefit from memorising some or all of their pieces. Though musicians differ in the apparent ease with which they can memorise music, my aim here is to show that memorising is a skill that can be learned. I identify several methods for teaching memorisation systematically. I also discuss whether good memorisers are naturally poor sight-readers, and good sight-readers poor memorisers.

Human memory has been studied extensively by psychologists and much has been written about it. Memory can be classified in several ways. There is memory of the senses, including those of hearing, sight, movement, touch, smell, and taste. There is also long-term memory (we can remember things from many years ago), short-term memory (which operates over one to 30 seconds), and sensory memory (the very short-lived memory of a fleeting sense). All the information we assimilate starts in short-term or sensory memory. In order for material to be retained, this information must be rehearsed - in the way, for example, we may mutter a telephone number in the period between looking up the number and dialling it. To transfer it to long-term memory, it must be integrated into the existing memory structure. This involves understanding the information and organising it into existing memory frameworks for long-term storage. When we wish to access material held in long-term memory (as when we perform music from memory), the brain must know how to locate and reactivate the relevant stored material.

Security of performing from memory seems to come from memorising in several different ways. I have outlined ten different approaches to memorising. Adopting as many methods as possible should lead to greater success.

10 points for successful memorising

1. Start memorising as soon as you begin to learn the piece
2. Analyse the structure of the piece
3. Focus on the musical patterns
4. Break down difficult passages
5. Rehearse in your mind without playing – mental rehearsal
6. Once piece is known – correct from memory not the music
7. Practise starting from anywhere in the piece
8. Play the piece frequently and regularly
9. Listen to master performances
10. The more you memorise, the easier it becomes

Start memorising as soon as you begin to learn the piece

Do not learn the piece first, and then decide to commit it to memory. After playing through the piece a couple of times to get the gist of it, memorising should begin immediately, according to Edwin Hughes in D.A. Norman's book *Memory and Attention*.

At an early stage of learning a piece, the pianist Gabriella Imreh, in a study conducted by Roger Chaffin, selects and practises certain features of the music which will help her remember the next section. She says she needs to concentrate on repeats of the theme which are 'the same but different'.

Analyse the structure of the piece

Pure repetition is an inefficient way of memorising. If music is memorised with no conscious effort, it can be retrieved only in the same way; if the performer tries to think about the music, the memory becomes unavailable. Researchers agree that it is essential to support memory of the sounds, movements and sight with analysis of the forms and harmonies of the music. In this way, material to be remembered is related to other relevant information. Imreh talks about developing a map of the piece in her mind. This involves thinking more about the structure of the music, and leads to its being permanently stored and immediately accessible.

Interestingly, a study by Michiko Nuki shows composition students to be significantly better than performance students at memorising, suggesting that an understanding of musical structure is indeed an important factor in successful memorisation.

Focus on the musical patterns

It seems to be more important to concentrate on the *musical* aspects of a piece than the *technical* aspects when memorising. And the memory is improved, according to research by Norman Segalowitz and his colleagues, by looking at *several* musical aspects. These aspects might include identifying phrase shapes, climaxes and the emotional colour of the music. The more links there are between the different musical aspects, the more likely they are to be remembered.

Experienced performers are very flexible about solving minor memory problems, while inexperienced performers may lose overall musical control because they are struggling to solve immediate local problems, says music psychologist John Sloboda. This suggests that novice performers should play music that is both musically and technically well within their grasp. They should then be able to give fine performances. One successful memorised performance increases confidence so the task becomes less demanding next time.

Break down difficult passages

Effective practice requires breaking down and repeating passages that are causing difficulty. To prevent errors, practising slowly and then gradually bringing the piece up to full speed is often required. Particularly troublesome passages can be played slowly in different keys, suggest Paul Harris and Richard Crozier in *The Music Teacher's Companion*.

Fanny Waterman, in an interview with Jeremy Siepmann in *Piano*, strongly recommends memorising hands separately, especially the left hand. Practising hands separately prior to practising hands together has been found by researcher Grace Rubin-Rabson to produce greater stability and clarity. The harpsichordist, Ralph Kirkpatrick (quoted in Nicholas Cook's *Music, Imagination and Culture*), claims that careful and consistent fingerings are an enormous help to the memory.

A pianist studied by Miklaszewski divided a piece of music by Debussy into fragments in which the more difficult the section, the shorter the fragments. The pianist often alternated fast practice with slow remedial work. As the piece improved, the fragments became longer and less time was spent practising each one. According to Farnsworth (quoted by Gabrielsson in *The Performance of Music*), musicians need to work with as large a section of the music as they can manage, so less capable musicians will work in smaller sections and more capable ones in larger sections, in order to benefit from the musical value of thinking in larger units.

Rehearse in your mind without playing – mental rehearsal

Leimer, teacher of Gieseking, goes to extremes when he suggests the need to know the score by heart before practising on one's instrument (again, quoted by Gabrielsson). Yet it is important to be able to hear the music with one's 'inner ear'. Anton Kuerti, in the same interview in *Piano*, says: 'I wouldn't like to go on stage unable to think through a piece without moving my fingers'.

Those who are more able to visualise the score and hear it with their 'inner ear' are quicker and more accurate to memorise the music, claims Nuki. However, Don Coffman's research found that the less advanced the musician, and the more difficult the music, the more important motor practice is over mental rehearsal.

Once piece is known – correct from memory not the music

If mistakes are made when practising from memory, it is important to listen and correct the errors by ear, rather than refer to the music, in order to develop aural awareness and security, according to the pianist William Fong. He advises placing the score next to the instrument, where it can be referred to after finishing playing, rather than on the music stand where it may be glanced at during playing.

Practise starting from anywhere in the piece

A memory of the physical movements – kinaesthetic memory – will develop as a piece is practised repeatedly. One problem with kinaesthetic memorising is that if something does go wrong in performance, it may be very difficult to re-establish the musical thought and continue the performance. Harris and Crozier emphasise the importance of identifying certain strategic points in the music and practising from each of them.

Play the piece frequently and regularly

Practising a piece several times during the day offers repeated opportunities for the music to transfer from short-term to long-term memory. Rubin-Rabson found it to be of especial value to less able learners. This links to research by Adcock, which shows clearly the benefits of distributing the memorising over a period of time. In this research, one group read through material to be memorised sixteen times in one day; the other group read it through once a day for sixteen days. When tested a fortnight after completion of learning, the first group remembered 9% of the material while the second group remembered 79%.

Listen to master performances

Knowledge about musical structure takes time to acquire, whether through explicit learning or implicitly through listening to music. Shinichi Suzuki recommended students should listen extensively to master performances of the music they are learning, as well as to other classical music. This makes playing from memory very easy, for pupils' 'inner ears' are well developed. When performing, the music continues in students' ▶

heads, whatever the fingers do. Odd slips of the fingers are not distracting because performers have the larger picture in their minds.

The more you memorise, the easier it becomes

Many teachers recommend that musicians practise performing to others in all sorts of situations, in order to build confidence. Jennifer Mishra believes that memory lapses will occur more frequently when performances are in settings that differ from the learning environment. She says that when music is initially memorised, various aspects of the environment are memorised along with the music. These environmental features later serve as reminders. It may be important, especially for younger and less experienced musicians, to rehearse in a variety of environments.

Music researcher Andreas Lehmann suggests that the ability to memorise music could depend on how much has already been memorised, and on how much the memory is used for other activities.

Sight-reading and memorising

Sight-reading and memorising are different processes. The good sight-reader rapidly and effectively reads chunks of music using short-term memory. Conversely, when memorising, the performer works slowly with awareness and control of each note until the procedures to a large extent become automatic and stored in long-term memory. But there is no reason to believe one ability excludes the other. Research by Nuki found positive correlation between sight-reading ability and memorising ability.

So good memorisers need not necessarily be poor sight-readers, nor *vice versa*, but it is easy to understand why the two skills tend to be mutually exclusive. Good memorisers rely on aural skills and may not need to develop such fluent reading skills, while good sight-readers rely on visual skills and find it frustrating to have to persevere with a score and practise repeatedly in order to memorise the music.

Sight-reading and memorising both rely on a knowledge of structure and both use memory. Sight-reading relies on short-term memory, while memorising relies on transferring material from short-term to long-term memory. Speed of musical sight-reading depends largely on the performer's knowledge of musical structures and patterns. Memorising, likewise, depends on theoretical and structural knowledge.

Sloboda conducted extensive research into reading music in the 1970s and 1980s. He suggests it is important to develop musical sensitivity *before* learning to read. No one would consider teaching a child to read at the very early stages of learning spoken language. Children are already fluent speakers before they learn to read; but most learn to read music *alongside* learning a new instrument. This double task is so burdensome that many children memorise each piece as soon as possible and therefore give themselves little practice at reading. It may be better to develop playing from memory from the earliest lessons, while reading music could be taught after musical awareness has been developed.

Conclusion

I have often listened to students participating in piano competitions. My view is that those who perform from memory generally produce a better sound and are more sensitive to the music and, therefore, communicate the music more successfully to the audience than those who follow the score. Though the ability to memorise differs from person to person, there are good grounds for encouraging music students to memorise at least some of the pieces they learn and to perform from memory on occasion. It is as much a part of the skill of musicianship as playing an instrument. ■

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Musical Memory and the Brain

by Aaron Williamon

Background

Listening to an accomplished performance of a great piece of music, played from memory, constitutes a much-cherished cultural experience, as well as an astounding achievement of recollection by the performing artist. Exceptional memory is a hallmark of expertise, and a number of theories have been proposed to explain how experts, from chess grandmasters to stage actors to concert pianists, are able to achieve such prodigious feats of memory in performance (see Gobet (1998), Williamon and Valentine (2002)).

In many respects, the Skilled Memory Theory – first proposed in 1981 and since extended in 1995 into the Long-Term Working Memory Theory – has been accepted as accounting for the remarkable memory abilities observed in experts across several fields (Chase and Ericsson (1982), Ericsson and Kintsch (1995)). In short, the theory can be summarised as follows: ▶

- Superior memory abilities are underpinned by a vast knowledge base specific to the domain (for example, chess grandmasters will display exceptional memory abilities for chess pieces, moves and matches, but are no more likely to have better memory for tasks outside of chess than anyone else).
- Information in this knowledge base is continually collected and stored into meaningful groups (or 'chunks'), often becoming associated with specific physical actions and commands.
- Once a large database of knowledge has been acquired, the individual can then use it to create a mental representation (or 'retrieval structure') of any new information that must be memorised (simply put, a mental representation is a kind of internal map that can be reliably used to recall specific details).
- As with any map, important landmarks (or 'cues') within the information are identified in practice and then used to guide memory so that a resulting performance can stay on track.

These basic concepts can easily be applied to music:

- Professional musicians, like experts in other domains, train and listen to music extensively, which assists in the accumulation of a vast music-specific knowledge base.
- Information within this knowledge base is typically grouped into meaningful units – through hours of practising scales, arpeggios, etudes, and suchlike – so that these chunks will come easily to mind or 'to the fingers' when necessary, without delay or prolonged deliberation.
- Musicians can work intensively to arrive at a personalised conception and thorough understanding of specific pieces for performance, from a composition's highest level of global understanding (the piece as a whole) down to the lowest level (the piece as individual notes).
- Access to this hierarchical representation is available through aural, visual, kinaesthetic and analytic cues, depending on the learning preferences of the performer and the piece being learned.

Theoretically, the exploitation of mental representations is central to the process of preparing for a memorised performance. In practical terms, limits in human information processing and attention make it unlikely that an entire representation will be activated during performance. Instead, just part of it will be activated at any one time, with the involved region shifting as the performer progresses through the music (Clarke (1988)). In the middle of a phrase, for instance, the performer may be primarily concerned with connections within the phrase itself. In that case, only low-level aural, visual or kinaesthetic cues would be active. Conversely, at a phrase or larger section boundary, a performer may need to know how the previous and subsequent phrases relate to one another and to the overall structure of the piece. At such a moment, higher-level cues specifying larger-scale relationships would be active, although some low-level cues may be needed for the immediate executions of notes.

Much recent research has been directed towards identifying specific characteristics of the mental representations that musicians form when memorising music for performance. Interview studies with professional and student musicians by Susan Hallam (1995) and with members of the piano faculty at the Juilliard School by Rita Aiello (1999) indicate a great deal of individual differences in their use of aural, visual and kinaesthetic cues when memorising and recalling music. Nevertheless, one of the most effective methods for organising music in memory – as indicated consistently by the professional musicians in these studies – is to incorporate analytic strategies into practice. By doing so, they claim to produce a solid foundation upon which to learn compositions aurally, visually and kinaesthetically.

The importance of such analytic strategies has been confirmed in recent observational studies of piano practising. Roger Chaffin and colleagues (2002) systematically studied a concert pianist's practice and memorisation of the 'Presto' from Bach's *Italian Concerto*. They analysed over 33 hours of videotaped rehearsals and found that the pianist started and stopped her practice more frequently at 'structural' boundaries (complying with the work's formal structure) than in the middle of sections. From this, they argued that, since the learning of information was organised according to structural components, the retrieval of that information must too be dependent on the same components. They used comments made by the pianist during and after each practice session and in interviews to confirm their interpretation of the data. In addition, a follow-up study 27 months later (in which she was asked to write out the first page of the score from memory without prior warning) revealed that recall accuracy was significantly better for the bars beginning each section than for bars at other locations. This provided further support for their claim that the music's structure afforded an enduring foundation for the pianist's mental representation of the piece.

However, not every performer will be as familiar with the 'formal' structure of a composition as the pianist in Chaffin's study. Nevertheless, subsequent work that I and other colleagues (2002) have carried out with student musicians offers further support for the notion that some sort of understanding and exploitation of musical structure – through self-styled analytic strategies – is essential for effective memorising. Similar to Chaffin's research, we recorded and studied the practice of 22 pianists at different levels of skill, spread across the Associate Board's eight grades. From the recordings, the frequency of practice starts and stops on 'structural', 'difficult' and 'other' bars, as identified by each pianist, were obtained. Although not all pianists identified the same bars (and indeed, some provided only rudimentary analyses of the music), the data revealed that they all, regardless of skill level, started and stopped their practice increasingly on 'structural' bars and decreasingly on 'difficult' bars, from the initial practice session until the session just prior to performance.

Still, a stronger case for the importance of mental representations for memorising music, organised according to an analytic understanding of the music being learned, could be made by providing evidence of how the brain itself processes such information. In actual fact, very little is known about brain function in relation to musical memory. This is because remembering music, at the level observed in elite performers, is closely linked to the physical execution of notes and related movements and that techniques for studying the brain, such as EEG, fMRI and MEG, typically

require that people remain still while recording takes place. However, given that so much data now confirms the prevalence of musical structure in performers' learning and remembering, the prospects for carrying out systematic, laboratory-based investigations in this area seem promising.

Results from a recent study

In a study to be published later this year in the journal *Cognitive Brain Research* (Elsevier publications), Tobias Egner, a neuroscientist from Columbia University, and I report the results of new research in this area. We hypothesised that, if there are structurally crucial bars that aid the learning and recollection of a piece (such as the structural bars referred to above), then the recognition of such bars should be accomplished with greater ease and should give rise to qualitatively different brain activity.

In order to test this, we devised a recognition memory task. A group of six advanced pianists were presented with bars on a computer screen that were either (1) from a piece that they had all learned and performed from memory (the Prelude in A Minor from Bach's *Well-Tempered Clavier II*, BWV 889) or (2) not from the Prelude but matched in terms of time signature, key signature, note durations and melodic contour (see Figure 1 for examples). Of interest to our prediction was whether responses to 'structural' bars identified by the pianists would differ from bars that also belonged to the prelude but were presumed to be 'non-structural'.

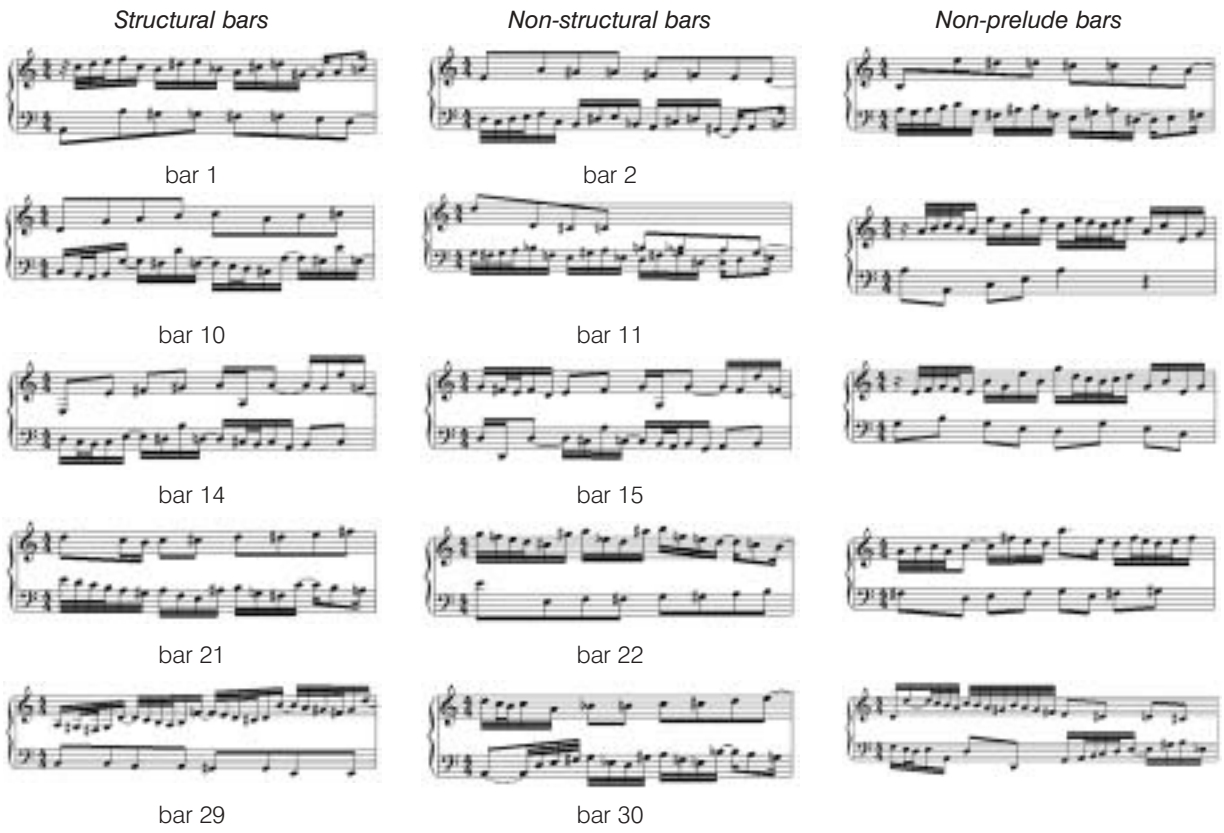
We measured the brain's electrical activity through so-called event-related potentials (ERPs), which provide data gleaned from an electroencephalograph (EEG, a device for measuring brain rhythms) and which have proven important for assessing brain activity related to processes of memorisation (see Friedman and Johnson (2000), Rugg (1995)). For example, previous ERP studies have shown that brain responses during the learning of new material (e.g. lists of words) that are successfully recalled differ from those that are not remembered (Paller *et al* (1987), Sanquist *et al* (1980)).

The results of our study confirmed the hypothesis that structural bars are processed differently from other bars within a memorised piece. On the recognition task, pianists identified the structural bars faster and with higher accuracy than the non-structural ones. In addition, their recognition of structural bars was associated with a significantly different brain activation pattern than compared with non-structural bars, as well as with non-prelude bars. This was primarily displayed at a right centro-parietal scalp distribution (see Figure 2).

Conclusions and recommendations

In terms of theories of expert memory, this study confirms several predictions of the Skilled Memory Theory. In particular, it supports earlier work in music which demonstrates that musicians form and rely on highly ordered mental representations when recalling the compositions they have memorised. In this case, as with previous studies, the data suggest that the salient components of the musicians' mental representations (i.e. the retrieval cues) coincided with key positions in the composition's structural organisation. Indeed, the findings show that structural bars were accessed more quickly and in a qualitatively different way than the other encoded musical information. The identification of an ERP ▶

Figure 1. *Examples of structural, non-structural and non-prelude bars presented to participants as part of the experiment. The entire set consisted of the 32 prelude bars and a matched set of 32 non-prelude bars.*



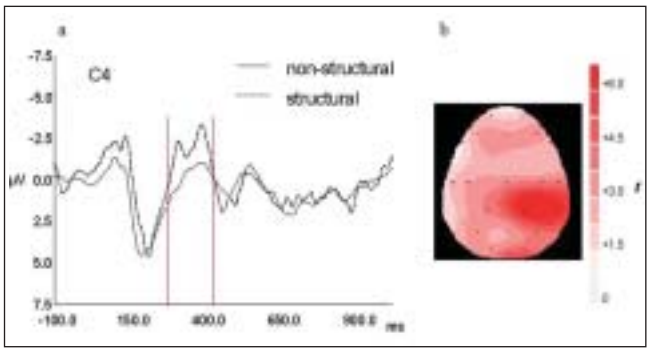


Figure 2. *(a) Representative ERP traces elicited by structural versus non-structural Prelude bars at the right central C4 electrode site. Red vertical lines indicate the time interval for a pronounced 'negative peak', which showed a significantly higher amplitude towards structural bars. (b) As show in bright red, the effect was particularly pronounced at right central and posterior scalp sites (this representation of the head is from a downward looking perspective).*

component that appears to be related to the recollection of such musical material constitutes a novel finding.

As for recommendations for performance and teaching, from the existing research literature, it seems reasonable to conclude that generating and using mental representations to recall specific information is a core component of memorisation. Interview and observational studies have shown that exploiting one's understanding of musical structure through analytic strategies (even if they are idiosyncratic) can provide a secure and enduring foundation upon which to build a mental representation, which can then be supported by the musician's preferences for learning through aural, visual and kinaesthetic modalities. Although advocating that all musicians carry out in-depth 'formal' analyses of every composition they perform would be unrealistic, musicians should develop their own analytic strategies and, most importantly, integrate them into the early stages of learning. This will enable the recognition and stable, assured use of important landmarks within a piece, to which reference can be made as a performance progresses or when there is a need to resume a performance that has unexpectedly deviated from its planned course.

Before firm conclusions can be drawn about the neural foundations of musical memory – or of expert memory more generally – additional research must be conducted with more participants and with stimuli drawn from other types of music. With regard to the latter point, the majority of studies in music psychology focus on the learning, performance and reception of tonal music from the standard repertory of solo instruments (namely, the piano). It is well documented that such music typically conforms to hierarchical principles of organisation (Williamon and Valentine (2002)). The demands on musicians' memories, however, are not limited to the successful recollection of just those types of compositions. Rather, pieces must often be memorised that run counter to the tonal, rhythmic and structural 'rules' that have been established through the works of composers such as Bach, Mozart, Haydn, Brahms, Mendelssohn and so on. Studying exactly whether and, if so, how performers form, organise and exploit mental representations when learning and performing music that defies (or at least does not conform exactly to) convention should provide insight into characteristics of cognition that have enabled musicians to meet new and evolving demands for hundreds of years.

For specific practical advice on memorising music, I recommend reading Jane Ginsborg's chapter, 'Strategies for memorizing music', in *Musical Excellence: Strategies and Techniques to Enhance Performance*, published this year by Oxford University Press

Further information on theories of memory and musical memory research can be found in chapter 8 of *Musical Performance: A Guide to Understanding*, published by Cambridge University Press in 2002. ■

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Emotion, Imagination and Movement:

New strategies to help memorisation

by Patricia Holmes

Introduction

Performing from memory on the piano can be a daunting prospect, yet all learning involves memory and even if the performer chooses to retain the score as a prompt, any fluent and convincing performance will be largely memorised. However, even those who memorise with apparent ease don't always understand how the memory works and this can be a source of insecurity. If the constituent processes are not understood, they cannot be managed. There is no doubt that the greater the understanding of the channels through which music is committed to the memory and how this can be developed during learning, the more secure will be the performance. The

performer is then in a position to assess their own strengths and weaknesses and develop strategies that suit them. This should enable them to feel less anxiety at the prospect of performing from memory, which in turn will free them to explore the undoubted benefits this can bring, for both performer and audience.

In order to cast further light on the processes of memorisation and to give more understanding of how they work for the pianist, this article focuses on solo performers at the highest level of expertise. Experienced performers who have given much thought to playing from memory provide an overview and sense of direction, as well as detailed analysis of their thinking processes, all of which can be an invaluable source of new ideas for the less experienced. In this respect, I introduce a dimension of memorisation further to the conventional strategies that are normally used and taught by pianists. This dimension, identified in string players, but not so far in pianists, demonstrates how motor activities (technique), generated by interpretation (or concept), can actually form part of the memory store. Little attention has so far been given to this aspect of memorisation, but since previous research has shown how an understanding of the structure of the music to be memorised will improve memory capacity, it seems reasonable that structures derived from technical strategies or interpretative concepts or an integration of the two may do the same. There is evidence that it would be worthwhile to explore the possibilities of how pianists might find a similar approach both useful and productive.

How much do we already know?

How information is encoded, stored and retrieved from the memory is fairly well understood and there is increasing knowledge of how the relevant cognitive mechanisms are utilised when one is learning and memorising music for performance. There is an invaluable body of literature available for pianists, from the early work of Grace Rubin-Rabson in the 1940s through to recent discoveries made by Aaron Williamon and Elizabeth Valentine, particularly about how encoded information is retrieved from the memory store. Since almost all such research has been conducted with pianists, some useful practical guidance emerges, but studies involving more than one subject find differences, depending on both individuals and levels of expertise. Since performing from memory remains a mystery to some and a potential source of anxiety to others, further understanding of its constituent elements can only be beneficial.

How the musical memory works

If the process of learning piano music were fully analysed, the cognitive and motor activities involved would produce a pattern of staggering complexity. The same would be true for learning to play any instrument, but the picture is complicated for pianists by the nature of the score – many different musical events happening at the same time, but all requiring very different input. It must therefore be worth giving some thought to the processes by which a performer can transform their concept of a piece into sound and how these processes might aid the memory.

It is generally accepted that pianists store music in the memory using an individual specific mixture of aural, visual, kinaesthetic (motor) and structural/analytical memories. These different modes of memory will vary in dominance according to the age, experience and individual mental proclivities of the individual, but the more they can be consciously developed during learning and recalled during performance, the more secure will be the memory. Briefly, their relative functions are as follows:

- the aural memory will enable the performer to hear the music in their head (the 'inner ear') both as a predictor during performance and also for the all-important practice of 'mental rehearsal'.
- the visual memory will be formed from mental images of whatever is within vision at the time of learning, primarily the score, but also the keyboard and the surroundings. This explains why for some, performing in an unfamiliar setting can disturb the functioning of the memory. The visual memory can also include associated imagined images, which can be consciously recalled during performance.
- the motor memory is likely to be formed largely through repeated movements, so that the brain gets used to a particular sequence of motor events. This enables progress through the music without conscious thought about what follows. The motor memory tends to be relied upon by younger players, but as the music becomes more complex, it becomes increasingly unreliable and other modes of memory need to be developed.
- the structural/analytical memory is formed from the mental organisation of the music, through a variety of strategies ranging from a formal analysis of the score to a concept derived from a playing perspective – for example, the phrasing, patterns and fingerings.

All musicians need to be aware that the more of these mental images that are available for retrieval at the time of performing, the more secure will be the performance and it follows that further modes of memory are likely to enhance this.

Can we learn from string players?

It is from studying the learning and memorisation processes of two experienced solo string players (cello and guitar), that I became aware that there is indeed a further dimension of memorisation, of which pianists tend not to be consciously aware. This dimension arises from a conscious awareness of the physical movements associated with technique and their relationship to the interpretative concept of the player. From past studies of pianists memorising, it would seem that their methods differ significantly from those of other instrumentalists. However, the detailed data that emerged from interviews with the above string players suggest that there is a chain of cognitive events, which appear to link 'feeling' with the conscious use of instrumental techniques during learning and memorisation. This particular area of learning has yet to be explored and it seems to be something of which pianists remain largely unaware, but may well find worth consideration.

There could be a number of reasons for the contrast between the string players' and the conventional pianistic approach. Firstly, because of the nature of a piano score and the layout of the keyboard, pianists will inevitably be to a greater or lesser extent preoccupied with the mechanistic aspects of learning. Decisions must be made about fingerings, location and direction of the hands, the speed and distance of movements and many other things before a satisfactory sound representation of the score can be realised. It is not really surprising that when ▶

technique and memory are linked in literature relating to the piano, it is almost always the means by which the pianist gets round the keyboard and manages to play all the notes in the desired way that is being referred to. This is most eloquently illustrated in a study conducted by Roger Chaffin and Gabriella Imreh in which Imreh recorded her practice on video, while preparing the last movement of Bach's *Italian Concerto* for performance (Chaffin, Imreh & Crawford, 2002).

However, when questioning my own methods of memorising piano music, despite fully recognising the way Imreh worked, I found that with little effort, I could identify in my own thoughts something akin to the direct links between physical movement and emotional concept that were so illuminating in the string players. As with the Chaffin and Imreh study, any such embryonic thoughts were generally squeezed out, certainly in the early stages of practice, by the need to manage the 'mechanics'.

There may be little room to be consciously aware of imagery that might relate technically generated physical movement and emotion. However, for the string players interviewed, this is exactly what appears to happen, in that their emotional concept of the music was uppermost in their minds from the first and technical decisions were totally bound up in it.

I then began to think that if it were possible to develop tried and tested pianistic memorisation strategies along similar lines, it would be a useful way of creating a further pathway through to the memory store. By being generated by emotional concept, and by implication being deeply felt, this added dimension might be able to reinforce significantly the other ways in which the music is stored, particularly in the long term memory. Expert memory must involve meaningful encoding and efficient and effective retrieval and one would expect this to apply universally to expert instrumentalists. In order to assess the viability of extending current conventions of piano memorising, it is worth examining some of the two string players' descriptions of these processes. The following quotations clearly illustrate the sort of thing to which I refer.

For example, when describing how he modifies his technique in response to musical nuance in the first two bars of the *Prelude* from Bach's Suite for Solo Cello No 6, the cellist said:

> *… it's a very strong, driving rhythm and to make it work, the first bar is very, very strong – a lot of attack on the first note – flat hair of the bow, moving onto the edge of the hair on the second quaver, adapting the bow grip for a lot of string crossing – the second bar is an echo – very light, so move nearer the fingerboard, onto the edge of the hair – move away from the heel and lighten the left hand pressure.*

Not surprisingly, given the level of detail in the work, this demonstrates the impact of musical (in this case, rhythmic) features upon technical decisions. He then illustrated how this level of technical detail contributes to the memory process by saying:

> *Rather than thinking about the notes, the technical side can become the trigger – so for example, going back to the Bach Suite, just starting to perform it – rather than thinking what the notes are, I would think about both hand positions – the attack – very high left arm so that the*

open string is not touched and the subtle changes to the bow that I was talking about earlier – that's what I'd be thinking about initially…

The function of technique in forming retrieval cues is made very clear here and there seems no reason why pianistic equivalents should not contribute to memorisation in a similar way. We will not be able to generate an effective performance without initially considering *how* we are going to produce an appropriate sound.

The cellist and the guitarist both described how they consciously relate technically generated physical movement to their emotional concept of the music – their interpretation. The guitarist gave the following example:

… I tend to think of them now more as gestures and the way they feel – for example, are you stretching or squashing your hand – is your hand in a relaxed state – what's the angle of your elbow – are you playing from above the string or slightly to one side? A lot of it is physical – it's to do with gesture and movement, like a choreography of some kind.

It is clear that they retain a strong impression of what these technical/physical movements *feel* like, in addition to their aural and visual properties. These vivid descriptions illustrate what can only be identified as *motor imagery* – being able to imagine the actual physical feeling of playing (a term generally associated with sport rather than music performance).

Both string players gave a good example of motor imagery when they referred to executing a shift (movements of the left hand up the string to change the playing position). They both spoke of how the speed and energy of the shift may require totally different physical resources according to its musical context. The guitarist described it in the following way:

… if you're playing a slow piece, it might be a very relaxed shift, but if you're playing a fast piece, it's going to be very energetic. In many ways the shift looks the same, but you would remember the vigorousness with which you actually move. It's an interesting exercise to try with your eyes shut, so that you just feel what you're doing…

His use of the word 'vigorous' rather than just 'speed' suggests that the musical character is an influence on the imaged movements in his memory and therefore an important part of learning. There is no doubt that pianists, as their own expertise increases, develop similar influences, but they are generally less prominent in the memory. It is perhaps because of the intrinsic features of piano music and of the instrument itself, that the music itself becomes central, rather than the instrument or the player. The complexity of a piano score requires multi-layered processing, involving to a large extent the recognition of such structures as large and small-scale patterns and irregularities, sequences and shapes of chords and phrases. As does the guitar too, but none of this really addresses the part played in the memory by the physical processes of producing sound. However, as a pianist develops, the ability to command and manipulate a range of tonal qualities becomes increasingly important, requiring an increasingly sophisticated range of technical strength and control. As a natural product of the interpretative drive, this awareness of the physical input must deserve greater attention than is usually expressed. ▶

What is motor imagery?

Having established the existence of motor imagery as contributing to learning and memorising music, the concept should be further explained so that it might help individual pianists to transfer these ideas to their own playing and pedagogical methods. As previously established, the normally accepted modes of memory do not relate directly to the players' use of technical resources, leaving an apparent gap in this respect, between the mental representation of the music and the onset of the sound. The idea of 'imagining in music' may be helpful here. Carl Seashore used the analogy of a dream to show how an action can be felt. When dreaming of singing, one has all the experience that comes from the kinaesthetic (motor) sense, living through the same sorts of actions that would be experienced if one were actually singing. The motor image would then become the '… raw material from which emotion can be built up' (1938). If Seashore's statement is true, it might well link technique with interpretation. It seems reasonable to hypothesise that, for any instrument, certainly at the highest levels of expertise, an emotional element might be present in motor programming, as the performer's emotional concept is conveyed into sound. The motor memory then becomes much more sophisticated than the kinaesthetic memory generally referred to in relation to repetition of actions. If a part of motor ability is actually motor imagery, it would seem less surprising that technical movements forming a part of the performer's mental representations of the music can be imagined as if they are being played.

How can this be applied to the piano?

Imaging movement has been mentioned in a study of an advanced piano student practising *Feux d'Artifice* by Debussy (Miklazewski, (1989)). Technical (fingering) problems are related to musical understanding and auditory imaging to the acquisition of necessary techniques, but it is not explained exactly *how* these might function. Miklazewski did find that performers will use technical means to develop and refine their sound during the learning process and that this will occur in parallel with the evolution of the interpretation.

It could be that for other instruments, interpretative goals will be the precursors of technical decisions regarding the quality of the sound to be produced, but might not pianists be considering at least tone production and control from the first and might not this also affect choice of fingerings? The musical concept is the 'goal' that will emerge when the performer has been able to meet the technical challenges. Technique and realisation of interpretation will then be more likely to be encoded simultaneously, giving greater security.

Since in performers at the highest level one can assume that the creation of sound will always be related to expressive intent, one might also assume that they feature strongly during learning. There seems no reason why this basic principle cannot be implemented at much more elementary levels as well. This would not only enable a much more holistic (and secure) approach, but also encourage close attention to expressive, interpretative matters and their relationship with tone production – surely a continual pre-occupation for all good piano teachers.

Conclusion

The main thrust of this article is to put forward the possibility that players' own mental images relating to conception and production of sound are a significant part of the memory store. As such, they can be consciously harnessed during the memorisation process and then retrieved from the memory store during performance. By being actively engaged with the interpretative, emotional input, they seem to have a significance that can transcend the more analytical approach.

However, the study of imagery related to music performance is in its infancy. Evidence relating to motor imaging is both scarce and largely anecdotal and recent neuroscientific discovery about how imagery functions has not yet been applied to the playing of musical instruments in any organised way. But, it may be that since extensive use of imagery as described here is particularly evident in players of exceptional skill there could be good pedagogical reasons for encouraging its wider use.

Many questions remain. Is the ability to create images associated with particular levels of expertise and intuition? Does it depend on the strong motivational force of 'inspiration' or 'insight'? Can it be conveyed through the medium of teaching or master classes? My own feeling is that as with most musical abilities, learners will find themselves somewhere along a continuum in this respect, but the more they can be encouraged to involve the imagination and understanding, the more satisfying will be the result. ■

With thanks to the cellist Richard Holmes and the guitarist Gary Ryan for their contributions to this article.

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The notes I handle no better than many pianists. But the pauses between the notes - ah, that is where the art resides.

Schnabel

'I have *forgotten* my music'

by Heli Ignatius-Fleet

ON THE UNDERGROUND, not long ago, I sat opposite a musician reading a score. Next to me, a woman lent forward and asked him in a foreign accent, pointing at the score: 'What do you call that?' 'Music' the man answered politely. 'No, I mean that thing there' said the frustrated lady, stabbing her finger at the page. Alas, the train stopped and she left before we got any further.

I know what puzzled her: as a non-native English speaker, it took me a while to learn what exactly my pupils meant when they apologised for 'having forgotten the music'. In English, the word 'music' means both the creation in all its beauty and its graphic representation, or the score. A quick mental scan of my other languages, confirms that in other languages this is not the case. While the word for the music we hear is in most European languages something resembling *music*, for the score I came up with *Die Noten, noter, nuotit,* and *la partition* (in German, Swedish, Finnish and French).

playing from memory liberates players to operate in a compelling inner landscape

Does this, equating the representation with what is represented, explain why playing music from memory is less established here? As a student taking part in international masterclasses, I had noticed that if any fellow student ever played from music, they were most likely to come from the UK. When I started to teach the piano in England, I found to my surprise that pupils were not expected to play from memory in grade exams, in spite of the fact that professional pianists here generally did play from memory. This situation meant a new approach to the whole issue; it was easy enough to teach young beginners to play from memory, whereas transfer pupils presented a problem.

Teaching memorisation skills, and justifying this rather challenging aspect of piano studies meant that I had to articulate embryonic ideas, to bring to the surface something only intuitively understood. Much of what I have discovered is familiar from accounts by other pianists. The EPTA UK Piano Pedagogy Course has also proved a valuable testing ground for some of the techniques suggested in this article; a majority of the students stated in their performance assignments that these practical suggestions had given them new insights into playing from memory.

Why play from memory?

Those who do not perform from memory no doubt feel that the score provides them with a safety net. While it certainly releases the performer from some of the anxiety of having a memory lapse, mistakes still occur, especially if the player has not internalised the music. Performers set out to communicate their own understanding of an artistic, ideative creation, which, while accessed through notation, is not fully represented by it. Playing from memory liberates players to operate in an inner landscape so compelling that they are prepared to pay the premium (fear of forgetting) to gain access to it. The secret garden of potent images needs all the concentration of the player for whom the printed score can even be a distraction.

Williamon (1999) Sloboda (1985) and Mills (2003) have shown that audiences prefer memorised performances and that performers need to internalise music in order to know it properly. I return to the idea of *music* as not synonymous with *score*. It is the former we memorise and internalise - with the help of the latter. Perhaps that is why the idea of memorising the printed score (photographic memory) seems to me an anomaly - even though I have come across pupils who rely on this faculty.

My list of further reasons for playing from memory is as follows: memorised music goes everywhere with the player - music can be rehearsed in an aeroplane or a doctor's waiting room; an unexpected chance to play the piano can be fully exploited; it is useful to work at technical detail away from the piano (just as golf players mentally work on their swing); when working on technical details, including fingering, it is helpful to look at one's hands. While only a minuscule number of our students ever take up music professionally, some do and will be expected to play from memory; all our pupils deserve to be given the same opportunities.

Teach them to memorise music from an early age

In the interview with Riitta Poutanen in a previous issue, it was apparent that the Finnish successes in instrumental teaching are due to the systematic, high quality teaching the children receive from a very early age. We all know from our own experience that starting early is important for musicians. Children develop sensitivity to musical conventions very early in life, without formal training, just as is the case with language.

A number of studies suggest that rehearsal strategies develop most between 5 and 11 years of age. The success of the systematic music education in Finland provides evidence for this. All children learning an instrument are expected to play from memory, and as a consequence, music is seen as a creative activity and playing from memory is taken for granted. It is also worth noting that Finnish children, whilst benefiting from a highly organised nursery education, start their formal schooling later than children here. Is it possible that insistence on literacy at a very early age limits the time given to nurturing creativity and imagination, both of which are factors in musical memorisation? Odam (1995) goes even further when he writes about children being 'bound to the clutch of notation' when ▶

they are directed to read rather than memorise at primary school age.

The idea of 'sound before symbol' is now generally accepted but has not necessarily filtered down to the piano teaching profession as a whole. The easiest way for piano teachers to structure their teaching is to use a primer. These tend to start with notation, without an indication that the 'inner language of music' needs to be developed first. However, there are some which start with creative exercises in order to familiarise a beginner with musical concepts and sound physical habits before notation becomes an issue.

Taking possession

Of the various kinds of musical memory, the automatic muscular memory is the least reliable. Developing the other kinds is therefore the obvious task. Understanding the music, developing a personal interpretation, learning to execute in an optimal way the complex physical movements in order to produce the sounds, are components in a conscious learning process. These components need balancing: for the average pianist (who does not learn by reading the score of a piece on the train the day before performing it) the physical ease, the dance of the music and the joy of discovering how to shape the music go hand in hand. These discoveries are backed by observation of the 'nuts and bolts' of music, theoretical aspects that are understood intellectually.

The following is a possible scenario for teaching purposes: in order to make the inner landscape of music more real, the teacher and the pupil discuss the character of the piece, and of individual passages from the outset of the learning process. Climaxes are pointed out as exciting, rewarding events. Only meaningful segments are rehearsed, the occasional tricky detail can be worked on but it is always re-inserted into its context. Passages which need rehearsing are pointed to as 'that happy passage which starts with the low D in your left hand in bar 14' rather than just 'to bar 14'. A mental map begins to take shape.

With older students, and pieces of greater complexity, we need to develop further rehearsal strategies. Every lesson is a chance for us as teachers to help the student invest more in the music, make it their own. For a student who has been helped to make their own discoveries and performance decisions, the inner landscape consists of familiar features: they are less likely to forget what they understand and wish to put across. 'What do you want me to hear?' is a good question to put to a student. Further questions might be 'So what colour is this passage?' or 'what time of the day is it in this bit here?' or even 'what kind of a person is this about'. Seeing these questions written makes them look rather strange, even silly. In the context of a musical experience they work; while one person may find the question about colour unhelpful, one of the other images may activate the musical imagination.

These nuts and bolts of music are a good parallel safety net, a rational map to superimpose on that elusive one of the subjective, alluring images. How much detail should be included in this second map depends on how natural the concepts are to the student: too much detail can be confusing. The outline of harmony is for many a very useful feature to retain, but again, this needs to be based on listening, and recognising the dynamism of harmonies. (Who can confuse a dominant and a diminished seventh if they are discussed as aural experiences!)

Storing for future use

What might work in the privacy of a rehearsal studio can often become impossible in front of a listener. The fear blots out the easy access to one's subconscious, and the shortfalls in one's preparation become apparent. We might have created that inner map, and have the safety net of the more intellectual aspects, but we also need to make sure that the information is securely stored in a retrievable form.

The elusive images, that secret garden, for which only the player has the key, is for many the most valuable information. This kind of imaging of the music can be rehearsed away from the piano: we can start from an inner image for the whole composition, and then go into ever smaller details. Whatever has been decided upon at the keyboard - how to approach a climax, where to follow an inner melody, where to allow a little more time - all those thoughts need repeating away from the piano.

The nuts and bolts can be written down in some form (which need not make sense to an outsider), first in broad outline, and then adding as much detail as necessary. It is also very useful to play the left hand part with the right, and vice versa (one hand at a time!) to check that the memory is also secure on an intellectual, conscious level. For the greatest security, pianists can visualise the complete composition as played on the keyboard. Visualising the hand and finger movements and the keys, while inwardly hearing the music, is certainly my best safety net.

Recalling in performance

The benefits from learning to *play* a piece from memory - the quality of the experience of playing - are obvious. *Performing* from memory is a further (optional) step, which needs careful preparation: playing from memory in public is a challenge and, for many, the benefits are outweighed by the strain.

Helpful thought processes can be rehearsed in advance. We need to identify the most useful landmarks: while acting as memory props they also need to work as triggers for the creative potential to blossom. On the other hand, while the *interpretative* ideas are no doubt the vital ones, there are moments when the focus needs to be on a *physical* aspect of the performance. Every piece has its technical challenges: how to solve them is part of the process of knowing the piece from all angles. Underpinning this intimacy with the music is the *intellectual* knowledge stored for recall when necessary.

The thorough knowledge of the music means that any phrase can be played in isolation, recalled at will, without the trigger of leading up to it from the previous one. Such well known material, that familiar landscape, is there as a private treasure. Recalling the landmarks ahead of time creates a sense of security - not just what is to be played but how it should sound, how it fits into the considered interpretation. This technique of anticipation serves not just the memory recall, it is also a way of directing one's mind to the music then and there, rather than to those all too familiar inner voices distracting the musician. (The whole issue of performance anxiety, so closely connected with successful memorisation, has been addressed in commendable books by, for instance, Eloise Ristad.)

Playing from memory is a complicated process involving intense artistic experiences as well as highly developed physical skills. The pianist on the platform may well appear 'so lucky, just sitting down and playing' when in fact what we see

is someone walking a tightrope while meditating on and beholding the most wonderful, elusive images.

Foolproof recipes for memorisation do not exist. As in all our teaching, we need to understand, analyse and articulate our own experiences as pianists to direct our students to find a path for themselves. ■

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