

Understanding and Developing Musical Memory: The Views of a Concert Pianist and a Psychologist

by Gabriela Imreh
with Roger Chaffin

Memory is one of humanity's greatest assets, but is at the same time a mystery that has invited speculation and inquiry over the centuries. Memory affects our everyday life, our performance and our efforts to achieve the extraordinary. In my twenty years on the concert stage and some fifteen years of teaching piano, I have experienced the devastation of memory lapses and the sublime feeling of rendering a performance flawlessly. I have watched all the painful, small steps that my students take to ensure those flawless performances. And the same questions always arise: how do we do it? How can we improve? What if memory fails?

Some years ago I attended a lecture on expert memory given by my research partner, Roger Chaffin. I was totally absorbed by the subject, the wealth of knowledge that contemporary psychology has collected and its extraordinary potential in the field of music performance. My mind was racing with memories of con-

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fessions from great artists, my personal experiences as a performer, my studies of pedagogy, my teaching . . . they were all bursting to the surface. Thus, a long and painstaking, but extremely fulfilling, collaboration started. There were so many questions that we wanted answered. Where to start? What would our roles be? What research on expert memory in music has been done in the past? What could we do better? I found out quickly that my continuous contact with the stage was influencing many of our decisions as much as my colleague's precise, no-nonsense approach as a research psychologist. We had miles of unknown terrain between us to cover. How do we bridge the gap between the extraordinary precision and control of execution required for accurate performance, and the creativity required for an aesthetically and emotionally pleasing performance? How do we integrate such diametrically opposed demands?

Psychology of Expert Memory

Psychologists have learned a lot about the workings of memory over the years by studying memory performance under carefully controlled conditions. We will describe three of the principles they have discovered and explain their application to music and performance.

There are different kinds of memories or memory codes. Piano performance requires simultaneous use of at least four different types of memory. *Auditory memory* tells the pianist what comes next, providing many of the cues that elicit the music from the performer, while also letting the performer know that things are on track. *Motor memory* is "in the hands" and allows automatic execution of all motions.

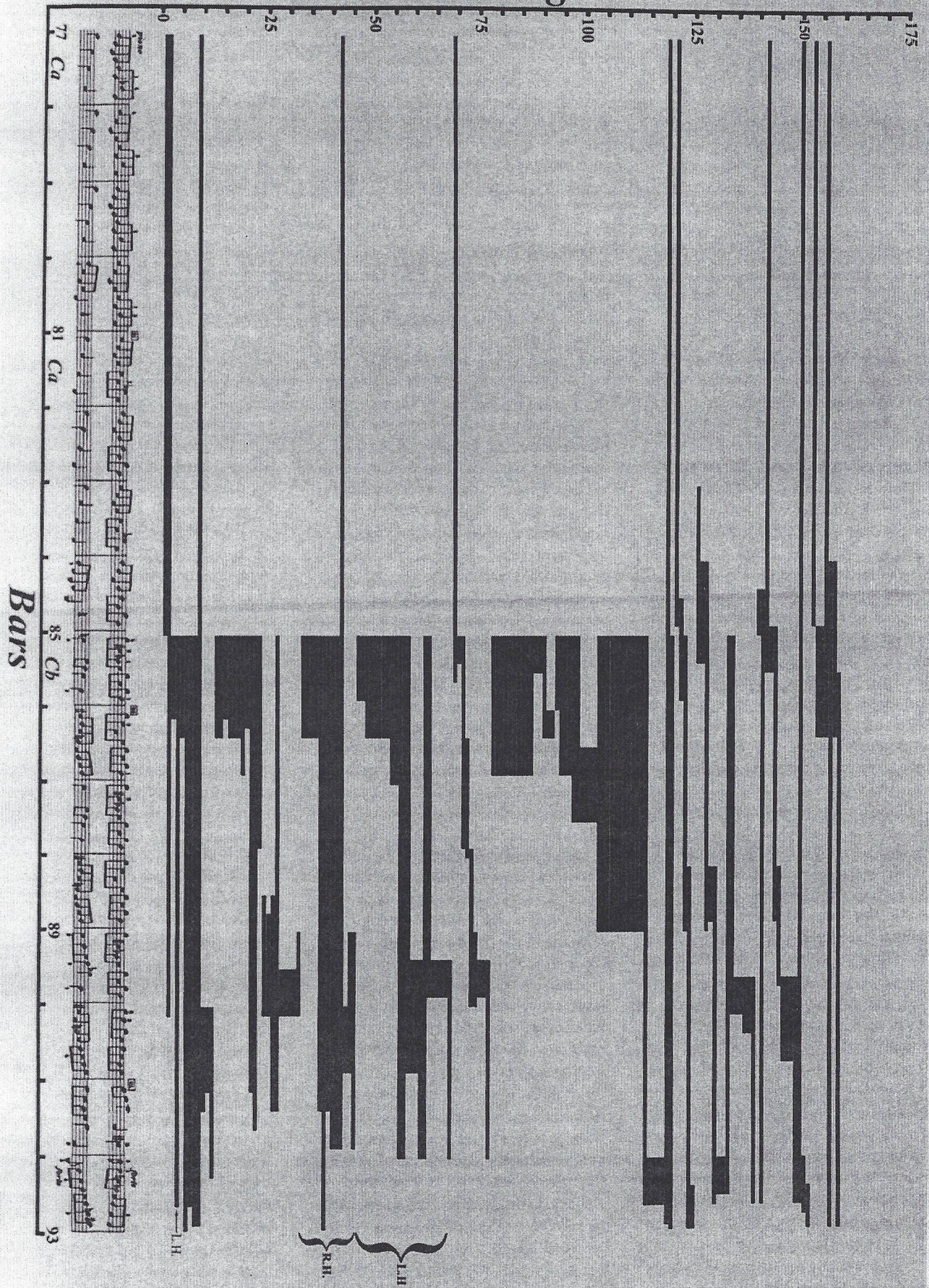
Conceptual memory involves a hierarchical organization of units, from major divisions of the piece down to chord, scales, fingering and notes. *Visual memory* has two distinctive applications in piano performance. Visual memory of the score plays a role in the early stages of memorizing, while visual memory of the hands on the keyboard becomes more important in the later stages.

You can memorize only what you already know. New memories are constructed out of "chunks" of knowledge already in memory. This is why an advanced performer can memorize more rapidly than a novice. The expert has more of the necessary building blocks already in memory. Psychologists have found the same difference between experts and novices in every area they have looked at. Chess masters can remember the positions of the pieces in the middle of a game after seeing the board for only five seconds. Novices can remember only a few pieces. It is not that chess masters are gifted with some extraordinary memory capacity. If the same pieces are placed randomly on the board the chess master does no better than the novice. Rather, experts have less to remember than novices. The expert does not see individual pieces, but configurations of pieces. Similarly, the experienced musician sees scales, arpeggios and other familiar patterns where the novice sees individual notes. When we memorize, it is these "chunks" that we have to remember, rather than individual notes. The more musical patterns we can recognize, the easier our memorization task.

Memory is automatic. This seems paradoxical; when we think about memoriz-

Practice Segment

Figure 1



ing it seems far from automatic. But that is because we only think about memorization when things are not working automatically for us as they do most of the time. For example, as you read, you understand the words in this sentence. You think about what we are saying but you are not thinking about what the individual words mean. These automatically "pop out" of memory and play their expected role in the process of understanding without drawing attention to themselves. This is the way we would like all of our memories to work—to be there to do their job when we need them.

Memory and Piano Performance

How do you get a memory to "pop out" when you need it? A memory will often surface if you are able to re-create a situation similar to the one in which you last remembered it. The more similar the present situation is to the last time, the more reliably it will cue the memory. For example, if you want to recall what you did with your car keys, it is a good idea to go to the room where you last had them and retrace your steps. You might see the keys, but, if not, you might remember what you did with them, because you have created a situation similar to the last time you had the keys.

If you want to be able to play a piece from memory starting at the second theme, you need to establish a memory cue for that spot. Look at the opening chord of the second theme in the score and its fingering and play it. Then just think of the opening chord and play. Next time you think of the second theme, the opening bar should be there. But will it? It depends on how similar the circumstances are to the previous times you did it. The circumstances include what you have been thinking about beforehand, your emotional state and the physical setting. The more similar the circumstances, the more likely the right memory will be available.

We practice the piece to be memorized repeatedly so that we have retrieved the memory under a variety of different conditions. Memorizing for performance is a matter of making sure that memory cues work under the conditions of the perfor-

mance. This is why it is so important to practice in front of other people before a performance. The presence of other people changes the memory cues.

A Case Study

We wanted to see how the general memory principles developed by psychologists applied to expert piano performance. I offered to videotape my practice from first contact with a work until completion (public performance). As it happened, the ideal opportunity arose, the recording of the *Italian Concerto* by J. S. Bach, a piece that I had never before played or studied. We selected the third movement because of its polyphonic writing (much more challenging to memorize), its fast tempo (skilled motor memory is highlighted), and its length and *moto perpetuo* style (which put demands on concentration and endurance).

My self-protective instincts rebelled against the video camera preserving my most personal, private time—practicing. Sometimes I felt terribly inadequate; my mistakes seemed embarrassing, but when you love and believe in what you do, humility must be part of your vocabulary. It serves as a chance to learn and improve, and an artist should never refuse such a chance.

So we collected our first twelve hours of practice until I was able to play the third movement by memory (though not up to tempo and with some hesitations). Eventually we logged thirty-five hours of practice before our project culminated in the recording of an all-Bach compact disc.

To understand the complex memory process involved, we needed to somehow record, transcribe and sort out my seemingly erratic practice. An example of our solution appears in figure 1. Reduced sheets of the score were attached at the bottom of graph paper. We enlisted the aid of some dedicated and hard-working undergraduate students to put all the music from the videotapes in visual form.

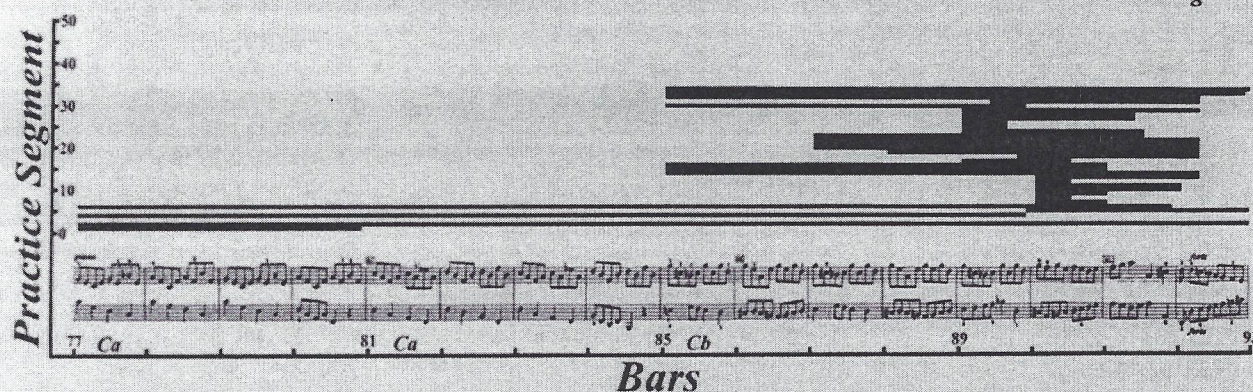
The record of the practice starts at the bottom left with two runs through the Ca section followed by several runs through the Cb section. The record reads from bottom to top. Each line represents the

playing of the music that appears below it. For each time I stopped playing, the line stops and the record moves up one step. For each time that I started, the line begins again at the point that I started to play, but one step above the previous line.

At the beginning, we had enormous sheets of paper that covered an entire room. Eventually we managed to fit everything in a binder and were able to get a picture of how my practice developed. Following is a brief report of our observations:

- I used the architecture of the piece in Italian Rondo form to organize my practice from the very beginning. Figure 1 represents the first work on section C, played in 159 segments of various lengths over a ten-minute period. The work here focuses on a single section and is typical of my practice at an early stage. The Italian Rondo form provides the large-scale conceptual framework within which the more detailed learning takes place.
 - More difficult sections received more practice than easier sections. The first eight bars (Ca) are much simpler than the second eight (Cb). This is reflected in the record of the practice: In figure 1 there are nineteen segments of practice for Ca, while for Cb there are 155 segments of varying lengths, approximately eight times as many. There are other differences. For the more difficult Cb section, more of the work was in shorter segments than for the easier Ca section. Also, I played Ca with both hands from the beginning, while, for Cb, I first played each hand separately.
 - The differences between easier and more difficult sections decreased with practice. Figure 2 shows the second time I worked on section C. The differences in my treatment of the two sections were much less pronounced. By the fourth time I practiced this section, I was treating the two sections identically.
- Up to this point our conclusions seemed to fit what every experienced teacher would expect from all the practical knowledge that has been handed down in the piano community for over a century. The formal organization of the

Figure 2



music into sections and sub-sections provided the major landmarks of the piece, and provided the large-scale organization of my memory of the piece.

The real challenge was the next step, identifying the memory cues that I used. The level of organization that produces actual notes for performance is a finer micro-level—scales, arpeggios, chords, rhythmical patterns and so on, which are familiar to all performers from years of training. These familiar patterns are the “chunks” that provide the building blocks of our memories. To try to somehow describe the chunks I used, I marked on a copy of the score the groups of notes that formed recognizable patterns for me. These were my *conceptual* memory cues.

Remembering notes is, however, only a small part of the memory task. Pianists must also remember their choices of fingerings, deal with technical difficulties and make decisions about interpretation and expression. We devised a series of graphs to give us a visual image of all the memory cues for the different dimensions of piano playing that I attended to during my practice. Figure 3 (p. 24) shows the memory cues for section C. The top layer of the figure shows what we call the *basic cues*: conceptual cues for each familiar pattern of notes, fingerings and places that posed technical difficulty. The middle layer of the figure shows the *interpretive cues*: phrasing, dynamics, tempo and use of pedal. Notice that the first eight bars (the two Ca sub-sections) contain many fewer cues than the second (the Cb sub-section). This was reflected in the

practice on this section that we saw in figures 1 and 2.

I identified these cues after the piece was thoroughly memorized, but while I was still preparing for performance. I included all of the points that I could remember thinking about during my work on the piece, every place that I had made a decision or worked on during my practice. Then, I marked the cues that would still be of vital importance to think of at performance time. These *performance cues* are shown in the bottom layer of figure 3. They include a number of the most crucial basic and interpretive cues and the *expressive cues* that represent the different emotions I wanted to convey during the performance of the piece.

The goal of musical performance is the creation and communication of an aesthetically engaging experience. In the later stages of preparing for a performance, musicians increasingly attend to the feelings they wish to convey with each note and section (energetic, exuberant, light, determined, playful). In writing down the expressive cues, I identified the places where I deliberately tried to elicit certain changes in expression or mood.

By now we were really getting close to answering our questions. The memory cues indicate what I thought about during practice and during performance. During performance, I think about the emotion I want to convey and about a limited number of basic and interpretive features of the music. Thinking of the expressive cues automatically elicits the motor responses that earlier in my prac-

tice had been prompted by the basic and expressive cues.

Teaching Memorization

During my long years of professional training, I was always taught to treat memory work with the utmost respect because of its enormous impact on performance. This research has substantiated and elaborated the practical knowledge that has been passed down to today's teachers from the teachers and performers of previous generations.

I have always been able to tell what my students' strengths and weaknesses are. I guide their memory work with this important information in mind. In lessons, I always start even the shortest, simplest piece by defining the large form structure, working on segments and establishing firm memory cues for all the key points—the start of each section and each phrase. We analyze the score, treating it like a mystery. Together we find the clues—similarities and differences, repeats and new material, familiar patterns. I ask my students, even the youngest, to try to describe exactly what it is they remember about the music.

Then we set a performance or competition deadline and work backward from it. At least four weeks before the deadline the material should be well memorized. If possible, we allow a week or more of rest to let the piece mature. After this, we relearn, re-working the piece during the final weeks. With each re-learning step, the improvement is dramatic.

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I test the accuracy of students' memory cues by asking them to start in different places. Sometimes we do a condensed performance of the work, playing all the major cues, starting each section and each phrase, in order. With my advanced students, I do a lot of work on imagery, asking them to imagine, in detail, the music being played, while switching in and out of actual playing. I clap to signal the switch, and I find more difficult places to make the transition as the student's memory cues become more fluent.

The last week is generally reserved for polishing the performance, getting the emotional map of the piece perfectly balanced, and securing the last musical details. By this time, memory is a source of enjoyment, a wonderful asset that allows us to communicate with our audience.

Perhaps the most interesting outcome of this research for me has been the discovery that the point at which we take the music away and start *memorizing* is very arbitrary, and usually comes very late. I have challenged my students to memorize earlier, and they have met the challenge with ease every time. Their performances were strengthened by the additional weeks or months of memory work. The gray period of working alternately with and without the score is extended and this always seems to improve the reliability of the performance.

A Brief Summary

- ◆ All learning processes are really memory processes.
- ◆ We memorize many and extremely varied things about our music.

- ◆ Memory is made easier by general musical knowledge of theory, harmony, form analysis, musical history and so on.
- ◆ Through practice we try to make all of our memory cues automatic and to check them under different conditions.
- ◆ Our cues are organized in a hierarchical manner with the highest level cues oriented toward emotional expressiveness and balance of the general structure of the piece performed.
- ◆ The point at which we let go of the score is arbitrary and usually comes much later than necessary.
- ◆ There are distinctive stages when learning and working through a piece. The *first stage* is definitely the most laborious. It contains the forming and recognition of an enormous number of cues

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Figure 3

Basic Cues

This section shows a musical score with three staves of cues above and below the main score. The top staff is labeled 'Technical' and has upward-pointing arrows. The middle staff is labeled 'Fingering' and has upward-pointing arrows. The bottom staff is labeled 'Conceptual' and has downward-pointing arrows. The main score is a piano piece with treble and bass clefs.

Interpretive Cues

This section shows a musical score with three staves of cues above and below the main score. The top staff is labeled 'Tempo' and has upward-pointing arrows. The middle staff is labeled 'Dynamics' and has upward-pointing arrows. The bottom staff is labeled 'Phrasing' and has downward-pointing arrows. The main score is a piano piece with treble and bass clefs.

Performance Cues

This section shows a musical score with three staves of cues above and below the main score. The top staff is labeled 'Expressive' and has upward-pointing arrows with text: 'Light but mysterious', 'Surprise', 'Hold back', 'Surprise', 'Start building cresc.', 'No holding back', 'Prepare'. The middle staff is labeled 'Interpretive' and has upward-pointing arrows. The bottom staff is labeled 'Basic' and has downward-pointing arrows. The main score is a piano piece with treble and bass clefs.

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that cover in depth all aspects of musical memory. In the *second stage*, cues become automatic. We maintain their availability and we continuously check their reliability, but we start focusing more on the higher levels of performance and set up cues for them. In the *last stage* of the work, the balance weighs heavily toward the interpretive and expressive cues. But many times we trace back our steps and, in a much

shorter and more concise way, we reenact the entire learning process. The basic cues are readily available, but remain in the background. Attention is directed toward the expressive musical goals of our work.

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ACKNOWLEDGEMENTS

We would like to thank Ben Chaffin for preparing the figures, and Ellie Corbett, Jennifer Culler, Elizabeth Dohm, Helene Govin, Amelia McCaskey, Sandra Paez and Aaron Williamon for transcribing the videotapes. We thank C. F. Peters Corp. for permission to reproduce the music in figures 1-3.

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