11 Spontaneity and creativity in highly practised performance

Roger Chaffin, Anthony F. Lemieux, and Colleen Chen

11.1 Introduction

Musical performance in the Western classical tradition is generally considered to be a creative activity (Clarke, 1995; Gabrielsson, 1999; Neuhaus, 1973; Persson, 2001). At the same time, performances are prepared and practised to the point that the motor skills involved become automatic. Nuances of timing, trajectory, speed, and force become highly stereotyped and are repeated with minimal variation from one performance to the next (Seashore, 1938; Shaffer, 1984; Shaffer, Clarke, & Todd, 1985). There seems to be a contradiction here. How can a performance be both creative and highly automatic at the same time? Pablo Casals tells us that, after the many hours of hard work needed to prepare a new work for performance are over, "The work of preparation ruled by discipline should finally disappear, so that the elegance and freshness . . . strike us as being spontaneous" (Corredor, 1957, p. 204). How does the performer do this? How can a highly automated performance be spontaneous; or is spontaneity simply an illusion created by a skilled performer?

We believe that spontaneity in performance is not an illusion. Even though soloists in the classical tradition generally strive to reproduce the same interpretation from one performance to the next, repeated performances generally differ in small but musically significant ways. As Emil Gilels reports, "It's different each time I play." (quoted in Mach, 1991, vol. 2, p. 123). This kind of spontaneous variation can be viewed as a form of *musical creativity*, although we would not disagree with anyone who preferred to talk of *musical spontaneity*. Performers adjust to the idiosyncratic demands and opportunities of each occasion. For example, if a concert pianist is faced with an unresponsive instrument or the acoustics of the hall are poor, rather than struggling to bring out all the refinements of interpretation that have been prepared, the soloist may choose to give more emphasis to larger gestures and downplay more subtle effects. The creativity involved in this kind of spontaneous micro-adjustment of a highly prepared interpretation makes each performance a creative activity, separate from the creativity involved in preparing the interpretation in the first place. The possibility of this kind of

musical creativity is surely one reason that live performance continues to be valued in an age when high-fidelity recordings might otherwise eliminate the need for it.

Not that spontaneity during performance is the most important source of musical creativity. At least in the Western classical tradition, by far the most significant creative activity takes place in the privacy of the practice studio when an artist first settles on a particular interpretation, making the myriad decisions about trajectories, timing, speed, and force needed in order to convert the abstract representation of a piece of music in a score into the physical reality of a performance (Clarke, 1995; Gabrielsson, 1999; Neuhaus, 1973; Persson, 2001). These nuances of execution make each musician's interpretation of the same piece somewhat different (Clarke, 1988; Palmer, 1989, 1997; Snyder, 2000, pp. 85–90; Repp, 1992, 1998). The ability to create a unique and yet convincing interpretation is highly valued and performers' reputations depend importantly on how their efforts are appreciated and judged by audiences, critics, and promoters.

Here, however, we will be concerned not with the initial creation of an interpretation, but with its re-creation in successive performances. The performance must be automatic (Anderson, 1982; Fitts, 1964; Shiffrin & Schneider, 1977) to cope with the speed of response demanded by virtuoso performance and with the highly charged atmosphere of the concert stage. If actions are not as fluent and automatic as tying one's shoes, they will be swept away in the adrenalin rush of stepping out in front of an audience (Steptoe, 2001). But how then is the performer to achieve the spontaneity needed to "produce a vital performance . . . [and] recreate the work every time" (Pablo Casals, quoted by Corredor, 1957, p. 196)? If every nuance of interpretation has been practised over and over until it occurs automatically, how does a performer keep the performance fresh, adjusting to the special demands of each occasion?

The answer, we propose, is to be found in what the musician thinks about during the performance. If the musician is not paying attention to the music, then a performance can easily be automatic and lack the important qualities of vitality and spontaneity. Highly prepared performances can be delivered this way all too easily. Similarly, if the performer focuses on possible pitfalls and mistakes to be avoided, this also is unlikely produce a creative performance. On the other hand, if the performer focuses on interpretive and expressive goals, then a spontaneous and creative performance is possible. The small variations that inevitably occur in any performance will be shaped by the performer's musical goals and are likely to enhance the expressive qualities of the performance by adapting it to the idiosyncratic qualities of instrument, hall, fellow musicians, and audience.

Performers are able to modify their highly practised performances in this way because the performance is under the control of *performance cues* (Chaffin & Imreh, 1997, 2001, 2002; Chaffin, Imreh, & Crawford, 2002, pp. 169–173; Imreh & Chaffin, 1996/97). Performance cues are the landmarks

of the piece that a musician attends to during performance, carefully selected and rehearsed during practice so that they come to mind automatically and effortlessly as the piece unfolds, eliciting the highly practised movements. Performance cues become an integral part of the performance and provide a way of consciously monitoring and controlling rapid, automatic actions of the performance. They provide points of intervention at which the performance can be restarted when something goes wrong and where adjustments can be made in response to the demands of the occasion and the moment. Performance cues make it possible for the execution of a highly prepared, automatic skill to be a creative response to the demands of a particular performance.

During practice, a performer makes many decisions about basic issues (e.g., fingering, technical difficulties, patterns of notes), and interpretation (e.g., phrasing, dynamics, tempo, timbre) whose implementation becomes automatic with practice (Chaffin *et al.*, 2002, pp. 166–176). This allows the performer to select a limited number of critical features to pay attention to during performance, e.g., a tricky fingering or critical phrasing. Practising with these features in mind turns them into performance cues, features of the music that come to mind automatically as the piece unfolds, along with their associated motor responses. We distinguish three types of performance cues. (Other categorizations are possible but these have proved adequate in our research on piano performance.) *Basic performance cues* include critical fingerings, technical difficulties, and patterns of notes to watch out for. *Interpretive performance cues* include critical phrasings, dynamic emphases, changes in dynamic level and tempo, and use of the pedal. *Expressive performance cues* represent the musical feelings that the performer wants to convey to the audience, e.g., surprise, gaiety, excitement.

The different kinds of cue are organized in a hierarchy framed by the formal structure of the music (see Figure 11.1). While practising, a musician's attention shifts between the levels of the hierarchy, with most attention going to the level on which problem-solving efforts are currently focused (Chaffin, Imreh, Lemieux, & Chen, 2003; Clarke, 1988; Williamon, Valentine, & Valentine, 2002). Work on a new piece starts by taking account of all the levels in the hierarchy in order to develop an "artistic image" of how the piece should sound (Neuhaus, 1973; see Chaffin *et al.*, 2003). After this, practice time is mostly spent on lower level problems of technique and interpretation. In front of an audience, however, problems must recede into the background so that musical expressiveness can take centre stage, both in the mind of the performer and (as a result) in the aesthetic experience of the audience. This transformation is achieved during the final polishing for performance by attending to the expressive performance cues that represent musical feelings. Expressive goals are identified early on (Chaffin *et al.*, 2003), but in this final phase of practice the pianist practises playing with expressive cues as the main focus of attention. As a result, the musician learns to access the action hierarchy directly at the level of the expressive cues, making it possible to play
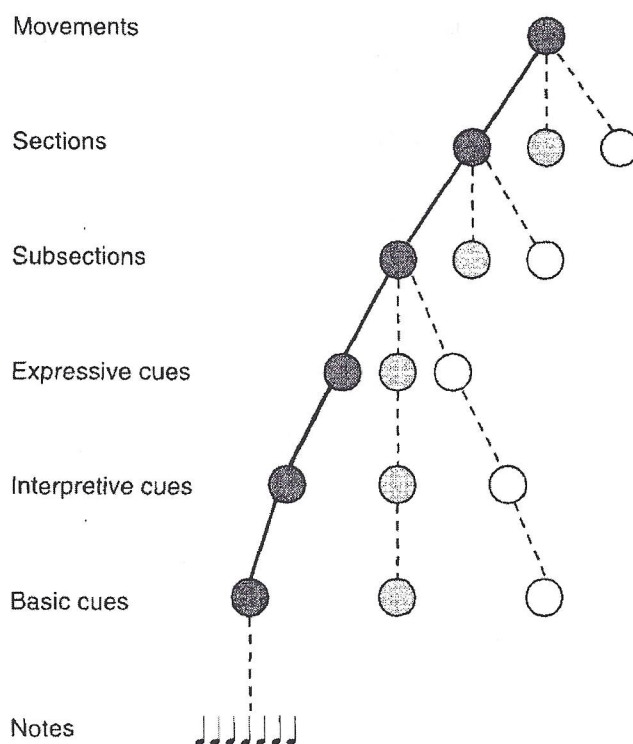
Movements

Sections

Subsections

Expressive cues

Interpretive cues

Basic cues

Notes

Figure 11.1 Schematic representation of the hierarchical organization of perform-
ance cues showing the three levels of formal structure identified by the
pianist for the *Presto* and three types of performance cue.

with expressive goals in the spotlight of attention, while structural, basic, and
interpretive cues form a penumbra on the edges of awareness, ready to be
called on as needed (Chaffin & Imreh, 2002).

To test these intuitions, we observed a concert pianist as she prepared the
third movement (*Presto*) of the *Italian Concerto* by J. S. Bach for perform-
ance. We have described the study elsewhere (Chaffin & Imreh, 1997, 2001,
2002; Chaffin *et al.*, 2002; Imreh and Chaffin, 1996/97), but have not
previously discussed the issue of creativity in performance. Here, we review
the study with the issue of creativity in mind and summarize new measure-
ments of tempo variation during polished performances that are particularly
relevant.

The pianist was Gabriela Imreh, a coauthor of previous reports of the
study, who was learning the *Italian Concerto* for the first time for the profes-
sional recording of an all-Bach CD (Imreh, 1996). Gabriela identified the
performance cues she used for the *Presto* and we looked at how these cues
were established and developed over the months of practice. We will examine
four types of evidence that the pianist's attention shifted from one type of
performance cue to another as learning progressed. First, Gabriela com-
mented, as she practised, about what she was doing, stopping briefly to do so.
We will report four occasions when she described in some detail what she was

thinking about as she performed the piece. Second, starts and stops during practice provide behavioural evidence confirming these self-reports. Third, tempo fluctuations during polished performances indicate the location of performance cues and show that expressive goals were not always implemented in exactly the same way. Finally, later recall of the score provides a window into the way that the piece was organized in the pianist's mind when it was last performed.

11.2 Learning the *Presto*

11.2.1 *Stages of the learning process*

The pianist videotaped her practice from the first time she sat down at the piano until the piece was ready to record 33 hours, 57 sessions, and 42 weeks later (see Table 11.1).[1] The learning of the *Presto* can be divided into six stages, beginning with *scouting-it-out* during the initial sight-reading through the entire concerto at the start of the first practice session. Six sessions of *section-by-section* practice followed during which the pianist worked through the piece a few sections at a time, deciding on fingerings and working the music into the hands. There was then a break of a few days while the pianist worked on the first movement. When work on the *Presto* resumed in session 7, practice was organized differently, with every section of the piece being played at least once in each session. Gabriela called this the *grey stage* because her playing was at an uncomfortable, intermediate stage, not yet fully automatic, but fluent enough that efforts to consciously direct it sometimes interfered. The grey stage was interrupted after session 12 by the first of two long breaks during which the piece was not played.

The first break lasted for three months after which the piece had to be relearned, so that the next stage of *putting-it-together* did not begin until session 17. The new goal of playing fluently through the whole piece from

Table 11.1 Six stages in the learning of the *Presto*, showing the time practised, the distribution of sessions over weeks, and the location of the two long breaks

Stage	Session	Duration (h:min)	Week
Scouting it out	1	0:20	1
Section by section	1–6	6:00	1–3
Grey stage	7–12	4:59	3–5
BREAK 1			
Grey stage cont'd	13–16	2:51	20
Putting it together	17	1:02	20
Polishing	18–24	4:13	21–22
BREAK 2			
Polishing cont'd	25–44	10:05	30–40
Maintenance	45–57	3:55	41–42

memory was achieved in this one session. The next stage of *polishing* began in session 18 and continued in three phases over the next five months. Polishing for the first performance took two weeks (sessions 18–24) and ended with the pianist's first public performance of the piece as part of a recital programme. This performance was not, however, the end of the learning process. After taking a two-month break, she relearned the piece and polished it again (sessions 25–30). Preparation might have been complete at this point, but the pianist decided that the piece needed to go faster to make it "gel" (Chaffin *et al.*, 2002, p. 152), and sessions 31–44 were devoted to increasing the tempo. When the piece was finally ready, its high state of preparation was maintained for the remaining two weeks before the recording session with a final stage of *maintenance* practice (sessions 45–57) of which only two sessions (49 and 50) were videotaped.

Nearly three months later, as she was listening to the tapes of the recording session, the pianist wrote down all of the performance cues and provided reports of other features of the music (Chaffin & Imreh, 2001; Chaffin *et al.*, 2002, pp. 166–169). During the following two years, the pianist did not play the piece, and, 27 months after the recording session, she wrote out the first page of the score from memory.

11.2.2 Pianist's reports after practice performances at four stages of the learning process

The pianist's comments during practice document both the development of the performance cues for the *Presto* and the development of the *concept* of performance cues in her thinking. At the time that recording of practice began, the idea of performance cues had not yet been clearly articulated. The pianist and the first author of this chapter had recently presented a workshop together describing piano memory in terms of standard psychological constructs such as chunking, retrieval cues, and automaticity (Imreh & Chaffin, 1993). An opportunity to present the same ideas at a conference on practical applications of memory research the following year provided the impetus for the study (Chaffin & Imreh, 1994).

This is why, when the pianist completed her first performance of the piece without the score at the end of session 12, she took a few minutes to describe how she had done it. Opening the score, she went through it describing what she had been attending to during the performance just completed. She did the same thing again at the end of session 17, after learning to play from memory, and at the end of session 24, before the first "live" performance. Then, between sessions 31 and 32, she wrote out a more formal description of the same information for one section. These four occasions provide a picture of how her attention focused on different levels of the hierarchy of performance cues as learning progressed.

Session 12 was the end of the first learning period and the pianist was about to set aside the piece for several months. She had been using the score

during practice and now wanted to show, for the record, that she could play without it. Closing the score, she played through it twice from memory. During the first attempt she ran into trouble with the transitions between sections.

> Probably now the seams are quite obvious . . . It's going to take a while to get through this, but it's good [for me]. Now I have to check each transition [between themes] because each time it's something different. That's the second time, so . . . Oh, I confused them.

The description focused on the sections and subsections of the formal structure.

At the end of session 17, just after playing through the piece successfully four times in succession without the score, the pianist talked again about what was going through her mind as she played. The description was several times longer than that of session 12 and, while structure was still mentioned, most of the comments were about basic cues.

> Well, I have to tell you a few things. Eventually at this level you start to have a sort of map of the piece in your mind and you . . . focus on certain places in it. I'll try to tell you . . . I have a thing in bar 42 where I have to remember to go all the way to the G . . . I have to concentrate on the fingering in bar 65, the left hand divided between two, four fingers . . . The next place I have really planned to concentrate was, an old friend, bar 118. I have, oh boy, the scale in the left hand at [bar] 124, the two fours in a row.

Here we have examples of the three different types of basic performance cue – a technical difficulty (a [jump] in bar 42), a fingering (in bar 65), and a pattern of notes (the scale in left hand) – each needing attention during performance.

The third occasion was at the end of session 24, the day before the pianist performed the piece in public for the first time. The description was much more detailed than in session 17, and again the focus had changed. Now, most of the cues involved interpretation: basic and structural cues were hardly mentioned.

> And again the . . . double counterpoint that I've been working on ever since in bar 45. And then it changes in bar 49 – the hands switch roles . . . I'm doing a little bit of *ritard.*, just smaller than the other one in bar 75. I'm trying to bring out, in 77, the C's in the left and F in left hand. And I'm still trying to do a fairly aggressive . . . [plays], just in left hand. And then I return to very lightly *pianissimo*. And again, just the left hand B♭ (accented), and then I return to *pianissimo*. . . . And that gives me again room for a nice *crescendo* in 86 and on . . . I try to put the accents in. It's very hard. Most times I'm lucky, but in 93 I sometimes

miss that D below the staff. It's a big jump and it goes awfully fast. But I want to emphasize it because it's a theme.

Most of these are interpretive performance cues: phrasing (double counter-point), tempo (*ritardando*), dynamics (*pianissimo*) and articulation (put the accents in).

It is interesting to note that, although the pianist was about to perform the piece in recital, expression is scarcely mentioned. The absence does not mean that the performance the following day was not expressive – expression was built into the automatic actions of hands and fingers – but it does mean that the piece was not completely ready yet. This was evident the next day when the pianist performed using the score, something she rarely does, and also in the more than 10 additional hours of practice on the piece after the second break. In session 24, the focus was still on the interpretive cues and not yet on the expressive goals those effects were designed to achieve.

The transition to focusing primarily on expressive cues took place at the beginning of the third learning period. The pianist did not provide another spontaneous description of the cues she was using like those we have described so far, but between sessions 31 and 32 she gave a more formal, written description for one section of the piece. This was prompted by the memory conference for which we had begun collecting the data nine months earlier. It was time to give a talk on "Memorizing for piano performance" (Chaffin & Imreh, 1994). To provide a concrete example of the cues she was using, Gabriela drew the diagram reproduced in Figure 11.2, showing the cues for the *C* theme.

Figure 11.2 shows how the sections of the formal structure were labelled and the basic, interpretive, and expressive performance cues were indicated by arrows. Unlike the figure, only the expressive cues were labelled. This, together with the fact that expressive cues were explicitly mentioned here for the first time, suggests that it was the expressive cues that were now in the spotlight of attention.
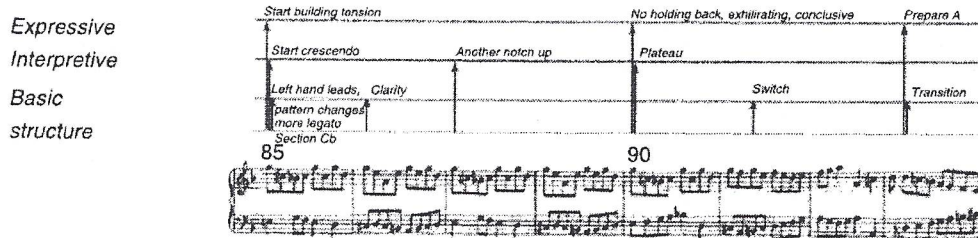
Performance Cues

Figure 11.2 The performance cues (indicated by arrows) that the pianist reported attending to during practice for subsection *Cb* (bars 85–93) of the *Presto*. The number of cues per bar of each type served as predictors of practice, tempo, and recall. From Chaffin & Imreh (1997). Adapted with permission.

Figure 11.2 illustrates the relationship of the different types of cues. Bar 85 contains all four kinds: basic, interpretive, expressive, and structural. Each represents a different way of looking at the same point in the music. In session 12, Gabriela was worrying about transitions between sections and in bar 85 was thinking about starting section *Cb*. In session 17, she was focused on what her hands should be doing and thinking about the basic cue, "left hand leads". By session 24, the focus was on how the piece sounded, and attention was on the interpretive cue, "start *crescendo*". Finally, some time before the end of session 31, she was able to focus on the musical effects of all of this, and the expressive cue "start building tension" took centre stage. We can see in this one bar the progression that we have been tracking from the upper levels of the hierarchy in session 12 (structure), to the bottom level in session 17 (basic), back up one level in session 24 (interpretive), and up another level by session 31 to the expressive cues.

11.2.3 Effects of performance cues on starts and stops during practice

Another source of information about the pianist's focus of attention is provided by her practice. Where did she start and stop? Which bars were repeated more? Starting at a particular location requires attention to that location, as does stopping, at least when it is deliberate. Repetition, likewise, indicates that a passage was singled out for attention. Figure 11.3 shows a portion of the practice record for session 9 for the same short passage for which we described the performance cues, immediately above. Each time the pianist stopped a new line begins (Figure 11.3) on the next line up. The record shows that some bars were repeatedly used as starting places. What was special about these bars? Inspection of Figure 11.2 provides the answer.
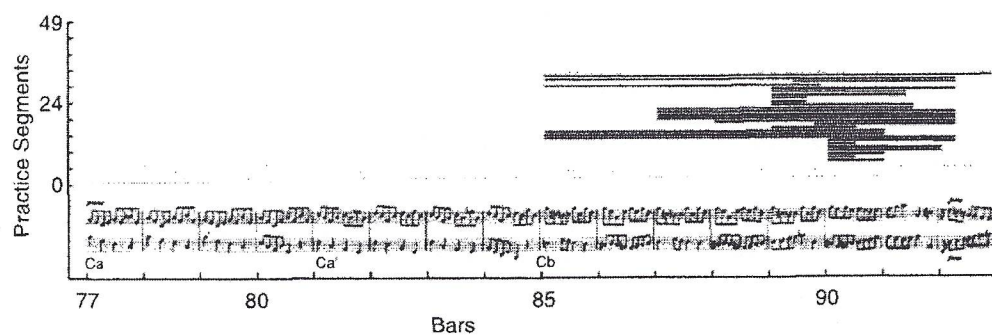

Figure 11.3 The record of practice of section *C* (bars 77–84) during session 9. The record reads from bottom to top, with each line representing the playing of the music shown below. Each time the pianist stopped and started again the record begins again on the next line up. The starting places correspond to the location of the performance cues for the passage. In session 9, the pianist was setting up the performance cues by using them as starting places. From Chaffin & Imreh (2001). Adapted with permission.

These bars contained performance cues and in Figure 11.2 we see these cues being set up (Chaffin *et al.*, 2003). Starting at those locations established them as performance cues so that later simply thinking of that spot was sufficient to initiate playing (Chaffin & Imreh, 2002). This conclusion is not based solely on the few bars in Figures 11.2 and 11.3. Detailed statistical analysis of practice of the rest of piece in this and other sessions confirmed that the same was true for the piece as a whole (Chaffin & Imreh, 2001, 2002; Chaffin *et al.*, 2002, Chapter 8; Chaffin *et al.*, 2003).

The practice in Figure 11.3 consists mainly of the repetition of short segments. We call this kind of practice *work*, and distinguish it from *runs* in which longer passages are played with minimal interruption (Chaffin & Imreh, 2001; Chaffin *et al.*, 2002, Chapter 6). We have used work to illustrate practice in Figure 11.2 because the small number of bars involved in work makes the figure easier to read. For the purpose of identifying performance cues, however, runs are more informative. Runs cover substantial portions of the piece and so require use of performance cues to retrieve the upcoming passage from long-term memory. Interruptions are likely to occur when a cue does not operate fast enough, so that playing stops at the cue and the bar has to be repeated. Deliberate starts and stops are also likely to occur at performance cues since they are the main landmarks. So, we will look at starts, stops, and repetitions during runs to see when each type of performance cue was receiving attention.

Table 11.2 shows the sessions in which runs were affected by each type of performance cue. The table summarizes the results of statistical analyses that

Table 11.2 Summary of changes across sessions in the effects on practice of the formal structure and of basic, expressive and interpretive performance cues

	Type of performance cue			
Session	Structure*	Basic	Interpretive	Expressive
7–8	+	+	+	+
9–10	+	+	+	+
11–12	+	+	+	•
17	+	+	•	•
20–24	+	•	+	+
28–30	+	(+)	•	+
31–44†	+	•	+	•

* Effects of structure include effects of section boundaries, serial position of a bar in the section, and switches (places where two identical variations of a theme first diverge).

+ Significant effects ($p < .05$) in regression analyses with starts, stops, and repetitions as dependent variables and performance cues and structure as predictor variables.

• Non-significant effects in regression analysis.

(+) This effect was negative and may reflect avoidance rather than practice of performance cues. With one other exception the remaining effects were positive.

† Development of expressive cues was completed by session 31; sessions 31–44 were devoted to increasing the tempo.

identified when starts, stops and repetitions during practice tended to cluster at performance cues of each type (see Chaffin *et al.*, 2002, Chapter 8 for details). A "+" in the table indicates the sessions in which this happened for each type of performance cue.[2] The effects of performance cues on practice showed the same ordering -- from basic to interpretive to expressive -- that we have already seen in the self-reports (there were also interesting differences, which we discuss below). Practice of performance cues began in sessions 7–8, when the pianist began to play through the entire piece rather than practising section by section. This was the first time that performance cues were needed to recall the music from memory as the piece unfolded and all four kinds of cue were practised, both in sessions 7–8 and again in 9–10. The framework for performance was being set up. Structural cues then continued to affect practice throughout the entire learning process, while for the other three kinds of cue there was an interesting progression of effects.

The progression is consistent with the idea of a hierarchical ordering of cues from basic to interpretive to expressive. After initially encompassing all four kinds of cues in sessions 7–8 and 9–10, the pianist's attention first narrowed. The effect of expressive cues disappeared in sessions 11–12, then the effect of interpretive cues disappeared in session 17, leaving basic cues as the focus. The progression in the first half of the learning process was thus: expressive, interpretive, basic. Session 17, in which performance from memory was finally mastered, marked the turning point.

After session 17, attention moved back up the hierarchy one level at a time -- basic, interpretive, expressive -- the effects of each type of cue disappearing in turn as it was mastered. (Effects of structural cues were present throughout.) Effects of basic cues, which were present in session 17, disappeared in sessions 20–24. Next, the effect of interpretive cues, which had been present in sessions 20–24, disappeared in sessions 28–30. (The effect of basic cues in sessions 28–30 was negative and probably indicates that the pianist was ignoring these trouble spots while she focused on the expressive cues.) Finally, the effect of expressive cues, which had been present in session 28–30, disappeared in sessions 31–44. The progression was: basic; interpretive; expressive.

The ordering of effects is consistent with the idea that the three types of performance cue were hierarchically ordered, with lower level basic cues being practised and mastered first and expressive cues last. The progression was down the hierarchy before session 17 and back up again afterwards. The spotlight of attention began at its widest and then narrowed, withdrawing first from expressive and then from interpretive cues, leaving only basic cues as a focus of both self-report and practice in session 17. Then the spotlight moved back up the hierarchy as first basic, then interpretive, and finally expressive cues were mastered.

Sessions 31–44 represent an inconsistency in this orderly picture. The learning process did not end neatly with the practice of expressive cues in sessions 28–30. The practice of interpretive cues in sessions 31–44 suggests that, contrary to our account, the learning process concluded with attention to

interpretation rather than expression. We do not believe that this was the case. As noted above, the piece was essentially ready for performance by session 31 except that the pianist decided on a faster tempo. Sessions 31–44 were spent bringing the performance up to the new tempo and the effect of the interpretive cues in these sessions tells us that the new tempo was achieved mainly by adjusting the interpretive cues, probably by reducing their number. The effect of these cues in these sessions does, however, muddy the waters. The next two sections provide further evidence to support our claim that during the final performance the spotlight of attention was on the expressive cues. First, however, we need to discuss the relationship between the self-report and practice data.

For the four occasions (described in the previous section) when the pianist described what she was attending to while playing, the self-reports and practice were in agreement. The cues that Gabriela described, she also practised. But practice was also affected by other kinds of cues not mentioned in the self-reports. In session 12, when the comments indicated that the pianist was having trouble keeping the different sections straight, practice was affected by structure, but also by basic and interpretive cues. In session 17, when the pianist's self-report was all about basic cues, basic cues were practised but so were structural cues. In session 24, when interpretation became the focus of the self-report, interpretive cues were practised, but so were expressive cues. In sessions 28–30, just before the expressive cues were first mentioned between sessions 31 and 32, expressive cues were practised, but so were basic cues. The reason for these differences between self-reports and practice is that the two types of data give somewhat different pictures of what was happening. The self-reports tell us what the pianist was focusing her main problem-solving efforts on. Practice reflects the same influences, but was also influenced by other aspects of the music whose effects were more automatic and whose influence on practice occurred without the spotlight of attention (Chaffin & Imreh, 2001; Chaffin *et al.*, 2003).

In spite of their differences, practice and self-reports both point to the same progression from basic, to interpretive, to expressive cues. As noted above, however, the practice of interpretive cues in sessions 31–44 casts some doubt on this conclusion and so we turn now to the final performance, recorded on CD, for more direct evidence of what the pianist was attending to as she played.

11.2.4 The effects of performance cues on the polished performance

Effects of structural and expressive cues were evident in the final performance of the *Presto* recorded on the CD (Chaffin & Imreh, 2002; Chaffin *et al.*, 2002, Chapter 9). The tempo was regular, appropriate to the performance conventions of the Baroque period and the character of the *Presto*. There were, however, small variations, which were detectable in measurements of inter-bar intervals made from the audio signal (Chaffin & Imreh, 2002; Chaffin

et al., 2002, pp. 228–233; Chaffin, Lemieux, & Chen, 2006). The tempo of each bar was systematically related to the formal structure and to the location of expressive cues. The differences were very slight and, if they are detectable to the ear, it is only as subtle changes of emphasis, not as changes in tempo. But the differences occurred consistently enough throughout the piece to register as statistically significant in analyses similar to those described in the previous section for practice. The results for the CD performance are summarized in the first row of Table 11.3.[3] The formal structure was marked by a slowing of tempo from beginning to end of sections while expressive cues were marked by faster tempos. The effects draw the listener's attention to the boundaries between sections and expressive phrases (Clarke, 1988, 1995; Shaffer, 1984) and their presence suggests that the pianist was also attending to these places as she played (Sloboda & Lehmann, 2001).

The presence of effects of structural and expressive cues on the CD performance does not, however, prove that the pianist was attending to these cues as she performed. The effects might have been produced automatically, the product of highly trained motor responses. The effect of expressive cues was, however, *not* present in trial performances in sessions 49 and 50, just a week before the CD performance. And these were *performances*, not simply practice; the pianist was trying to capture a perfect performance on videotape to use in talks about the research. For most purposes, the performances in these sessions and on the CD were identical, but our measurements were able to detect two subtle differences in the effects of performance cues. First, expressive cues, which were marked by faster tempos in the CD performance, were distinguished by slower tempos in two performances in session 49. It seems that the heightened arousal of the recording session may have resulted in a more expressive performance. Second, bars containing basic cues were slightly longer than other bars in three performances in session 49 but not in

Table 11.3 Summary of effects of performance cues on tempo during the CD performance and on performances in sessions 49 and 50

| Performance | Structure* | Type of performance cue | | |
		Basic	Interpretive	Expressive
CD	+	•	•	−
49.2	+	+	•	•
49.3	+	+	•	•
49.4	•	•	•	+
49.5	+	+	•	+
50.2	+	•	•	•
50.3	+	•	•	•

* Effects of structure include effects of section boundaries, serial position in a section, or both.
+/− Significant effects (*p* < .05). Positive effects indicate slower, negative effects faster tempos. Positive effects of serial position were due to tempo decreasing from beginning to end of a section.
• Non-significant effects in regression analysis.

the other performances. The effect probably reflects the pianist's desire for a note-perfect performance. Taking a little more time on basic cues ensured accuracy. The degree of caution or risk-taking is something that must be decided each time (Kenny & Gellrich, 2002) and is one source of the spontaneous decision-making that makes performance a creative activity.

In summary, the fact that basic and expressive cues had different effects in these performances indicates that the performances differed subtly at musically important locations and suggests that these differences were the product of how attention was directed to the various performance cues.

11.2.5 *Effects of performance cues on memory for the score after two years*

One final piece of evidence that performance cues provided the main landmarks for the final performance comes from the pianist's memory for the piece more than two years later. She had not played the *Presto* in the meantime, so her memory provided a window into the way the piece had been organized in her mind the last time she had played it – in the recording studio two years earlier. Recall of an ordered series is generally better for the first item and declines with each succeeding item (Broadbent, Cooper, & Broadbent, 1978; Roediger & Crowder, 1976). This kind of *serial position effect* is indicative of a memory organization in which a retrieval cue activates the first item in an associative chain; then recall of each successive item is cued by the previous item in the chain (Rundus, 1971). If the pianist's memory of the *Presto* were organized into chunks on the basis of the formal structure, then we would expect to find a serial position effect for sections, with recall being best for the first bar of each section and declining with each successive bar. Likewise, if her memory were organized by expressive goals, we would expect recall to be best for bars containing expressive cues and to decline with each successive bar after these cues. Serial position effects for interpretive or basic cues would similarly indicate that memory for the piece was organized into chunks that were accessed at these cues.

So, 27 months after the recording session, the first author, without warning, asked the pianist to play the *Presto* from memory. She indignantly refused. Then, relenting, she agreed to write out part of the score from memory. Her memory was remarkably good, 65 per cent accurate (Chaffin & Imreh, 1997; Chaffin *et al.*, 2002, p. 212). More interesting, though, were the effects of the different kinds of performance cue on memory.

Table 11.4 shows the effect of serial position with respect to each type of performance cue on recall of the score (Chaffin & Imreh, 2002; Chaffin *et al.*, 2002, p. 214). The top row of the table shows that distance from the start of a section had the expected effect. Recall for the first bar of each section was nearly perfect; it declined progressively with distance from the beginning of the section. This pattern of results tells us that the pianist's memory was organized, as expected, in terms of the sections of the formal structure with

Table 11.4 Probability of correctly recalling the score decreased with distance from section boundaries and expressive cues and increased with distance from basic cues

Type of performance cue	Serial position: Distance from cue (number of bars)				
	1	2	3	4	5–8
Structural boundary	.97	.90	.87	.69	.28
Expressive	.85	.85	.74	.43	.00
Basic	.68	.77	.78	.77	.46
Interpretive	.75	.78	.61	.00	no value

the start of each section providing a landmark (retrieval cue) at which memory for the piece could be accessed and with memory for each succeeding bar being triggered by the bar before it. Expressive performance cues showed a similar serial position effect. Recall was highest for bars containing expressive cues and for the bar immediately following and then declined sharply over the next two bars. This tells us that the pianist was right when she said that she had retrained herself in the latter stages of the learning process so that expressive cues came to be the main focus of her attention.

Interpretive and basic cues did not show the same effect. The interpretive cues did show a small decline with serial position but the effect was not statistically reliable. For basic cues, the effect of serial position was in the opposite direction. Bars containing basic cues were remembered *worse* than other bars. This tells us that role of basic cues was different. Basic performance cues ensure the execution of critical details, such as the placement of a particular finger. Attention to details of this sort leaves fewer attentional resources for other features, resulting in poorer recall. Attention to expressive and structural cues, on the other hand, elicits memory for the entire passage that follows. Rather than coming at the expense of other features, these cues encapsulate or chunk a passage. Thinking of a section or expressive phrase activates its more detailed representation in memory, while thinking of a basic cue activates just the memory for that particular detail.

Thus, recall of the score provided a window into how the pianist's memory was organized at the time of the final performance. Musical structure and expression provided the main landmarks, while basic cues represented specific obstacles that might require attention. The conclusion is consistent with our suggestion that at end of 10 months' practice the pianist's main focus of attention during performance was on the expressive cues.

11.3 Conclusion

Solo recitals in the Western classical music tradition place extraordinary demands on the performer. Performances must be practised to the point that

they can be delivered automatically in order to ensure reliability under the pressures of the concert stage. At the same time, the performance must remain fresh and flexible enough to permit recovery from inevitable mistakes. We suggest that the integration of automatic motor performance and cognitive control needed to provide this flexibility is achieved through the practice of performance cues. Use of performance cues is an attentional strategy that maintains conscious control of a highly automated performance. It is in the ability to control, and thus to modify, a highly prepared performance that the creativity of musical performance lies.

When a performer has to think mostly of basic cues dealing with matters of technique, the possibilities for creativity are limited. When a performer is focused on interpretive cues and is thinking about what the music sounds like, the opportunities for creativity are greater but still limited. The goal of performance is to evoke musical feelings and this is best achieved when the performer focuses on expression. A creative performance is, therefore, most likely when the performer is focusing on expressive cues. This allows the artist to adjust the performance to the unique opportunities and demands of the occasion to achieve the maximum possible impact on the audience.

We have illustrated this account of how a performance is prepared with a case study of a pianist learning the *Presto*. Our analysis was based initially on the performer's report of her own experience. We then looked for behavioural evidence to test that account. The pianist's spontaneous descriptions of what she was attending to during practice indicate that during her first practice performance without the score in session 12 she was focused on structure, that the next time she played from memory, in session 17, she was thinking mostly about basic cues, and that by session 24, when she was ready for her first public performance, she was attending mostly to interpretive cues. Only when preparation was almost complete, between sessions 31 and 32, were expressive cues mentioned explicitly for the first time. The practice data showed a similar progression, with practice focusing initially on all of the different levels of cues and then progressively on basic, interpretive, and finally expressive cues, with musical structure influencing practice throughout. Both self-report and practice showed that the pianist was training herself to attend to performance cues and focused attention successively on structural, basic, interpretive, and expressive cues.

The fact that the pianist paid more attention to expressive cues in sessions 28–30 is suggestive, but does not prove that these cues were the main focus of attention during the final performance. This conclusion is, however, supported by two additional sources of evidence. First, expressive and structural cues affected the tempo of the CD performance even though the expressive cues did not affect practice performances recorded a week earlier, suggesting that the pianist was attending more to expressive cues during the CD performance. Second, expressive and structural cues provided the main landmarks of the pianist's memory for the piece two years later, again suggesting that these cues had also served as landmarks when she last played the *Presto*

two years earlier. The behavioural evidence thus supports the pianist's report that she trained herself to attend primarily to expressive cues during performance. Attending to these cues provides the means to creatively adjust a performance to make the most of the expressive possibilities of the occasion.

The presence of differences between practice performances of the *Presto* at musically significant locations suggests that this kind of variation is probably characteristic of most performance. Tempo variation in the *Presto* is not a promising place to look for musical spontaneity or creativity and finding it suggests that such differences are a normal part of musical performance. With a live audience or with music that called for greater expressive variation in tempo, greater variation between performances would be expected.

Musical performance is a creative activity because a soloist must adapt a highly prepared interpretation to the differing circumstances of each performance. We have shown that a highly prepared performance varied from one occasion to another and that, at least for the highly skilled professional we studied, some of the variation was related to the performance cues that she was attending to as she performed. The differences thus reflect a kind of musical spontaneity and suggest that the creative process of developing the interpretation was continuing, albeit in small ways, in successive performances. Although performances in the Western classical tradition are highly practised and polished, performance can and should be a creative activity.

Acknowledgements

Notes

1   The description of the weeks during which each stage of practice occurred has been simplified in the table by ignoring one or two isolated sessions that occurred during each break (see Chaffin *et al.*, 2002, p. 99 for details).
2   For the analyses, adjacent sessions were grouped together into 11 session sets. Four session sets were omitted from the table to simplify description. Sessions 1–6 were omitted because they were devoted to practice of technique; performance cues were not practised (see Chaffin *et al.*, 2002, p. 188). Sessions 13, 14–16, and 25–27 were omitted because they occurred after the two long breaks and were mainly devoted to relearning. The sessions that are included give a picture of how the practice of performance cues developed continuously across the learning process.
3   The results summarized here for the CD performance differ slightly from those reported previously for the same performance (Chaffin & Imreh, 2002; Chaffin

et al., 2002, Chapter 9), in being more accurate (mean error of measurement = 8 ms; 90% of errors < 16 ms). The most important difference is that the effect of expressive cues became statistically significant for the CD performance, while with the previous measurements it was not.

References

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review*, *89*, 369–406.

Broadbent, D. E., Cooper, P. J., & Broadbent, M. H. (1978). A comparison of hierarchical matrix retrieval schemes in recall. *Journal of Experimental Psychology: Human Learning and Memory*, *4*, 486–497.

Chaffin, R., & Imreh, G. (1994). Memorizing for piano performance. *Piano Journal*, *15*, 16–19.

Chaffin, R., & Imreh, G. (1997). "Pulling teeth and torture": Musical memory and problem solving. *Thinking and Reasoning*, Special issue on expert thinking, *3*, 315–336.

Chaffin, R., & Imreh, G. (2001). A comparison of practice and self-report as sources of information about the goals of expert practice. *Psychology of Music*, *29*, 39–69.

Chaffin, R., & Imreh, G. (2002). Practicing perfection: Piano performance as expert memory. *Psychological Science*, *13*, 342–349.

Chaffin, R., Imreh, G., & Crawford, M. (2002). *Practicing perfection: Memory and piano performance*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Chaffin, R., Imreh, G., Lemieux, A. F., & Chen, C. (2003). "Seeing the big picture": Piano practice as expert problem solving. *Music Perception*, *20*, 461–485.

Chaffin, R., Lemieux, A., & Chen, C. (in press) "It's different each time I play": Variability in highly prepared musical performance. Manuscript under review.

Clarke, E. F. (1988). Generative principles in music performance. In J.A. Sloboda (Ed.), *Generative processes in music*. Oxford: Clarendon Press.

Clarke, E. F. (1995). Expression in performance: Generativity, perception and semiosis. In J. Rink (Ed.), *The practice of performance: Studies in musical interpretation* (pp. 21–54). Cambridge, UK: Cambridge University Press.

Corredor, J. M. (1957). *Conversations with Casals*. New York: Dutton.

Fitts, P. M. (1964). Perceptual-motor skill learning. In A. W. Melton (Ed.), *Categories of human learning* (pp. 243–285). New York: Academic Press.

Gabrielsson, A. (1999). The performance of music. In D. Deutsch (Ed.), *The psychology of music* (2nd ed.) (pp. 579–602). San Diego, CA: Academic Press.

Imreh, G. (pianist). (1996). *J. S. Bach* [CD]. New York: Connoisseur Society.

Imreh, G., & Chaffin, R. (1993, July). *Memory and performance*. Workshop presented at the meeting on "Memory and piano performance", European Music Teachers Association, London.

Imreh, G., & Chaffin, R. (1996/97). Understanding and developing musical memory: The view of a concert pianist. *American Music Teacher*, *46*(3), 20–24, 67.

Kenny, B. J., & Gellrich, M. (2002). Improvisation. In R. Parncutt and G. E. McPherson (Eds.), *The science and psychology of musical performance: Creative strategies for teaching and learning* (pp. 117–134). New York: Oxford University Press.

Mach, E. (1991). *Great contemporary pianists speak for themselves.* New York: Dover. (Originally published in two volumes, 1980 and 1988.)

Neuhaus, H. (1973). *The art of piano playing.* New York: Praeger.

Palmer, C. (1989). Mapping musical thought to musical performance. *Journal of Experimental Psychology: Human Perception and Performance, 15,* 331–346.

Palmer, C. (1997). Music performance. *Annual Review of Psychology, 48,* 115–138.

Persson, R. S. (2001). The subjective world of the performer. In P. N. Juslin & J. A. Sloboda (Eds.), *Music and emotion: Theory and research* (pp. 275–290). Oxford: Oxford University Press.

Repp, B. H. (1992). Diversity and commonality in music performance: An analysis of timing microstructure in Schumann's *Träumerei. Journal of the Acoustical Society of America, 92,* 2546–2568.

Repp, B. (1998). A microcosm of musical expression: I. Quantitative analysis of pianist's timing in the initial measures of Chopin's Etude in E major. *Journal of the Acoustical Society of America, 104,* 1085–1100.

Roediger, H. L., III, & Crowder, R. C. (1976). A serial position effect in recall of United States President. *Bulletin of the Psychonomic Society, 8,* 275–278.

Rosenbaum, D. A. (1987). Hierarchical organization of motor programs. In S. Wise (Ed.), *Neural and behavioral approaches to higher brain functions* (pp. 45–66). New York: Wiley.

Rundus, D. (1971). Analysis of rehearsal processes in free recall. *Journal of Experimental Psychology, 89,* 63–77.

Seashore, C. E. (1938). *The psychology of music.* New York: McGraw-Hill.

Shaffer, L. H. (1984). Timing in solo and duet piano performances. *Quarterly Journal of Experimental Psychology, 36A,* 577–595.

Shaffer, L. H., Clarke, E .F., & Todd, N. P. (1985). Meter and rhythm in piano playing. *Cognition, 20,* 61–77.

Shiffrin, R. M. & Schneider, W. (1977). Controlled and automatic human information processing: II: Perceptual learning, automatic attending, and a general theory. *Psychological Review, 84,* 127–190.

Sloboda, J.A., and Lehmann, A.C. (2001). Tracking performance correlates of changes in perceived intensity of emotion during different interpretations of a Chopin piano prelude. *Music Perception, 19,* 87–120.

Snyder, B. (2000). *Music and memory: An introduction.* Cambridge, MA: MIT Press.

Steptoe, A. (2001). Negative emotions in music making: The problem of performance anxiety. In P. N. Juslin & J. A. Sloboda (Eds.), *Music emotion: Theory and research* (pp. 291–307). London: Oxford University Press.

Williamon, A., Valentine, E., & Valentine, J. (2002). Shifting the focus of attention between levels of musical structure. *European Journal of Cognitive Psychology, 14,* 493–520.