

**A self-study of learning the Prelude from Bach's Suite No. 6 for cello solo:
Comparing words and actions**

Tânia Lisboa, Roger Chaffin, Topher Logan

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Prologue

What are the strategies, thoughts and artistic behaviours involved in learning a new piece? We answer these questions by describing how an experienced cellist prepared the Prelude from Bach's Suite No. 6, for cello solo, BWV 1012, for performance. The chapter describes my (the first author's) experience and insights as a musician studying my own practice with the help of collaborators: psychologists who study music cognition. The longitudinal case study described here took place over a period of 3½ years during which we recorded the process of learning, memorising and giving ten public performances of the Prelude—a total of 38 hours of practice in 75 practice sessions.

Effective practice

Musicians have been interested in methods for effective practice for many years, at least since Carl Czerny's famous report of his lessons with Ludwig van Beethoven (Badura-Skoda 1970) and Leopold Mozart's treatise on the fundamental principles of violin playing. Recently, Anders Ericsson and colleagues have provided empirical evidence for the importance of effective practice. Even among exceptional performers, the level of achievement is closely related to the amount of *deliberate* practice. A minimum of ten years and 10,000 hours of deliberate practice are required to achieve eminence (Ericsson, Krampe and Tesch-Römer 1993; Ericsson 1997). Given the number of hours involved, even small differences in the effectiveness of practice may be important (Chaffin and Lemieux 2004).

One simple way to identify effective methods of music practice empirically is to interview eminent performers (e.g., Hallam 1995, 1997; Chaffin, Imreh and Crawford 2002, 26–65). Nevertheless, despite their interest, interviews are of limited value due to the possibility of inaccuracy and distortion (Ericsson and Simon 1980). Experiments have the advantage of objectivity and can also assess the efficacy of different practice techniques (e.g., Rubin-Rabson 1941). Experiments, however, are limited by the need to study practice techniques that have already been identified, and by the possibility that the artificial tasks involved may overshadow the creative problem-solving that is of interest. Naturalistic observation of practice provides a happy compromise, combining objectivity with ecological validity (e.g., Gruson 1988; Miklasewski 1989; Nielsen 1999; Williamon, Valentine and Valentine 2002). One variant is to enlist the cooperation of the artist in a longitudinal case study in which the musician studied also becomes a full member of the research team (e.g., Chaffin, Imreh and Crawford 2002; Ginsborg, Chaffin and Nicholson 2006). This was our approach.

The prospect of studying one's *own* practice, however, can be terrifying. Might scrutinising the process destroy the “spell” or compromise the “freshness” of performance? I confronted such fears repeatedly during the course of our study. The process was challenging, and my dual roles as performer and investigator had to be carefully managed. In the end, the combination of self-reflection and the gaining of objective information about what actually happened during practice led to a positive

outcome. I gained a deeper understanding of the music and of my own practice. As a result, my learning has become more focused and memorising has become easier, quicker and more reliable.

The investigation

As I started practising, I restrained myself from reading reports of other studies by my collaborators so as to avoid influencing my usual practice behaviour. However, towards the end of the learning process, as I became more involved in the analysis and interpretation of the data, I took a more active role as a researcher. I began to read my colleagues' previous publications so that together we could understand how the data we were collecting related to psychological theories of memory, expertise, and skill acquisition. Sometimes the match of theory to data was straightforward, but often elaboration was needed. My experience as a musician and my understanding of my own musical goals for the Prelude were critical in mapping the abstract constructs of psychological theory onto the messy reality of my long hours in the practice studio.

I kept a log book in which I recorded notes about each practice session. As I practised, I spoke periodically to the camera, commenting on my playing, goals, progress, strategies, frustrations, and much else. My psychologist colleagues transcribed my comments and also where I started and stopped in my practice. We then classified the comments into the six categories shown in table 1.¹

Category	Topics
<i>Technique</i>	Bowing; Fingering; Hand Position; Change of Strings; Intonation; Vibrato
<i>Musical Structure</i>	Formal Structure; Harmonic Structure; Melodic Structure
<i>Interpretive</i>	Articulation; Dynamics; Phrasing
<i>Memory</i>	Conceptual Memory; Difficulty; Memory Cue
<i>Metacognitive</i>	Concentration; Equipment; Evaluation; Stages
<i>Strategies</i>	Counting; Practice Tempo; Rhythmic Variations, etc.

Table 1. Categories used to classify comments made during practice, with examples of sub-topics.

My colleagues also provided me with graphs of my practice sessions showing where I started and stopped. The graphs showed fascinating patterns of activity: bouts of focussed work intermittently connected together into longer runs. To improve understanding of what was going on, I provided reports about every aspect of my musical thinking during practice. Around session 33, I marked the musical structure and all of my decisions about technique and interpretation on copies of the score. Later, around session 68, I reported my *performance cues* (PCs) in the same way. PCs are those aspects of the piece to which I paid attention during performance; the landmarks in my mental map of the piece that told me where I was and what came next (see Chaffin, Lisboa, Logan and Begosh 2010).

We used these retrospective reports to gain a better understanding of what I was doing during my practice sessions. By the time I saw the graphs, many months had passed and I no longer had detailed memories of individual practice sessions. By comparing the practice graphs with my reports, we were able to identify the aspects of the music to which I was paying attention during practice. For example, if I started repeatedly at beginnings of sections, then we inferred that I was thinking about the

¹ An additional category of "other" comments, mainly directed at my colleagues to assist with transcription (such as the bar numbers of my starting points), is excluded from this description.

musical structure. If I started repeatedly at places where I reported decisions about dynamics, then we inferred that I was thinking about dynamics. We have described these analyses in an earlier report of this study (Chaffin et al. 2010). Here, we will draw on the earlier report to compare what I *did* in practice with what I *said*.

The contrast between practice and comments is striking. They provide different windows into a musician’s mind (Chaffin and Imreh 2001). I talked about the problems that preoccupied me—for example, the technical issues about fingering and bowing that the Prelude presents because it was written for a five-stringed instrument rather than for the four-stringed contemporary cello. These problems were also reflected in my practice, of course. But practice was also affected by other aspects of the music that I thought about more fleetingly and less explicitly—more intuitive aspects of playing—and by habits deeply ingrained over time. For example, I spoke very little about the musical structure but, as we will see, it provided the framework for my practice. My practice was also influenced by thoughts that were more ineffable, feelings about expressive goals that were hard to articulate. These intuitions shaped my music-making directly, without the intervention of words. Subsequent reflection on the relationship between comments and practice has provided me with a new understanding of how these different aspects of musical creativity shape my activities as a musician.

Stages and Cycles in Learning the Prelude

Learning Period	Initial Learning				First Re-Learning				Second Re-Learning
Stage (goal)	Exploration	Smoothing Out	Listen	P R E L U D E	Rework Technique	Prepare Performance		P R E L U D E	Prepare Performance
Practice sessions	1-10	11-19	20-32		33-35	36-47	48-67		68-75
Duration (hrs:min)	5:58	7:10	4:34		2:24	5:12	8:04		4:17
Duration (weeks)	3	6	3		1	5	1		4
Public Performances						1-2	3-8		9-10

Table 2. Overview of the learning process, showing the main breaks that divided learning into three periods, the five main stages, and the practice sessions in each stage, with duration of practice (number of hours practiced and weeks covered) for each stage, and when public performances took place.

My practice moved through stages similar to those identified in previous research (Wicinski 1950, reported in Miklaszewski 1989). However, I initially found it quite difficult to identify and label such stages. For instance, while I was still in the middle of learning the Prelude and had to prepare our first conference report on this project, I noted that “[I] found it impossible to reduce the detailed and complex memory of [my] progress to a set of tidy stages and boxes” (Lisboa, Chaffin, Schiaroli and Barrera 2004). A year later, after examining the practice graphs, I was able to identify a clear progression in my work on the piece, and it was at this point that I divided my learning into the following five stages: *exploring the piece*, *smoothing out*, *listening*, *reworking technique*, and *preparing for performance*. I needed the distance in time, as well as the objective record of my practice, to recognise the larger-scale patterns. Table 2 lists the number and duration of the practice sessions in each stage

and provides a timeline, showing where I took long breaks from my work on the Prelude (while preparing other repertoire; see Chaffin et al. 2010).

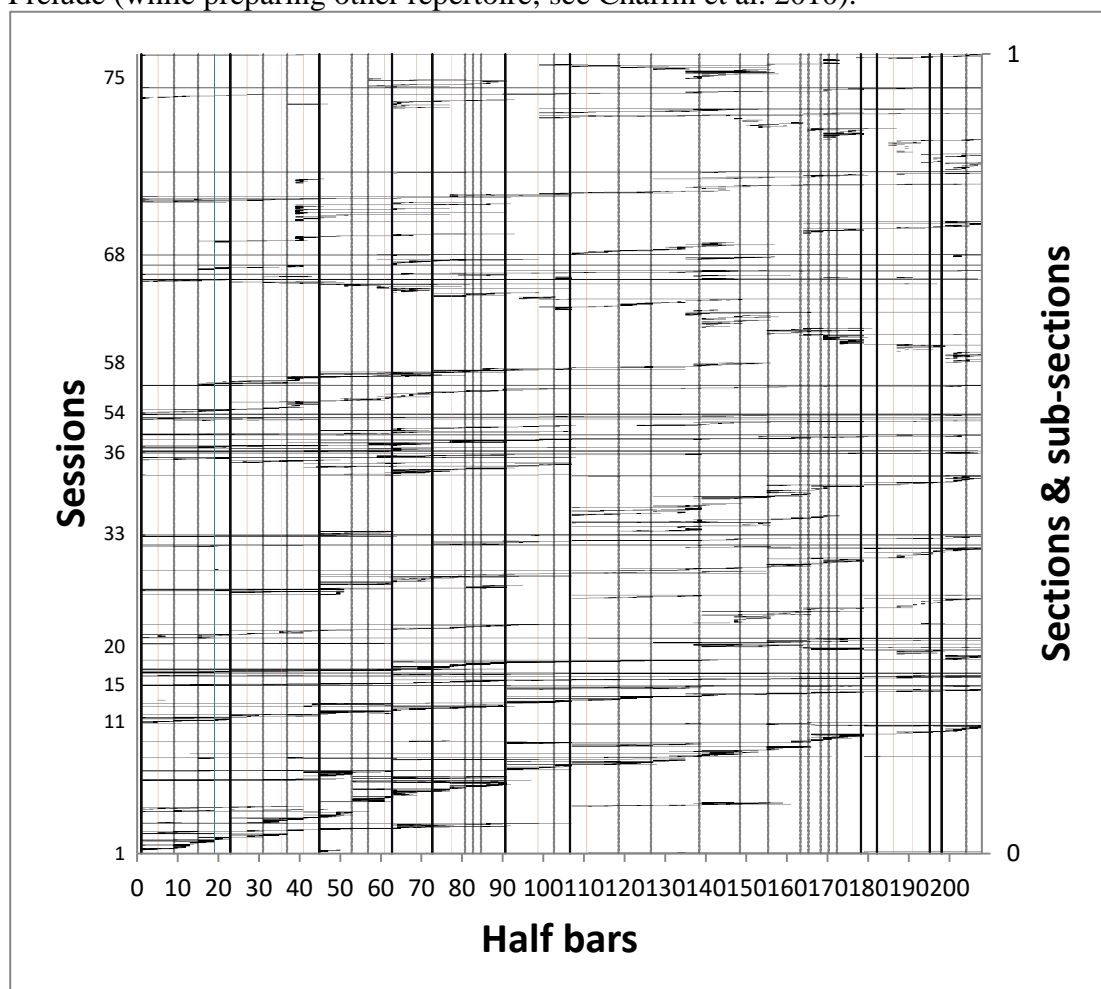


Figure 1. Practice graph of sessions 1–75 with vertical lines marking the locations of sections (dark lines) and sub-sections (paler lines).

Figure 1 shows the entire record of practice for sessions 1-75.² The graph reads from bottom to top with horizontal lines representing practice *segments*: uninterrupted playing. The horizontal axis represents the music, in half bars.³ The vertical axis represents successive practice sessions, beginning with session 1 at the bottom and ending with session 75 at the top. Also numbered along this axis is the first session of each of the stages identified in Table 2 and sessions 15 and 28, which are discussed in detail below. Also included are sessions 33 and 36, in order to

² The practice shown in figure 1 represents 59 of the 75 practice sessions and nearly 33 hours of the 38¼ hours of practice. Sessions 48 to 53 (approximately 2½ hours) following the first public performance were not video-recorded in order to see whether practicing without the distraction of the camera would make a difference. There is no reason to think these sessions were different from sessions that were recorded. Also not recorded were other sessions involving mental review of the piece before public performances and sessions that involved simply playing through the piece in a practice performance. These sessions were, however, recorded in the log book and are included in the total practice time.

³ We used half bars as the unit of analysis for the 12/8 time signature because it reflected the way in which I understood bar structure. See bars 3 and 4 for an example of half-bar repetition.

delineate sessions 33-35, which are also discussed below. Within each session, successive practice segments read from bottom to top.

Inspection of figure 1 shows that practice cycled between *section-by-section* practice, in which I focussed on individual sections of the Prelude, and *integrative* practice, in which my goal was to connect the various sections into a unified and coherent performance (Chaffin et al. 2010). This kind of alternating pattern within a session has been referred to as *work* and *runs* (Chaffin et al. 2002, 116-126). The pattern has been noted in several studies of expert music practice (Miklasewski 1989; Williamon et al. 2002). Our study is the first to observe the same pattern on a larger time scale, across practice sessions. Student musicians, in contrast to experts, are more likely to simply play through the piece (Lisboa 2008).

Relating Practice and Reports

The vertical lines in figure 1 represent my reporting of the beginnings of main sections and sub-sections. Inspection shows that I often started and stopped at these locations. The intersections of horizontal lines, representing practice, and vertical lines, representing my reports, show that I used the formal structure of the music as a framework for practice. This is another characteristic of expert practice (Chaffin et al. 2002; Williamon et al. 2002).

I reported on every aspect of the music I thought about during practice: bowing, fingering, technical difficulties, dynamics, intonation, and phrasing, along with performance cues for each (see Chaffin et al. 2010, Table 1). Using practice graphs such as figure 1, we were able to see when each of these different aspects of the music related to the way in which I practised. For each report we asked the same question: did I start, stop, or repeat these places in the music more than others?

We used the statistical technique of multiple regression to simultaneously relate each of the different reports to the number of starts, stops, and repeats. Table 3 summarises the results, showing when each of fifteen types of report related to starts, stops, or repetitions. The top two rows of data in table 3 show that I used the beginnings of sections and subsections as starting and stopping places throughout most of the learning process. The statistical analyses thus confirm the conclusion already reached from visual inspection of figure 1: I used the musical structure as a framework for my practice.

Stage	Explore	Smooth	Listen	Re-work	Prepare Performance
Sessions	1-10	11-19	20-32	33-35	36-75
Structural cues					
Expressive/Sections	B	BE	BE	B	B
Subsections	BE	BE	B		BE
Switches	E		E		
Performance Cues					
Interpretive				BER	BER
Intonation				ER	ER
Basic: left hand		ER	ER	E	BER
Basic: right hand			BER		-E
Interpretation					
Dynamics	BER				-R
Sound quality	R	R		R	BER
Intonation	R	-E	ER		BER
Phrasing		BR			B

Basic Technique					
Hand position	R	R	R		R
Fingering					
Bowing/Change string		E	ER		E
Technical difficulties			ER		<i>BER</i>

Table 3: Summary of effects ($p < .01$) on practice at each stage of learning. Effects on starts (B), stops (E) and repetitions (R) are shown separately for different types of performance cues and for each type of decision about interpretation and basic technique. Intensive practice (simultaneous effects on starts, stops and repetitions) is shown in ***bold italics*** (condensed from Chaffin et al. 2010, Table 2).

Intensive practice (multiple repetitions of the same short passage), shown in bold italics in table 3, indicates that I was focussing on a particular problem, starting, stopping and repeating. In figure 1, intensive practice is represented by the small blocks of black ink that show where I repeated the same passage over and over, starting and stopping at the same place. Table 3 tells us when the various aspects of the music that I provided reports about received this kind of intensive treatment.

The distribution of intensive treatment suggests that my practice was guided more by my musical conception of the piece than by its technical challenges (Chaffin, Imreh, Lemiux and Chen 2003). Intensive practice in the initial, exploratory stage was directed at dynamics, as I established the building blocks of my interpretation. Intensive practice of technique does not appear until the final stage, preparing performance. I felt it was important to acquire a general musical conception of the piece before investing the time necessary to master the technique to project my musical ideas. In the next section, however, we will see that my comments suggest exactly the opposite strategy.

Comparing Practice and Comments

Figure 2 shows the proportion of comments (by category) for each of the five stages of the learning process. Inspection shows that I initially spoke a lot about technique and very little about interpretation. Across the five stages, the proportion of comments on technique decreased steadily, and the proportion on interpretation increased. The pattern makes sense: first technique, then interpretation. However, this is the opposite of the pattern for practice identified in table 2.

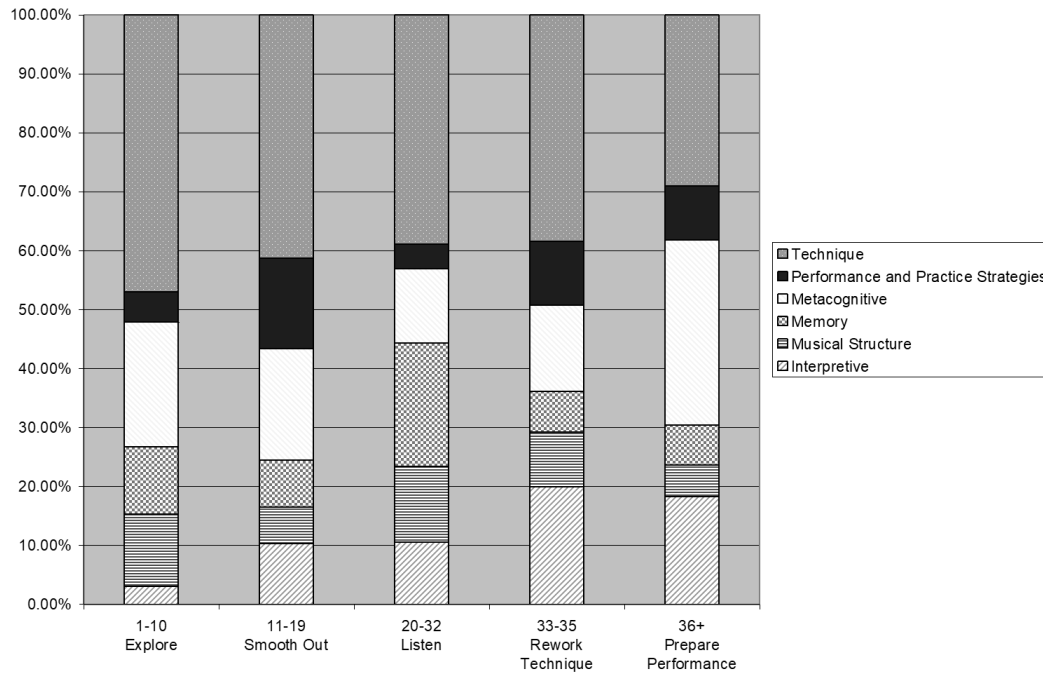


Figure 2. Proportion of the different categories of comments in each of five stages of learning.

We have already discussed why practice and commentary might differ. In the early sessions my comments were mostly about technique, because I needed to make basic fingering and bowing decisions prior to playing the piece with fluency. However, I was not ready to do the extended work needed to secure technique until I was sure that it would work musically. Meanwhile, my playing was shaped by musical intuitions which I spoke less about, both because they were less problematic and also because they were hard to articulate. Later, as I started to think about projecting musical ideas, I talked more about interpretation. By this time, I had settled on the technical decisions and spoke about them less (though comments on technique were still in evidence, because I continued to work on it and also because these things are easy to talk about). Thus, practice and commentary both reveal my concerns, but in different ways and at different times.

Stage 1: Exploration

Practice

The practice record for session 1 is shown in figure 3. As in figure 1, each line represents the uninterrupted playing of a practice segment. At the bottom of the figure is my initial sight-reading through the entire piece. Although my playing was interrupted by technical difficulties and pitch mistakes, I tried to maintain the musical direction, focusing on the musical “big picture” (i. e., an overall musical conception) rather than details of pitch, bowing and fingering. This first run-through gave me a sense of the overall musical shape and revealed the main technical problems. This was followed by the start of the section-by-section practice that would continue throughout the exploring stage. In session 1, I first looked briefly at the technical issues in half-bars 46–54, a passage that required many decisions about bowing and fingering. I then spent the rest of the session on the first section of the piece, half-bars 1–22.

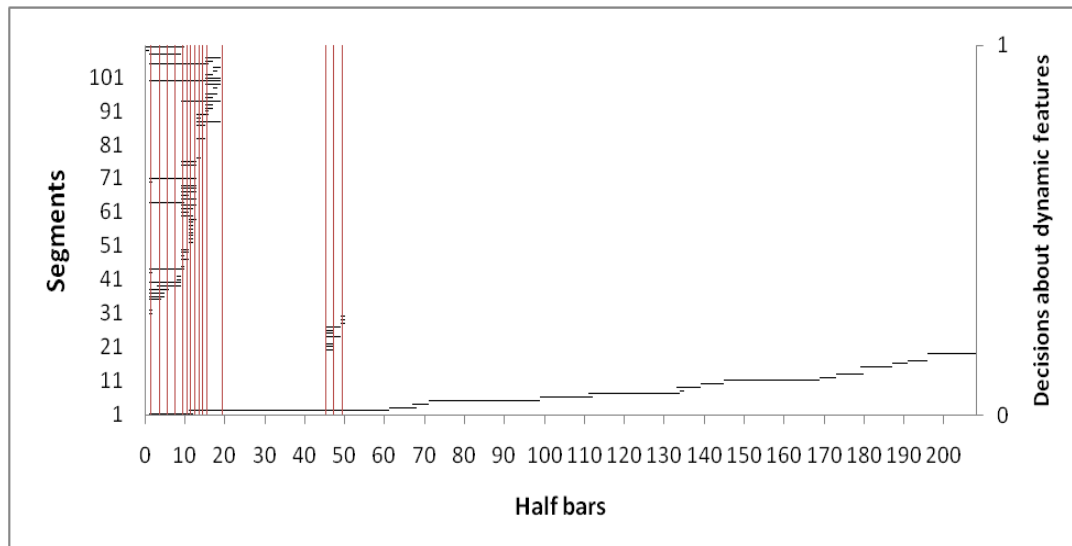


Figure 3. Practice graph for session 1, showing initial sight-reading through the piece at the bottom, followed by work on half-bars 46–52 and 1–22. The location of decisions about dynamics in half-bars 1–22 is marked by vertical lines.

The vertical lines in figure 3 show the points of decision-making about dynamics. As mentioned above, I practised dynamics intensively in the initial exploratory stage. The intensive practice of dynamics is reflected in the intersections of the vertical lines (representing decisions about dynamics) with the beginnings and ends of horizontal lines (representing practice). Since Bach provided no dynamic markings (other than in the first two bars), this was simply my first reaction to the piece, using dynamic contrast to emphasise the implicit musical shape.

Comments

As already noted, the highest percentage of comments in sessions 1–10 concerned technique. I was acutely aware of the choices that I had to make with regard to fingering and bowing, and I talked about them even though I was not ready to make the final decisions. A typical comment from session 1 was: “I’ve got an option of fingering on bars 23 onwards to about bar 32, so I’m going to try a different fingering.” Later, in session 3, I explained my strategy: “I’m looking at two different editions to check bowing to try and decide what to use. . . . I’m going to follow the fingering from one edition, the bowing from the other one. . . . One edition is more technically comfortable than the other, but I’m not sure if it works musically.”

In session 3, I reached an important decision: “Okay, there’s no way out. I have to decide musically what I want and then I can choose a fingering.” In the end, I used the strategy I had described in session 3. However, I was not yet sure that this was going to work musically, and so I postponed work on the technical issues until much later. This is why there was no intense practice of technical difficulties, but plenty of comments about them, during these early practice sessions.

Instead, my practice was organised by the musical structure and the intensive practice of dynamics, which I scarcely mentioned. There was not a single comment about musical structure in session 1, and I mentioned dynamics only twice: “First bar forte, second bar piano. [The] repetition is the same.”; and “I was just checking the . . . dynamics . . .”

Stages 2 and 3: Smoothing out and Listening

Practice

Session 15 was a pivotal session: the first session of integrative practice and the first practice performance from memory. The integrative nature of the session is evident in the practice graph for session 15, in figure 4. I worked through the piece in short sections, using the musical structure to organise my practice as in previous sessions.⁴ At the end of the session, I integrated the separate sections by playing through the entire piece. The practice performance appears as a single, unbroken line running across the top of figure 4. Before starting to play, I commented: “I’m going to keep the music here, but see if I can remember most of it. If I can’t, I’ll just look.” As I finished: “Ok, I just about know it. I think it’s memorised.” I had played from memory.

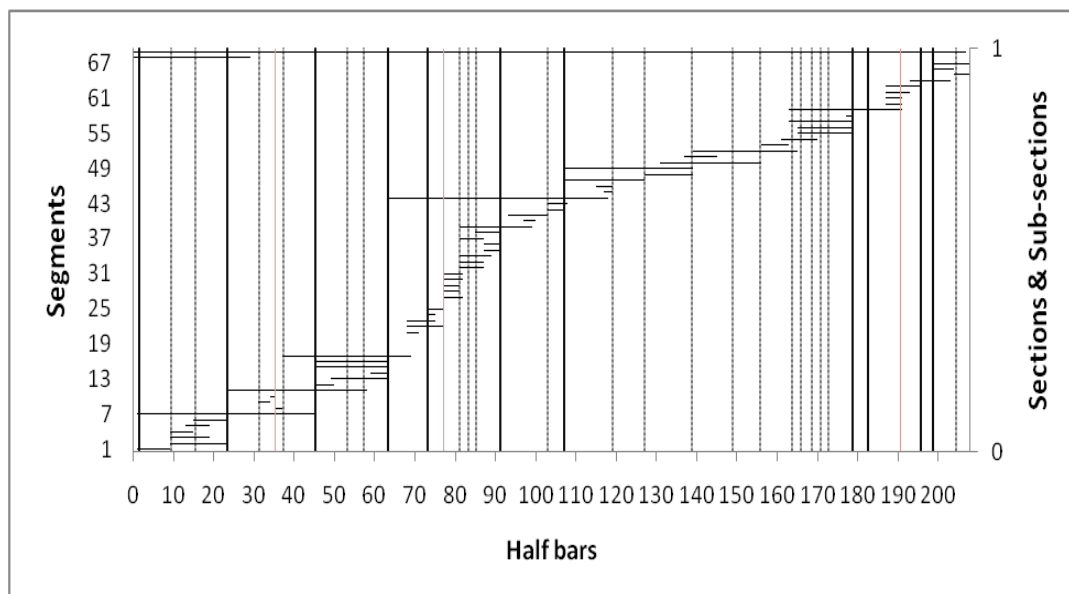


Figure 4. Practice graph for session 15, showing beginnings of sections (dark lines) and subsections (pale lines).

Comments

Session 15 is another example of the mismatch between my words and actions. I began the session by announcing, “I am not going to focus on memorisation. It’s cold so I’m going to play slowly and concentrate on projection of sound and getting the bow to speak clearly, and to work on left hand. It will be boring musically.” Instead, for the first time, I talked extensively about interpretation and barely mentioned memorisation: “I’ve got a diminuendo in bar 7. . . . Now . . . it makes more sense. Do it one more time. . . . See if I can do the crescendo in steps. . . . From the beginning, thinking about accents . . .”. This is in complete contrast to preceding sessions in which I rarely mentioned interpretation but talked a lot about memorisation.

In the context of my comments, the decision at the end of the session to “see if I can remember most of it” seems sudden and unplanned. The practice graph, however, shows otherwise. I had spent the entire practice session systematically working through the piece, getting ready to put it together. In the context of my actions, my announcement at the outset—“I am not going to focus on

⁴ The report of musical structure identified five levels, hierarchically organized. Figure 4 shows the top level (sections) and two levels of subsections (top and bottom).

memorisation”—takes on a different meaning: I would let memorisation take care of itself. I was announcing my memorisation strategy for the session.

“Smoothing out” continued with section-by-section work on technique in sessions 17–19. At the end of session 19, I reported: “I feel I am ready to move on . . . I know the notes, bowing and fingering . . . I need to think about phrasing [and] harmonies [to] bring them out. . . . It is getting to the stage where I feel like I would very much like to listen to a recording of this by somebody. See how it compares to my understanding . . .”. This announced a change in focus that would characterise the listening stage.

During the listening stage, I continued to talk about interpretation but often linked it to other issues. For example, connections were made to: musical structure (“I’ve got two voices going on here”); technique (“the fingers are too articulated. [It] has to be smoother”); expression (“I’m going to . . . get the whole [picture of the] phrasing, then try to do a bit more [with it] music[ally]”); practice strategy (“okay, I’ll have to do a lot of listening . . . for intonation”); and metacognition (“okay, I will try putting it all together”). At this stage, I listened to a variety of performances by other cellists, including Casals, Tortelier, and Fournier. I also watched the recordings of my own playing. The video recordings of my practice sessions provided me with an unusual opportunity to reflect on my own stage presence, posture, bodily movement, and degrees of relaxation.

Towards the end of the listening stage, I used a rehearsal at the Wigmore Hall in London to try the Prelude in the acoustics of a good concert hall. At the start of the next practice session I recorded my impression:

The acoustics are beautiful for the cello. I really enjoyed playing there. . . . I was just basically trying to play through the music. . . . It felt really wonderful and also gave me the feeling that this is starting to move towards a proper public performance in terms of thinking bigger . . . [about] the projection of sound—the quality of sound; and of course, that has technical implications for what I am trying to do.

Stage 4: Re-working Technique

By this point, I knew how I wanted the piece to sound and now needed to ensure technical accuracy in order to project my musical ideas clearly. I made the necessary adjustments to my playing in sessions 33–35. Here, the focus of my practice changed to polishing technique, and so I identified this as a separate stage even though, at 3½ hours, it was much shorter than other stages. I wanted a clearer sound, good intonation and well-projected phrasing, and I therefore needed to be accurate with hand positions, fingerings and bowings.

Practice

The practice for the entire re-working stage is shown in figure 5. The section boundaries here make it clear that I was still practising in sections. Unlike the integrative practice in session 15, however, I did not work through the whole piece in the same session, or attempt a practice performance. These sessions formed the final episode of section-by-section practice.

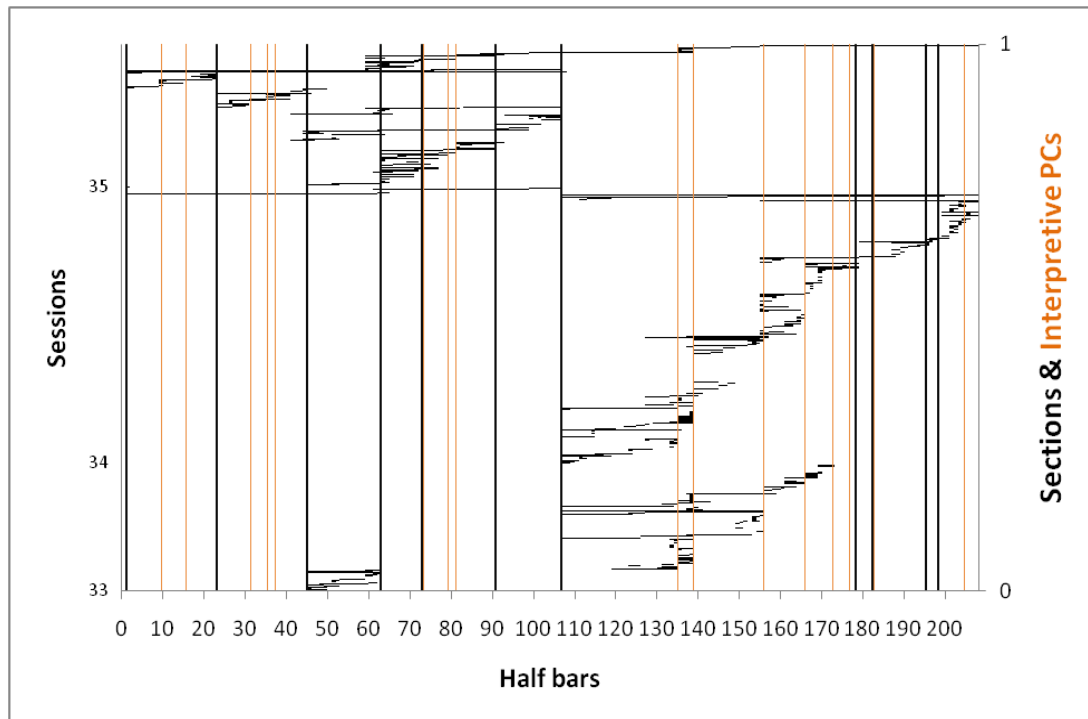


Figure 5: Practice graph for the “re-working stage” (sessions 33–35) showing beginnings of sections (dark lines) and interpretive performance cues (PCs; pale lines).

According to the analysis summarised in table 3, I engaged in intensive practice of interpretive PCs during this stage. In figure 5 we can see examples of this, where my playing started repeatedly at interpretive PCs. For example, the PCs in half-bars 135 and 139 were a repeated focus of attention in sessions 33 and 34 and again at the end of session 35, when an otherwise continuous run to the end of the piece was interrupted at these same places.⁵ We see here how my interpretive PCs were established. Thinking about interpretive goals as I played a passage created a link between thought and action that could later guide my performance on stage.

Comments

Here, for the first time, comments and practice tell the same story as to why I needed a performance cue in half-bar 135. I was having trouble with memory, confusing this passage with an earlier, similar passage. In session 33, I wondered, “Maybe [thinking about] the dynamics would help because I’ve got a crescendo on the up-bow . . . and then one on the down bow.” In session 34, I returned to the same point: “Okay, back to [half-bar 108], thinking about dynamics and articulation and phrasing.” Figure 5 shows that I practised this PC repeatedly, starting at half-bar 108 and playing through to the PCs in half-bars 135 and 139 (see Chaffin et al. 2010).

At this point in the process, my comments focused more on interpretation than in earlier stages (see figure 2). In particular, I often spoke of musical goals: “Okay, um, I’m not doing the dynamics exactly where I should be”; “I have to play . . . smoother, without too many accents”; “now it’s dynamics, expression and everything.” As in earlier sessions, I continued to voice my thoughts on technique, for

⁵ Two interpretive PCs at half bars 73 and 183 are not visible in figure 5 because they coincide with a section boundary.

example commenting, “I think I’ll practise the new fingering for a bit longer and see if I can get used to it.”

Stage 5: Preparation for Performance

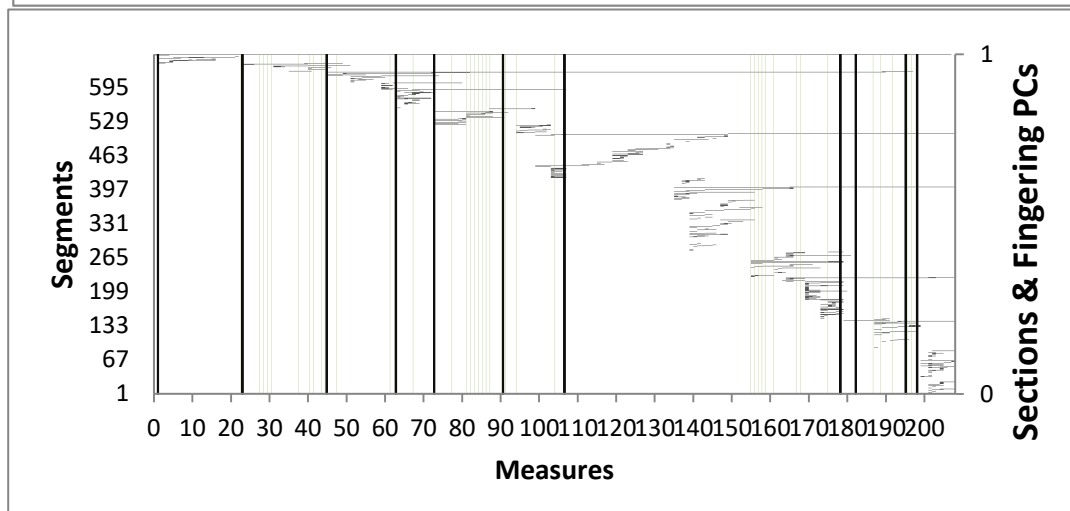
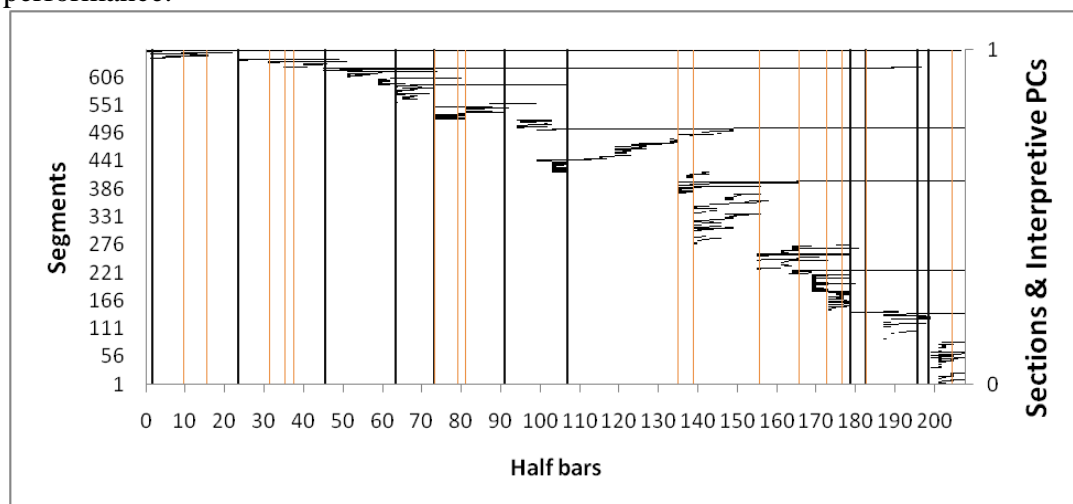
More than a month before the first public performance—an informal house concert—my practice became more intense, marking a new stage of *preparation for performance*. Three more public performances followed the first in short order, and I then flew to the United States for a two-week stay with my collaborators, during which I was scheduled to give four additional performances.

Practice

Figure 6 shows the first practice session after my arrival in the United States. At 96 minutes, session 58 was much longer than any previous practice session. I described my plan at the beginning of the session:

I’m going to start at the end, and I’m really going to concentrate on my left hand positions and intonation. I’m going to practise for quite a long time very slowly and sometimes just the bow . . . for technique and security.

The section boundaries in figure 6 show that, although working backwards, I was still working in sections. The session provides another example of integrative practice; I worked through the entire piece, and concluded the session with a practice performance.



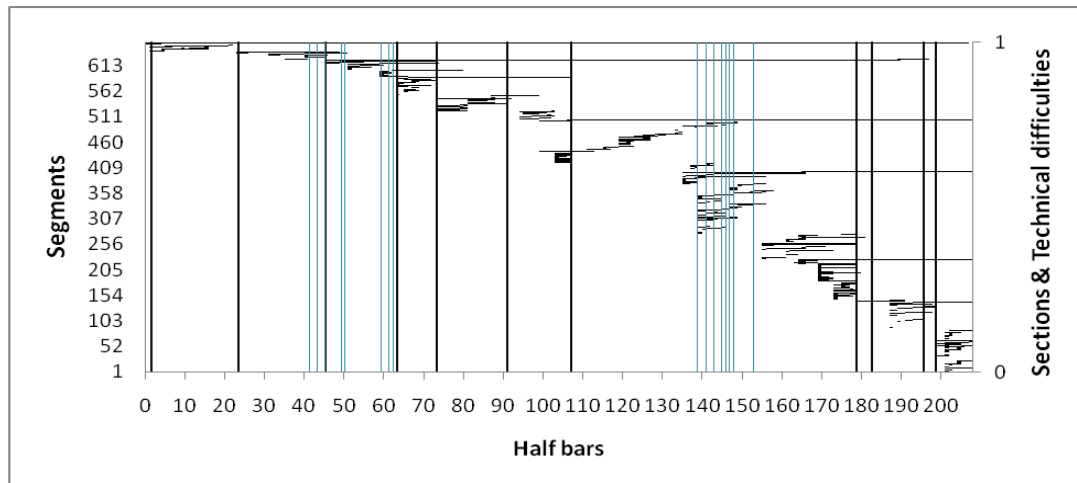


Figure 6: Practice graphs for session 58, showing beginnings of sections (dark lines) and interpretive performance cues (top panel; pale lines), performance cues for fingering (middle panel; pale lines), and technical difficulties (bottom panel; pale lines).

Perhaps the most striking change in my practice during this stage was the number of different aspects that were subject to intensive practice. In table 3, bold italics identify five sets of effects indicating that five different aspects of the music received this kind of treatment. Figure 6 shows three of these effects: PCs for interpretation (top panel), PCs for left hand, i.e., fingering (middle panel), and places where there were technical difficulties (bottom panel). In addition, table 3 shows intensive practice of sound quality and intonation in this stage; these are not shown in figure 6.

Comments

In preparing for performance, I did not talk much to the camera as it disrupted my concentration. I was focusing on subjective musical intentions and on the projection of musical ideas that were difficult to express. Figure 2 shows that the main change was an increase in the proportion of metacognitive comments. These were mostly negative, dispassionate, evaluations of my playing: “Not very clean”; “Sounds flat”; “It’s no good”; “I’m concentrating on the bits that I heard on the last recording (of the recent concert) which were not good at all in terms of intonation.” Cleaning up problems of this sort was an important part of preparing for performance.

Connecting theory and practice

Seeing the “big picture”

The noted pianist and pedagogue Heinrich Neuhaus suggests that when a great musician first approaches a new piece, “an instantaneous and subconscious process of ‘work at the artistic image’ takes place” (Neuhaus 1958/1973, 17). Neuhaus’s dictum points to an important characteristic of expert problem-solving: experts start with the big picture. For example, when a mathematician or physicist tackles a new problem, she or he starts by identifying underlying principles. If these are not immediately evident, time is taken to develop a deeper understanding of the issues before proceeding. The steps then taken towards solving the problem are guided by this big picture. Novices, in contrast, plunge into the details without developing a clear idea of the big picture. As a result, their understanding of problems is more superficial and

their efforts in problem-solving less effective (Glaser and Chi 1988; Chi, Feltovich and Glaser 1981).

In similar fashion, Neuhaus suggests that a musician's first goal in approaching a new piece should be to develop an "artistic image" of its musical shape (Neuhaus 1973, 7–29). The artistic image guides detailed decisions with regard to technique and interpretation (Chaffin et al. 2003). Our study of the Prelude" shows how the process works when the music is difficult to play fluently at the outset. Of course, I was familiar with this prelude, one of the best-known works of the cello repertoire, but I did not have strong preconceptions about how to play it. I wanted my "artistic image" to develop with my cello and bow in hand. We have seen how my decisions about technical and musical issues were interwoven throughout my learning of the Prelude.

At the end of the study I was gratified to discover that I seemed to have followed Neuhaus's advice. From the outset, my practice was organised around the musical structure. In other words, I was thinking about the general musical shape of the piece (Chaffin et al. 2003). I also gave priority to developing my artistic image for the piece over solving its technical difficulties. Intensive practice during the initial exploratory stage was directed at developing my interpretation and building the dynamic contrasts implied by the score. I did not invest in intensive practice of the technical difficulties until I was sure that my musical ideas were going to work—not until the stage of preparing for performance.

At the time, however, musical and technical issues were scarcely separated in my mind. It was not until I saw the analyses of the early practice sessions that I became aware that my playing was directed much more by my emerging musical image than by technical issues. In retrospect, I can now see how tensions between the two are reflected in the divergence between what I did and what said.

Words vs actions: two windows on the mind

Although my commentary focused very little on my musical image of the piece, the plan announced in session 3 did recognise its importance: "I have to decide musically what I want and then I can choose a fingering." Why did I not mention this plan again? Perhaps, in answer, I might ask you, the reader, why you are reading this chapter: what is your plan? Perhaps you are interested in processes of music cognition, or hope to improve your practice technique. Whatever your answer, though, you may not have explicitly formulated your intentions until just now. The goals that direct routine activities are normally implicit (Wegner and Vallacher 1986, 559–563).

I was capable of articulating my goals—this one, at least—but mostly they remained implicit. The feeling slowly evolved that my musical intentions could successfully be articulated technically. This started to take hold during the listening stage and solidified in the re-working stage. Meanwhile, my comments focused on technical problems, both because they were easier to put into words and because I knew that, ultimately, technical matters would influence the musical outcome. Practice and commentary provide different windows into a musician's mind; both are important.

Reflection-in-action vs. reflection-on-action

Inevitable tensions arose between my roles as artist and research participant, and these needed constant management. Deep reflection upon the artistic processes can disrupt the flow of artistic work, a risk of reflection-in-action (Schön 1987). It is possible to overdo conceptual preparation and I had to be careful not to let this happen. Sometimes I mentally withdrew from the project in order to re-establish my musical

relationship with the piece. In addition, the research required certain activities that do not form a normal part of everyday practice: talking to the camera, articulating ideas explicitly, and reacting to questions from the team of researchers. At times, these activities made the whole process feel slightly artificial.

Providing reports of my musical decisions and understanding—reflection-on-action (Schön 1987)—was extremely difficult. I had to exteriorise feelings and intuitions about the music that normally remain tacit. While valuable in the long run, this was difficult to do at the time. Sometimes, talking to the camera (and changing tapes) interrupted the flow of musical ideas; this may explain why the number of comments diminished considerably as the first performance approached.

On the other hand, the strains imposed by the nature of the project have had beneficial effects. Firstly, the objective picture I gained of my practice has increased the efficiency and focus of my practising of other repertoire. Secondly, understanding how I memorise music has made the process faster, more solid, and more confident, leading me to rely more on a conceptual approach. Thirdly, at the time, the effort of noting musical decisions on the score helped to consolidate my musical ideas. Finally, knowing how starts and stops during practice affected the PCs necessary for memorised performance led me to vary my practice, starting and stopping at less predictable places.

Coda

I hope that this description of my practice will encourage others to undertake similar studies. Systematic self-study is a good route to improving the effectiveness of one's practice. Self-reflection deepened my understanding of my musical goals for the Prelude, and subsequently my practice has become more efficient. However, these methods are not for the fainthearted; they are demanding. The outcome of this project was, nonetheless, a happy one. The mysteries of performance were transformed, not destroyed, by the scrutiny of the scientific method. For those prepared to put in the time and effort, I believe that practice-based artistic research of the sort described here provides a path to both personal improvement and more effective pedagogy.

References

- Chaffin, Roger, and Gabriela Imreh. 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, Roger, Gabriela Imreh, and Mary E. Crawford. 2002. *Practicing Perfection: Memory and Piano Performance*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Chaffin, Roger, Gabriela Imreh, Anthony F. Lemieux, and Colleen Chen. 2003. "Seeing the big picture': Piano practice as expert problem solving." *Music Perception* 20: 461–485.
- Chaffin, Roger, and Anthony F. Lemieux. 2004. "General perspectives on achieving musical excellence." In *Musical Excellence: Strategies and Techniques to Enhance Performance*, edited by Aaron Williamson, 19–39. Oxford: Oxford University Press.
- Chaffin, Roger, Tânia Lisboa, Topher Logan, and Kristen T. Begosh. 2010. "Preparing for memorized cello performance: The role of performance cues." *Psychology of Music* 38: 3–30.
- Chi, Michelene T. H., Paul J. Feltovich, and Robert Glaser. 1981. "Categorization and representation of physics problems by experts and novices." *Cognitive Science* 5: 121–125.

- Czerny, Carl. 1970. *On the Proper Performance of All Beethoven's Works for the Piano*, edited by Paul Badura-Skoda. Wien: Universal Edition A.G.
- Demos, Alexander, and Roger Chaffin. 2009. "A software tool for studying music practice: SYMP (Study Your Music Practice)." Poster presented at the European Society for the Cognitive Science of Music (ESCOM), Jyväskylä, Finland.
- Ericsson, K Anders, Ralf T. Krampe, and Clemens Tesch-Römer. 1993. "The Role of Deliberate Practice in the Acquisition of Expert Performance." *Psychological Review* 100 (3): 363–406.
- Ericsson, K. Anders. 1997. "Deliberate practice and the acquisition of expert performance: an overview." In *Does Practice Make Perfect? Current Theory and Research on Instrumental Music Practice*, edited by Harald Jørgensen and Andreas C. Lehmann, 9–51. Oslo: Norges musikkhøgskole.
- Ericsson, K. Anders, and Herbert A. Simon. 1980. "Verbal Reports as Data." *Psychological Review* 87: 215-249.
- Ginsborg, Jane, Roger Chaffin, and George Nicholson. 2006. "Shared performance cues in singing and conducting: A content analysis of talk during practice." *Psychology of Music* 34: 167–194.
- Glaser, Robert, and Michelene T. H. Chi. 1988. "Overview." In *The nature of expertise*, edited by Michelene T. H. Chi, M. J. Farr, and Rober Glaser, xv-xxviii. Hillsdale, NJ: Erlbaum.
- Gruson, Linda M. 1988. "Rehearsal Skill and Musical Competence: Does practice make perfect?" In *Generative Processes in Music: The Psychology of Performance, Improvisation and Composition*, ed. John A. Sloboda, 91–112. Oxford: Clarendon Press.
- Hallam, Susan. 1995a. "Professional musicians' approaches to the learning and interpretation of music." *Psychology of Music* 23: 111–128.
- Hallam, Susan. 1995b. "Professional musicians' orientation to practice: Implications for teaching." *British Journal of Music Education* 12: 3–19.
- Hallam, Susan. 1997. "What do we know about practising? Towards a model synthesising the research literature." In *Does Practice Make Perfect? Current Theory and Research on Instrumental Music Practice*, edited by Harald Jørgensen and Andreas C. Lehmann, 179–231. Oslo: Norges musikkhøgskole.
- Lisboa, Tânia, Roger Chaffin, Adrienne G. Schiaroli, and Abby Barrera. 2004. "Investigating practice and performance on the cello." In *Proceedings of the 8th International Conference on Music Perception and Cognition*, edited by Scott D. Lipscomb, Richard Ashley, Robert O. Gjerdingen, and Peter Webster, 161–164. Evanston IL: Northwestern University.
- Lisboa, Tânia. 2008. "Action and thought in cello playing: An investigation of children's practice and performance." *International Journal of Music Education* 26: 243–267.
- Miklaszewski, Kacper. 1989. "A case study of a pianist preparing a musical performance." *Psychology of Music* 17: 95–109.
- Neuhaus, Heinrich. 1973. *The Art of Piano Playing*, translated by K. A. Leibovitch. London: Kahn & Averill. (Original work published 1958).
- Nielsen, Siw G. 1999. "Learning strategies in instrumental music practice." *British Journal of Music Education* 16 (3): 275–291.
- Nielsen, Siw G. 2001. "Self-regulating learning strategies in instrumental music practice." *Music Education Research* 3: 155–167.

- Rubin-Rabson, Grace. 1941. "Studies in the psychology of memorizing piano music: VII. A comparison of three degrees of overlearning." *Journal of Educational Psychology* 32: 688–696.
- Schön, Donald A. 1987. *Educating the Reflective Practitioner*. San Francisco, CA: Jossey-Bass.
- Wegner, Daniel M., and Robin R. Vallacher. 1986. "Action identification." In *Handbook of Motivation and Cognition: Foundations of Social Behaviour*, vol. 1, edited by Richard M. Sorrentino and E. Tory Higgins, 550–582. New York: Guilford.
- Williamson Aaron, Elizabeth Valentine, and John Valentine. 2002. "Shifting the focus of attention between levels of musical structure." *European Journal of Cognitive Psychology* 14: 493–520.

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