

# Preparation and spontaneity in performance: A singer's thoughts while singing Schoenberg

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**ABSTRACT**—*The longitudinal case study method has been used for over a decade to study professional musicians' preparation for performance from memory. This research suggests that a subset of the features to which the performer attends during practice and rehearsal is retained as performance cues (PCs). PCs guide the performer's attention and serve as cues for memory retrieval during performance. The present study asked if PCs can also emerge spontaneously during live performance. A singer reported the features that she attended to during practice of Schoenberg's two songs Op. 14 (1907-1908). Immediately after the performance she recalled all the thoughts she remembered having about the piece during the performance. Comparison of the two sets of reports showed that although many of the singer's thoughts during performance were about features that she had attended to in practice (prepared PCs), a substantial number were about features that acquired new musical or expressive significance during the performance (spontaneous PCs). The reports were compared with those from an earlier study of a performance by the same singer of the first Ricerar from Stravinsky's Cantata (1952). The proportions of reports about various aspects of the music (basic technique, interpretation, and expression) reflected differences between the works by the two composers.*

**KEY WORDS**—*cues, features, memory, practice, recall*

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What do musicians think about while performing? On the one hand, performances in the Western art music tradition are usually highly prepared, and thinking too closely about a highly practiced skill is a sure way to disrupt it (Beilock & Carr, 2001). On the other hand, to perform mindlessly, relying on the automaticity of well-practiced motor sequences, is both risky and unlikely to produce an aesthetically satisfying performance (Chaffin, Lemieux, & Chen, 2006; Ericsson, 2002). To avoid this dilemma, experienced

performers train themselves during practice to attend to specific features of the music. These *performance cues* (PCs) come to mind automatically during the performance, providing a series of landmarks that the performer can use to monitor progress through the piece, and directing attention as needed to technical issues, interpretation, and expressive gestures.

Evidence that experienced musicians use PCs comes from longitudinal case studies in which experienced soloists recorded their practice as they learned new works for public performance. Each musician reported the features of the music that they made decisions about or otherwise paid attention to during practice and the PCs that they attended to during performance, marking them on copies of the score. The musicians' spontaneous comments during practice explained the function of particular PCs (Chaffin, Imreh, & Crawford, 2002; Chaffin, Lisboa, Logan, & Begosh, 2010; Ginsborg, Chaffin, & Nicholson, 2006a). Written recall of the score showed that section boundaries and expressive PCs persisted as landmarks in memory months and years after the performance (Chaffin & Imreh, 2002; Chaffin et al., 2010; Ginsborg & Chaffin, 2011). Tempo fluctuations at PCs, during both practice and public performances, indicated their significance (Chaffin et al., 2006; Lisboa, Chaffin, Logan, & Begosh 2007). Most important, for present purposes, was evidence that the musicians had paid attention to particular features of the music during practice, thus establishing them as cues (Chaffin et al., 2002, 2010; Chaffin, 2007; Ginsborg et al., 2006a,b; Noice, Jeffrey, Noice, & Chaffin, 2008).

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In the present study, an experienced soprano soloist (the first author) reported the features that she attended to during practice and the PCs that she attended to during a public performance, from memory, of two songs by Arnold Schoenberg. Most of the case studies of PCs conducted to date have not compared the use of PCs by different performers or by the same performer for different pieces (Chaffin, 2007, is the one exception). One goal of our study was to assess the consistency with which a performer used PCs in different pieces. The singer learned the two songs constituting Schoenberg's Op. 14, allowing us to assess the consistency of her identification of musical features and use of PCs in two similar works.

We were also able to compare her reports of PCs (thoughts during performance) and features (decisions made during practice) for the two Schoenberg songs with her similar reports in an earlier longitudinal case study of preparation for performance of another work: *Ricercar I* from Stravinsky's *Cantata* for solo soprano, solo tenor, women's choir and instrumental ensemble (two flutes, oboe, cor anglais, and cello) (Ginsborg et al., 2006a,b). These two works by different composers provide an instructive comparison. They are similar in that both date from the first half (broadly speaking) of the 20<sup>th</sup> century, the Schoenberg from 1907-8, and the Stravinsky from 1951-2. They are approximately the same length: the 402 crotchet (quarter-note) beats of the two Schoenberg songs took about 6 min. to perform while the 250 quaver (eighth-note) beats of the Stravinsky took about 4 min. Text and melody were of equal importance in both pieces (Ginsborg, 2004). They differ in the expressive demands they make on the singer and in their complexity: the Schoenberg requires more expressivity while the Stravinsky is technically more difficult. The two Schoenberg songs are composed for singer and piano, and have a simple structure: the first song has two verses, the second three, although neither is strophic. They both have a regular meter and only one measure has an unusual number of beats. In contrast, the Stravinsky requires larger musical forces, has a more complex structure (three main sections, in the first of which verses alternate with refrains), and employs frequent changes of meter.

The differences between the works by the two composers led us to expect that the singer would report more interpretive and/or expressive features and PCs for the Schoenberg and more technical features and PCs for the Stravinsky. Reports of PCs and features can be grouped into four main types depending on which aspect of the music they address: structure, expression, interpretation, and basic technique. Structural PCs occur at critical places in the formal structure of the work such as section boundaries, and expressive PCs at locations where a particular emotion is to be conveyed, for example "sad", "yearning." Interpretive PCs represent the changes in tempo, dynamics, timbre, or color whereby expressive effects are achieved, while basic PCs remind the performer of technical details requiring particular attention, such as breathing or – for an instrumentalist – fingering. In addition, for ensemble performance, musicians may require shared PCs at points where they have established a mutual understanding of how they achieve coordination (Ginsborg et al., 2006a). We compared the proportion of features and PCs of each of these main types.

We also compared features and PCs reported by the singer for the Schoenberg songs and the Stravinsky *Ricercar* on two other measures: density and frequency of multiple reports at the same location. The density of the features and PCs provides a measure of the rate at which a performer switches attention from one feature or PC to the next. It can be measured by the number of features or PCs per beat of the score or per second of a performance. Chaffin, Demos, and Crawford (2009) calculated PCs per beat for four professional musicians and four students for a variety of different pieces. The highest density observed was 0.85 PCs per beat for a professional pianist, Gabriela Imreh, playing Bach's *Italian Concerto (Presto)*, a fast and technically demanding piece. A lower rate of 0.20 was obtained for the same pianist playing Debussy's *Clair de Lune*, a slower piece which the pianist learned much more quickly. Two student pianists reported 0.22 and 0.55 PCs per beat for the *Presto*. The lowest rate of 0.01 PCs per beat was reported by the youngest musician in the study, a fourteen-year-old piano student. The density of PCs may be influenced by the difficulty

and level of preparation of the piece and the experience of the musician.

In addition, we examined the frequency with which the singer reported one or more PCs at the same location in a piece. Chaffin et al. (2009) examined the use of multiple PCs at the same location for the *Presto*. The professional pianist's PCs were divided more or less equally between locations where she used one, two and three PCs in the same place. Both students, however, noted only a single PC at a location for the majority of PCs (79% in one case, and 67% in the other), two PCs at the same place for a minority (15% and 26% respectively), and three PCs in the same location for less than 10% of PCs. Use of multiple PCs may provide another index of performance expertise since it permits the musician to focus on different aspects of the music simultaneously.

We have previously suggested that many of the decisions that a musician thinks about during practice are implemented automatically during live performance (e.g., Chaffin et al., 2002). To evaluate this claim, we compared the singer's reports of features attended to in practice with her reports of PCs to determine how many of the features she continued to think about during performance, that is, reported as PCs. Those features that were *not* retained and reported as PCs were assumed to represent decisions made during practice that had become automatic.

Another goal of our study was to examine more closely our previous claims that PCs are prepared during practice (Chaffin et al., 2002; Ginsborg et al., 2006b; Chaffin et al., 2010). This claim was based on evidence that starts, stops and repetitions during practice coincided with features subsequently noted as PCs, and that such effects occurred throughout the learning process. We assumed that these effects reflected attention to these features during practice and occurred at most, if not all, PCs. It is possible, however, that the effects were due to a relatively small number of PCs and that most PCs emerged for the first time during public performance. In the present study, we used the comparison of features and PCs to check on this possibility for the two Schoenberg songs and the Stravinsky *Ricercar*. For PCs prepared during practice, there should be a corresponding

feature reported as attended to during practice. We expected to find corresponding practice features for most of the PCs reported.

An additional goal was to examine the singer's spontaneous thoughts during performance and to compare these with thoughts about the PCs that she had prepared during practice. In the present study, the procedure for reporting PCs was different from that used in previous studies. As before, the reports were made by marking PCs in the score immediately after the performance. In the Stravinsky study (Ginsborg et al., 2006b), however, the singer was asked to mark "things that you think about while performing in order to direct and control your singing to produce the performance that you want". In the present study, the singer simply reported all the thoughts she remembered having during the public performance. Later, she classified them as *prepared PCs*, *spontaneous PCs*, or *extraneous thoughts*. Prepared PCs were thoughts during performance about features of the music that she had previously thought about during practice. Spontaneous PCs were thoughts about features of the music that she had not registered noticing before and that were likely to be retained as PCs in subsequent performances. Extraneous thoughts were spontaneous thoughts that were unlikely to recur in later performances because they were about things that were specific to that performance.

Many musicians believe that live performance provides an important opportunity for musical insight and creativity. Maharaj (2005) coined the term "*thinking-through-performance*" to refer to this process during rehearsal; Östersjö (2008) extends it to live performance, noting that "[thinking-through-performance] is a process of validation that goes on also in the performance itself" (p. 80). How does this relate to claims that we have made previously that PCs are carefully prepared during practice (e.g., Chaffin et al., 2002; Ginsborg et al., 2006b)? We believe that performers do need to prepare PCs and also that performance provides an important opportunity for musical insight and spontaneity (Chaffin et al., 2006). Our goal in this study was to examine the interplay of preparation and spontaneity in live performance.

While every instrument presents its own unique challenges, the interplay of preparation and spontaneity during performance may be particularly important for singers. The performance of vocal music requires the recall of text, in addition to melody, and involves an instrument that is also routinely used in non-musical contexts to articulate spontaneous thoughts. By comparing the singer's thoughts during performance with the features that she attended to in practice, we were able to identify potential PCs that remained unarticulated until the performance itself. Although we cannot know for sure which spontaneous thoughts will endure as PCs and which will not, the singer felt confident in identifying those insights about the music that she intended to retain in future performances. The new procedure for reporting PCs that we used here also allowed us to examine an assumption that was implicit in our previous research: that experienced performers *only* think about PCs during performance. By reporting *all* of her thoughts during performance, the singer was able to identify those that were extraneous, that is, neither prepared nor spontaneous PCs. The ability to control extraneous thoughts is a skill that performers must learn. We did not expect the experienced performer in our study to suffer unduly from extraneous thoughts, but were interested to discover how large the proportion of such thoughts would be.

## METHOD

### *Musician and music*

The musician, the first author of this paper, is a classically-trained, formerly-professional singer, now primarily a researcher. As in the case of the Stravinsky *Ricercar*, the singer had performed the music approximately 25 years earlier but had not sung or listened to it since. The music consisted of two songs by Arnold Schoenberg, Op. 14, dating from 1907-1908, *Ich darf nicht dankend* ("I must not in thanks [sink down before you]") and *In diesen Wintertagen* ("In these winter days"), settings of poems by Stefan George and Karl Henckell respectively. The first song consists of 30 measures and the

second of 71 measures; both have 2/2 time signatures, but the second includes one measure in 2/4. The singer's performance of the two songs lasted 6 min. and 3 s.

### *Procedure*

The singer practiced and re-memorized the songs in five sessions of about half an hour each over the course of 3 weeks prior to undertaking approximately 1½ hours of rehearsal with her regular accompanist (her husband George Nicholson, who had also fulfilled the role of pianist / conductor for the Stravinsky *Ricercar*) on each of three occasions, the final rehearsal taking place on the morning of the performance, which took place in the evening. The concert was given by the voice, clarinet, and piano trio, Triple Echo, as part of a university weekly concert series, before an audience of 80-100 people. In addition to the Schoenberg songs, the program included works for solo clarinet by Nicholson, for clarinet and piano by Berg and Lutosławski, and trios by Schubert, Spohr, Poole, and Nicholson.

After the final rehearsal, the singer annotated a copy of the score, marking the locations and nature of the features of the music and text that she had made decisions about, practiced, or otherwise paid special attention to during practice. Immediately after the performance (some 10 hours after she had made the post-rehearsal annotations), while the concert still continued, the singer made a second set of annotations on another copy of the score representing her PCs and extraneous thoughts during performance. These were the features of the music, text, or performance itself that had been particularly salient during the performance. Examples of her annotations of features and PCs are shown in Figure 1.

The singer subsequently classified both sets of annotations as basic, interpretive, expressive, shared, or structural (see Table 1). The frequency of each type of annotation was then tabulated separately for the two Schoenberg songs and compared with the Stravinsky *Ricercar* for which similar data had been compiled for the earlier study (Ginsborg et al., 2006b). For the Schoenberg songs, the singer further classified the post-performance annotations

The figure consists of two panels of musical notation for a vocal line and piano accompaniment. The top panel is annotated with features: 'Etwas bewegter' (circled), 'move on!', 'milde - word changed!', 'roll r', and 'Strong - sing through'. The bottom panel is annotated with performance cues: 'canon', 'milde - remember!', 'burn strong roll r, finish high', and 'roll r'. Both panels show measures 93, 97, 101, and 105. The piano part includes dynamics *p* and *f*.

Figure 1: Features (top panel) and performance cues (bottom panel)

as prepared, spontaneous, or extraneous, referring to her pre-performance annotations when in doubt about whether an annotation was prepared or not.

## RESULTS

### Comparing the two songs by Schoenberg with the Stravinsky *Ricercar*

There was no difference between the proportions of basic, interpretive, expressive, and shared features or PCs in the two Schoenberg songs, although there was a trend towards more interpretive and

expressive PCs for *In diesen Wintertagen* than for *Ich darf nicht dankend*,  $\chi^2(2) = 4.78, p < .09$ . For comparison with the Stravinsky *Ricercar*, the reports for the two songs were combined. Frequencies of each type of annotation are shown in Appendix I separately for the two songs. The singer's reports of features and PCs for Stravinsky's *Ricercar*, originally summarized in Ginsborg et al. (2006b), are also provided.

The different styles of the Schoenberg songs (combined) and the Stravinsky *Ricercar* were reflected in the singer's annotations for the two works. Figure 2 compares the proportions of features (left panel) and PCs (right panel) for the songs and the *Ricercar*. The greater expressiveness of the Schoenberg songs

Table 1  
 Examples of annotations representing features and cues in Schoenberg songs

Features		
Basic	Intonation	'pitch higher' ( <i>Ich darf nicht dankend</i> , beat 10)
	Word (pronunciation)	't' [end of <i>dankend</i> ] (ibid., beat 14)
	Breath	Breath mark after <i>Trost</i> (ibid., beat 33)
	Technical	Underlined: change pitch sideways not up and down! ( <i>Liebe, In diesen Wintertagen</i> , beat 227)
Interpretive	Prepare (pitch, count, listen)	'think through' <i>Wintertagen</i> (ibid., beat 25)
	Word (meaning)	'strong' ( <i>fort</i> , ibid., beat 105)
	Sound	'clear sound' ( <i>du, Ich darf nicht dankend</i> , beat 21)
	Notice musical feature	'notice canon' (ibid., beat 62)
	Rubato	wiggle on <i>du</i> (ibid., beat 65)
Expressive	Dynamics	'crescendo' ( <i>In diesen Wintertagen</i> , beat 72)
	Convey meaning	'milde' – word changed! (ibid., beat 94)
Shared	Co-ordinate	'be aware of G's phrase' ( <i>Ich darf nicht dankend</i> , beat 65)
Performance cues		
Basic	Intonation	'intonation' ( <i>Ich darf nicht dankend</i> , beat 100)
	Word (pronunciation)	't' [end of <i>dankend</i> ] (ibid., beat 14 – feature retained as PC)
	Breath	Breath mark after <i>Trost</i> (ibid., beat 33 – feature retained as PC)
	Technical	'roll "r", finish high' ( <i>In diesen Wintertagen</i> , beat 106 – two spontaneous PCs at same location)
Interpretive	Prepare (pitch, count, listen)	'count' [ <i>ver</i> ]hüllt (ibid., beat 33 – feature retained as PC )
	Word (meaning)	'(leises) missing from text' (ibid., beat 122 – feature retained as PC)
	Sound	'enjoy legato' ( <i>seligen</i> , ibid., beat 225 – spontaneous PC)
	Notice musical feature	'notice canon' ( <i>Ich darf nicht dankend</i> , beat 62 – feature retained as PC)
	Rubato	'wiggle – more time' ( <i>Leides</i> , ibid., beat 76 – spontaneous PC)
Expressive	Dynamics	'decreasing' ( <i>hinein, In diesen Wintertagen</i> , beat 171 – feature retained as PC)
	Convey meaning	'growing excitement, more than in rehearsal' (ibid., beat 207 – extraneous thought)
Shared	Co-ordinate	'co-ordinate' ( <i>Ich darf nicht dankend</i> , beat 76 – spontaneous PC)

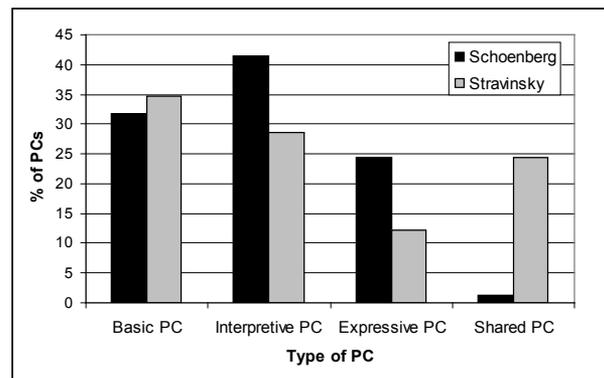
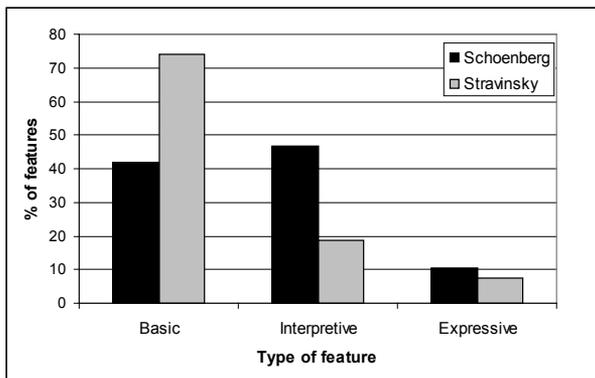


Figure 2: The percentage of features (left panel) and performance cues (right panel) reported for the Schoenberg songs and Stravinsky *Ricercar*

is reflected in the larger number of interpretive features reported, and the greater technical difficulty of the Stravinsky is reflected in the higher proportion of basic features,  $\chi^2(2) = 31.25, p < .001$ . In contrast, there was no difference between the two works in the proportions of basic, interpretive and expressive PCs,  $\chi^2(2) = 3.42$ . This pattern of results suggests that, despite the differences between the works of the two composers, the singer used similar strategies to monitor and guide her performances of them.

There was one difference between the singer's PCs for the two works. The singer reported fewer shared PCs for the Schoenberg. Shared PCs represented places where the singer and conductor had established a mutual understanding during rehearsals of what they were going to do during the performance, for example, towards the end of the *Ricercar* where they made the annotation "gathering point" (a shared basic PC, "arrival/off"). When shared PCs were added to basic, interpretive and expressive PCs, and all four categories were compared for the two works, the difference was significant, *Yates'  $\chi^2(3) = 20.68, p < .001$* . Coordinating with the pianist in the Schoenberg songs was a relatively straightforward task for the singer that did not often require attention. Coordinating with the larger musical forces involved in the Stravinsky (conductor and instrumental ensemble), in contrast, required attention more often, resulting in a larger number of shared PCs.

The lesser complexity of the Schoenberg songs was also reflected in a lower density of PCs. Density determines the rate at which a performer has to switch attention from one feature or PC to the next.

We computed density in two ways, as the number of reports per beat and per second of performance. Performance duration was measured by the time taken by the singer to perform each piece in public (6:03 min. for the two Schoenberg songs together and 4:00 min. for the Stravinsky). On both measures, the singer reported lower densities for the Schoenberg songs than for the Stravinsky. Density was 0.26 features and 0.20 PCs per beat for the Schoenberg and 0.81 features and 0.39 PCs per beat for the Stravinsky. When density was computed using performance time, there were 0.29 features and 0.23 PCs per second for the Schoenberg and 0.85 features and 0.41 PCs per second for the Stravinsky. The singer thus switched her attention from one PC to the next every 3 s during the Schoenberg and every 2 s during the Stravinsky.

The lesser complexity of the Schoenberg was also reflected in the frequency of reports of multiple features and PCs at the same location (i.e., on the same beat). We counted the frequency with which one, two, and three or more different features or PCs were reported at the same location (see Table 2), tallying features and PCs separately. At most of the locations where the singer made annotations (70%), she reported just one feature or PC. In places where she reported more than one feature or PC, she mostly reported two. The exception was for the Stravinsky where she reported three or more features at 14% of the locations. Locations where three or more features were reported were less frequent in the Schoenberg than in the more complex Stravinsky,  $\chi^2(2) = 10.89, p < .004$ . There was no corresponding difference between the works of the two composers for multiple PCs at the same

Table 2

*Percentage and frequency (in parentheses) of locations where single, double and multiple reports of features or performance cues (PCs) were reported*

Composer	Features			PCs		
	1	2	3+	1	2	3+
Number of reports at each location						
Schoenberg %	65.4 (51)	32.1 (25)	2.6 (2)	68.9 (42)	27.9 (17)	3.3 (2)
Stravinsky %	67.2 (88)	18.3 (24)	14.5 (19)	79.7 (63)	17.7 (14)	2.5 (2)

location. This difference between the frequencies of features and PCs was significant,  $\chi^2(2) = 8.16, p < .02$ . One possible explanation is that the singer limited the number of multiple PCs for the Stravinsky to keep the mental load at an optimum level during performance.

The frequencies with which different types of features and PCs occurred in combination reflected the singer’s perception that the Schoenberg songs called for more expressivity than the Stravinsky. Table 3 shows the frequency with which different types of features were reported at the same location. In both the Schoenberg and the Stravinsky, the most frequent combinations of two features included a basic feature. For the Schoenberg songs, the most frequent combinations also involved an interpretive or expressive feature (51.9%), whereas for the Stravinsky the most common combination was with another basic or a structural feature (32.6%),  $\chi^2(3) = 12.87, p < .005$ . For example, in the Schoenberg songs, the singer reported features for both word pronunciation and word meaning at the point where she had decided to “roll the r” of *brennen* so as to emphasize its meaning, “burn”. In the Stravinsky, she reported features for word pronunciation and technical / breath at the second syllable of “princis” to remind her both to pronounce it “[prin]cess” and to prepare to take a good breath at the end of the

word before starting on the next, unaccompanied section.

The frequencies with which different types of PCs occurred in combination at the same locations are shown in Table 4. As already noted, the singer reported no shared PCs for coordinating with the pianist for the Schoenberg songs. In contrast, the task of coordinating with the larger musical ensemble required for the Stravinsky is reflected in the high proportion of combinations involving shared PCs for this piece (56.3%). For example, at the same location where the singer reported the shared PC “gathering point”, she also marked a basic PC, reminding her to count the correct number of beats for the word “sing” and prepare to take a breath before the final “Amen”.

The more expressive character of the Schoenberg songs is also reflected in the higher proportion of combinations of interpretive and expressive PCs (42.1% vs 12.5%). For example, in the Schoenberg, the singer marked both interpretive and expressive PCs at the word *Losungswort*, indicating that during the performance she had thought about its meaning, “watchword”, as well as the need to sing it with a tender expression. This was because, in the published text of the poem, *Losungswort* is preceded by the adjective *leises* – “tender” – and, although *leises* does not appear in the song, the musician wanted to

Table 3  
Frequency of combinations of different types of features

	Schoenberg		Stravinsky	
	No.	% of all double and multiple features ( $n = 27$ )	No.	% of all double and multiple features ( $n = 43$ )
Structural + basic	0	0	5	11.6
Structural + interpretive	0	0	1	2.3
Basic + basic	1	3.7	9	20.9
Basic + interpretive	10	37.0	7	16.3
Basic + expressive	4	14.8	1	2.3
Interpretive + interpretive	4	14.8	0	0
Interpretive + expressive	5	18.5	1	2.3
Interpretive + shared	1	3.7	0	0
Combination of three features	2	7.4	21	27.9
Combinations of four, five and six	0	0	7	16.3
Total	27	100	43	100

Table 4  
Frequency of combinations of different types of performance cues

	Schoenberg		Stravinsky	
	No.	% of all double and multiple PCs ( $n = 219$ )	No.	% of all double and multiple PCs ( $n = 16$ )
Basic + basic	2	10.5	0	0
Basic + interpretive	5	26.3	2	12.5
Basic + expressive	1	5.3	1	6.3
Basic + shared basic	0	0	5	31.3
Interpretive + interpretive	1	5.3	0	0
Interpretive + expressive	8	42.1	2	12.5
Interpretive + shared basic	0	0	1	6.3
Interpretive + shared expressive	0	0	2	12.5
Expressive and shared expressive	0	0	1	6.3
Combinations of three and four	2	10.5	2	12.5
Total	19	100	16	100

convey this feeling. The two PCs represent the singer's interpretive and expressive intentions. She also reported interpretive and expressive features at the same location, indicating that she had formed these intentions during practice.

### *Automaticity in performance*

One goal of practice is to make performance more automatic. What proportion of decisions that the singer made during practice was executed automatically and what proportion did the singer attend to during performance? To find out, we compared the singer's reports of the features that she attended to in practice and in performance. Just under half of the features that the singer reported thinking about during practice were retained as PCs: 47.6% and 46.2% for the Schoenberg songs and the Stravinsky *Ricercar* respectively (see Appendix II). The remainder, just over half of the decisions that she made during practice, were executed automatically during performance. The similarity of these proportions for the pieces by the two composers reflects a striking degree of within-musician consistency across different works.

Figure 3 shows the proportions of basic, expressive and interpretive features that were executed

automatically (the percentage of features shown in Appendix II as retained PCs subtracted from 100.0%). A higher proportion of interpretive features were executed automatically for the Schoenberg, and a higher proportion of basic features for the Stravinsky,  $\chi^2(6) = 20.75$ ,  $p < .002$ , another reflection of the differences between the works by the two composers. Many of the annotations representing technical difficulties in the Stravinsky were located at fast ("fanfare") passages. These were practiced many times during the rehearsal period in order to develop automaticity in performance. In contrast, many interpretive annotations in the Schoenberg songs dealt with the meanings of words that, once

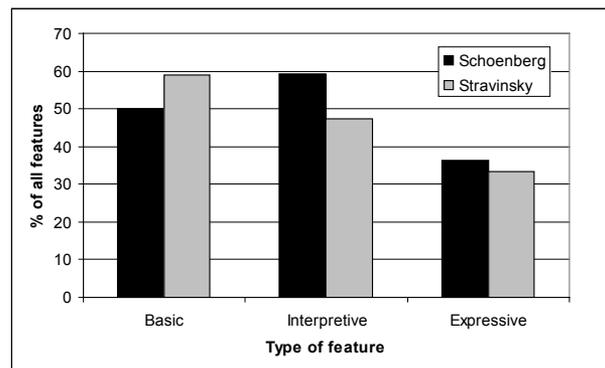


Figure 3: Percentage of features of each type executed automatically, that is, not retained as performance cues

internalized, did not require attention in performance but were executed automatically (or became the locations of expressive PCs). Because the singer tried to think about expression as much as possible in performance, expressive decisions were least likely to be executed automatically.

### *Preparation of PCs during practice*

Comparing the singer's reports of thoughts during performance with the features she attended to during practice allowed us to evaluate our claim that PCs are prepared during practice. If this claim is correct, then each PC would correspond to one or more of the features that she reported attending to during practice. Thoughts about the piece that were registered by the singer for the first time during the public performance, in contrast, would not correspond to features reported before the performance. Table 5 shows the total number of PCs of each type reported and the percentage that were prepared during practice, that is, corresponding to features reported prior to public performance. More than half of the PCs were prepared, 61% for the Schoenberg songs and 51.3% for the Stravinsky. As expected, most PCs were prepared during practice. We were surprised, however, that the proportion was not higher. We turn next to an examination of the singer's spontaneous thoughts during performance.

### *Spontaneous thoughts during performance of the two Schoenberg songs*

During her performance of the two Schoenberg songs, almost 40% of the singer's thoughts did not correspond directly with features of the music that she reported noticing during practice. These spontaneous thoughts were further classified by the singer as spontaneous PCs or extraneous thoughts. The analysis was restricted to the Schoenberg songs as too much time had passed since the performance of the Stravinsky *Ricercar* to allow accurate classification. Table 6 compares the frequency of the two kinds of spontaneous thoughts and the prepared PCs. Just over 60% of the singer's thoughts during performance involved prepared PCs, almost 30% were spontaneous PCs, and less than 10% were extraneous. The proportions did not differ significantly for the two songs.

The spontaneous PCs were musical insights about the songs that the singer will probably remember when she performs these works again, for example, "notice canon" at beat 62 of *Ich darf nicht dankend*. The extraneous thoughts were about issues specific to the particular performance that are unlikely to be remembered in subsequent performances, for example "unwanted fog in voice" at beat 17 in the same song. The singer reported, however, that all of her extraneous thoughts involved issues that needed her attention. None

Table 5

*Percentage and frequency (in parentheses) of prepared PCs originating in features (works by both composers)*

PC/feature	Prepared PCs (originating in features)	Total number of thoughts about the music reported during performance
Schoenberg		
<i>Basic + Shared</i>	28.0 (23)	28
<i>Interpretive</i>	24.4 (20)	34
<i>Expressive</i>	8.5 (7)	20
<i>Total</i>	61 (50)	82
Stravinsky		
<i>Basic (not including Shared)</i>	38.1 (53)	139
<i>Interpretive</i>	88.9 (32)	36
<i>Expressive</i>	81.3 (13)	16
<i>Total</i>	51.3 (98)	191

Table 6

Percentage and frequency (in parentheses) of spontaneous (vs prepared) thoughts during performance judged by the singer as likely (vs unlikely) to reappear in subsequent performances

Type of thought	Spontaneous (not originating in features)		Prepared	Total number of thoughts/PCs reported during performance
	PCs (likely to reappear in subsequent performances)	Extraneous thoughts (unlikely to reappear in subsequent performances)	PCs (originating in features)	
<i>Ich darf nicht</i>	7.3 (6)	3.7 (3)	24.4 (20)	29
<i>In diesen Wintertagen</i>	22.0 (18)	6.1 (5)	36.6 (30)	53
Total	29.3 (24)	9.8 (8)	61.0 (50)	82

was a product of mind wandering or non-musical distractions.

Table 7 shows the proportions of thoughts during performance that were about basic, interpretive, and expressive issues. Spontaneous PCs and thoughts were more often about interpretive and expressive issues and less often about basic issues than prepared PCs,  $\chi^2(2) = 8.90, p = .01$ . The difference reflects the fact that the singer's attention during the performance was more on interpretation and musical feeling than on technical issues.

There were also five instances where the singer reported thinking about a feature differently during the public performance than during practice (see Table 8). These five cases, which represent

spontaneous thinking during performance, are described below.

## DISCUSSION

### *Comparing the two songs by Schoenberg with the Stravinsky Ricercar*

As expected, there was no difference between the two Schoenberg songs in the proportions of the various types of features or PCs that the singer reported attending to. There were, in contrast, substantial differences between the Schoenberg songs and Stravinsky's *Ricercar*. These differences

Table 7

Percentage and frequency (in parentheses) of prepared PCs, spontaneous PCs and spontaneous thoughts about basic, interpretive, and expressive aspects of performance for the two Schoenberg songs

Type of thought	Spontaneous (not originating in features)		Prepared	Total number of thoughts/PCs reported during performance
	PCs (likely to reappear in subsequent performances)	Extraneous thoughts (unlikely to reappear in subsequent performances)	PCs (originating in features)	
<i>Basic + Shared</i>	3.7 (3)	2.4 (2)	28.0 (23)	28
<i>Interpretive</i>	15.9 (13)	1.2 (1)	24.4 (20)	34
<i>Expressive</i>	9.8 (8)	6.1 (5)	8.5 (7)	20
Total	29.3 (24)	9.8 (8)	61 (50)	82

Table 8  
*Schoenberg: Features becoming performance cues of different types*

Beat	Word	Feature	PC	Annotation
17	<i>nieder[sinken]</i>	Interpretive word meaning	Technical	“unwanted fog in throat”
46	<i>abzu[winken]</i>	Interpretive word meaning (“shrug off”)	Expressive	“imagine shrug”
75	<i>[Lei]des [Nähe]</i>	Basic word pronunciation	Interpretive rubato	wiggle
87	<i>ihm</i>	Basic breath after “ihm”	Expressive	“didn’t need breath”
107	<i>Schlaf [nen]</i>	Interpretive word meaning	Interpretive sound	“colour”

are attributable to differences in the complexity (technical, structural, instrumental) and expressiveness of these works by the two composers.

First, the lower technical demands of the Schoenberg resulted in the singer noticing fewer basic features while practicing the songs, so that she subsequently made fewer annotations on the score when she made her report. Second, this difference was also reflected in a lower density of features that the singer noticed during practice and attended to during performance: one PC every 3 s for the Schoenberg versus every 2 s for the Stravinsky. Third, the straightforward organization of the Schoenberg songs into verses was sufficiently predictable that it did not attract the singer’s attention either in practice or in performance. As a result, she reported no structural features or PCs for the songs. Fourth, for the Schoenberg, the singer did not need shared PCs in order to coordinate with the piano accompanist, a musician with whom she had performed many times. In contrast, although the same musician was also the conductor for the Stravinsky, substantial numbers of shared PCs were required to coordinate their performance with the larger musical forces involved. Fifth, the lesser complexity of the Schoenberg songs was reflected in fewer reports of multiple features and PCs at the same location than for the Stravinsky.

Another difference is that the singer saw the Schoenberg songs as more expressive than the Stravinsky. The singer reported a higher proportion of interpretive features and PCs and used a combination of expressive and interpretive PCs in the same location more often for the Schoenberg songs. These differences were a product of three factors: her understanding of the intentions of the two

composers, the process through which she reached that understanding, and her own experience in performing the two works.

First, she believed that the two composers had very different attitudes to musical meaning. As Stravinsky (1936) writes in his autobiography,

music is, by its very nature, essentially powerless to *express* anything at all, whether a feeling, an attitude of mind, a psychological mood, a phenomenon of nature, etc.... *Expression* has never been an inherent property of music... (p. 53).

Although she knew that the autobiography was ghost-written (Cross, 2003), the singer took this statement to reflect the composer’s views. In contrast, she had recently read Ross’s (2007a) description of Schoenberg’s *Ich darf nicht dankend*:

[The text, to a poem by Stefan George] begins: “I must not in thanks sink down before you / You are the spiritual plain from which we rose.” The music hangs by only the thinnest thread to the old harmonic order. It purports to be in B minor, yet the home chord appears only three times in thirty measures, once beneath the word “agonizing”. Otherwise, it is made up of a ghostly flow of unrooted triads, ambiguous transitional chords, stark dissonances, and crystalline monodic lines, approximating the picture of an “ice-cold, deep-sleeping stream” with which the poem concludes (p. 49).

In his blog of December 2007, Ross adds,

It may be no coincidence that Schoenberg wrote the song ... just eight days after the departure for New York of Gustav Mahler. [...] With Mahler gone, Schoenberg may have felt at once abandoned and liberated – free to become himself. (Ross, 2007b).

With this in mind, the singer's first annotation on her rehearsal score – categorized as an expressive feature – was “Serious, sad – departure (of Mahler?)”. An analogous context may exist for the Stravinsky *Cantata*, but the singer did not explore this, and so it did not impinge on her preparation of the *Ricercar*.

Secondly, the higher proportion of interpretive features reported for the Schoenberg is attributable to the texts of the two pieces. While the Schoenberg songs are in German, the *Ricercar* is in English. Although the singer had to make some inferences about the meaning and pronunciation of archaic 17<sup>th</sup> century usage in the Stravinsky, the Schoenberg needed considerably more preparatory work. As the singer looked for existing translations and made her own word-for-word translation, several unexpected anomalies emerged. In the second verse of *In diesen Wintertagen* the published score reads *Was wilde Glut entzündete*. According to Jackson (1989-1990), the poet (not George Henckel, as on the title page of the score, but Karl Henckell) actually wrote *Was milde Glut entzündet* – “That which kindles a gentle glow”, rather than a “wild glow”. The mistake is the typesetter's, not Schoenberg's. Further, the word *leises* (“tender”) before *Losungswort* (“watchword”), in the poem, is omitted in the song. Finally, the last line of *Ich darf nicht dankend* reads – according to the score (and Ross's translation, above) – *Am eisigkalten, tiefenschlafnen Flusse* (“in the ice-cold, deep-sleeping stream”). Yet the poem reads *Am eisigklaren...* (“ice-clear...”). Jackson does not comment on this; he writes as though the score is correct. The singer checked the original manuscript of the song (“Arnold Schönberg Center,” n.d.) and found that the syllable *klar* has been written over the syllable *kalt*, indicating that the published score is

incorrect. These discoveries changed the singer's previous understanding of the composer's intentions, and her approach to practice, rehearsal and performance. She would have to sing the correct words, not those printed in the score (and memorised many years previously), and she would have to sing them with the appropriate color. These decisions became additional expressive features and PCs.

A third reason for the higher proportion of interpretive PCs reported for the Schoenberg is that during the performance the singer found herself responding strongly to the feelings expressed in the songs and, as a result, reported a substantial number of thoughts that did not correspond directly to features of the music noticed during practice. These spontaneous PCs and other extraneous thoughts are discussed below.

The differences between the pieces by the two composers were more pronounced for the features noticed during practice than for the PCs attended to during performance. This may be because there is an optimum rate for attending to PCs during performance. We speculate that there is an upper limit, determined by the rate at which the performer can switch attention, and a lower limit, determined by the risk of unwanted, extraneous thought when the mind is not fully occupied. For pieces in which the upper limit is exceeded, the number of PCs can be reduced by increasing automaticity through practice. For pieces in which the lower limit is not reached, more PCs can be added during practice, for example, by the addition of interpretive nuances. This hypothesis could be tested in future research.

### ***Automaticity in performance***

During the performance, the singer did *not* think about approximately half of the musical features that she had been thinking about during practice. These included the pronunciation and meanings of words, breath locations, and some aspects of preparation, including pitches in the accompaniment used for pitching the melody. Practice had done its work, and these features had become automatic; the singer was able to implement them without thinking about them. The proportion of features

retained as PCs was very similar for the Schoenberg and Stravinsky songs, suggesting that the 50:50 ratio may be typical for this singer, at least for this kind of early- to mid-20<sup>th</sup> century repertoire.

In a handful of cases in *Ich darf nicht dankend*, features became PCs of different types. The singer's strategy for dealing with a problem ("unwanted fog in throat") was to change from thinking about an interpretive feature – meaning – at *niedersinken* to thinking about technique. Where there was no problem, at *abzuwinken*, an interpretive feature for meaning ("shrug off") changed to an expressive PC. In this case, the meaning of the word had been internalized and become automatic, allowing the singer to think about the feelings it conveyed. Similarly, focus on pronouncing the final consonant of *Leides* in rehearsal led in performance to a rubato that was reported as an interpretive PC, since it represented a deeper understanding of the meaning of the words "[your] sorrow, near". By contrast, when the singer reached the location where she had planned to breathe after *[und nur mit] ihm* ("[and only with] him"), she found herself responding to the music and the pianist's performance in such a way that she realized that the planned breath was not only unnecessary but would interfere with the communication of the meaning of the phrase to the audience. She therefore omitted the breath, and marked this location as an expressive PC. Finally, in the last line of the song she had noted, in rehearsal, an emphasis on the word *[tiefent]schlafnen*, thinking of its meaning ("sleeping") as an interpretive feature. In performance, this became a deliberate attempt to color the sound. Again, she had internalized the meaning of the word and was able to think instead of how to convey its connotations, not simply its translation from the German, resulting in a spontaneous, interpretive PC.

### ***Preparation of PCs during practice***

Around half of the singer's PCs – a little more in the case of the Schoenberg songs – were prepared during practice. This is consistent with the suggestion of Chaffin et al. (2002, pp. 169-170) that experienced performers prepare PCs by repeatedly attending to them in practice. As a result, the

musical feature comes to mind automatically during performance, ensuring that it will be implemented as planned.

Not all of the singer's thoughts during performance, however, corresponded to features of the music that she had previously attended to during practice. This discovery requires modification of Chaffin et al.'s (2002) suggestion that *all* PCs are prepared during practice. Many of the singer's spontaneous thoughts during performance represented new musical insights. Typically, these related to features of the music that she had noticed before, during practice, but without appreciating their importance. For example, the singer was amazed, when comparing her post-performance and post-rehearsal annotations, to find she had not marked the canon at beat 93 of *In diesen Wintertagen* (shown in Figure 1) after the rehearsal. This and other similar insights are unlikely to be forgotten. We expect that, when she performs the songs again, they will be PCs; a study testing this hypothesis is currently under way. These spontaneous thoughts – which may well be related to features that had not already been noticed consciously during rehearsal – are best understood as new PCs emerging during the concert performance. We should not be surprised to find, however, that spontaneous PCs of this sort had received special attention during rehearsal. Unfortunately, the hypothesis cannot be tested because we did not record the practice of the Schoenberg.

### ***Spontaneous thoughts during performance***

The difference in the proportions of the singer's spontaneous PCs in the works by Schoenberg and Stravinsky may be partly due to the difference in how quickly the two works were prepared. The Schoenberg songs were prepared for performance in three weeks, half the time for the Stravinsky *Ricercar* (six weeks), leaving more need and opportunity for musical insight to occur on stage. Another factor may have been that the lower density of PCs for the Schoenberg gave the singer more time to engage in spontaneous thought during performance. The lower density may also have been a strategic response by the singer to the more evocative nature

of the Schoenberg songs, which were more inviting of spontaneity. The singer certainly responded to the songs spontaneously, reporting increasing numbers of thoughts about musical expression and her own emotional response to the music, as the performance progressed. Some of these thoughts are described below.

Spontaneous PCs in the Schoenberg songs were more or less equally divided between expressive and interpretive PCs. There were very few spontaneous basic PCs. This is consistent with the strong intuition of many musicians that public performance is an important source of insight into music (Östersjö, 2008). As the pianist Emil Gilels wrote: "When I am in top form . . . the ideas are always different. Sometimes I play with greater changes in dynamics, sometimes with less . . . I must say it is different each time I play, and it is a process which . . . includes mastery of the work, knowing the details, being comfortable with it, and then adding the fantasy" (Gilels, in Mach, 1991, p. 123). The high proportion of spontaneous thoughts about interpretation and expression during the performance of the Schoenberg songs provide empirical support for these claims.

The proportion of extraneous thoughts was low (less than 10%). One consequence of training oneself to attend to PCs may be to reduce the frequency of unwanted and distracting thoughts during performance. Although some extraneous thoughts may be necessary to cope with unanticipated events, for example, "fog in throat", others may be unnecessary and unwelcome. For example, thoughts about what a member of the audience is doing or about how well (or badly) the performance is going are rarely helpful. In the present study, the singer's extraneous thoughts were all to do with the music and her reaction to it. We suspect that a low proportion of extraneous thoughts is characteristic of expert performance and that PCs may help keep extraneous thoughts to a minimum.

### ***Limitations***

The present study reports one singer's approach to one piece of music (albeit in relation to a second), and its results cannot readily be generalized.

Inevitably the singer's approach will have been informed by her training as a musician (she holds a degree in music), and as a performer. It is possible that her experience as a research psychologist, studying singers' strategies for practicing and memorizing, and latterly as a performer-researcher herself, influenced her practice and the nature of the annotations she made after the final rehearsal and performance. This is typical, however, of practice-led research. We believe that the benefits of access to an experienced musician's insights into her own performance outweigh the disadvantages of the case study method.

Evidence of the generalizability of our results comes from their consistency with previous case studies using similar methods (e.g., Chaffin, 2007) and with the earlier case study of the same singer (Ginsborg et al., 2006a,b; Ginsborg & Chaffin, 2011). One difference between the previous studies and the present study is that, in the latter, features were reported immediately after the final rehearsal in the morning, and the PCs were reported some 10 hours later, after the performance. While the length of time between the rehearsal / performance and making the annotations on each occasion was longer than that recommended for maximum reliability (Ericsson & Simon, 1993) and it is possible that some annotations made after the rehearsal in the morning were recalled after the performance during the evening of the same day, there was less likelihood of overlap between features and PCs in this study than in previous research. More generally, musicians' use of musical structure and PCs is consistent with principles of expert memory developed from the study of experts in other fields and with principles of memory derived from the study of the general population (Ericsson & Oliver, 1989). There is good reason to expect, therefore, that our conclusions will generalize to other experienced performers.

Our method of inquiry relied on the singer's retrospective self-reports. Such reports cannot be taken at face value because they are subject to distortions induced by self-presentation strategies, demand characteristics, and the vagaries of memory (Ericsson & Simon, 1993). For this reason, our previous studies related reports of practice features and

PCs to a wide range of behavioral measures: starts, stops, and repetitions in practice; spontaneous comments during practice; spontaneous movement during practice; cued and free recall many months after public performance; and fluctuations in tempo and sound level in practice and public performance (Chaffin et al., 2002; Chaffin, 2007; Lisboa et al., 2007; Noice et al., 2008). The lawful relationships between reports and behavior demonstrate that self-reports can provide useful insights into behaviors that are important to musicians, such as practice and performance. In previous publications we have demonstrated that the singer's reports of features and PCs for the Stravinsky were related to all of the above types of behavior except for tempo and dynamic fluctuations in performance (Ginsborg & Chaffin, 2011; Ginsborg et al., 2006b). These data provide assurance that her reports provide a reliable guide to her practice, memorization, and performance strategies.

### ***Practical applications***

We suspect that the use of the procedures we have described, noting features during practice and PCs following performance would be a valuable exercise for advanced students. Research is needed to test this intuition. (Software designed for this purpose is available at <http://www.musicpsyc.uconn.edu/symp/intro.html>). The more musicians are aware of their goals – for example, of which features they want to become automatic and which they want to keep in mind during performance – the more efficiently they can practice.

### **CONCLUSION**

Ideally, most performers would probably prefer to focus entirely on expression during performance (Chaffin & Imreh, 2002). Well-prepared PCs can make this possible, although they certainly do not guarantee that it will happen. When a performer is able to focus on expressive PCs, other aspects of the music retreat into the background. The

musical feelings become the focus of attention and the performer experiences a state of “flow” (Csikszentmihályi & Csikszentmihályi, 1988). This happened increasingly for the singer as the performance progressed. Her annotations reflect her increasing enjoyment of the performance. First, her confidence grew as she recovered from a difficult start (“unwanted fog in voice”). Second, while the mood of *Ich darf nicht danken* is “serious, sad”, the mood of *In diesen Wintertagen* is intimate, tender, becoming passionate and ending in exultation. Her first expressive feature – and PC – was “smiling”. Above the C major chord at which the singer enters, she wrote “hearing beautiful harmony.” During the extended interlude before the beginning of the last sentence of the poem (*Dem Schein der Welt verschollen* – “the glitter of the world may disappear”), she reminded herself, again, “listen to harmonic progression / build from here.” Then over the next phrase (*auf unserm Eiland wollen wir Tag und Nacht* – “on our island let us day and night...”) she noted “growing excitement (more than in rehearsal).” The song ends ... *der seligen Liebe weih'n* – “consecrate to holy love,” at which she noted “enjoy legato.” Finally, over the last 10 bars of the piano postlude, she made the following annotations: “real feeling of pleasure during postlude – such beautiful music, and sense of coming / being home.” She describes the feelings that prompted these annotations thus:

This “homecoming” for me was not just a response to the C major tonality of the song's conclusion, but a reference to the context of the performance: the first concert given by my soprano, clarinet and piano trio for twenty years, on the occasion of a birthday celebration for the pianist, my husband. Not only, then, did it feel like a homecoming to be singing with long-standing and very dear friends, but also to be in the role – once again – of professional musician, rather than / as well as (musician-) researcher.

REFERENCES

- Arnold Schönberg Center Music Manuscripts. (n.d.). Retrieved November 14, 2010, from [http://www.schoenberg.at/index.php?option=com\\_content&view=article&id=374&Itemid=705&lang=en](http://www.schoenberg.at/index.php?option=com_content&view=article&id=374&Itemid=705&lang=en)
- Beilock, S. L., & Carr, T. H. (2001). On the fragility of skilled performance. *Journal of Experimental Psychology: General*, 130, 701-725.
- Chaffin, R. (2007). Learning Clair de Lune: Retrieval practice and expert memorization. *Music Perception*, 24, 377-393.
- Chaffin, R., Demos, A., & Crawford, M. (2009). Sources of variation in musicians' use of performance cues. In K. Buckley, S. Fazio, B. Kruithof, E. Schubert, & C. Stevens (Eds.), *Proceedings of the 2nd International Conference on Music Communication Science (ICoMCS2)*. Sydney, Australia: HCSNet, University of Western Sydney.
- Chaffin, R., & Imreh, G. (1994). *Memorizing for piano performance: A case study of a concert pianist*. Paper presented at the 3<sup>rd</sup> Practical Aspects of Memory Conference, University of Maryland, College Park.
- 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: Erlbaum Associates.
- Chaffin, R., Lemieux, A., & Chen, C. (2006). Spontaneity and creativity in highly practiced performance. In I. Deliège & G. A. Wiggins (Eds.), *Musical creativity: Multidisciplinary research in theory and practice* (pp. 200-218). London: Psychology Press.
- Chaffin, R., Lemieux, A., & Chen, C. (2007). "It's different each time I play": Spontaneity in highly prepared musical performance. *Music Perception*, 24, 455-472.
- Chaffin, R., Lisboa, T., Logan, T., & Begosh, K. T. (2010). Preparing for memorized cello performance: The role of performance cues. *Psychology of Music*, 38, 3-30.
- Cross, J. (2003). *The Cambridge companion to Stravinsky*. Cambridge: Cambridge University Press.
- Csikszentmihályi, M., & Csikszentmihályi, I. S. (Eds.). (1988). *Optimal Experience: Psychological studies of flow in consciousness*. Cambridge: Cambridge University Press.
- Ericsson, K. A. (2002). Attaining excellence through deliberate practice: Insights from the study of expert performance. In M. Ferrari (Ed.), *The pursuit of excellence through education* (pp. 47-56). Mahwah, NJ: Erlbaum.
- Ericsson, K. A., & Oliver, W. L. (1989). A methodology for assessing the detailed structure of memory skills. In A. M. Colley & J. R. Beech (Eds.), *Acquisition and performance of cognitive skills* (pp. 193-215). Chichester: Wiley.
- Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data*. Cambridge, MA: MIT Press.
- Ginsborg, J. (2004). Strategies for memorizing music. In A. Williamon (Ed.), *Musical excellence: Strategies and techniques to enhance performance* (pp. 123-141). Oxford: Oxford University Press.
- Ginsborg, J., & Chaffin, R. (2011). Performance cues in singing: Evidence from practice and recall. In I. Deliège & J. Davidson (Eds.), *Music and the mind: Investigating the functions and processes of music (a book in honour of John Sloboda)* (pp. 339-360). Oxford: Oxford University Press.
- Ginsborg, J., Chaffin, R., & Nicholson, G. (2006a). Shared performance cues in singing and conducting: A content analysis of talk during practice. *Psychology of Music*, 34, 167-194.
- Ginsborg, J., Chaffin, R., & Nicholson, G. (2006b). Shared performance cues: Predictors of expert individual practice and ensemble rehearsal. In M. Baroni et al. (Eds.), *Proceedings of the 9th International Conference on Music Perception and Cognition*. Bologna, Italy.
- Jackson, T. L. (1989-1990). Schoenberg's Op. 14 songs: Textual sources and analytical perception. *Theory and Practice (journal of the Music Theory Society of New York State)* 14/15, 35-58.
- Lisboa, T., Chaffin, R., Logan T., & Begosh, K. (2007). Variability and automaticity in highly practiced cello performance. In A. Williamon & D. Coimbra (Eds.), *Proceedings of the International Symposium on Performance Science 2007* (pp. 161-166). Utrecht, The Netherlands: European Association of Conservatoires.
- Mach, E. (1991). *Great contemporary pianists speak for themselves, Vol. 2*. New York: Dover.
- Maharaj, S. (2005, June) *Thinking through performance*. Paper presented at Knowledge Lab, Haus der Kulturen der Welt, Berlin.
- Noice, H., Jeffrey, J., Noice, A., & Chaffin, R. (2008). Memorization by a jazz pianist: A case study. *Psychology of Music*, 36, 47-61.
- Östersjö, S. (2008). *Shut up'n'play: Negotiating the musical work*. Lund: Malmö Academies of Performing Arts, Lund University.
- Ross, A. (2007a). *The rest is noise: Listening to the twentieth century*. London: Fourth Estate.
- Ross, A. (2007b, December 15). Worldwide Atonality Day [Web log post]. Retrieved from <http://www.therestisnoise.com/2007/12/100-years-of-1.html>
- Stravinsky, I. (1936). *An autobiography*. New York: Simon & Schuster.
- Study Your Music Practice. (n.d.). [Computer software]. Available at <http://www.musicpsy.uconn.edu/symp/intro.html>

## APPENDIX

*Frequency of features and PCs reported for the two songs by Arnold Schoenberg and for the Ricercar by Igor Stravinsky*

Table A1

*Schoenberg*

		<i>Ich darf nicht dankend</i>	<i>In diesen Wintertagen</i>	Total	% of features/PCs
<b>Features</b>					
Basic					
	Intonation	2	0	2	1.9
	Word (pronunciation)	4	11	15	14.3
	Breath	7	5	12	11.4
	Technical	0	2	2	1.9
	Prepare (pitch, count, listen)	3	10	13	12.4
<b>All basic features</b>		<b>16</b>	<b>28</b>	<b>44</b>	<b>41.9</b>
Interpretive					
	Word (meaning)	8	12	20	19.1
	Sound	2	7	9	8.6
	Notice musical feature	1	11	12	11.4
	Rubato	2	1	3	2.9
	Dynamics	0	5	5	4.8
<b>All interpretive features</b>		<b>13</b>	<b>36</b>	<b>49</b>	<b>46.7</b>
Expressive	Convey meaning	5	6	11	10.5
Shared	Co-ordinate	1	0	1	1.0
<b>All features</b>		<b>35</b>	<b>70</b>	<b>105</b>	<b>100.00</b>
<b>Performance cues</b>					
Basic PC					
	Intonation	1	0	1	1.2
	Word (pronunciation)	2	5	7	8.5
	Breath	5	2	7	8.5
	Technical	2	1	3	3.7
	Prepare (pitch, count, listen)	3	5	8	9.8
<b>All basic performance cues</b>		<b>13</b>	<b>13</b>	<b>26</b>	<b>31.7</b>
Interpretive PC					
	Word (meaning)	1	6	7	8.5
	Sound	2	5	7	8.5
	Notice musical feature	1	12	13	15.9
	Rubato	3	0	3	3.7
	Dynamics	1	3	4	4.9
<b>All interpretive performance cues</b>		<b>8</b>	<b>26</b>	<b>34</b>	<b>41.5</b>
Expressive PC	Convey meaning	6	14	20	24.4
Shared PC	Co-ordinate	2	0	2	1.2
<b>All performance cues</b>		<b>29</b>	<b>53</b>	<b>82</b>	<b>100.00</b>

Table A2  
Stravinsky

	Total	% of features/PCs
<b>Features</b>		
Structural		
Start of section	9	4.4
Switch	7	3.5
Start of phrase	29	14.3
Basic		
Prepare (count, listen, think, watch)	35	17.2
Basic words (pronunciation)	25	12.3
Technical (including breath)	45	22.2
<b><i>All basic features</i></b>	<b><i>150</i></b>	<b><i>73.9</i></b>
Interpretive		
Words (interpretation, i.e. meaning)	29	14.3
Dynamics/tempo	9	4.4
<b><i>All interpretive features</i></b>	<b><i>38</i></b>	<b><i>18.7</i></b>
Expressive features		
Expressive	15	7.4
<b><i>All features</i></b>	<b><i>203</i></b>	<b><i>100.00</i></b>
<b>Performance cues (PC)</b>		
Basic PC		
Prepare	20	20.4
Technical (including breath)	14	14.3
<b><i>All basic PC</i></b>	<b><i>34</i></b>	<b><i>34.7</i></b>
Interpretive PC		
Stress on words (pronunciation + meaning)	28	28.6
Expressive PC		
Expressive	12	12.2
<b><i>All individual performance cues</i></b>	<b><i>74</i></b>	<b><i>75.5</i></b>
Shared Performance Cues (SPC)		
Basic SPC		
Score	11	11.2
Arrival/off	8	8.2
Expressive SPC		
Expressive	5	5.1
<b><i>All shared performance cues</i></b>	<b><i>24</i></b>	<b><i>24.5</i></b>
<b><i>All performance cues</i></b>	<b><i>98</i></b>	<b><i>100.00</i></b>

(Appendix continues)

*Number of features retained as PCs for two songs by Arnold Schoenberg and for the Ricercar by Igor Stravinsky, showing the % of each type of feature retained*

Table A3  
*Schoenberg*

	Total number of features	Number of features retained		Total number features retained	% of features retained
		<i>Ich darf nicht dankend</i>	<i>In diesen Wintertagen</i>		
<b>Basic</b>					
Intonation	2	1	0	1	50.0
Word	15	2	4	6	40.0
Breath	12	5	2	7	58.3
Technical	2	0	0	0	0.0
Prepare	13	3	5	8	61.5
<b><i>All basic features</i></b>	<b><i>44</i></b>	<b><i>11</i></b>	<b><i>11</i></b>	<b><i>22</i></b>	<b><i>50.0</i></b>
<b>Interpretive</b>					
Word	20	0	4	4	20.0
Sound	9	1	4	5	55.6
Notice	12	1	5	6	50.0
Rubato	3	2	0	2	66.7
Dynamics	5	0	3	3	60.0
<b><i>All interpretive features</i></b>	<b><i>49</i></b>	<b><i>4</i></b>	<b><i>16</i></b>	<b><i>20</i></b>	<b><i>40.8</i></b>
<b><i>Expressive features</i></b>	<b><i>11</i></b>	<b><i>4</i></b>	<b><i>3</i></b>	<b><i>7</i></b>	<b><i>63.6</i></b>
<b><i>Shared features</i></b>	<b><i>1</i></b>	<b><i>1</i></b>	<b><i>0</i></b>	<b><i>1</i></b>	<b><i>100</i></b>
<b><i>Total</i></b>	<b><i>105</i></b>	<b><i>20</i></b>	<b><i>30</i></b>	<b><i>50</i></b>	<b><i>47.6</i></b>

Table A4  
*Stravinsky*

	Number of features	Number of features retained	% of features retained
<b>Basic*</b>			
Preparation	35	19	76.0
Word (pronunciation) <sup>+</sup>	25	13	52.0
Technical including breath	45	11	24.4
<b><i>All basic features</i></b>	<b><i>105</i></b>	<b><i>43</i></b>	<b><i>40.9</i></b>
<b>Interpretive</b>			
Word (meaning) <sup>+</sup>	29	20	69.0
Dynamics	9	0	0
<b><i>All interpretive features</i></b>	<b><i>38</i></b>	<b><i>20</i></b>	<b><i>52.6</i></b>
<b><i>Expressive features</i></b>	<b><i>15</i></b>	<b><i>10</i></b>	<b><i>66.7</i></b>
<b><i>Total</i></b>	<b><i>158</i></b>	<b><i>73</i></b>	<b><i>46.2</i></b>

\*Structural features are not listed since none was marked as a PC.

+ Six locations where both Word (pronunciation – basic) and Word (meaning – interpretive) features were marked were later marked as PCs for Stress on Words. Both the basic and interpretive features were counted separately as features retained as PCs. If these locations are counted once, then the % of feature locations retained is 42.4%.

#### **AUTHOR NOTES**

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BIOGRAPHIES



Jane Ginsborg

**Jane Ginsborg** read music at the University of York (UK), and trained as a singer at the Guildhall School of Music and Drama, London. Following a successful freelance career as a professional singer and singing teacher, she studied psychology with the

Open University, gaining a BA degree with first class honours, and completed her ESRC-funded PhD in psychology at Keele University under the supervision of John Sloboda. Jane is a Chartered Psychologist and member of the British Psychological Society. She carried out post-doctoral research at the University of Sheffield and has lectured in psychology at the University of Manchester, at Leeds Metropolitan University, and for the Open University. She is Associate Dean of Research and Director of the Centre for Music Performance Research at the Royal Northern College of Music, Manchester, UK, where she encourages colleagues and students to undertake practice-based research.

Jane has published widely on expert musicians' approaches to practicing and memorizing, and won the British Voice Association's Van Lawrence Award in 2002 for her research on singers' memorizing strategies. She is Managing Editor of *Music Performance Research*, Associate Editor (Music Performance) of the *Journal of Interdisciplinary Musicology* and Associate Editor of *Musicae Scientiae*. Her principal research interests are in singing, and in expert musicians' preparation for performance and long-term recall of music. Current and recent investigations include interactive performance for musicians with hearing impairments (funded by the AHRC), the teaching and learning of small group performance (funded by PALATINE), the roles of gesture and talk in duo rehearsal, dancers' long-term recall for movement with and without music, musicians' career transitions, and musicians' health.



Roger Chaffin

**Roger Chaffin** is Professor of Psychology at the University of Connecticut in the USA. He studies the cognitive processes involved in musical performance. His longitudinal case studies of experienced musicians preparing for performance combine the

third-person perspective of the scientist with the first-person perspective of the musician to learn how performance is shaped by decisions made during practice. These studies often confirm the musicians' understanding of their experience, but sometimes the musicians are surprised. On these occasions everybody learns something. He has reported this research in journals such as *Psychological Science*, *Music Perception* and *Music Psychology*, and in *Practicing perfection: Memory and piano performance* (2002), written in collaboration with pianist Gabriela Imreh and social psychologist Mary Crawford. The book describes how their friendship led to the first longitudinal study of Gabriela's learning of the Italian Concerto (Presto) and initiated the research on performance cues that is still an important focus of the music performance lab today. His work on musical memory complements his earlier work on memory and language reported in journals such as *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *Cognitive Science* and *Psychological Bulletin*. He is co-editor of *Memory in Historical Perspective* (1988) and co-author of *Cognitive and Psychometric Analysis of Analogical Problem Solving* (1991). Professor Chaffin is a chorister and amateur flautist, but prefers the excitement of running white-water rapids in a kayak to that of performing on the concert stage.

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