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Recording thoughts as an aid to memorization: A case study

Tania Lisboa[1], Roger Chaffin[2], and Alexander Demos[2]

[1] Centre for Performance Science, Royal College of Music, London, UK
[2] Department of Psychology, University of Connecticut, USA

We describe how an 18 year-old piano student (Grade 7, ABRSM) learned to memorize. The student, who had previously ignored suggestions that she play from memory, decided to learn to memorize, selecting Schumann's "Der Dichter Spricht" for this purpose. Rather than explicitly teaching the student to memorize, the teacher taught her to record her thoughts by marking them on copies of the score, a technique inspired by studies of how experienced soloists memorize. Over a seven-week period, the student recorded her thoughts while practicing (5 times) and while performing from memory for the teacher (3 times) and video-recorded three weeks of practice and three performances. Her thoughts were relatively stable over time and occurred at locations where playing started during practice. The student was able to perform from memory after four weeks and to reconstruct the piece from memory after a four-month break. The speed and durability of her memorization inspired the student to perform in public and use the same technique for new pieces. Recording thoughts appeared to aid memorization.

Keywords: memory; practice; performance; learning; performance cues

Students generally practice by rote; this results in rote memory (*associative chaining*), which is not very robust. When a failure does occur, the performer has to go back to the beginning of the chain. Experienced performers avoid such embarrassment by creating a safety net that provides them with *content addressable* access to their memory, allowing them to re-start at different points in the music (Chaffin *et al.* 2009). They do this by training themselves, during practice, to attend to *performance cues* (*PCs*). PCs are musical features that serve as mental landmarks during performance, allowing the

musician to monitor progress through the piece to ensure that the performance unfolds as planned.

The development of PCs has been documented in longitudinal case studies in which experienced soloists recorded their practice as they prepared new works for public performance. They then reported the features of the music they had attended to during practice and in performance by marking them on the score (Chaffin 2011). PCs were thoughts during performance that had previously occurred during practice (Ginsborg and Chaffin 2012, Ginsborg *et al.* 2013). PCs affected starts and stops during practice and written recall of the score months after the performance (Chaffin 2011).

As the musician in one of these studies, the first author was impressed by the benefits of the procedure to her own playing (Chaffin *et al.* 2010). Reporting practice decisions and PCs made her more aware of her musical intentions and strategies. She found that her practice and memorization became more efficient, for other pieces, as well as the piece under study. She wondered whether the same procedure might help one of her students. The student had never deliberately memorized before. Although the student had sometimes memorized incidentally, while learning a piece, after a few weeks, the memory would be gone. Now, the student wanted to memorize more permanently and securely. PC-theory suggested that she needed a retrieval organization to provide content addressable access to her rote memory.

METHOD

Participants

Maria was an 18 year-old piano student (Grade 7, ABRSM) of the first author. The teacher (the first author) trained in classical cello and piano, performs regularly as a cello soloist, and has taught private students on both instruments for more than three decades.

Materials

The student had worked on "Der Dichter Spricht" (The Poet Speaks) from R. Schumann's *Kinderszenen* a year earlier, but had set it aside as too difficult. She now selected it for memorization.

Procedure

Over a period of six weeks, Maria had seven lessons, practicing the piece at home in between. She first performed the piece for the teacher from memory in lesson 4 and continued to do so in each lesson until lesson 7, at which point

she concluded that the piece was memorized and ended her work on the piece. During this time the student made five reports of her thoughts during practice and three reports of her thoughts during performances, which occurred during lessons. The teacher showed the student how to mark copies of the score with arrows to indicate features that were the focus of her attention. Together they classified each feature as involving expression, interpretation, basic technique, or musical structure. The teacher marked Maria's phrasing on another copy of the score at the end of the study.

Maria video-recorded three weeks of practice and three performances, starting after lesson 3. She also recorded herself, 11 weeks after last playing the piece, when she reconstructed it from memory during a lesson. She worked through the piece from memory, starting and stopping, until she recovered her earlier fluency.

We transcribed the reports by tallying the location (in beats) and type of thought in each report and the recordings by tallying the locations of starts and stops. For analysis we reduced the 114 beats of the score to 73 locations where we judged that a thought might plausibly be reported, eliminating beats on which notes were simply held. The lower value provided a more conservative test of the hypothesis that thoughts were randomly distributed. We used a mixed effect model to evaluate the relationship of starts in practice to the reports. Predictors were dummy-coded to represent the location of thoughts about basic, interpretive, and expressive features of the music in each report and of starts of phrases in the teacher's report. Predictors for each week's practice were drawn from the reports for the performance that ended the week. We treated thoughts and phrases as fixed effects. Phrases were also included as a random effect, nested within the longer piece.

RESULTS

Maria and her teacher were both surprised at the speed with which Maria memorized the piece and her success in reconstructing it from memory almost four months later. Her teacher also noted that she played more musically than usual. To determine whether reporting her thoughts had contributed to this success, we looked for evidence that the thoughts were stable over time and had been prepared during practice.

Many of Maria's thoughts were stable. Thoughts were not distributed randomly but occurred at a limited number of locations (beats) within the piece. Figure 1 shows that while many locations elicited no thoughts, other locations elicited thoughts multiple times. To quantify this, we compared the number of thoughts that occurred in one report versus multiple reports for

each of the different types of thoughts (Figure 2). Most thoughts about basic and interpretive issues occurred in multiple reports, indicating substantial stability over time. In contrast, thoughts about structure and expression mostly appeared just once, reflecting lower stability or later appearance.

Thoughts during performance were related to the the practice that preceded it. Table 1 shows that starts during practice occurred at locations where Maria subsequently thought about expression during performance. The trend towards a similar effect for basic thoughts was not significant. Thoughts about interpretation, in contrast, were negatively related to starts, indicating that Maria systematically avoided starting at these locations,

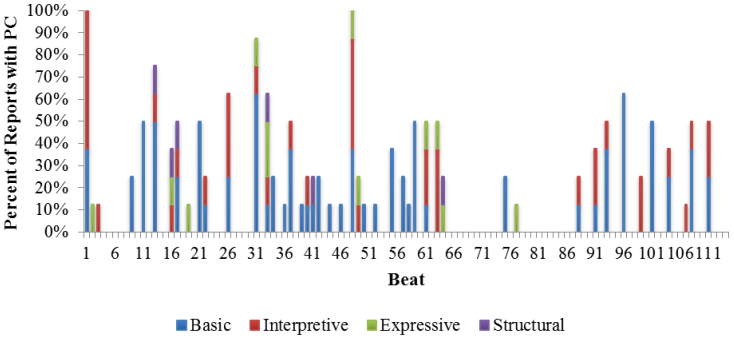

Figure 1. The percentage of reports in which thoughts were reported at each beat of the piece, showing the classification of the type of thought.

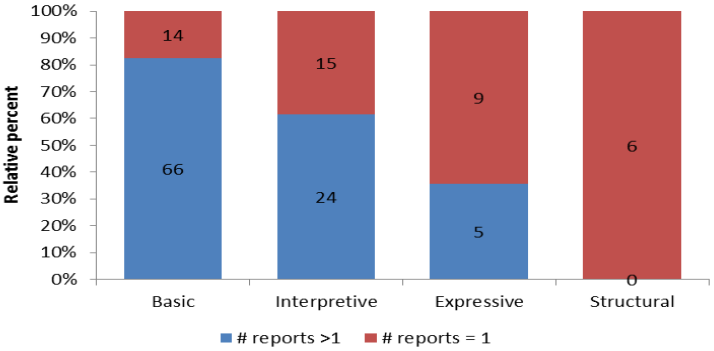

Figure 2. Relative percent of thoughts occurring in one versus more than one report. (See full color versions at www.performancescience.org.)

Table 1. Summary of mixed model of relation of thoughts during subsequent performance to starts during prior practice.

Fixed effects	*Estimate*	*SE*
Intercept	-2.04***	0.37
Expressive thoughts	1.82**	0.56
Interpretative thoughts	-1.05*	0.51
Basic thoughts	0.78†	0.41
Session	-0.76***	0.16
Phrase starts	0.33	1.13
Random effects		*SD*
Events		2.0
AIC		226.8
BIC		250.4
Deviance		-106.4

Note. †p<0.10, *p<0.05, **p<0.01, ***p<0.001.

providing them with "practice in context", an appropriate practice strategy for interpretation (Chaffin *et al.* 2002, p. 187). There were also more starts in early practice sessions, reflecting their greater length.

DISCUSSION

Maria's thoughts during performance appear to have been PCs. They were not simply random thoughts about whatever happened to catch her attention on that occasion. They were prepared during practice and stable over time. Thoughts about expression occurred at places where playing started during the previous week's practice. Thoughts about interpretation occurred at places where Maria avoided starting. In either case, thought and action were linked, increasing the likelihood that the same thoughts would occur during performance. Although thoughts about basic technique were not reliably related to starts, they were stable, appearing in multiple reports, as were thoughts about interpretation.

Unlike the professional musicians in previous PC studies, Maria paid little attention to phrasing or musical structure. Her few thoughts on this topic appeared in a single report and were unrelated to starts during practice. The teacher resisted her impulse to direct Maria's attention to phrasing in order to avoid shaping the outcome. As a result, we are able to see that thinking about structural features just once was not enough to produce an effect on practice.

Thinking repeatedly about interpretive and expressive features, on the other hand, did affect practice. It seems likely that combining thought-reports with suggestions to attend to musical structure would be even more effective.

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Address for correspondence

Tania Lisboa, Centre for Performance Science, Royal College of Music, Prince Consort Road, London SW7 2BS, UK; *Email:* tania.lisboa@rcm.ac.uk

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