

VERY LONG TERM MEMORY FOR WORDS AND MELODY: AN EXPERT SINGER'S RECALL OVER THREE YEARS

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ABSTRACT

This study forms part of a longitudinal case study of a singer's preparation for performance and long-term recall of a piece of music, the first *Ricercar* from Stravinsky's Cantata. Content analyses of talk with the pianist with whom she rehearsed, and who conducted the public performance of the piece, have been reported, as has an analysis of the effect of performance cues on practice behaviour. In this paper we report accuracy of memory in three free recalls undertaken 18, 32 and 42 months after the performance. The singer's memory was surprisingly durable; there was a significant decrease in accuracy of recall after 18 months to 75% but thereafter accuracy decreased only gradually to 66% three and a half years after the performance. Memory for melody appears to be more reliable than for words but both are likely to be forgotten together, confirming earlier findings suggesting that words are stored and retrieved in association with the melody to which they are set.

1. INTRODUCTION

The longitudinal case study method, pioneered by Chaffin & Imreh (1994), has been used to investigate the development of performers' mental representations for music. One key aspect of the formation of mental representations is the development of performance cues. These are the basic, interpretive and expressive features of the music to which the musician pays attention during practice and rehearsal and which, as a result, become 'landmarks' when the piece is performed (Chaffin, Imreh, & Crawford, 2002; Noice, Chaffin, Noice, Jeffrey, & Pelletier, 2004; Logan, Begosh, Chaffin, & Lisboa, 2007).

Ginsborg's research with singers focuses on the learning and memorization of the words and melodies of songs (Ginsborg, 2000, 2002; Ginsborg & Sloboda, 2007). In the present programme of research we have examined collaborative learning when a singer and conductor prepare a work for performance. We have reported a content analysis of the verbal commentaries they provided in their individual practice sessions, and discussions during rehearsal, cross-referenced with post-performance annotations of the musical score, in order to reveal how they negotiated goals and the way they were implemented (Ginsborg, Chaffin & Nicholson, 2006a). An analysis of the effect of musical features and performance cues on practice and rehearsal (Ginsborg et al., 2006b) concluded that the different roles and requirements of singer and conductor determine the way they prepare for performance: the singer performs from memory, aware of, but

relying only intermittently on information from the other musicians while the conductor has to have an overview of the whole score. Nevertheless these different conceptualisations – and those they resolve during the rehearsal process – combine so that ultimately the musicians give a performance that is experienced by both of them, and by their audience, as entirely unanimous.

We now turn our attention to the effect of musical features and performance cues on the singer's recall from long-term memory, 18 months, 32 months and 42 months after the public performance of the work. Recall from long-term memory has been a topic studied by psychologists for more than a century (Ebbinghaus, 1885; Jones, 1989; Bahrck, e.g. 1994; Rubin and Wenzel, 1996; Chessa and Murre, 2005). There is comparatively little research on recall for music stored in long-term memory; exceptions include Sloboda and Parker (1985), who showed that experts' and novices' recall for newly-memorized folksongs was far from verbatim, although harmonic and, especially, metrical structure was preserved. Indeed the majority of studies of recall for the words and music of songs focus on those that are newly memorized (see Ginsborg & Sloboda, 2007, for a review), and almost none involve expert musicians or their recall for music as well as words.

In the study that provides the model for the present research (Chaffin et al., 2002), the pianist Gabriela Imreh prepared Bach's *Italian Concerto* for public performance from memory and a CD recording over the course of 33 hours of practice. Two years later she wrote down as much as she could remember of the first page of the score. After playing through what she had written and making some additions and corrections, she was found to have recalled around 65% of the notes. Regression analyses using annotations representing structural features of the music and performance cues as predictor variables, and recall for each bar as criterion variables, showed that section boundaries and 'switches', act as retrieval cues.

The aim of the present research was to examine long-term recall for the words and melody of a song 18, 32 and 42 months after performance from memory, to investigate the types of errors that were made and the extent to which they were correlated with each other in each recall.

2. METHODS

2.1 Participants

Jane Ginsborg, the first author, is a former professional singer; she has worked with the pianist and conductor George Nicholson for more than 30 years, performing as a duo and as members of a variety of ensembles.

2.2 Materials

Stravinsky's *Cantata* for two solo singers, women's choir and small instrumental ensemble includes one movement for solo soprano and ensemble, *Ricercar 1* (circa 4 minutes in length). The present study investigated the singer's preparation and performance of the *Ricercar* only.

2.3 Procedure.

1. Rehearsal. From mid-November to mid-December 2003, the singer undertook five individual practice sessions lasting 4 hours 13 minutes in all. She carried out four joint rehearsals lasting 2 hours 47 minutes with the conductor. These nine practice sessions and rehearsals (although not three ensemble rehearsals lasting 57 minutes) were recorded and analysed. A public performance of the complete *Cantata*, conducted by George Nicholson, with the first author as solo soprano, was given on 16 December 2003.

2. Free recalls and performances from memory. The singer wrote out one free recall during the preparation period, as was her custom as a way of checking that her memory would be secure. She gave four complete performances from memory, and made several further written free recalls for the purpose of the present study. The decision to make them was taken after the public performance had been given, however; practice and rehearsal were not undertaken only in preparation for the performance. The singer did not mentally rehearse the piece between recalls; it was inevitable that she would think about it while engaged on the project, so the recalls were made just before each period of data analysis or writing-up. The first free recall (FR1) was made between the last two rehearsal sessions, five days before the performance, and involved writing out the words from memory and indicating the notated rhythms above each word. In the course of the penultimate rehearsal the singer and conductor, playing the piano, gave two uninterrupted performances of the piece. The singer made one error in one performance and two errors in the other (99.6% and 99.2% accuracy respectively). The final rehearsal included an uninterrupted performance in which the singer accommodated to two errors made by the conductor. The public performance was accurate in all respects.

The singer made seven further free recalls after the public performance. The first was six weeks later (end of January 2004), the second ten weeks later (end of February 2004), the third 14 months later (February 2005) and the fifth 18 months later (June 2005). In each case she wrote down what she could remember of the words and melody without looking at the score but humming, pulse beating and conducting as necessary,

working through the whole song from start to end and then going back to reconstruct what she had forgotten. The fifth free recall was the only one to yield more than one or two trivial errors, and was the first post-performance free recall to be analysed (FR2). Only the first working-through was used in the analysis, however, while the reconstructed passages were ignored. In August 2006 and June 2007, 32 and 42 months after the performance, the singer made two more free recalls that were analysed (FR3 and FR4). On these occasions no reconstructions were made; the singer simply worked through the song from start to end. The versions she notated were then compared with the score.

3. Analyses. Words and note-durations in each free recall were deemed correct or incorrect; pitches in FR2, FR3 and FR4 were also deemed correct or incorrect. Simultaneous errors involving note-durations and words were recorded, as were simultaneous omissions of words and melody, and omissions of rests. Two correlational analyses were made: a) between errors of *all* types made in performances from memory during practice and rehearsal (complete and incomplete) and the four free recalls, and b) between errors of *each* type made in the four free recalls.

3. RESULTS

3.1 Accuracy of Recall and Errors

Accuracy and errors are shown in Table 1, below. Exactly half the piece was recalled accurately in all four recalls.

Free recall 1 (FR1), December 03. The singer was able to notate the words and rhythms with 92% accuracy five days before the performance. The majority of errors (70%) concerned the recall and notation of rhythms; the remainder involved word errors and omissions. Twenty percent of all errors were corrected in all subsequent recalls; 0.05% were corrected in FR2 but repeated in FR3 and corrected again in FR4, 25% were corrected in FR2 but repeated in both FR3 and FR4, 20% were repeated in FR2 and FR3 but correct in FR4 and 0.05% were repeated in all subsequent recalls.

Free recall 2 (FR2), June 05. 75% of the piece was recalled correctly. This represents a significant decrease in recall since December 03 ($t = 5.47$, $p < .0001$). Apart from three pitch errors and two duration errors at switches the majority of errors involved omitting the words while preserving the melody and omitting the words and melody altogether. Twenty-two percent of all new errors were corrected in subsequent recalls, 35% were correct in FR3 but repeated in FR4, 17.5% were repeated in FR3 but correct in FR4 and 17.5% were repeated in both subsequent recalls.

Free recall 3 (FR3), August 06. There was a very slight, non-significant decrease in recall since June 05: 72% of the piece was recalled correctly. Apart from five pitch errors, which were not the same as those made in FR1 the majority of errors were durations (21%), forgetting the words but preserving the pitch if not the rhythmic/durational components of the melody

(28%) and forgetting both words and melody altogether (51%). Eighteen percent of all new errors were corrected in FR4 but 32% were repeated.

Free recall 4 (FR4), June 07. A further decrease in recall since August 06, nearing significance ($t = 1.87, p = .06$), was

observed: 66% of the piece was recalled correctly. The majority of errors were durations (26%), forgetting the melody but preserving the words (12%) or involved omitting words and melody simultaneously (57%). Fifteen percent were new errors.

	FR1		FR2		FR3		FR4	
	No.	% (all beats)	No.	% (all beats)	No.	% (all beats)	No.	% (all beats)
Beats recalled correctly (250)	230	92	187	74.8	179	71.6	164	65.6
Errors	20	8.7	63	25.2	71	28.4	86	34.4
		% (all errors)		% (all errors)		% (all errors)		% (all errors)
Pitch errors and omissions (words and durations preserved)	-	-	3	4.76	5	6.58	1	1.16
Duration errors (pitches and words preserved)	14	70	2	3.17	16	21.05	22	25.6
Pitch and duration errors (words preserved)	-	-	-	-	-	-	10	11.6
Word errors and omissions (pitches and durations preserved)	6	30	28	44.44	0	0	2	2.32
Word error (pitch and duration omission)	-	-	-	-	-	-	1	1.16
Simultaneous duration and word errors (pitches preserved)	0	0	1	1.58	21	27.63	1	1.16
Simultaneous omissions of words and melody	0	0	29	46.03	34	47.9	49	57

Table 1: Free recalls in December 03, June 05, August 06 and June 07

3.2 Correlations Between Errors During Preparation for Performance and the Four Free Recalls

There was no significant correlation between errors of all types made during preparation for performance and errors of all types in the four free recalls. There were, however, significant correlations between the latter. The significant correlation between errors of all types made in FR1 and FR4 ($r = .159, p = .012$) is attributable to word errors/omissions ($r = .188, p = .003$) and duration errors ($r = .133, p = .036$); between errors of all types made in FR2 and FR3 ($r = .166, p = .009$) to simultaneous omissions of words and melody in both ($r = .221, p < .0001$); between errors of all types made in FR2 and FR4 ($r = .394, p < .0001$) to simultaneous omissions of words and melody in both ($r = .325, p < .0001$) and between errors of all types made in FR3 and FR4 ($r = .403, p < .0001$) to pitch errors/omissions ($r = .235, p < .0001$), duration errors ($r = .196, p = .002$), word errors/omissions ($r = .191, p = .002$) and simultaneous omissions of words and melody in both ($r = .333, p < .0001$). There were also significant correlations between duration errors in FR1 and FR3 ($r = .241, p < .0001$).

4. DISCUSSION

4.1 Accuracy of Recall

The singer recalled a high proportion of the piece correctly, 18 and 32 months after the performance given in December 2003. This performance, given from memory, was prepared over the course of the prior four weeks. The singer had initially

performed the piece once before, but over 25 years earlier, and she had not looked at it in the interim. In the months after the 2003 performance, however, she annotated scores, transcribed recordings of practice and rehearsal sessions and analysed a variety of data arising from them. She also made two free recalls during this period, and two further free recalls the following year, which yielded very few errors. The first useful post-performance free recall (FR2) was made after four months, and the second post-performance free recall (FR3) was made after six months of not having carried out any analysis or writing associated with this research. There was a further six-month gap between preparing an earlier version of this paper and the third free recall (FR4).

In FR2 the singer either remembered the melody – relatively accurately, in relation to both pitch and rhythm – but forgot the words, or forgot the words and the music altogether. This is consistent with research by Ginsborg and Sloboda (2007) showing that expert singers are more likely to make ‘separate’ errors (preserving one component while making errors in or omitting the other) when they recall the words and melody of a song than ‘conjoint’ errors (where both words and melody are sung inaccurately), if simultaneous omissions of both are disregarded; if they are included in the analysis then conjoint errors are much more frequent.

In FR3 she remembered less of the song generally, and where she remembered the melody with or without the words there were likely to be rhythmic errors (within the phrase) or durational errors (note-lengths at the ends of phrases). She also omitted rests during short instrumental passages or ‘fills’.

In FR4, still less was recalled – about the same proportion as Gabriela Imreh's recall of the first page of the *Italian Concerto* in Chaffin et al. (2002). The first section after the final appearance of the refrain was omitted altogether and the last few phrases of the piece were recalled in very piecemeal fashion, one component at a time, with the bulk of the penultimate phrase completely forgotten.

4.2 Correlations Between Errors During Preparation for Performance and the Four Free Recalls

Correlations between errors during practice and rehearsal and in the four free recalls were non-significant. This is attributable to the very different nature of the two kinds of performance from memory. The free recalls involved imagined, single, performances (see below). The performances from memory during practice and rehearsal included short sections and subsections of the piece repeated many times at different stages of the learning process. These had many purposes other than recall, from ensuring that pitches and rhythms would be produced accurately to experimenting with different interpretive possibilities.

The correlational analysis, however, shows that the singer did make similar types of errors and omissions on the four occasions she undertook post-performance free recalls. One example is the passage she had found hardest to learn and memorize (judging by the number of errors she made during practice and rehearsal), which was secure by the time of the performance. This passage was remembered inaccurately in FR2, entirely forgotten by FR3, and once again remembered inaccurately in FR4. This could be for a number of reasons: it is the last section of the piece; it does not repeat musical material from earlier on, as do previous sections; it is metrically straightforward, unlike earlier sections; it is rhythmically more complex than earlier sections; the text is somewhat opaque. All these possibilities could be explored in future empirical research.

We have reported elsewhere (Ginsborg et al., 2006b) the results of a regression analysis using musical features and performance cues, both individual and shared – as predictor variables, and practice behaviour – start-beats, stop-beats and repetitions – as criterion variables. Future analyses will determine the extent to which errors are predicted by serial position from the locations of these landmarks.

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