All those words! Accounting for singers' memory

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Abstract

Classical singers face a formidable challenge. Not only must they fulfill the complex musical demands of the score and its associated technical difficulties, but (uniquely among performing musicians) they must also remember words. In a major operatic role or full length recital, this can mean thousands and thousands of words, which must be expressed in an affecting, characterful manner, according to a set rhythm that does not allow for hesitation. Singers are able to step in and replace ailing colleagues on short notice, even in a part they have not recently sung. To accomplish all of this, they must have verbatim recall of words and music over long periods of time. In this graduate forum, I propose an experiment investigating the optimum distribution of study events for the long range retention of sung verbal materials. Whereas distributed practice effects are well documented in the psychological literature, there have been few studies to date of distributed practice in musical performance, and none on the effect of distributed practice on singer's learning and memory over long intervals. An experimental design is proposed that compares the effects of 'massed' and 'spaced' learning on memory for a song after a six week period. As a further condition, lyric text without music is compared to a folk song setting to see if the constraints offered by melody can enhance the retrieval of words. Finally, current cognitive theories of singers' memory are examined and evaluated for relevance to singers' actual performance practice.

Singers face a formidable challenge. Not only must they fulfill the complex musical demands of the score and its associated technical difficulties, but (uniquely among performing musicians) they must also remember words. In a major operatic role or full-length recital, this can mean thousands and thousands of words, which must be expressed in a moving, characterful way, according to a set rhythm that does not allow for hesitation. Singers are able to step in and replace ailing colleagues on short notice, even in a part they have not recently sung. To accomplish all of this, they must have verbatim recall over words and music over long periods of time. My particular concern is how best to accomplish this.

In this paper I am going to review cognitive theories of expert memory; proceed to a discussion of musical memory; and then look at current theories of singers' memory. I will briefly describe my own research, which looks at how to space song practice to achieve maximum results; and then leave you with a few "take-aways" which I hope will be applicable to your own teaching and performing.

Musical Memory as Expert Memory

Musical memory is best understood as a kind of expert memory. Expert memory is largely a matter of three different factors: meaningful encoding of novel material, use of well-learned retrieval structures, and extended practice, which decreases the time necessary to retrieve the information from LTM (Ericsson et al., 1993).

It is well understood that mechanically repeating words does not help memory (Craik & Tulving, 1975). Considering the meaning or semantic content of particular words as compared to attending to their surface features (an example of this might be letter or vowel frequency, for instance) will help you remember (Craik et al., 1972).

Similarly, the most skilled musicians practice in a highly effective manner that is not simply mechanical repetition (Ericsson et al., 1995). In general, the probability that information will be recalled depends on the depth to which the information has been processed (Baddeley, 2004: 2). Depth of processing is aided through elaborative rehearsal, where the imaginative representation of the material to be remembered is thought about in different ways (Bellezza, 1996).

Meaningful elaborative rehearsal for musicians has been called 'deliberate practice' (Ericsson et al., ibid). Memorization through practice, however, will only be effective when the cuing mechanisms learned are meaningful retrieval structures, a deep processing condition (Segalowitz et al., op. cit.). Elaborative rehearsal allows the musician to create a rich structure of retrieval cues that allow for seamless, continuously unfolding performance. For musicians, however, this may involve something different from the attention to semantic contents that is characteristic of verbal memory strategies. Musicians have many ways of paying attention to meaning, other than using verbal description.

There are three kinds of retrieval structures that can be used to cue recall (Glenberg, 1979); they are contextual, structural-associative and descriptive. Elaborative rehearsal for a musician work may include all of these. For instance, the lived context of learning becomes unconscious contextual information that is associated with the notes. This has to do with where I was when I learned the material, how I was feeling, the feelings that the music evoked in me, or any other experiences coincident with learning the music.

Structural associative cues may be laid down through instrument-specific technical practice (Chaffin et al., 2002); elucidation of emotional character (Plunkett

Greene, 1912); structural analysis (Ginsborg, 2004); harmonic analysis (ibid); and narrative analysis (Shaffer, 1995); and this is by no means an exhaustive list. These can all be used without being consciously thought of, and may all be guided in turn by inner hearing (Hill, 2002).

Descriptive cues have also been used by musicians to describe and monitor the performance. In this context, they have been called performance cues (Chaffin & Imreh, 2002). They have been described in studies of instrumental performance, especially with regard to a pianist's memory for the third movement of the Bach Italian Concerto. This is an unusual work, a piece without rhythmic breaks where overt description may be necessary in order to safeguard against memory slips (ibid). The use of explicit, consciously thought-of performance cues by a cognitive psychologist/singer has been shown in rehearsal and performance (Ginsborg, 2006), but their use as retrieval structures for the general population of singers during performance has not otherwise been demonstrated.

In summary, any aspect the musician can imagine may serve as a retrieval cue, as long as it is meaningfully associated with the musical material. Elaborative rehearsal allows the musician to 'understand' the work by relating the ongoing articulation of detail to higher-level structures, whether harmonic, emotional, narrative, motivic, or what-have you.

Singers' Memory

Understanding of musical structure has been cited as the defining feature of musical memory. For example, it has been observed that musicians use structural analysis of the hierarchical organization of music into sections and subsections based on melodic, harmonic and metrical sections to guide practice, and ultimately, memory (Chaffin et al.,

2008). As mentioned above, although this claim has been empirically verified in research on pianists (i.e. Chaffin et al., 2002; Williamon et al., 2002 etc.), explicit structural understanding may not be the most relevant higher level grouping structure for singers (Rubin, 1997). Singers who are effective memorizers get right to the demands of performance. They do not usually analyze the music on a structural level, although they do have an implicit understanding of phrase structure (Ginsborg, 2002). They do not systematically memorize words separately from the music. Once the tune is familiar, they practice words and music together (Ginsborg & Sloboda, 2007). They are practicing performance.

Whereas explicit structural understanding has not been shown to be important for singers' memory processes, implicit structural understanding does play a significant role in melodic coding and retrieval, where words and music each act as a cuing mechanism for the other (Peretz, Radeau & Arguin, 2004; Schön et al., 2008). Implicit structural understanding is [3]"unconscious statistical learning" which keeps a record of regularities in the environment, and "structures unconscious expectation about environmental events" (Snyder, 2009: 109). It operates through associative chaining.

Associative Chains in Singers' Memory

A study of the oral tradition suggests that the dominant form of cuing for singers of ballad and epic is not semantic, but associative: "What is sung cues what is to be sung…. Local, implicit word by word cuing which is the dominant form of cuing in the oral traditions is easiest to discuss as a network of associations." (Rubin, 1997: 12). Recall of words and music is "serial recall guided by multiple constraints" (Ibid: 176) "with rhythm entering first as an overall organizing device known at the beginning of the piece, and with [5]meaning, imagery, and repetition of sound pattern operating only locally and acting later in the process." (Ibid: 94-95)

Ballads or epics have a single rhythmic pattern that is inferred from the structure

of the initial verses. Rhythm thus operates globally as a general constraint related to the genre of the chosen song (ibid: 176). Multiple constraints help singers remember the text far more effectively than any single constraint acting on its own (Rubin et al., 1989). In verse set to music these constraints function as retrieval cues. "Having many kinds of cues makes it much more likely that there will be a unique solution." (Rubin, 1997: 12). The constraints arise from meaning, imagery, and various sound patterns, including rhyme, alliteration, assonance, and rhythm. To these I would add the melodic contour, harmonic tension and release, and structure offered by the music.

"Music is a rich structure that chunks words and phrases, identifies line lengths, identifies stress patterns, and adds emphasis as well as focuses listeners on surface characteristics. The musical structure can aid in learning, retrieving, and if necessary, reconstructing a text" (Wallace, 1994: 1471).

Here is a summary of what we have learned about singers' memory through empirical methods: Singers learn to associate words with notes, largely through the operation of implicit understanding. Retrieval cues are formed based on constraints derived from the song lyrics and the musical structure of the setting. These associative elements combine with contextual elements in the learning environment, and any other structural cues added by the singer, (an example might be the emotional content of the words, or the physicality of performing the song) to enable a smooth, associative chain of cues in performance.

My own research deals with distributed learning for singers. Given the implicit operation of an on-going association of words with music through the constraints of the

poetic text and the musical setting, are there ways to enhance retrieval for singers? Is there a particular way to distribute my practice sessions to help me remember the words? In more formal terms, what is the optimal distribution of learning events for long-term retention of sung materials?

Distributed Learning in Vocal Performance

Distributed practice effects are a well-documented phenomenon in the psychological literature. In its simplest form, distributed practice describes the effect of changing the amount of time between study events on a subsequent measure of retention. For example, in massed practice, learning events are not separated (Cepeda, Pashler, Vul, Wixted & Rohrer, 2006: 354). This would be analogous to a single cram session before a performance.

Spaced practice allows for time to elapse between repetitions of the same item. For instance, given that you have to perform your song the next day, you might space the time you have for practice over two separate sessions, separated by half an hour, two hours, or even overnight. The time between successive study episodes is known as the inter-study interval, or ISI. The interval elapsed between the end of the last learning event and the subsequent test is called the retention interval, or RI. The spacing effect refers to the enhanced memory for items presented in a spaced over a massed condition. The effect of varying the inter-study intervals in a spaced condition has been called the lag effect.

Spacing the intervals between study sessions in relatively simple cognitive tasks (like remembering lists of words) can have a significant effect on memory at different retention intervals (Carpenter et al., 2012). Recent studies have shown a spacing effect in conceptually more difficult tasks, and tasks involving fine muscular coordination

(Carpenter et al. 2012). In general, the optimal spacing gap to enhance retention is 10-20% of the retention interval.

Distributed practice effects in music learning, involving both complex motor co-ordination and complex cognition, are largely unexamined (Simmons, 2011). The few existing studies have mostly evaluated musical learning using short piano and instrumental figures (Rubin-Rapson, 1940; Simmons and Duke, 2006; Allen, 2007: Duke et al., 2009; and Simmons, 2011). Results generally indicate the positive effect of sleep-based consolidation on learning for simple musical materials. I could find only one study of distributed practice effects for music memory at longer retention intervals, a study with inconclusive results done at York last year. For singing, with the added cognitive demands of accurate, rhythm-limited textual recall, the optimal distribution of study for long retention is yet to be determined.

Results of a small pilot study (n=4) I conducted last year at the RCM showed a very large difference in mean scores between singers who memorized a two verse song in two sessions, with a break of 15 minutes, compared to singers who memorized the same song with two study intervals spread out over a week. Singers who learned the song in two spaced learning sessions had a 94.1 % retention of correct notes and words after 6 weeks, compared to scores of 58.8% correct notes and words in the massed condition. The full scale experiment will examine song learning over three different learning schedules, using two learning sessions separated by 10 minutes, one week, and four weeks. Song retention will be tested at six weeks and at twelve weeks.

The Take-Away

All this is fine, but you might well ask, "What is the take-away from all of this in terms of my own teaching and concert preparation?"

1. Learn the tune first. In order to function as a retrieval structure for words, the tune must be in place before you attach words to it. Working memory, the memory system we use when learning new material, is a memory system of limited capacity. Don't overload your working memory while you learn by asking it to handle too many different modalities at the same time.
2. Don't bother writing out the words. Practice performance by singing the melody and words together. A lot.
3. Be clear in your intention to communicate something specific to someone specific. Studies of actor's memory indicate that the single most important element in actors' ability to remember verbatim large amounts of text is the intention to communicate (Noice & Noice, 1996?)
4. Embody your performance. Vocabulary words accompanied by music and gesture are learned more robustly for foreign language learners than through musical setting alone. A sincere expression of the text and music is an embodied expression. Allow feelings to dictate movement expressive of those feelings.
5. Musicians are expert in inducing feelings in themselves (Damasio, 1993?). Practice a meaningful emotional expression of the text through music. It will allow for a deeper processing of the material that will give you a more robust retrieval structure.
6. Thinking in words about the music will not help you as a performer, except in those unusual cases, where a marked parallelism in the score could function as a switch, leading you to make a wrong turn (Chaffin & Imreh, 1997). In those very rare cases, a semantic "performance cue" is necessary to assure memory security.
7. Imaginative rehearsal away from the piano, when combined with physical practice, can be as effective as instrumental practice alone (Bernardi et al. 2013). This has yet to be tested empirically with singers.
8. Learn your material to criterion at the first rehearsal, if at all possible, and quit once you have achieved the 95% correct level. Criterion learning means learning to a memorized standard of 95% correct. It is better to learn a smaller amount very well, than to learn a larger amount not so well.
9. The second encounter with the material should be at least a day later. There is already strong (but limited) evidence for a sleep-consolidation effect. Wait at least this much before practicing again.

Please stay tuned for the optimal distribution of multiple learning events! I don't yet know how expanding, equal or contracting learning schedules play out for learning song; I anticipate that the crucial element is learning to criterion and a delay

of at least 24 hours before the second learning episode. My research over the next few years should help to establish a "best practices" schedule for song learning.

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