

# **Solmization expertise correlates with superior pitch memory**

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A perícia na  
solmização  
correlaciona-se a  
uma memória de  
nível superior do  
parâmetro altura

## **Abstract**

Memory is a complex phenomenon, and musical memory is especially interesting because it can involve so many facets: a visual image of the score, an aural recollection of the melody, the kinesthetic response of a performer, an analytical understanding of the music's compositional structure, etc. This article investigates a possible verbal component of musical memory, specifically in the form of American-style moveable-*do* solfège. Solfège, the long-standing tradition of associating pitches with corresponding syllables, is one of the most fundamental verbal cues commonly used among musicians. The results of the two experiments presented here suggest that expertise in moveable-*do* solfège is advantageous when remembering pitch patterns, especially when these patterns are transposed. The significant positive correlation between demonstrated solfège ability and melodic discrimination performance supports the widely held pedagogical belief that training with a moveable solmization system benefits musicians.

**Keywords:** memory, encoding, solfège

## **Resumo**

Assim como a memória é um fenômeno complexo, a memória musical é particularmente interessante, pois pode envolver muitas facetas: uma imagem visual da partitura, uma reminiscência auditiva da melodia, uma resposta sinestésica de um instrumentista, uma compreensão analítica da estrutura composicional da música, etc. Este artigo investiga um possível componente verbal da memória musical, especificamente na forma do estilo americano do solfejo *dó* móvel. O solfejo, tradição sempiterna de associar notas com sílabas correspondentes, é um dos sinais verbais mais fundamentais comumente empregados entre os músicos. Os resultados dos dois experimentos apresentados aqui sugerem que a perícia no solfejo *dó* móvel é vantajosa para se lembrar padrões de altura, particularmente quando esses padrões são transpostos. A significativa correlação positiva entre a destreza demonstrada no solfejo e a *performance* de discriminação melódica sustenta o ponto de vista pedagógico amplamente acreditado de que o treinamento com um sistema de solmização móvel traz benefícios aos músicos.

**Palavras-chave:** memória, codificação, solfejo

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**M**usic exists in time, necessarily relying upon the listener's memory. Our musical memory enables us – among other things – to recognize a recurring theme, to notice that this theme has moved from the violins to the horns, to realize that the music has returned to its original key, and to hypothesize that the alternating tonic and dominant chords we are hearing signal that the movement is nearly over. Our capacity to remember aural events is critical to our musical understanding. But what is a musical memory? Although most of us feel that we can play back music in our minds, we probably do not store music as simple auditory sensations. Psychologists agree that our capacity to store purely sensory memory without interpretation is quite finite: sensory memory is essentially a buffer holding only a few seconds of information, and the upper limit of short-term memory is believed to be about thirty seconds. Clearly music must engage other forms of memory.

Language is an especially long lasting and stable means for preserving information; verbal rehearsal and elaboration are well established techniques for enhancing memory. Previous research has shown that non-musical sounds seem to be retained in the form of verbal labels (Bower & Holyoak, 1973; Bartlett, 1977; Lawrence, 1979), and that these labels are more effective when they involve meaningful interpretations (Ferrara, Puff, Gioia, & Richards, 1978; Delis, Fleeer, & Kerr, 1978). Yet there is also evidence that verbal encoding can degrade

or “overshadow” our memories of fundamentally nonverbal experiences (Melcher & Schooler, 1996). We are only beginning to investigate the role of verbal encoding specifically in musical memory, but there is growing evidence that verbal encoding of music is common among trained musicians, and that consequently a musician’s musical vocabulary may influence the way in which he or she remembers music.

Solfège, the long-standing tradition of linking pitches with corresponding syllables, was identified as a suitable starting point for such investigations because it is one of the most fundamental verbal cues used among musicians. This article will present a pair of experiments that focus on how the accuracy of a listener’s pitch memory correlates with his or her ability to identify pitches in moveable-*do* solfège.

## **Subjects**

Participants in both experiments were enrolled in Musicianship and Theory III at the University of Iowa School of Music. These students volunteered in exchange for extra course credit. The 15 participants in Experiment #1 (7 male, 8 female) ranged in age from 19 36 years (average age 21.1 years). The 19 participants in Experiment #2 (9 male, 10 female) ranged in age from 19 28 years (average age 20.8 years). All had received at least one year of training in American-style moveable-*do* solfège.<sup>1</sup>

Participants took two post-tests at the conclusion of the experiment; the first determined whether they possessed absolute pitch, and the second assessed their solfège abilities. All participants were shown not to have absolute pitch: scores on a ten-pitch pre-test ranged from 0 3 correct identifications with an average of less than one correct identification.

## **Stimuli**

Participants in both experiments heard two pitch sequences separated by an interference pattern; their task was to indicate whether paired sequences were

the same or different. In Experiment #1, paired sequences were either exactly the same or differed by one note; in Experiment #2, paired sequences were either exact transpositions of one another or transpositions that differed by one note. In all other respects, the two experiments were identical.

Each stimulus consisted of an attention signal, a spoken question number, a seven-note pitch pattern with a rising and falling contour (henceforth, the *standard series*), an interference pattern that served as a minor distraction, and another seven-note pitch pattern with a rising and falling contour (henceforth, the *comparison series*). Each stimulus was followed by five seconds of silence during which listeners indicated whether the two pitch patterns were the same or different by circling numbers on a printed response sheet. Representative stimuli are diagrammed in figures 1a and 1b. Before the experiments began, participants were informed that all pitch patterns were seven notes in length, consisted mostly of notes within a single major key, began on the tonic, rose to a peak on the tonic an octave higher, and descended back to the lower tonic for the final note. Participants in Experiment #2 were also told that the second pitch pattern would be transposed from the first, but would otherwise differ by no more than a single note. Sample questions were provided to be sure listeners were adequately prepared.

There were six stimulus categories (illustrated in figure 2) and three realizations of each category, yielding a total of eighteen stimuli that were repeated throughout their respective experiments. The standard series was exclusively diatonic half of the time and included a single chromatic note the other half of the time. Notice that each pitch series – both standard and comparison – employed either seven diatonic pitches or six diatonic pitches and one chromatic pitch. The comparison series either matched the standard series exactly (in the case of a *target*) or differed by one note (in the case of a *lure*). Pitch substitutions in lures fell into four distinct categories: one diatonic note replaced by another, a diatonic note replaced by a chromatic note, a chromatic note replaced by a diatonic note, and one chromatic note replaced by another. In Experiment #2, all comparison series were transposed up a tritone, but were otherwise equivalent to those illustrated in figure 2.

The three different realizations of each stimulus category formed three distinct stimulus “families.” Members of each family had at least six pitches in common; only the seventh note was varied as described above. In figure 2, lines A, E, and G are members of one family; lines B and D are members of another family; lines

	<b>Standard Series</b>	<b>Interference Pattern</b>	<b>Comparison Series</b>	
Warning signal and spoken question number	<p>entirely diatonic </p> <p>entirely diatonic </p> <p>entirely diatonic </p> <p>one chromatic note </p> <p>one chromatic note </p>	<p>silence</p> <p>spoken solfège <i>re, sol, ta, fa, do, mi ...</i></p> <p>spoken intervals <i>major third, augmented second ...</i></p> <p>spoken neutral words <i>bird, car, tree, oil ...</i></p> <p>sung diatonic pitches  <i>do re do re do re do ...</i></p>	<p>no change </p> <p>diatonic-diatonic </p> <p>diatonic-chromatic </p> <p>chromatic-diatonic </p> <p>chromatic-chromatic </p>	<p>silence (Listener circles response)</p>
2 sec.	7 sec.	10 sec.	7 sec.	5 sec.

Figure 1a – Framework of stimuli used in the Experiment #1



	Standard Series:	Comparison Series:
A. Standard series is entirely diatonic, comparison series is identical/equivalent Designation: Target		
B. Standard series is entirely diatonic, comparison series substitutes one diatonic note Designation: Lure (Diatonic-Diatonic)		
C. Standard series is entirely diatonic, comparison series substitutes one chromatic note Designation: Lure (Diatonic-Chromatic)		
D. Standard series includes one chromatic note, comparison series is identical/equivalent Designation: Target		
E. Standard series includes one chromatic note, comparison series replaces it with a diatonic note Designation: Lure (Chromatic-Diatonic)		
F. Standard series includes one chromatic note, comparison series replaces it with another chromatic note Designation: Lure (Chromatic-Chromatic)		
G. Example of entirely diatonic target from Experiment #2 (compare to line A above):		

Figure 2 – Stimulus categories (six examples from Experiment #1 and one from Experiment #2)

C and F are members of the third family. The purpose of these families was to minimize unintended variables: each category of pitch substitution occurred within an otherwise identical context.<sup>2</sup> Each stimulus was heard four times during the course of the experiment, associated once with each of the four interference patterns (spoken solfège syllables, spoken interval names, spoken words unrelated to music, and sung diatonic pitches), forming a repeated measures design.

## Responses and Scoring

Participants were asked to listen to each pitch series pair, decide whether the standard and comparison series were the same or different, and indicate their responses by circling numbers on their printed response sheets:

- 1 = I'm sure the two are different
- 2 = I think the two are different
- 3 = I'm guessing the two are different
- 4 = I'm guessing the two are the same
- 5 = I think the two are the same
- 6 = I'm sure the two are the same

Each response contains both a same/different evaluation and a measure of confidence (i.e., “sure,” “think,” and “guessing”).

For clarity, circled responses were converted to scaled scores that reflect whether, and with how much confidence, participants judged the stimulus correctly. A score of 2.5 represents a correct response (i.e., either “hitting” a target or correctly rejecting a lure) at the highest level of confidence, 2.5 represents an incorrect response (i.e., either a “miss” or a “false alarm”) at the highest level of confidence, and all other responses fall at one-point intervals in between.<sup>3</sup> For example, if a note had been changed on the comparison series and a participant circled 2 – “I think the two are different” – this would be scored as 1.5. A response of 4 for the same stimulus would be scored as -.5. No individual response is recorded as a zero, but it is possible for multiple responses to average at zero, indicating chance performance.

## Hypotheses

Both of these experiments rely on the central assumption that most listeners find naming diatonic pitches easier than naming chromatic pitches. Therefore, the first prediction is:

- Diatonic pitches will be correctly identified on the solfège post-test at higher rates than will chromatic pitches.

Listeners who use verbal encoding strategies to help them remember the standard pitch series and evaluate the comparison pitch series will find some stimuli more difficult than others because diatonic notes will be easier to encode than will chromatic notes. Consistent with the belief that verbal encoding is common among musicians, the following effects are also predicted:

- Lures exchanging two diatonic (easily named) notes will be correctly rejected at higher rates than will lures exchanging two chromatic (less easily named) notes.

- Lures involving the exchange of diatonic and chromatic notes will be correctly rejected at relatively high rates.

- Targets that are entirely diatonic will be recognized at higher rates than will targets that include a chromatic note.

If listeners employ verbal encoding specifically in the form of solfège syllables, we may furthermore expect to observe the following results:

- Listeners who score higher on the solfège identification post-test will also score higher in experimental trials.

- Scores associated with the spoken solfège syllable interference pattern will be lower than scores associated with the other interference patterns.

If, contrary to the research hypothesis, listeners rely on uninterpreted memories of the pitches themselves rather than on any form of verbal encoding, all stimuli should be of equal difficulty and no significant differences will be observed.

## Results and discussion

The solfège identification post-test confirmed the central assumption that diatonic pitches were more easily namable than chromatic pitches: as expected,

significantly more diatonic notes than chromatic notes were aurally identified by the listeners. Also as hypothesized, a significant positive correlation was observed between listeners' solfège identification scores on the post-test and their performance on the pitch-series recognition test. This correlation between the ability to identify notes in solfège and the ability to recognize a series of pitches suggests that verbal encoding in the form of solfège syllables may be beneficial for remembering pitch patterns. The correlation was stronger in Experiment #2 ( $r = .553$ ,  $p = .01$ ) than in Experiment #1 ( $r = .512$ ,  $p = .01$ ), indicating that solfège syllable encoding may be particularly helpful in recognizing transposed pitch patterns. This is not surprising, given that storing specific pitches in a purely sensory strategy would be completely ineffective in this experiment because of the tritone transposition. The ability to name chromatic pitches appears to have been especially helpful in Experiment #2, where the correlation between chromatic pitch identification and overall performance rose to  $.634$  ( $p < .01$ ) – a strikingly strong correlation for such a small subject pool.<sup>4</sup>

These experiments focused specifically on moveable-*do* solfège because it reflected the subjects' training. One might reasonably expect to obtain similar results from an essentially identical experiment that focused on scale-degree numbers and involved participants whose education included substantial aural training with scale-degree numbers. However, one advantage of American-style moveable-*do* solfège is that it conveys chromatic inflection: for instance, a sharp *fa* is pronounced *fi*, and a flat *la* is pronounced *le*. Because scale-degree numbers do not traditionally convey chromatic inflection (for instance, in C major, both F and F# are typically called 4), it is possible that listeners trained exclusively on scale-degree numbers would perform somewhat differently.

The stimuli used in the main body of both experiments were specifically designed to detect verbal encoding. As described earlier, pitch substitutions fell into one of four categories: one diatonic note substituted for another, a chromatic note substituted for a diatonic note, a diatonic note substituted for a chromatic note, and one chromatic note substituted for another. For listeners who encode pitches as solfège syllables, stimuli exchanging two chromatic notes should be especially difficult, given that chromatic notes were shown to be less “namable” for these participants. Listeners who rely solely on uninterpreted aural memory, on the other hand, should find all stimuli comparably difficult. As hypothesized, listeners were better able to identify exclusively diatonic targets, although the difference

fell just short of statistical significance. The effect of chromaticism on correct rejection rates for lures was more complicated.

Figure 3 depicts the scaled responses for the four categories of lure, illustrating the effect of chromaticism on correct rejection rates. The “diatonic” and “chromatic” labels in this figure refer to the changed note in the standard and comparison series, respectively; for instance, “diatonic-chromatic” refers to a diatonic note being replaced by a chromatic note. As shown, lures replacing a diatonic note with a chromatic note were correctly rejected at rates that were higher than those for any other lure category. This was true in both experiments and was consistent across all levels of participant solfège ability. Conversely, lures replacing a chromatic note with a diatonic note were correctly rejected at lower rates than were other lures (although the differences were not all significant in Experiment #2).

It seems that listeners with lower solfège ability had much greater difficulty remembering chromatic notes in the standard pitch series: listeners with low scores on the solfège post-test rejected lures at near-chance levels in Experiment #1 and at below-chance levels in Experiment #2 when the single chromatic note from the standard series was replaced by a diatonic note on the comparison series. I believe that these listeners had a tendency to “correct” nondiatonic notes in the standard pitch series, and when the comparison pitch series matched this mentally corrected standard they responded that the two series were the same. From my experience, weaker students often exhibit this tendency to misremember music that violates their expectations. At the opposite extreme, introducing a chromatic note in the comparison series resulted in slightly higher correct rejection rates. Perhaps a chromatic (and less easily namable) note was more likely to stand out as “new”, resulting in more frequent responses that the standard and comparison series were different. Consistent with this interpretation, participants in the lowest solfège category were also more likely to reject targets mistakenly when they included a chromatic note, although this difference fell short of statistical significance.

In addition to considering the trends by group, we can focus more specifically on whether individual listeners were able to name most of the notes in any given question. In both experiments, stimuli including the highest percentage of namable pitches (as determined by each participant’s post-test) also received the highest scores. We can even narrow our focus further, asking whether individual listeners were able to name the changed notes in any particular lure. These results are

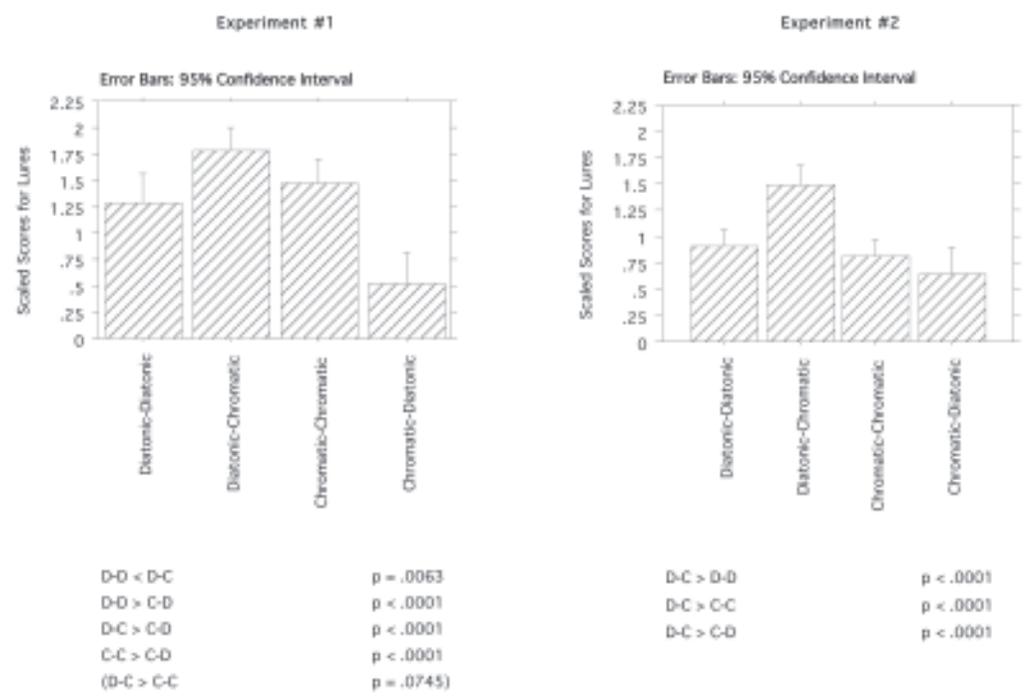


Figure 3 – Main effect of pitch substitution category on correct rejection rates for lures

depicted in figure 4. Scores were highest when listeners correctly identified both notes involved in the exchange and lowest when they weren't able to identify either note. Identifying one note was helpful, especially if it belonged to the standard series. In fact, identifying the missing note was almost as good as identifying both notes. It is possible that verbal encoding is particularly helpful in remembering a note that is missing. Alternatively, and consistent with theories of short-term memory, the advantages of verbal encoding may become more evident after a greater time delay; the standard pitch series demanded longer retention because it was heard first. Specifically identifying the substituted note in the comparison series was less critical because it needed only to stand out as new.

Of course, solfège syllables aren't the only widespread form of verbal encoding. Listeners could have been identifying the intervals between the notes, for instance. Listeners employing this strategy might find lures relatively easy, since changing a single pitch affects two of the six intervals in any given series.<sup>5</sup> Also, these listeners would presumably perform best on lures that displaced notes by a relatively large distance, thereby unambiguously changing interval sizes. (Obviously, a small change also affects intervals, but we have to consider the possibility that listeners might be employing only generic interval names such as "third" or "fourth.") My stimuli in these experiments were designed to address this possibility: all lures moved notes from the standard series by one, two, or three semitones.

Figure 5 displays the results. In Experiment #1 we can see that the smallest possible displacement was hardest to detect, suggesting that listeners may, indeed, have been comparing interval sizes, although the results are also consistent with simple sensory storage. On the other hand, in Experiment #2 the opposite trend is evident: relatively large displacements were hardest to detect.<sup>6</sup> Furthermore, there was some interesting interaction between substitution category and displacement interval. In Experiment #1, when one chromatic note was replaced by another, a two-semitone displacement was significantly harder to detect than was a three-semitone displacement; however, when one diatonic note was replaced by another, a two-semitone displacement was significantly easier to detect than was a three-semitone displacement. I believe this is because in tonal music pitches a minor third apart (three semitones) are likely to have the same harmonic function, whereas pitches a whole step apart (two semitones) are not. Similarly, the fact that chromatic notes replacing diatonic notes were less

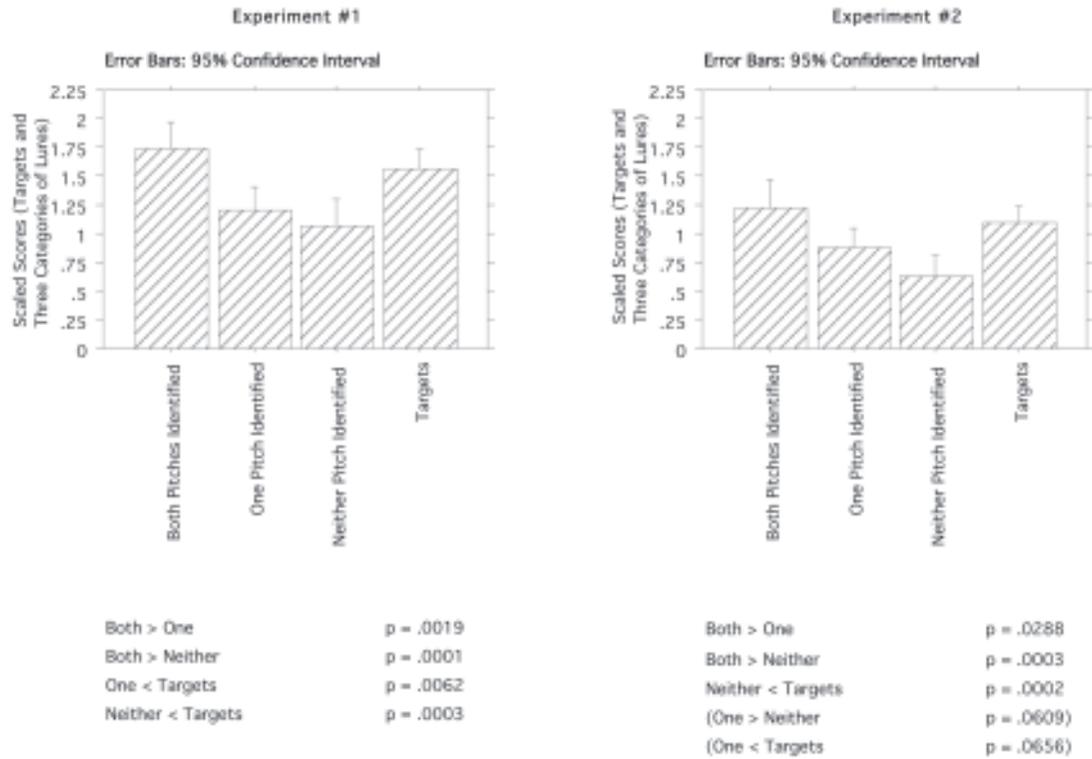
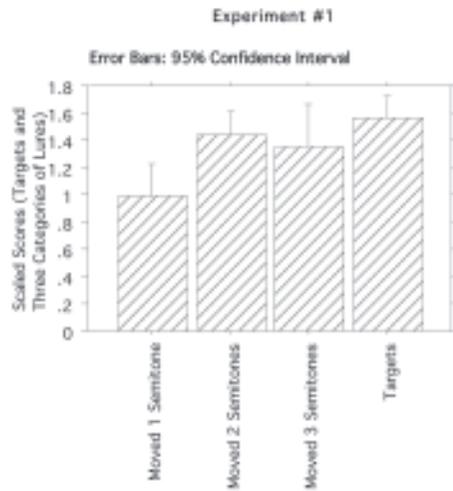


Figure 4 – Main effect of correctly identifying exchanged notes on correct rejection rate for lures



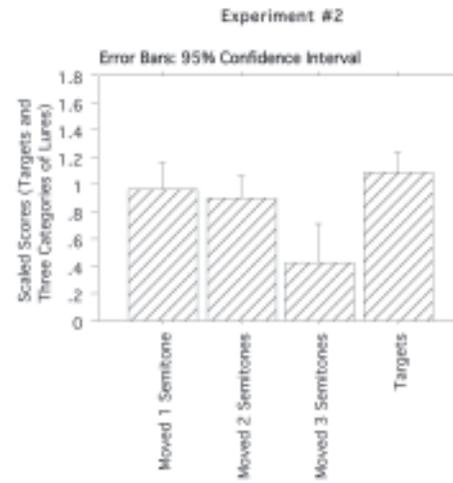
Moved 1 < Moved 2       $p = .0015$   
 Moved 1 < Targets       $p < .0001$   
 (Moved 1 < Moved 3)       $p = .0556$   
 Lures < Targets       $p = .0063$

Chromatic-Chromatic lures only:

Moved 2 < Moved 3       $p = .0235$

Diatonic-Diatonic lures only:

Moved 2 > Moved 3       $p = .0195$



Moved 1 > Moved 3       $p = .0014$   
 Moved 2 > Moved 3       $p = .0036$   
 Moved 3 < Targets       $p < .0001$   
 Lures < Targets       $p = .0138$

Diatonic-Chromatic lures only:

Moved 1 < Moved 2       $p = .0146$

Diatonic-Diatonic lures only:

Moved 2 > Moved 3       $p = .0174$

Figure 5 – Main effect of changed note's displacement interval on correct rejection rate (for lures)

likely to be detected when they were only a half-step away may reflect the familiar tonal phenomenon of mode mixture, which also generally maintains harmonic function. Holleran, Jones, & Butler (1995), among others, have discussed the tendency for listeners not to notice melodic changes when the perceived harmony remained the same. Their stimuli were melodies specifically designed to create a strong sense of harmonic function, but the stimuli in this experiment were not intended to create a sense of harmonic function, nor were they even truly melodic. This suggests that listeners' implicit knowledge of harmony may have greater effects on musical memory than previously realized, especially when uninterpreted aural memory is not a viable option (given that Experiments #1 and #2 were identical except for the use of transposition in Experiment #2).

The interference patterns used in this experiment were designed to detect verbal encoding. Sung pitches were presumed to be most distracting to listeners who rely primarily on sensory memory, whereas spoken solfège syllables and/or spoken interval names were presumed to be most distracting to listeners who employ verbal encoding. (Since these participants had received substantially more solfège training than interval training, it was assumed that those listeners who used a verbal strategy would be more likely to rely on solfège.)

Contrary to the research hypothesis, no significant differences were observed among the four categories of interference pattern for either experiment. However, other researchers have reported a variety of effects stemming from the use of interference patterns in musical experiments; see, for instance, Deutsch (1970) and Pechmann & Mohr (1992). My own experiments were patterned after Mikumo (1992), who also used four interference patterns: a twelve-note melody, a series of spoken note names, a series of spoken nonsense syllables, or a silent pause.<sup>7</sup> When associated with tonal melodies, Mikumo found that the note-name interference pattern produced significantly lower accuracy rates for music majors than did the silent pause or the nonsense syllables, suggesting that these listeners employed a verbal encoding strategy.<sup>8</sup>

In light of these three previous experiments, why did the experiment in this article find no main effects for interference patterns? Perhaps remembering a single pitch (as in Deutsch, 1970) typically involves different strategies from those used to remember a more complex stimulus like a melody. However, this does not explain why my results differ substantially from Mikumo's. One possibility is that my neutral words interference pattern was not equivalent to Mikumo's

nonsense syllable interference pattern: meaningful words may impact memory to a greater extent than do meaningless words, even if the meaningful words are not related to the stimulus itself. Also, my pitch stimuli were less typically melodic than Mikumo's, due both to their uniform contour and especially to their lack of a traditional underlying harmonic progression. Perhaps musicians are more likely to rely on sensory storage and non-verbal forms of encoding for stimuli that do not conform to traditional melodic expectations.<sup>9</sup> Finally, because Mikumo did not indicate whether her participants were absolute pitch possessors, it is impossible to determine the extent to which her note-name interference pattern was equivalent to my solfège interference pattern.

## Summary and Conclusions

These experiments suggest that musicians employ verbal encoding when comparing two pitch series. More specifically, the ability to identify notes with solfège syllables appears to be beneficial for pitch-series recognition tasks.

- A correlation was observed between performance on the experimental trials and performance on the solfège identification post-test.
- Stimuli were more likely to be correctly recognized or rejected when at least twelve of their fourteen notes were correctly named during the solfège identification post-test.
- Lures were more likely to be correctly rejected when participants correctly named the replaced pitch on the solfège identification post-test.

The results also suggest that listeners may rely on harmonic cues when comparing transpositions: listeners in Experiment #2 were least able to detect lures that displaced a single note by three semitones. However, when no transposition was involved, listeners were least able to detect lures that displaced a single note by one semitone. Contrary to the research hypothesis, the four interference pattern categories produced no significant main effects.

Music theorists should be concerned about the role that verbal labels play in aural memory. Our classroom teaching necessarily relies on verbal communication, and we devote a substantial portion of our core curriculum to verbal labels such as solfège syllables, interval names, triad qualities, cadence

types, harmonic categories, and formal elements. Even basic analytical terms like these can enhance musical memory as long as the aural connections are sufficiently reinforced. Vocabulary training, it seems, may be an important but often overlooked component of an effective ear-training program, because although we may only think of ourselves as providing a way to communicate effectively with other musicians (a worthy goal in its own right), we are also providing a means for recalling and recognizing music beyond the extremely brief limits of sensory memory.

The experiments presented therefore have important pedagogical implications, particularly regarding the relationship between traditional written theory classes and aural skills classes. True coordination, in my opinion, involves much more than similar content and pacing; it means carefully and deliberately linking concepts and techniques in order to promote the development of effective cognitive strategies. We must choose solmization systems that support our concept of musical building blocks, develop vocabulary that leads to helpful perceptual categories, engage in activities that promote the clear understanding and habitual use of these categories, and demonstrate how students can continue to refine and build upon this work long after they have left our classrooms.

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## Notes

<sup>1</sup> In moveable-do solfège (which is commonly used in the United States), the tonic note of any key is called do, 2<sup>^</sup> is called re, 3<sup>^</sup> is called mi, and so on; for instance, in D major, D is called do and A is called sol, whereas these same notes would respectively be called fa and do in A major. Most practitioners of moveable-do solfège convey chromatic inflections with a systematic change in vowel: for instance, #1<sup>^</sup> is di, #2<sup>^</sup> is ri, and #4<sup>^</sup> is fi, while b7<sup>^</sup> is te, b6<sup>^</sup> is le, and b3<sup>^</sup> is me. Similar results might be observed if the experiment focused on scale-degree numbers and involved subjects who routinely used scale-degree numbers. This will be discussed.

<sup>2</sup> A complete set of paired standard and comparison pitch series is provided in the appendix.

<sup>3</sup> This change in scoring does not affect the experimental results, because in either case responses are expressed on an equally-spaced six-point scale. The primary advantage of this system is that there is no need to remember whether 1 or 6 was the “most correct” response for any given stimulus.

<sup>4</sup> In Experiment #2, the association between solfège ability and high scores was stronger among juniors and seniors than it was among sophomores, and this interaction was significant. Although it would be dangerous to extrapolate from such a small sample, these results suggest that verbal encoding may be more common among more educated (and/or older) listeners. Further research on the possible correlation between verbal encoding and education (or age) is warranted.

<sup>5</sup> Recall that the first and last pitches of the standard series – which would have affected only a single interval – were never changed.

<sup>6</sup> This trend was particularly strong for participants who had the best overall performance on the pitch-series recognition test.

<sup>7</sup> Because Mikumo’s experiment was conducted in Japan, the note names were, in fact, spoken solfège syllables reflecting the fixed-do tradition. In general, Mikumo’s experiment seems to have emphasized absolute pitch rather than relative pitch. Not only did the interference patterns focus on note names, but Mikumo’s subjects were also asked to consider exact transpositions as different, whereas exact transpositions in my Experiment #2 were regarded as the same.

<sup>8</sup> When associated with atonal melodies, Mikumo found that the interfering melody produced significantly lower accuracy rates for music majors than did the silent pause, suggesting a purely sensory strategy (i.e., storing the sound itself without interpretation). For non-music majors, there were no significant differences among the four interference patterns under either the tonal or the atonal condition, suggesting that these listeners had no effective encoding strategy for melodies.

<sup>9</sup> Consistent with this explanation, Mikumo found that for atonal melodies the pitched interference pattern produced significantly lower accuracy rates for music majors than did the silent pause, suggesting a sensory strategy (i.e., storing the sound itself without interpretation).

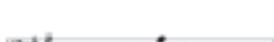
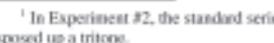
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Appendix

Repeated stimuli used in Experiment #1<sup>1</sup>

	Standard Series:	Comparison Series:
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		

<sup>1</sup> In Experiment #2, the standard series were identical and the comparison series were transposed up a tritone.