

Correlating Musical Memorization Styles and Perceptual Learning Modalities

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Abstract

The purpose of this research was to determine whether there was a correlation between musicians' perceptual learning modalities and preferred memorization styles. College instrumentalists (n = 82) completed the Musical Memorization Inventory (MMI) designed to measure preferred memorization styles (aural, visual, kinesthetic) and the Learning Styles Test (LST) and Vark Questionnaire designed to measure preferred learning modalities (aural, visual, kinesthetic). Generally, weak correlations were found between preferred learning modalities and memorization styles with only visual learners tending to prefer visual memorization strategies ($r = .34$). Visual learners tended to use visual memorization strategies more frequently; however few musicians used visual strategies in isolation (2.53%) rather combining visual strategies with kinesthetic (22.78%) and kinesthetic and aural strategies (16.46%). Based on the results of this study, strategies used for memorizing music are, to a large extent, independent of learning modality preferences.

Perceptual learning modalities (also known as modes or styles) refer to the way information is extracted from the environment during learning to aid perception, organization, and processing. There are many ways of defining the construct of learning style, but one common system emphasizes the perceptual or sensory input of information: aural (or auditory), visual, and kinesthetic (or tactile). While individuals may exhibit a personal preference for one modality, some individuals can easily alternate between multiple modalities or exhibit no dominant style (Barbe, Swassing, & Milone, 1979). Organization of information during learning is often unconscious and is engaged in without the awareness that a choice of learning style has been evoked, though it can be made conscious through training. In education, tailoring learning tasks to the dominant learning style of a student is commonly advocated (e.g., Barbe, Swassing, & Milone, 1979; Carbo, 1984).

In music settings, aural, visual, and kinesthetic approaches can be applied to discussions of perceptual learning in addition to memorization. Aural memory is the ability to hear the notes of a piece of music in the proper order without relying on a sound source or notational cues. The ability to recognize a performed passage as correct or incorrect also relies on aural memory. Visual memory is the ability to recall a mental picture of musical notation, visualize finger patterns, or hand positions on an instrument. Visual memory is often thought of as photographic memory, but a full-scale mental “photograph” of the notation is not necessarily required in the use of visual memory. Kinesthetic memory is the retention of muscular movements involved in performing a piece of music.

The similarity of terminology between perceptual learning modalities and memorization styles (aural, visual, and kinesthetic) and a similarity in constructs (identifying multiple ways of processing information from the environment) may suggest a link. However, little attempt has been made to connect these two constructs. The purpose of this research was to determine whether there was a correlation between musicians’ perceptual learning modalities and memorization styles.

Survey of Literature

Distribution of Musical Memorization Styles

When discussing musical memorization, three styles are commonly discussed: aural, visual, and kinesthetic. Though much discussion of these strategies exists in the pedagogical literature¹, there has been little research concerning the use of various sensory memorization styles. It is generally accepted that these strategies interact to various degrees and a combination of

¹ A content analysis of 121 pedagogical articles, concerned with the musical memorization process published since 1900, revealed that 60% focused on the use of aural, visual, and kinesthetic memory styles when memorizing. Of these, 51% advocated the use of a mixture of styles for a more efficient and/or stable memory.

strategies results in a more secure memory (e.g., Johansen, 2005; Jordan-Anders, 1995; Magrath, 1983; Proctor, 2001). However, there is little research on the topic and no research supporting an increase in memorization stability or efficiency when music is memorized using a combination of styles.

Despite the widespread discussion of memory styles in the pedagogical literature, only a few researchers have reported data on the use of aural, visual, and kinesthetic memorization styles (Chaffin, Imreh, & Crawford, 2002; Jones, 1990; Neagley, 1936; Rickey, 2004). Distributions vary widely, but most musicians report the use of a mixture of styles (Jones: 90%; Rickey: 47%) rather than the use of one memorization style in isolation. Neagley reported a more even distribution with 36% of musicians reporting use of visual memory, 35% kinesthetic, and 25% mixed styles. Most musicians reported using a mixture of memorization styles; however, a closer investigation of the reports indicated that some combinations were more common than others. Visual in combination with aural (Neagley: 14%; Rickey: 25%) or kinesthetic (Neagley: 81%; Rickey: 25%) appeared the most common.

Musicians did not report the widespread use of aural memory in isolation (Neagley: 5%; Chaffin, et al: 0%; Jones: 0%; Rickey: 6%), which may be surprising as music is primarily received through auditory channels. However, when Hallam (1997) interviewed professional musicians, advanced students, and novices to determine, in part, the use of aural, visual, and kinesthetic strategies, all professional and advanced musicians (100%) reported using aural memory and kinesthetic memory. Though not all novice musicians reportedly used aural and kinesthetic memory, most did (visual: 86%; kinesthetic: 92%). Visual memory was reportedly used to a lesser extent by all musicians with 45% of professionals, 33% of advanced students, and 28% of novices reporting the use of visual memory.

Rickey (2004) both observed and interviewed class pianists to classify the participants based on memorization style. Visual or kinesthetic methods were observed to be the most commonly used when memorizing; however, when interviewed, the participants indicated visual and *aural* (rather than kinesthetic) were the most dominant. Many participants (29%) added aural memory as frequently used even though its usage was not observed in during practice – possibly because use of aural memory might be expected as music is an aural medium.

In general, musicians appear to report the use of a mixture of memorization styles, most frequently visual combined with aural or kinesthetic. When reporting the use of one memorization style in isolation, visual and kinesthetic appear more frequently used than aural.

Distribution of Perceptual Learning Modalities

Research concerning perceptual learning modalities is extensive in the educational literature and an exhaustive review is beyond the scope of this paper. However, a number of researchers have attempted to study the effects of perceptual learning modalities in musical situations (e.g., Dunn, 1994; Saunders, 1991). Themes in musical research echo themes in education at large, focusing on identifying the distribution of dominant perceptual learning modalities, investigating the effects of perceptual modality on musical tasks, and matching teaching strategies to dominant learning styles.

Reports of the distribution of perceptual modality strengths in the general population have been varied. Table 1 summarizes information from studies of perceptual learning modalities from music-related research. As with memorization styles, distributions vary between studies. Unlike memorization styles, using a mixture of styles does not emerge as the dominant choice

(Dunn: 25%; Sanders: 13%). Each perceptual learning modality emerged as the dominant style in one or more studies only to be the least utilized modality in another.

One unexpected finding was that musicians' dominant perceptual learning modality or memorization style was not necessarily aural. As music is primarily obtained through auditory input, many researchers tested the hypothesis that talented musicians would favor aural presentation of materials or that auditory learners would be better musicians. Neither hypothesis has been supported in the literature. Sanders (1991) found no significant difference in music achievement based on dominant learning modality and Falkner (1994) found that third graders with high musical aptitude were primarily visual and kinesthetic learners rather than aural learners. Similarly, Kreitner (1981) found that musically talented junior high school choral students were predominantly kinesthetic and visual learners with fewest demonstrating

Table 1. *Distribution of perceptual learning modalities reported in music-related research. All results are reported in percentages.*

Researcher, Date	Aural	Visual	Kinesthetic	Mixed
Dobbs, 1989	24	28	14	34
Dunn, 1994	19	50	6	25
Falkner, 1994	22	29	50	x
Gates, 1993	33	11	13	43
Gates, 1993 (pilot)	4	40	34	33
Hughes, 1990	26	39	35	x
Kreitner, 1981 (SBMI)	14	24	7	55
Kreitner, 1981 (LSI)	12	0	31	58
Pautz, 1989	18	33	18	31
Persellin, 1988	27	43	12	18
Persellin & Pierce, 1988	42	50	8	x
Sanders, 1996	34	50	3	13

x = not included as an option in the study.

SBMI = *Swassing-Barbe Modality Index*

LSI = *Learning Styles Inventory*

preference for auditory learning. Apfelstadt (1986) found most second grade students' vocal accuracy was related to learning modality with visual learners demonstrating significantly higher

pitch accuracy and auditory learners demonstrating the lowest vocal accuracy. Sanders (1996) found only moderate relationships between scores on *Primary Measures of Music Audiation* (PMMA) and auditory scores on a learning styles inventory (tonal: $r = .52$; rhythmic: $r = .45$) however, higher correlations were found between kinesthetic scores and the PMMA rhythmic test ($r = .73$). Dobbs (1989) found second grade students' scores on the PMMA were related to dominant learning modality; with those preferring kinesthetic and mixed modalities scoring highest and aural learners scoring lowest. Finally, Hughes' (1990) found that the *weakest* singers were those identified as aural learners.

These findings may be explained partially when noting that while listening may be a primarily auditory behavior, performance of music is not. When performing music, auditory feedback is compared with an internal representation of the music, but performance also includes visual input from printed notation and/or from the shape of the body in relation to an instrument and kinesthetic input from muscles as music is performed or tactile input when contacting the instrument. Auditory learners do not appear to have an advantage in either music listening tasks or music performance tasks.

Effects of task modality on musical tasks

There have been mixed results as to whether presenting musical tasks designed to emphasize auditory, visual, or kinesthetic modalities influence success on these tasks, especially when presentation mode matched dominant learning modality. Persellin & Pierce (1988) also reported a connection between dominant mode and mode of presentation with preferred presentation mode matching preferred learning modality. First graders were able to reproduce more rhythms when they were presented in their dominant learning mode. Zikmund (1988) found that matching dominant modalities to reinforcements on melodic and rhythmic

conservation tasks facilitated perception. However, not all research has supported a link between modality preference and performance on musical activities. Pautz (1989) found fourth graders could learn songs equally well in three treatment conditions designed to emphasize auditory (song and verbal descriptions of the song), auditory/visual (iconic representations of the song), and auditory/kinesthetic (movement exercises with song) regardless of dominant learning modality. Hughes (1990) found that instruction in singing unison songs improved with instruction regardless of whether the teaching style utilized aural-only or supplemented aural with visual and kinesthetic strategies and regardless of whether the teaching style matched the students' learning style. Quindag (1992) also found no relationship between perceptual learning modality and performance achievement of beginning string players. Gates (1993) assessed first grade students' rhythmic ability after receiving treatment which either emphasized aural-only, aural/visual, or aural/kinesthetic instruction. Students identified as visual learners scored highest on a rhythm test regardless of treatment and students who were instructed with visual supplements scored higher on the rhythmic test overall.

While it is common practice in education to present materials using various methods designed to match preferred perceptual learning modalities, there are mixed results as to the effectiveness. Learning of musical tasks may or may not be related to learning modalities and matching task presentation with dominant learning modality may or may not facilitate learning.

In an exploratory study, Svard & Mack (2002) reported a link between perceptual learning modalities and memorization styles. Preferred learning modalities correlated with memorization styles which were determined through interviews. Musicians utilizing visual strategies to memorize music (e.g., visualizing the page, recognizing visual patterns, watching hands) were generally classified as visual learners. Aural learners generally reported listening to

the piece to recognize auditory patterns, hearing harmonic progressions, and being aware of variations in the melody. Kinesthetic learners relied on muscle memory and physical sensations.

While it is possible that a link exists between perceptual learning modalities and memorization styles, memorization music and memorization of material in a general classroom setting may require the use of different learning strategies. The purpose of this research was to determine whether there was a correlation between musicians' preferred perceptual learning modalities and memorization styles.

Methodology

Participants

Participants were 82 instrumentalists participating in a Southern university concert band (57% male; 41% female; 2% did not report gender). Data from one participant was excluded because the survey was incomplete and two others were excluded as they reported never having memorized music ($n = 79$).

Materials

The *Musical Memorization Inventory* (MMI) was developed to identify memorization style preferences (aural, visual, kinesthetic). Rather than asking musicians to label themselves as aural, visual, or kinesthetic memorizers, which assumes participants have similar definitions of these constructs and a common standard for use, the inventory measured how frequently activities or situations, reflecting each memory style, occurred.

Based on an extensive review of the pedagogical literature, activities commonly undertaken during memorization and situations often encountered when performing from memory were collected and labeled by a panel as reflecting one of the three memorization styles (aural, visual, kinesthetic) or a mixture of styles. If an activity or situation did not appear to

reflect a sensory mode or could reflect multiple modes, it was eliminated from the survey. A survey was constructed that included ten situations or activities reflecting each of the memorization styles. Use of multiple activities and situations to reflect each sensory memory style was important as the purpose of the MMI was not to determine how frequently each strategy or situation was encountered, but as a more general reflection of sensory memory styles. On the survey, Participants were asked to indicate whether each activity or situation was never, seldom, often, or always undertaken or encountered when memorizing. An activity that was always used indicated a greater strength of preference than if the activity was seldom used. Responses were coded with a response of “always” receiving three points and “never” receiving zero.

Initially, the survey was pilot tested with seven graduate and undergraduate music students and then a revised version of the survey was pilot tested with 37 members of a Midwestern university concert band. As the purpose of this inventory was to discriminate between musicians who use predominantly aural, visual, or kinesthetic memorization strategies, item-discrimination indices were computed within each category. The purpose of this measure was to identify questions which were best able to discriminate between musicians scoring high in a category (aural, visual, kinesthetic) and those scoring low in each category. Activities which were used frequently or infrequently by all Participants regardless dominant memorization strategy were omitted because the discriminatory ability of these questions was poor.

Five questions with the highest item-discrimination scores within each category were chosen for the final version of the MMI (see Figure 1). Questions were randomized and as there was the possibility of the participants having a pre-disposition towards a certain sensory memorization style, five questions not relevant to any sensory memorization style were included

to partially to obscure the focus of the survey. These questions concerned the memorization process, but did not reflect a sensory memory style and answers to these questions were not included in the analysis.

Perceptual Learning Modalities were assessed using both the *Learning Styles Test* (LST) (LdPride, n.d.) and the *VARK Questionnaire* (*Visual, Aural, Read/Write, Kinesthetic*)(VARK) (Fleming, n.d.). These assessments were chosen as measures of perceptual modality strength as the formatting most directly correlated with the formatting of the MMI. On the LST, Participants were asked to indicate how closely statements reflect their own experiences. For instance, participants stated how “like me” the following statement is: “I feel the best way to remember something is to picture it in my head.” Eight statements, each reflecting one learning modality, were included on the version of the LST completed by the participants. Answers were coded with “very much like me” receiving three points and “not like me” receiving zero for a total possible score of 24 in each category (aural, visual, kinesthetic). The *VARK Questionnaire* included 13 questions with each multiple choice answer reflecting either visual, aural, read/write, or kinesthetic learning styles. For the purposes of this study, the read/write answer was eliminated. For instance, “Do you prefer lecturer or teacher who likes to use...? A. flow diagrams, charts, graphs B. field trips, labs, practical sessions C. discussion, guest speakers.” Where the choice of answer A reflected a visual preference, answer B a kinesthetic preference, and answer C an aural preference.

MUSICAL MEMORIZATION

Please indicate how often you do the activities or experience the situations described. There are no right or wrong answers, so please describe your memorization as accurately as possible.

	Never	Seldom	Often	Always
1. How often do you memorize music you are practicing?				
2. If I have a memory lapse in practice, I only have to look at one note or measure in the notation as a reminder.				
3. I break the piece into sections and focus on memorizing one section at a time.				
4. I write in the notation, adding visual reminders or cues about what comes next in the music.				
5. If a memory slip happens when I am practicing, I sing or hum through the section (aloud or internally) before attempting to play it again.				
6. I test my memory by fingering through the piece away from my instrument.				
7. If I have a memory lapse when practicing, I fix the error and continue playing until the end of the piece.				
8. I know I'm about to have a memory slip when I can't see a mental image of the notation.				
9. I like to finger though, without actually playing, parts of the piece.				
10. If I have a memory lapse when practicing, I fix the error and start playing again from the beginning.				
11. When preparing to perform a memorized piece, I am worried about forgetting because the acoustics of the room will be different.				
12. When practicing, I like to play all the way to the end of the piece, even if I have to look at the music.				
13. I can stop myself from having a memory slip if I imagine where I am in the notation.				
14. I visualize the notation of a piece I am memorizing.				
15. When memorizing a difficult passage, it helps to hear someone play it.				
16. I know I'm about to have a memory slip when I feel detached from my fingers/muscles.				
17. I test my memory for a piece by singing or humming (aloud or internally) through the piece.				
18. When preparing to perform a memorized piece, I am worried about forgetting because my muscles feel different when they are nervous.				
19. I test my memory by playing each section of the piece a set number of times before practicing another section.				
20. I plan out my movements in advance when trying to memorize a piece.				
21. I usually know the beginning of the piece very well, but find I haven't practiced the end very much.				
22. I like to vocalize rhythms and/or melody of the piece I am memorizing.				

Figure 1. *Musical Memorization Inventory (MMI)*.

Procedure

Participants completed the MMI and the learning preferred learning modality assessments (LST and VARK) during a regularly scheduled ensemble rehearsal with 82 of 82 surveys returned (100%).

Results

The total possible score in each category (aural, visual, kinesthetic) on the MMI was 15 and on the LST was 24. The *VARK Questionnaire* answers were coded as aural, visual, or kinesthetic and the number of each was tallied for a potential total of 13. A correlation was computed between MMI and LST and between the MMI and VARK summed scores in each category (aural, visual, kinesthetic) to determine whether there was a relationship between memorization strategies and learning styles. Correlations were weak overall (see Table 2) with the strongest correlation ($r = .34$) resulting between participants preferring visual learning modality (LST) and visual memorization strategies. There was a tendency for participants who learned best in a visual mode to use visual memorization strategies. Though not as evident when using the LST to measure preferred learning modality, the Participants who preferred kinesthetic learning modality as measured by the VARK appeared to have a tendency to *avoid* kinesthetic strategies when memorizing music ($r = -.31$) and instead utilized aural memorization strategies ($r = .32$).

Table 2. *Correlations between preferred learning modalities as measured by the LST and the VARK and memorization strategies as measured by the MMI.*

	MMI Visual	MMI Aural	MMI Kinesthetic
LST Visual	.34	.19	.09
LST Aural	.18	.17	.17
LST Kinesthetic	.18	.20	.13
VARK Visual	.10	-.23	.24
VARK Aural	.03	-.11	.11

VARK Kinesthetic	-.15	.32	-.31
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To determine memorization style dominance, a total score for each category (aural, visual, kinesthetic) was computed for each Participant. Total scores in excess of 8 indicated that activities or situations representing the particular memorization style were often or always encountered or engaged in during memorization (see Figure 2). The scoring system of the MMI had the ability to reflect whether participants were using one dominant memorization style or a combination of styles. It was also possible that Participants either would show no dominance through an equally high usage of all sensory memory styles or memorize without the systematic usage of any sensory memory style.

Participants demonstrated preferences for kinesthetic memorization strategies alone (20.25%) and paired with visual strategies (22.78%) or visual and aural strategies (16.46%). A substantial percentage of the Participants did not regularly use the majority of the strategies represented on the MMI and thus did not demonstrate a dominant preference for aural, visual, or kinesthetic memorization styles (21.52%).

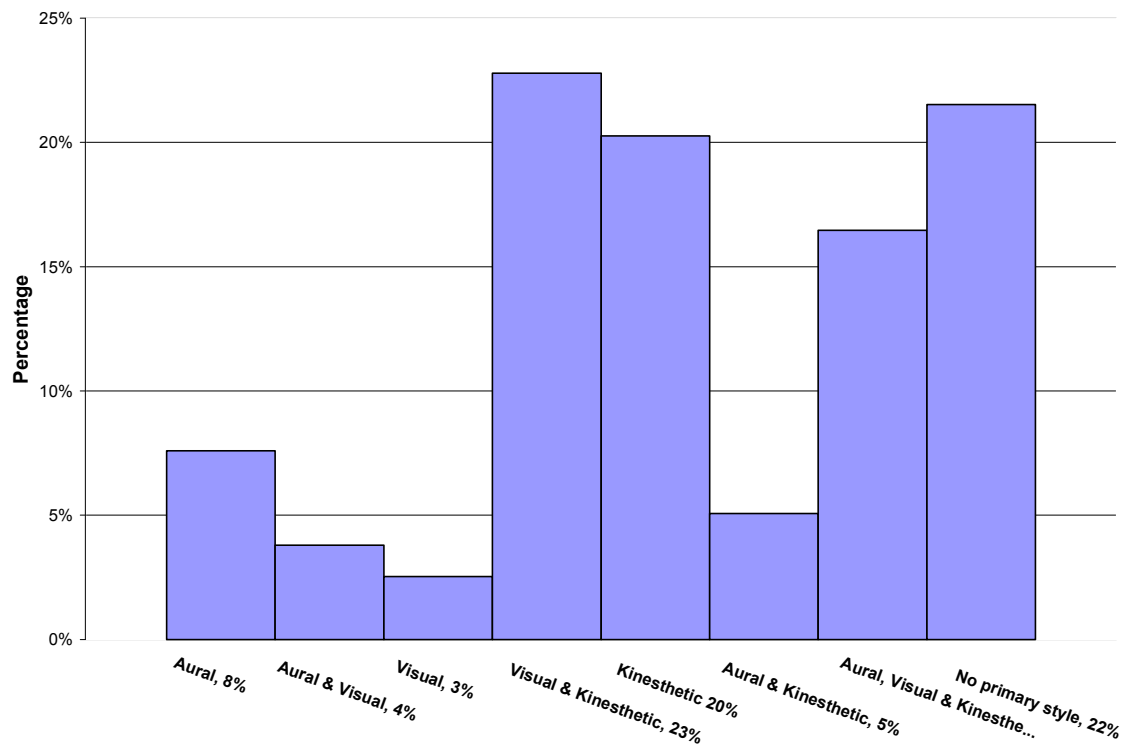


Figure 2. Preferred memorization styles based on results of the MMI.

Discussion

Similarity in terms common to both musical memorization and learning modalities (aural, visual, kinesthetic) may, at first, appear to imply a relationship between musical memorization and learning preferences; however, the results of this study indicate that there is very little relationship between the two constructs. Visual learners tended to use visual memorization strategies more frequently; however few musicians used visual strategies in isolation (2.53%) rather combining visual strategies with kinesthetic and aural strategies. Thus, the qualitative findings of Svard & Mack (2002), which indicated a link between memorization styles and learning modalities, were not supported through this correlational research.

Supporting findings of other researchers (e.g., Falkner, 1994; Kreitner, 1981; Sanders, 1996), the majority of college musicians did not demonstrate a preference for aural strategies when memorizing music. The results of this study reinforce that while music is primarily received through the auditory senses, performers utilize visual and kinesthetic sensory input more than auditory input.

A noteworthy percentage of musicians either used all memorization styles (16.46%) or reported not using any strategy systematically (21.52%). Shockley (1980) also found, when interviewing college musicians, that a large number (44%) reported no systematic method of memorization and 39% used no particular method other than repetition. These students in fact, may have a system of which they are unaware or may well be unsystematic in their memorization process. Shockley's findings may indicate either musicians do not use one of the three most commonly discussed strategies or they are not always aware of the strategies that are used to memorize music.

The use of multiple memorization strategies is commonly advocated in pedagogical writings on memorization. While many musicians appear to use aural, visual, and kinesthetic memorization strategies to a great extent (16.46%), the majority of college musicians preferred only one or two of the sensory modalities. The use of a combination of modalities is generally advocated to stabilize memorization and to reduce the number of memory lapses in performance; however future research must determine whether the use of multiple modalities strengthens memory. Further, the memorization style may change with the demands of the music to be memorized. Shinn, in 1898, theorized that the type of sensory memory used should be based on type of *music* not on learning style. Aural memory would be used to decide whether notes and rhythms were performed accurately. Kinesthetic memory should be used in extended passages

requiring rapid and precise finger movements and visual memory (looking at the keyboard) should be used with passages that include wide skips and extensions. It is possible that musicians change the memory style depending on the demands of the music rather than base the choice on preferred learning modality. A measure such as the MMI could be re-worded and specific passages added as a model to determine whether the same answers are given by a musician regardless of the music or if answers change depending on the technical demands of the passage. Shinn's theory has some support as concert pianists reported using only kinesthetic memory when playing fast, virtuosic passages because the automatic response is necessary at the fast tempo (Aiello & Williamon, 2002).

The study of learning styles has revealed that learning styles are not static, but are affected by development and, especially for adults, task-demands. It is possible that memorization styles similarly change naturally, either with maturity, or with musical education. As the predominant advice in memorization pedagogy is to use a mixture of styles, this prevalent advocacy may be reflecting in the results of this study. The majority of elementary school-age children are global. However, as children develop and progress through the grades, many become increasingly analytic (e.g., Dunn, Dunn, & Perrin, 1994). Past researchers have determined that children demonstrated a more defined sensory modality than adults, who were able to adapt to utilize various modalities when the situation required. One line of inquiry would be to determine memorization styles at various ages and skill levels to determine whether memorization styles change in a similar pattern.

Learning styles, as defined in this study focused on perceptual learning styles or ways of processing information via the senses. However, there are alternative conceptualizations of learning styles. For instance, the way in which a student approaches a learning task, globally or

sequentially, potentially may be related to memorization. In addition, figure-ground relationships, as measured by the *Group Embedded Figures Test* also have a long tradition of research. Field dependence/independence refers to how information is cognitively processed. While Mason (1990) did not find a relationship between sensory learning styles (aural, visual, kinesthetic) and music sight reading, a relationship was found between cognitive learning styles of field independence/dependences and music sight reading. It is possible that how information is analytically processed, rather than a preference for sensory input, is more relevant to how musicians practice and memorize music.

The primary purpose of this study was to determine whether there was a link between preferred learning modalities (aural, visual, kinesthetic) and musical memorization strategies (aural, visual, kinesthetic). The link between preferred sensory modalities was weak with only visual learners showing a tendency to utilize visual memorization strategies. A secondary purpose of this research was to develop the *Musical Memorization Inventory* (MMI) to determine preferences for sensory modalities when memorizing music. Discussions concerning the use of aural, visual, and kinesthetic memories are common in pedagogical literature. The MMI provides a measure of preferred memorization style for teachers who seek to identify memorization trends in their students by asking how frequently common memorization strategies and situations are encountered. Based on the results of this study, strategies used for memorizing music are, to a large extent, independent of learning modality preferences.

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