# Song Memory: Are Text and Tune Asymmetrically Related in Recognition Memory?

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## 1.0 Introduction

A song comprises two distinguishable and separate components - text and tune. Yet, hearing a song leaves the impression of a unified event. This incongruity has inspired the investigation into how song is represented in memory. *The integration hypothesis* proposes that text and tune are stored as a composite trace in which the meaning of the text-tune pairing eclipses the meaning of the parts (Crowder, 1993; Samson & Zatorre, 1991; Serafine, Crowder, & Repp, 1984; Serafine, Crowder, Davidson, & Repp, 1986). Associative theories propose that text and tune are represented as two separate memory traces bound by association (Peretz, 1993; Steinke, Cuddy, & Jakobson, in press).

Research has utilized a recognition task where listeners are asked to recognize the texts and tunes of song excerpts when presented with the same partner they were presented with at study (i.e., Match probes), or with a different, equally familiar, partner (i.e., Mismatch probes). The *integration effect* is the finding that a studied song component (i.e., a text or a tune) is recognized best when presented with the same partner it was presented with at study: $p(\text{Hit}|\text{Match}) > p(\text{Hit}|\text{Mismatch})$.

Research has provided evidence of the integration effect in tune recognition. That is, the tune of a song probe is better recognized as "old" in the context of a Match probe than in the context of a Mismatch probe (Crowder et al., 1990; Samson & Zatorre, 1991; Serafine et al., 1984, 1986). However, the integration effect has not reliably emerged in text recognition (Samson & Zatorre, 1991; Serafine et al., 1984). This disparity suggests an associative relationship between text and tune in memory in which a tune is more tightly associated with its text than the text of a song is associated with its tune. Thus far, an asymmetrical integration effect has been noted (Samson & Zatorre, 1991; Serafine et al., 1984), but it has not been investigated or discussed in much detail.

We investigated the relationship between the texts and tunes of songs in recognition memory. We expected that the integration effect would emerge in tune recognition but not in text recognition (i.e., *the asymmetrical integration effect*).

## 2.0 Method

**2.1 Listeners.** Thirty native English speakers from the Queen's psychology subject pool took part in the study (23 women and 7 men, *mean age* = 22.8 years, $SD = 6.5$). Music training was scored using a point system. One point was given for each year of private music lessons and one half point was given for each year of group music lessons. Half of the listeners had very little to no music training ($M = .60$, $SD = .78$, *range* = 0 – 2.5). The remaining listeners possessed considerably more music training ($M = 10.50$, $SD = 3.88$, *range* = 7 – 16.5).

**2.2 Materials.** Six pools of 20 songs were created and calibrated for the experiment. Tunes of songs were in 4/4 meter, were in the key of $A^b$-major, were two bars in length, and comprised 10 note events. Within pools, song texts possessed a similar stress pattern and were semantically congruous. All texts were eight syllables in length. All songs were sung by a professional male baritone.

**2.3 Procedure.** Testing sessions involved five sub-tests and took place a quiet room with groups of two to four listeners. In each sub-test, listeners were presented, twice, with a study-list of six songs. Listeners were then presented with two of each of five sorts of song probes: a) Songs that were in the study-list (i.e., Match probes); b) songs comprising a mismatched pairing of an old text and old tune from different songs in the study-list (i.e., $O_{TX}$:$O_{TN}$ probes); c) songs that combined an old text from the study-list paired with a new tune (i.e., $O_{TX}$:$N_{TN}$ probes); d) songs that paired a new text with an old tune from the study-list (i.e., $N_{TX}$:$O_{TN}$ probes); and e) songs that paired a new text and a new tune, neither of which were in the study-list (i.e., $N_{TX}$:$N_{TN}$ probes). Listeners provided old/new recognition judgments for each probe's tune, text, and text-tune pairing.

## 3. Results

'Old song', 'old tune', and 'old text' responses for each class of probe, across all five sub-tests of a testing session, were scored as proportions. The 'old song', 'old tune', and 'old text' data were analyzed separately using 5x2 mixed factors ANOVA designs with probe class as the repeated factor and training group as the between subjects factor.

**3.1 Song Recognition.** The 'old song' data are presented in Table 1. There was a main effect of probe class, $F(4, 112) = 74.38$, $p < .001$. A contrast comparison revealed that listeners in both training groups discriminated old from new songs, $F(1,28) = 173.50$, $p < .001$.

**3.2 Tune Recognition.** The 'old tune' data are presented in Table 2. There was a significant main effect of probe class, $F(4,112) = 40.66$, $p < .001$, and a significant interaction between probe class and training, $F(4,112) = 3.84$, $p < .01$. A first contrast revealed that trained listeners discriminated old from new tunes better than untrained listeners, $F(1,28) = 5.93$, $p < .05$. A second contrast confirmed the integration effect in tune recognition for both trained and untrained listeners, $F(1,28) = 24.53$, $p < .001$.

**3.3 Text Recognition.** The 'old text' data are presented in Table 3. There was a main effect of probe class, $F(4,112) = 160.87$, $p < .001$. A first contrast showed that listeners discriminated old from new texts, $F(1,28) = 332.83$, $p < .001$. A second contrast failed to confirm the integration effect in text recognition, $F(1,28) = 1.31$, $p > .25$.

## 4.0 Discussion

The results confirm the predicted *asymmetrical integration effect*. Recognition of a studied tune was best when presented with the same text it was paired with at study while recognition accuracy for a studied text was equivalent whether presented with the same tune it was paired with at study or with a different tune.

The asymmetrical integration effect contraindicates the integration hypothesis that demands a symmetrical integration effect. Associative theories, however, can accommodate the asymmetrical integration effect by proposing that text and tune are represented independently in memory with a stronger association from a song's tune to its text than the association from a song's text to its tune.

A third explanation for the asymmetrical integration effect is that the phonetic properties of a text impose subtle changes on the acoustical identity of a tune (e.g., note onsets, note offsets, timbral variations, and accent patterns). Since memory for a tune is acoustic in nature, the mental representation of a tune will incorporate elements of its accompanying text. In contrast, because memory for the text of a song is semantic in nature an accompanying tune would not alter a text's semantic representation in memory. Consequently, the recognition of a song's tune will display a context sensitivity for its originally paired text (i.e., the integration effect) while a song's text will not. This reasoning predicts the asymmetrical integration effect and , notably, describes the conditions under which the effect emerges.

Free of theoretical constraints, the current study shows a clear asymmetry in the relationship between text and tune in recognition memory. Unfortunately, the current study cannot address whether the asymmetrical integration effect emerges because of an asymmetrical association between text and tune in memory, or if it emerges as a consequence of the impositions of a paired text on the acoustical identity of a tune. Further investigation is needed to make this important distinction.

## References


Crowder, R.G., Serafine, M.L., & Repp, B. (1990). Physical interaction and association by contiguity in memory for the words and melodies of songs. *Memory & Cognition, 18,* 469-476.

Crowder, R.G. (1993). Auditory memory. In McAdams, S. & Bigand, E. (Eds.), *Thinking in sound: The cognitive psychology of human audition* (pp. 113-145). Oxford: Clarendon Press.

Peretz, I. (1993). Auditory agnosia: A functional analysis. In McAdams, S. & Bigand, E. (Eds.), *Thinking in sound: The cognitive psychology of human audition* (pp. 199-230). Oxford: Clarendon Press.

Samson, S., & Zatorre R.J. (1991). Recognition memory for text and melody of songs after unilateral temporal lobe excision: Evidence for dual encoding. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17,* 793-804.

Serafine, M.L., Crowder, R.G., & Repp, B. (1984). Integration of melody and text in memory for songs. *Cognition, 16,* 285-303.

Serafine, M.L., Davidson, J., Crowder, R.G., & Repp, B. (1986). On the nature of melody – text integration in memory for songs. *Journal of Memory and Language, 25,* 123-135.

Steinke, W.R., Cuddy, L.L., & Jakobson, L.S. (in press). Dissociations among functional subsystems governing melody recognition after right hemisphere damage.


**Table 1.** *Mean proportion of 'old song' responses for each class of recognition probe for trained and untrained listeners. Bracketed values are standard deviations. Bolded values are hit rates.*

| | Recognition Probe | | | | |
|---|---|---|---|---|---|
| | | New Songs | | | |
| Group | Match | $O_{TX}:O_{TN}$ | $O_{TX}:N_{TN}$ | $N_{TX}:O_{TN}$ | $N_{TX}:N_{TN}$ |
| Trained | **.64 (.15)** | .49 (.18) | .31 (.26) | .09 (.12) | .05 (.06) |
| Untrained | **.59 (.17)** | .45 (.17) | .43 (.23) | .10 (.16) | .07 (.17) |

**Table 2.** *Mean proportion of 'old tune' responses for each class of recognition probe for trained and untrained listeners. Bracketed values are standard deviations. Bolded values are hit rates.*

| | Recognition Probe | | | | |
|---|---|---|---|---|---|
| | | New Songs | | | |
| Group | Match | $O_{TX}:O_{TN}$ | $O_{TX}:N_{TN}$ | $N_{TX}:O_{TN}$ | $N_{TX}:N_{TN}$ |
| Trained | **.87 (.12)** | **.72 (.13)** | .49 (.21) | **.77 (.22)** | .40 (.16) |
| Untrained | **.83 (.12)** | **.74 (.18)** | .63 (.16) | **.63 (.13)** | .41 (.19) |

**Table 3.** *Mean proportion of 'old text' responses for each class of recognition probe for trained and untrained listeners. Bracketed values are standard deviations. Bolded values are hit rates.*

| | Recognition Probe | | | | |
|---|---|---|---|---|---|
| | | New Songs | | | |
| Group | Match | $O_{TX}:O_{TN}$ | $O_{TX}:N_{TN}$ | $N_{TX}:O_{TN}$ | $N_{TX}:N_{TN}$ |
| Trained | **.75 (.15)** | **.75 (.16)** | **.74 (.13)** | .14 (.12) | .14 (.15) |
| Untrained | **.80 (.15)** | **.72 (.21)** | **.76 (.18)** | .11 (.15) | .10 (.13) |


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