Old songs can be as fresh as new: An ERP study on lyrics processing

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ABSTRACT

Song familiarity has been systematically found to have a strong effect on music cognition, especially in aspects of emotion and memory; however, whether it would also influence the semantic processing of song lyrics is unclear. To address this, we asked subjects to listen to familiar and unfamiliar pop song excerpts, which were followed by visual target words semantically related or unrelated to the lyrics-final word, and to judge the concreteness of the targets. The ERP results revealed that larger N400 was elicited by unrelated visual targets compared with related ones, indicating that the subjects processed the meaning of the preceding lyrics even though that was not part of the required task. More importantly, the N400 relatedness effect did not vary with subjects' familiarity with the songs, suggesting that the subjects kept processing the meaning of the lyrics even though they had listened to the songs multiple times. The fact that repetition—the essential characteristic of familiar songs—did not diminish the meaning processing of lyrics suggests that lyrics and speech may differ at a higher communicative level.

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1. Introduction

Many of us listen to songs every day. Do we pay attention to what the lyrics are saying? Or, more interestingly, do we still process the meaning of the lyrics even when a song has been listened to many times?

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One of the major issues in song perception literature is to address how, instead of whether, lyrics are processed. Specifically, the focus has been on whether lyrics and melody are processed independently or interactively when people listen to a song. Findings in neuropsychological studies support the independent view. Patients with temporal lobe damage demonstrated dissociation between lyrics and tunes in song memory (Hébert & Peretz, 2001, 1996; Samson & Zatorre, 1991) and nonfluent aphasics had better production in melody than lyrics (i.e. producing more notes than words) (Hébert, Racette, Gagnon, & Peretz, 2003; Racette, Bard, & Peretz, 2006). Studies with normal subjects also bolster the independent view. Divided attention studies showed that subjects performed equally well in detecting either the semantic or melodic incongruity (single task) or both (dual task) (Bonnel, Faïta, Peretz, & Besson, 2001). An event-related potential (ERP) study also revealed that semantic anomalies elicited a widespread N400, harmonic anomalies induced a parietal P300, and the mean amplitudes of the double-incongruity condition were not statistically different from the predictions of an additive model of semantic and harmonic processing (Besson, Faïta, Peretz, Bonnel, & Requin, 1998).

In contrast, evidences supporting the integration of lyrics and tune in song processing have also been reported. Studies on song memory have shown that melodies and lyrics are better recognized when heard in their original form (i.e. melodies with original text and lyrics with original melody) than in a modified version (Crowder, Serafine, & Repp, 1990; Morrongiello & Roes, 1990; Samson & Zatorre, 1991; Serafine, Crowder, & Repp, 1984; Serafine, Davidson, Crowder, & Repp, 1986). Also, researchers have unveiled that, musical context, like regular linguistic context, can modulate phonemic and semantic processing in songs. Phoneme monitoring was faster when the target phonemes were sung on a referential tonic chord than on a less referential subdominant chord (Bigand, Tillmann, Poulin, D'Adamo, & Madurell, 2001), and semantic priming was modulated by harmonic structure, replicating the effect of semantic context on lexical decision tasks widely documented in psycholinguistics (Poulin-Charronnat, Bigand, Madurell, & Peereman, 2005). In fact, researchers supporting the interactive view of song perception have claimed that music and lyrics share underlying mechanisms. When non-musicians (subjects without musical training) were asked to judge whether the prime and target were the same while paying attention to either the linguistic or the musical aspect of songs, the N400s to sung words were modulated by melody, suggesting shared processing resources between the phonological/semantic aspects of language and the melodic/harmonic aspects of music (Gordon, Schön, Magne, Astésano, & Besson, 2010). In musically educated adults, harmonic violations in music elicited positivities similar in latency but different in topography (antero-temporal right-hemisphere lateralization) from the P600 found in syntactic violations in language (Patel, Gibson, Ratner, Besson, & Holcomb, 1998). Also, in non-musicians, an early right-anterior negativity (ERAN) was found to be sensitive to the degree of musical expectancy induced by the preceding musical context, similar to the early left-anterior negativity (ELAN) associated with local structure violation in linguistic processing (Koelsch, Gunter, Friederici, & Schröger, 2000). Imaging studies have further clarified the underlying neurological structures of previous ERP findings. A magnetoencephalography (MEG) study showed that, similar to ELAN, ERAN originates in Broca's area and its right hemisphere homolog in non-musicians (Maess, Koelsch, Gunter, & Friederici, 2001). fMRI studies demonstrated that the cortical brain regions known to support language processing also serve the processing of musical sequences or songs (Koelsch, Gunter, Zysset, Lohmann, & Friederici, 2002; Merrill et al., 2012).

A recent fMRI study seems to hint that there may be a middle ground between the independent and interactive views (Sammler et al., 2010). With the use of an adaptation paradigm, various regions along the bilateral superior temporal sulcus and gyrus (STS/STG) were found to be associated with independent or interactive processing of lyrics and melody: the left mid-STS (inferior to Heschl's gyrus) being associated with an interaction of lyrics and tunes at prelexical, phonemic processing levels, the left anterior STS with an independent processing of lyrics at semantic levels, and the left dorsal precentral gyrus with an integrated representation of lyrics and tunes for fusing musical and linguistic features (no region showed a predominance for tunes, possibly due to the nature of the experimental task). This study revealed that the independent/interactive views about lyrics and melody processing might represent the extremes of a continuum with different degree of interaction/independence at different stages of song perception (Sammler et al., 2010).

To sum up, whether melody and language are processed independently or interactively is still under debate; nevertheless, researchers seem to generally agree/assume that lyrics are processed in the same