

Music, Language, Picture: Cross-Modal Correspondences During Movement Perception

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Introduction: Landmark research linked movement to language processing [1], showing how processing action-related language engages motor brain areas [2]. Movement is also associated with music, as listeners can interpret music cues like pitch, tempo, and loudness as motion in space [3]. Moreover, harmonic properties of musical excerpts modulate language processing [4,5]. The present study investigates underexplored cross-modal interactions between music, and either language or moving pictorial input during movement perception.

Methods: Four web-based rating experiments (N=64 each, German monolinguals, ages 18-31), designed as pretests for upcoming eye-tracking studies, tested whether participants perceive congruency between musical excerpts and either linguistic or pictorial cues (Fig. 1). Experiments 1&2 examined a third-person agent's movement entering/within a location, while Experiments 3&4 focused on a patient-object movement toward/away from a deictic-you agent. Stimuli included melodies, assumed to convey movement, paired with either moving images (GIFs, Exp.1&3) or written sentences (Exp.2&4). The independent variable was stimulus-pair congruency. Musical movement was assumed to be conveyed via changes in pitch (enter-within) or in volume (toward-away). Pictorial stimuli depicted the movements described in the sentences. Participants rated congruency on a 100-point Likert scale.

Hypotheses: For all experiments hypotheses were formulated, expecting higher congruency ratings for matching versus mismatching stimulus pairs (Alternative hypothesis 1, AH1).

Analysis: Ratings were modeled as a function of the congruency condition (LMM).

Results: Significant effects of congruency were revealed in the music-picture experiments (Exp.1&3) and in the toward-within music-sentence experiment (Exp.2), confirming AH1.

Interpretation: The absence of an effect in exp. 4 may reflect interference from pitch cues or indicate a weaker music-language link, consistent with the smaller effect in experiment 2 ($\beta=-0.16$, $SE=0.06$, $p=0.02$) compared to experiment 1 ($\beta=-0.27$, $SE=0.05$, $p=0.00$) (Fig. 2). Reliable interactions notwithstanding, the significant main effects of congruency in Exps 1, 2, & 3 (Fig. 3A) and of condition, movement and modality (Fig. 3B) support systematic cross-modal associations between musical phrases, moving images, and semantically-related motion sentences.

References

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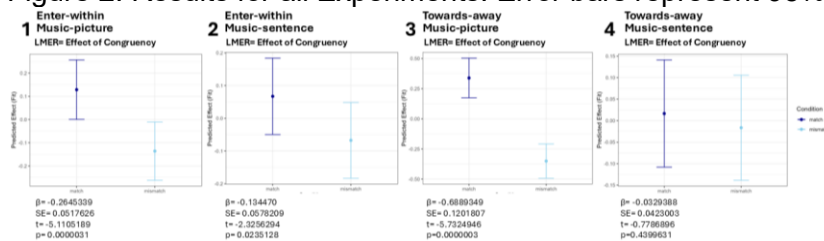
Figures and Tables

Figure 1: Stimuli examples.

Experiments 1 and 2: towards-within stimuli. Experiments 3 and 4: towards-away stimuli. Experiments 1 and 3: melodies and pictures. Experiments 2 and 4: Melodies and Sentences.

Towards-Within			
	Sentences	Melodies	Pictures
Within	Der Fisch schwimmt in der Flasche herum. DEF.NOM.fish swim-3SG.PRS in DEF.DAT bottle around. The fish swims within the bottle.		
Towards	Der Fisch schwimmt in die Flasche hinein. DEF.NOM.fish swim-3SG.PRS in DEF.ACC bottle into. The fish swims into the bottle.		
Towards-Away			
	Sentences	Melodies	Pictures
Away	Du gibst der Mitschülerin die Blumen. 2SG.NOM give-2SG DEF.DAT classmate DEF.ACC flower-PL You give the flowers to the classmate.		
Towards	Die Mitschülerin gibt dir die Blumen. DEF.NOM classmate give-3SG.PST 2SG.DAT DEF.ACC flower-PL The classmate gives the flowers to you.		

Figure 2: Results for all Experiments. Error bars represent 95% confidence intervals.



Figures 3a and 3b: Results of post hoc analysis.

