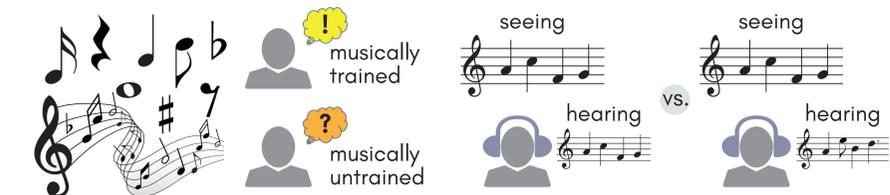


The impact of melodic sound on perceptual dominance of musical notes engaged in binocular rivalry

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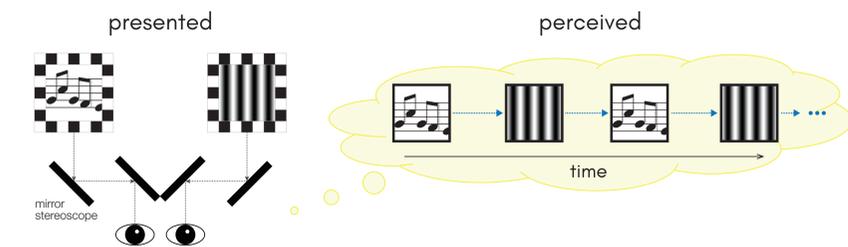
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Introduction



Using auditory musical melodies and visual scores, we investigated whether congruence of structured auditory information and visual representations of that information can impact perceptual dynamics during binocular rivalry.

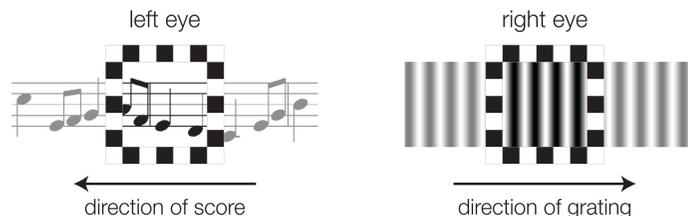
Binocular rivalry



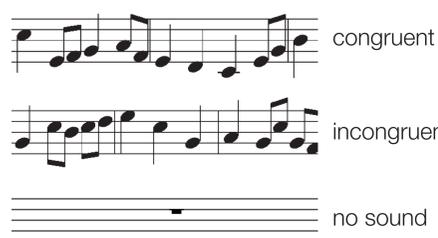
Experiment 1

Methods

- Participants 23 readers (people able to read music) 11 nonreaders (people not able to read music)
- Rival targets One of 7 scores & vertical grating (scrolling within viewing windows)



- Audiovisual conditions

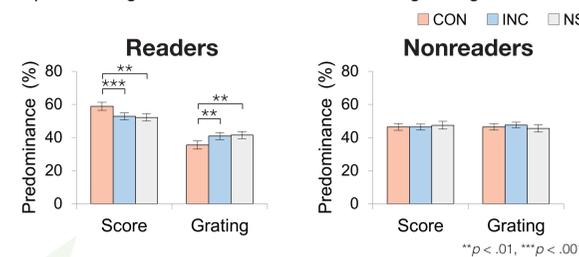


- Task Tracking alternation in perception by pressing one of the two assigned keys
- Trial duration 30–42 seconds (depending on the music)
- Number of trials 7 scores × 3 AV conditions × 2 eyes = 42 trials

Results

- Predominance

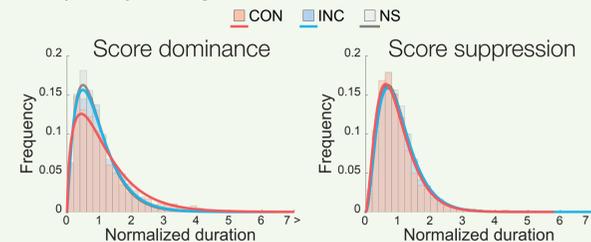
: percentages of time the score or the grating was exclusively dominant



• Musical scores enjoyed significantly greater predominance than did grating among readers, whereas score and grating predominance were not different for nonreaders.
 • In readers only, the predominance of scores was significantly greater in CON trials than in INC trials [t (22) = 3.87, P < 0.001] or in NS trials [t (22) = 0.78, P < 0.01].

- Dominance durations (normalized) - Readers

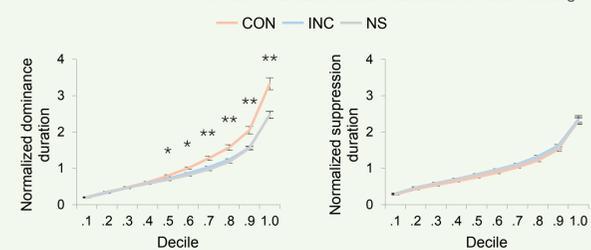
Frequency histogram



• Frequency histograms of normalized durations conform closely to the gamma distribution, the signature distribution for rivalry durations.
 • Higher incidence of **longer dominance durations** in CON trials than in INC trials.
 • Normalized **score-suppressed** durations (i.e., grating dominance) **did not differ** significantly across the three AV conditions.

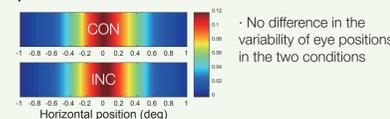
Decile plot

• The dominance durations and the suppression durations for each AV condition (sorted from the shortest to the longest) divided into deciles, i.e., 10 bins, separately for each participant.
 • The mean rival state duration calculated for each decile group, and then the decile means averaged over participants.



• The **significant influence of CON** did not emerge until dominance durations were equal to or longer than the dominance duration associated with the fifth decile. ☞ Congruence between a score and a melody requires experiencing multiple consecutive notes.
 • The CON and INC durations for the **score-suppressed durations** did **not** differ at any decile level.
 *p < .05, **p < .01, FDR corrected

- Eye movements



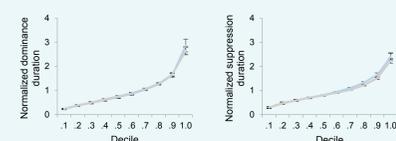
• No difference in the variability of eye positions in the two conditions

- In Experiment 1, congruence between auditory melody and visual score affected dominance durations for the score but had no significant influence on suppression durations for the score.

• This conclusion contrasts with other findings showing that contextual congruence (1, 2) and experience-based familiarity (3) can influence how quickly a visual stimulus emerges from interocular suppression to achieve dominance.

• Hence, we wanted to examine more carefully the impact of INC and CON during phases of score suppression using a discrete trial probe technique (Experiment 2) that is arguably more sensitive than rivalry tracking when it comes to detecting weak, subliminal influences during rivalry (4, 5).

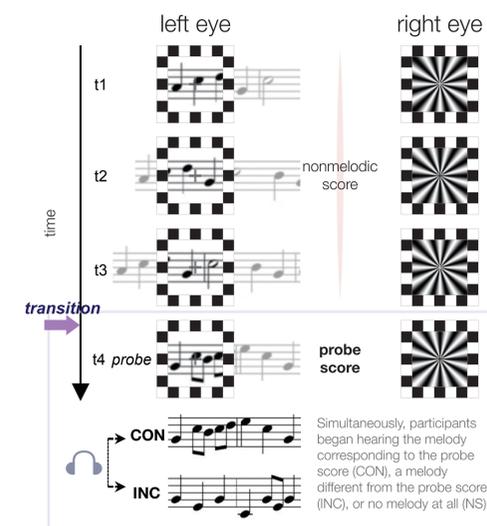
- Dominance durations - Nonreaders



• Normalized durations for the three AV conditions within the nonreader group were not significantly different both in score dominant and in score suppressed.

Experiment 2

Methods



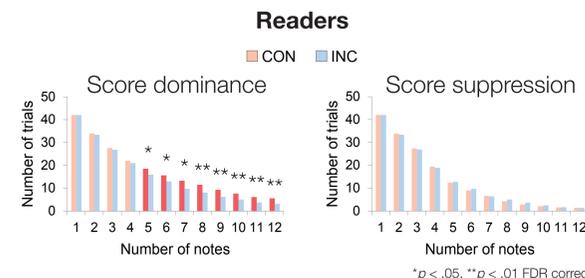
- Participants 15 readers & 15 nonreaders
- Rival targets Nonmelodic score 5-Hz counterphase flickering radial grating Melodic probe score (one of 7 scores)
- Task Tracking rivalry
- Types of trials **Dominance trials:** the *transition* from the nonmelodic score to the probe score happening at the onset of the second **dominance** phase of the nonmelodic score **Suppression trials:** the *transition* occurring at the onset of the second **suppression** phase of the nonmelodic score
- 3 blocks each comprising 84 trials (7 probe scores × 2 phases × 3 AV conditions × 2 eyes)

• A trial ended as soon as the participant indicated a change in perceptual dominance following introduction of the probe score; thus **each trial generated one phase duration**, which could be either a dominance duration for the probe score or a suppression duration for the probe score.

Results

Frequency histogram of trials

- Frequency histograms of trials in which **at least N notes** were visually presented before a state transition.



• The differences between CON and INC **dominance durations** are statistically significant for trials in which **more than 4 notes** had been seen and heard. ☞ The realization of the congruence between auditory and visual melodic structure emerges only after some critical amount of time.
 • On **suppression** trials, CON and INC were **equivalent** in terms of incidence of number of trials. ☞ Experiencing multiple musical notes does not reveal a subtle reduction in suppression durations associated with melodic congruence.

Conclusion

These results implicate experience-dependent, top-down influences of semantic information on the resolution of perceptual conflict created by binocular rivalry.

References

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