THE ROLE OF ATTENTIONAL SALIENCE IN INFANTS' DETECTION OF ARBITRARY INTERMODAL RELATIONS

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Abstract

Prior research demonstrated a developmental lag between infants' detection of amodal and arbitrary, modality-specific audio-visual relations. By the age of 3-months, infants were able to detect amodal relations uniting the sights and sounds of object motion, but not until 7-months could they detect the arbitrary relations between the type of sound and visual appearance of these same objects. This study tested the hypothesis that by making the visual and acoustic contrasts more discriminable, causing the modality-specific properties to be more salient, infants would detect the arbitrary, modality-specific relations at a younger age. Five-month-old infants were habituated to videos of two objects hitting a surface. The objects differed in visual appearance and in the type of sound they produced. Results indicated that these younger infants detected the changes in the pairing between the type of sound and visual appearance of the objects. These results suggest that the extent of the lag between infants' detection of amodal and arbitrary intersensory relations is influenced by task difficulty and salience of the modality-specific properties.

Introduction

Most multimodal events make both amodal and arbitrary intersensory relations available. Prior research from my lab demonstrated a developmental lag between the emergence of infants' sensitivity to amodal and arbitrary relations in a given set of multimodal events. For example, by 3-months of age, infants detect the amodal relations (temporal synchrony and object composition) uniting the sights and sounds of an object impacting a surface. However, not until 7-months (and not at 3- or 5-months) did infants detect the arbitrary relation between the color/shape of the object and the pitch of its impact sound, despite the fact that they could discriminate these pitch and color/shape changes by 3-months of age (Bahrick, 1992, 1994). The present research explored the basis for this developmental lag.

According to the intersensory redundancy hypothesis recently proposed by Bahrick & Lickliter (2000), in early infancy, when information is presented redundantly across two sensory modalities simultaneously, attention is selectively focused on amodal information (e.g., temporal synchrony, tempo, rhythm) and modality-specific properties (e.g., color, pitch) are relatively unattended. Thus, according to this view, the developmental lag observed between sensitivity to amodal versus arbitrary relations is likely a matter of attentional salience rather than the result of

limitations to the infant's ability to link up arbitrary audio-visual information. If this is true, then enhancing the attentional salience of modality-specific properties, should allow infants to demonstrate the ability to detect modality-specific audio-visual relations at an earlier age (e.g., 5-months). Thus, in the present study, 5-month-old infants were tested in the same procedure as before (Bahrick, 1994), however the salience of the modality-specific contrasts was enhanced by making the visual and acoustic contrasts more discriminable.

Procedure

Twenty-four 5-month-old infants were habituated in an infant-control procedure to films of two objects striking a surface in an erratic pattern (see Figure 1A). One of the two objects produced a high, metalic impact sound (it was struck against a cymbal), and the other produced a low, percussive impact sound (it was struck against a drum). Thus, the sounds differed in pitch and timber. The two objects also differed in visual appearance along a number of dimensions including color, shape, and type of impact motion. Four pairs of events were used and they were counterbalanced across subjects. Test trials were conducted to determine if infants detected the arbitrary relation between the type of sound and visual appearance of the object. During the test trials, infants received a change in the pairing of object and sound. That is, the object that was paired with the low, drum sound was now paired with the high, cymbal sound, and vice versa.

Results

Results (see Figure 2) indicated significant visual recovery ($t(23) = 3.78$, $p = .018$) to the change in modality-specific relations (the specific pairing of the type of sound and type of object). In contrast, 5-month-olds in the Bahrick (1994) study, who received the same task with less discriminable stimulus contrasts (see Figure 1B), showed no significant visual recovery. Thus, enhancing the salience of the modality-specific properties by making the event pairs more discriminable in terms of visual appearance and type of sound, led to the earlier appearance of sensitivity to arbitrary modality-specific relations.

Conclusions

These results taken together with prior research (e.g., Gogate & Bahrick, 1998; Hernandez-Reif & Bahrick, in press; Slater, Quinn, Brown, & Hayes, 1999) suggest several generalizations. First, infants can detect arbitrary, modality-specific relations at any age; at 7 months, 5 months, and even as neonates. Second, detection of this arbitrary information is initially constrained and guided by detection of amodal relations. That is, in each of the studies cited above, infants detected the arbitrary relations in the presence, but not in the absence of amodal relations. Third, because detection of amodal relations guides attention to arbitrary relations, there is a developmental lag between detection of amodal and arbitrary, modality-specific relations (Bahrick, 1992, 1994). Finally, detection of arbitrary relations is influenced by

attentional salience and task difficulty. By making the task easier and increasing the discriminability of the modality-specific properties of the objects (their visual appearance and type of sound), infants were able to detect these arbitrary, modality-specific relations at a younger age. These results suggest that the extent of the developmental lag observed between infants' detection of amodal and arbitrary audio-visual relations is influenced by attentional salience and task difficulty, and that the lag does not reflect inherent limitations in sensitivity to arbitrary relations across the senses at particular ages or for particular properties.

References

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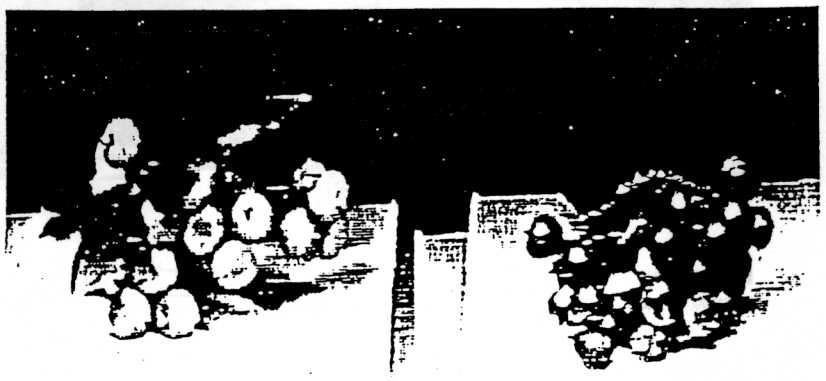
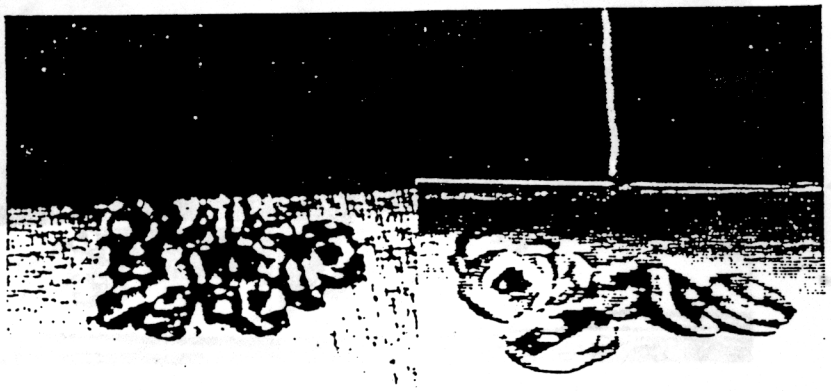
Figure 1B

Bahrick (1992, 1994): Less Discriminable Objects and Sounds





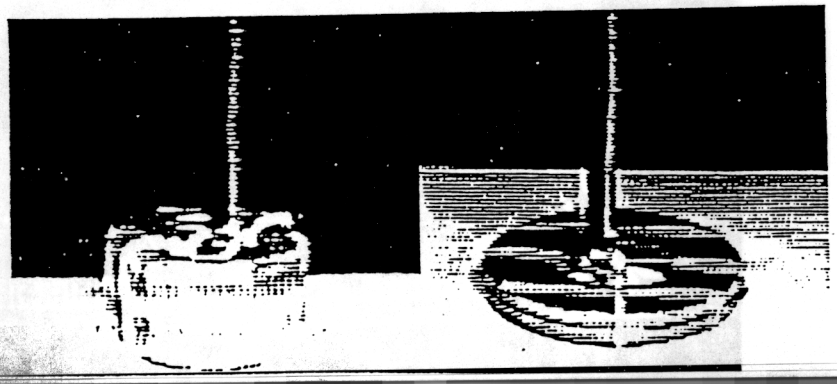
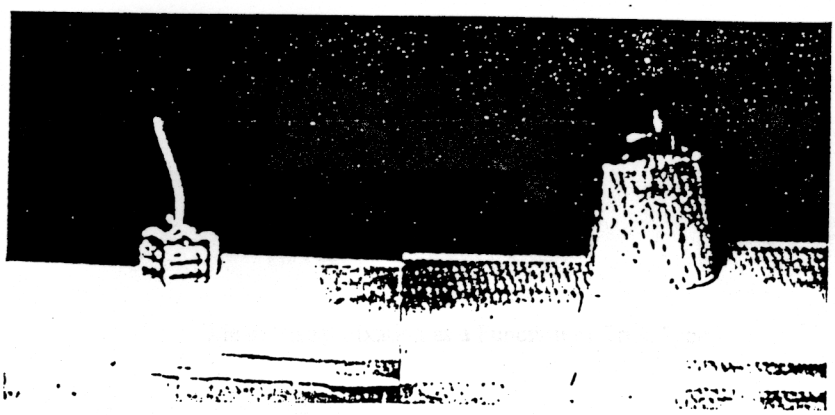
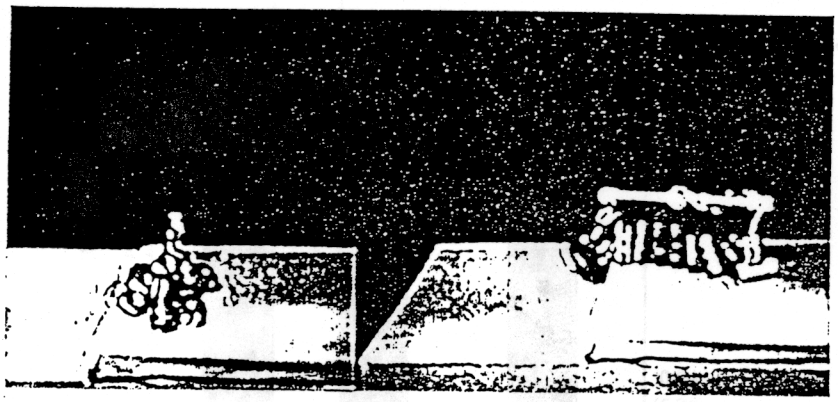
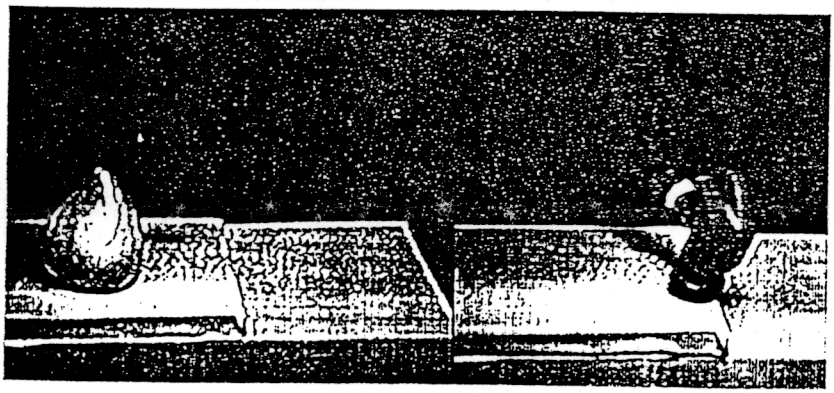


Figure 1A
Current Study: More Discriminable Objects and Sounds







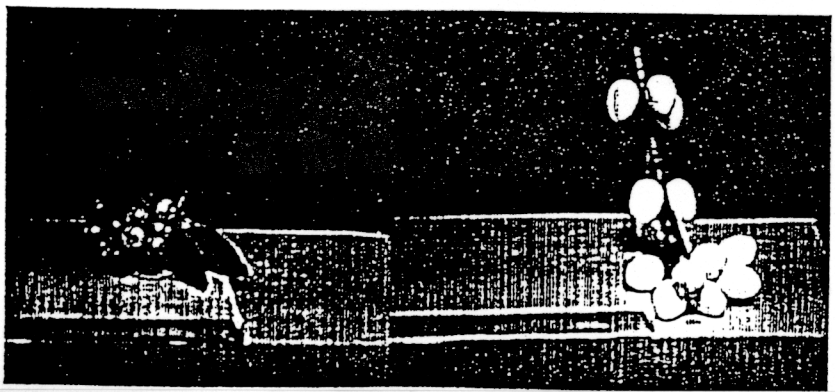
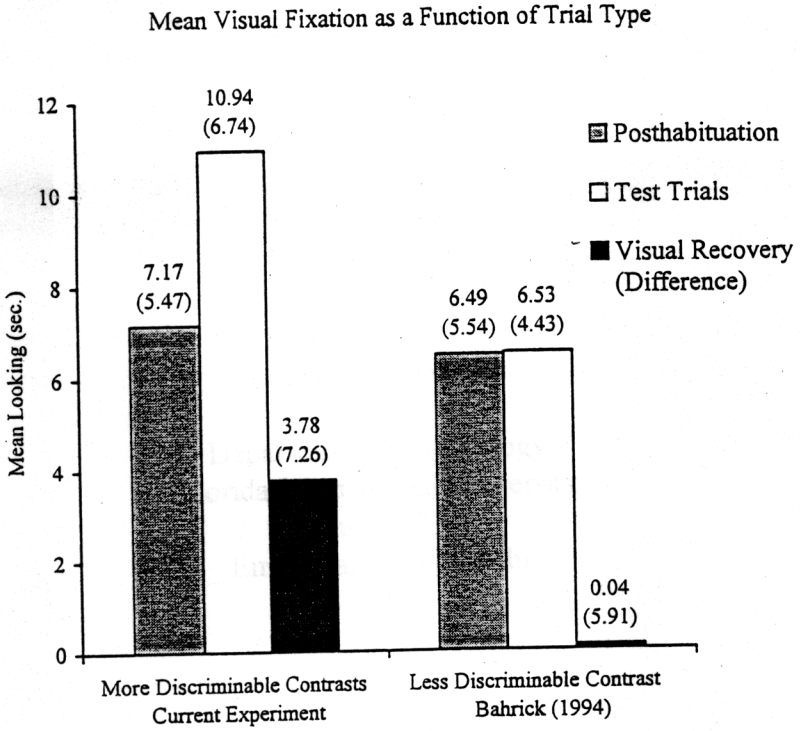


Figure 2


Mean Visual Fixation as a Function of Trial Type
Mean Looking (sec.)
12
10
8
6
4
2
0
10.94
(6.74)
7.17
(5.47)
3.78
(7.26)
6.49
(5.54)
6.53
(4.43)
0.04
(5.91)
Posthabituation
Test Trials
Visual Recovery
(Difference)
More Discriminable Contrasts
Current Experiment
Less Discriminable Contrast
Bahrick (1994)