

Introduction

Detection of intermodal information is foundational to language learning. To successfully map a label to its referent, infants must detect redundant information across visual and auditory events. Temporal synchrony between the motion of an object and uttering a verbal label facilitates learning of arbitrary label-object relations, and allows even the youngest language learners, 7-month-olds, to learn arbitrary object-label relations in an habituation procedure (Gogate & Bahrick, 1998; 2001). Using a more stringent language assessment, the Looking While Listening (LWL) procedure, Bion and colleagues (2013) found that 24- but not 18-month-olds, form arbitrary label-object relations following familiarization with *static* images of a novel object and label. Further, synchrony is still important for learning label-object relations in more experienced language learners (Jesse & Johnson 2016). Together these studies suggest that temporal synchrony between the object motion and label directs attention to label-object pairings and facilitates learning of these relations.

The present study assessed the role of temporal synchrony in learning novel object-label relations in the earliest language producers. We investigated whether 13-month-olds (an age group that shows no learning in the *static* LWL procedure) would show novel label-object learning when temporal synchrony was used in a *dynamic* LWL procedure. Events consisted of three objects being moved by a hand in synchrony with a novel label ("dofa," "taju," or "pifo"; Figure 1). Labeling was preceded by a carrier phrase (e.g., "Look at the dofa...dofa!"). A hand lifted up the object in synchrony with the onset of each novel label.

Methods

Infants ($N=15$; $M=395.33$ days, $SD=13.31$) participated in a *dynamic* LWL procedure. Following two baseline control trials (to assess initial preferences for one of the two novel objects), infants were familiarized with six single-screen familiarization trials (19s each) depicting two novel label-object pairings (3 trials each pairing), in an alternating order (e.g., object A-"dofa," object B-"taju," object A-"dofa"...etc.). Each trial presented three repetitions of the carrier phrase followed by the label. In the test phase, the two familiarized objects were presented side-by-side, moving in synchrony with one another, while one label was synchronized with the movements of both objects. Preferences for the target object (the familiarized object-label pairing) were assessed. Two blocks, consisting of 6 trials (6 s) each, were presented. Each block tested a different familiarized label. To assess learning of object-label relations, the proportion of total looking time (PTLT) on each test trial, following the label onset, to the target object was calculated. (PTLTs greater or less than 2 SD s from the mean for a trial were removed from analyses.)

Figure 1. Still images of the three novel objects used in the study. Each infant was randomly assigned to receive two of these novel objects. Object-label pairing and label order during familiarization and test were counterbalanced across infants.

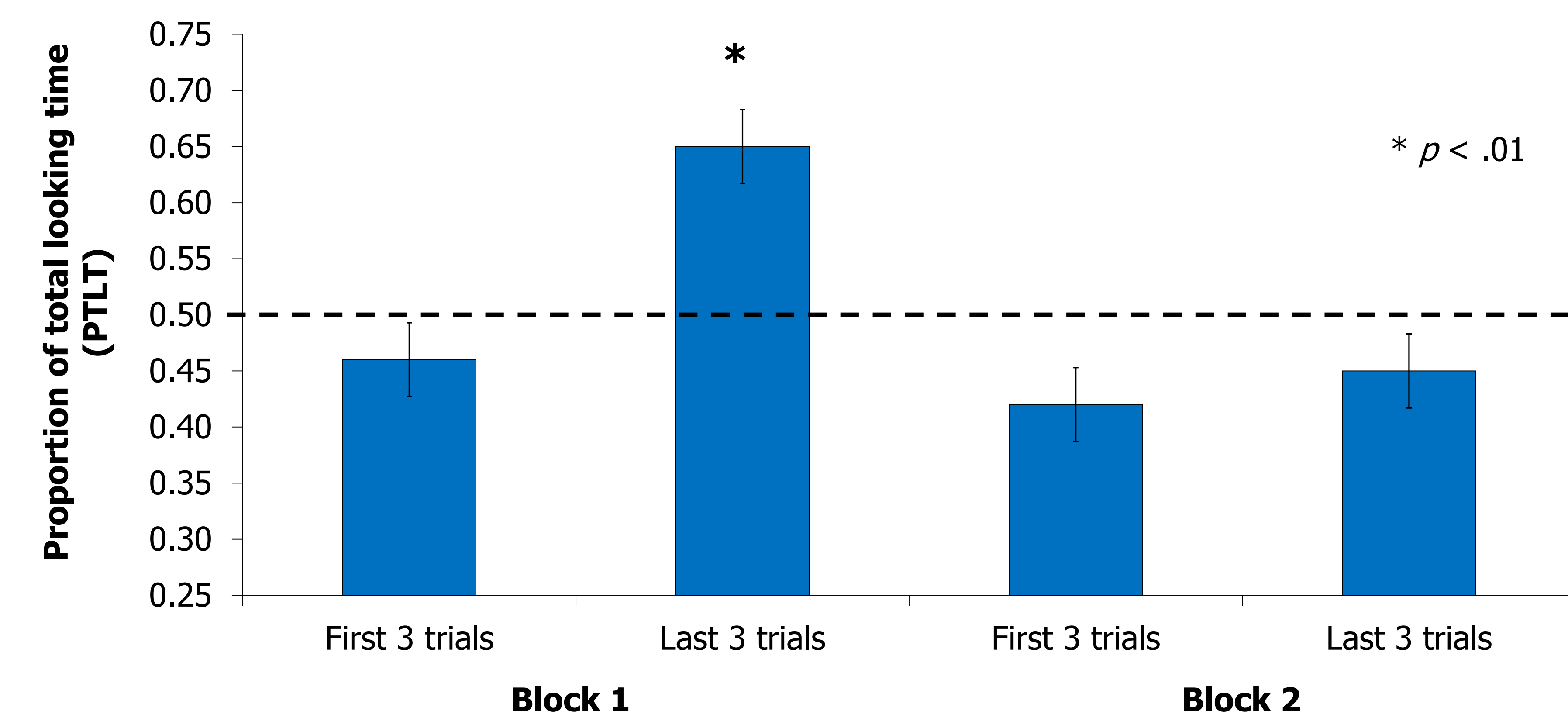


Results

Baseline and familiarization phase: During baseline, infants showed no preference for one novel object over another ($M=.50$, $SD=.21$, $t(14)=.02$, $p=.98$). Infants appeared highly engaged during familiarization, devoting an average of 81% ($SD=12\%$) of their looking time to the displays.

Test phase: During test, infants showed a marginally significant PTLT to the target object (familiarized object-label pairing) during Block 1 ($M = .56$, $SD = .13$; $t(14) = 1.82$, $p = .09$). Further inspection revealed no significant PTLT for the target object during the first 3 trials of Block 1 ($M = .46$, $SD = .22$, $t(14) = -.63$, $p = .54$), but a robust preference for the target object during the last 3 trials of Block 1 ($M = .65$, $SD = .14$, $t(14) = 3.90$, $p = .002$; see Figure 2). In contrast, during Block 2 (in which the second novel label was provided) infants showed no preference for the target object. Instead, they showed a marginal preference for the non-target object ($M = .44$, $SD = .11$, $t(14) = -1.97$, $p = .07$). However, this preference was not significantly different from chance for either the first or last 3 trials of Block 2 alone ($p>.1$).

Figure 2. Mean proportion of total looking time (PTLT) following label utterance during Blocks 1 and 2 of test trials.



Conclusions

Results suggest that 13-month-olds can learn a novel object-label relation when labels were presented in temporal synchrony with the object's dynamic movement. Learning the relation was only evident during Block 1 of test trials. Further, it was most robust during the second half of Block 1, suggesting the youngest language producers have difficulty learning multiple novel object-label relations even under ideal conditions of temporal synchrony and dynamic actions. Future studies will assess the basis for this limitation and whether infants as young as 13 months can show evidence of learning more than one label-object relation.

References

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