



Intermodal Perception of Self: Infants' Sensitivity to Temporal and Spatial Contingencies

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Introduction

Infant perception of the contingencies between proprioceptive feedback from their own motions and consequent visual or vocal stimulation is a fundamental basis for distinguishing self from other social stimulation (Bahrick & Watson 1985; Schmuckler 1996). Stimulation from the self is perfectly contingent with proprioceptive information whereas stimulation from social partners is imperfect. Bahrick & Watson (1985) demonstrated that 5-month-old infants could discriminate between a live, perfectly contingent video display of their own legs moving and a non-contingent display of their own legs or of another infant's legs, and preferred to view the noncontingent stimulation. Subsequent studies demonstrated that detecting this contingency required proper spatial alignment (Rochat & Morgan, 1996; Schmuckler 1996; Schmuckler & Fairhall, 2001). A more recent study found that infants could detect this intermodal proprioceptive-visual contingency on the basis of motion information alone, when featural information specifying the appearance of the legs was eliminated (Schmuckler & Fairhall, 2001). Specifically, infants of 5- and 7- months discriminated contingent from noncontingent point light displays of moving legs.

The present studies: 1) replicated and extended this finding to infants as young as 2-months of age, and

2) assessed whether infants of 5- and 9-months could discriminate point light displays of their legs even when the temporal and spatial contingencies were degraded

Experiment 1: Method

Research Question: Can infants detect the perfect temporal contingency between proprioceptive and visual information from self movement in the absence of featural information?

16 2-month-olds & 16 5-month-olds wore socks with three luminescent dots (i.e., point lights) that eliminated featural information but preserved the perfect contingency between visual-proprioceptive stimulation.

Infants viewed a live contingent point-light display of their own self-produced leg motion and a pre-recorded non-contingent point light display of another infant's motion across 4-40s trials (Block 1 = trials 1 & 2; Block 2 = trials 3 & 4). The dependent variable was the proportion of time infants spent looking toward contingent display or the non-contingent display.



Figure 1

Point-lights were about 2cm. Point-lights were placed over the knee, ankle, and toes.

Results: Experiment 1

Five-month-olds looked longer to the non-contingent display on Blocks 1 and 2 combined ($M = .60$; $SD = .15$) $t(15) = 2.6$, $p = .022$, as well as during Block 1 ($M = .62$; $SD = .17$), $t(15) = 2.7$, $p = .016$, but not during Block 2, $p = .31$, replicating the results of Schmuckler & Fairhall (2001).

Moreover 2-month-olds looked longer toward the non-contingent display during Block 1 ($M = .63$; $SD = .24$), $t(15) = 2.2$, $p = .042$, thus extending these findings to younger infants

Figure 3: 5-Month-olds

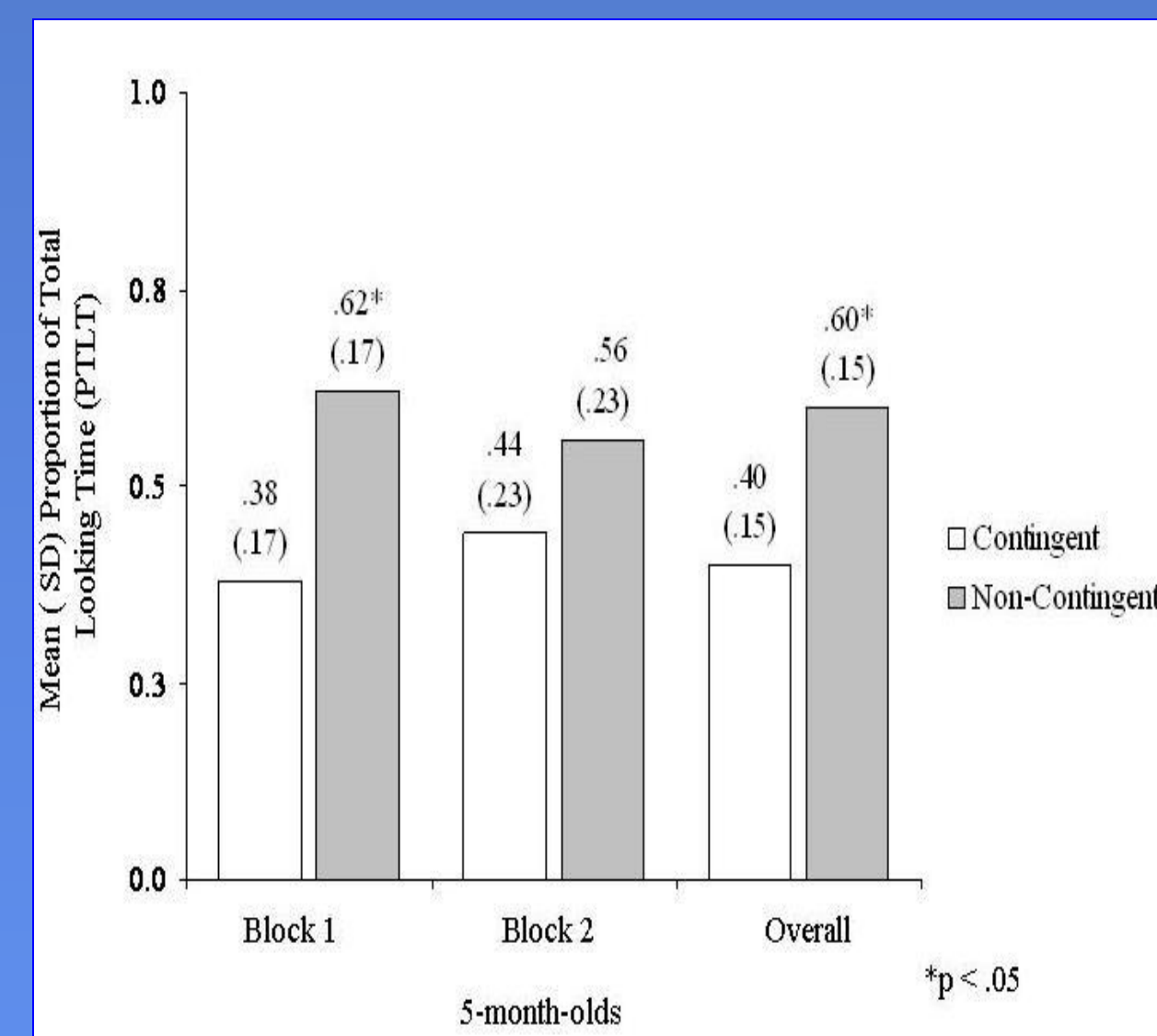
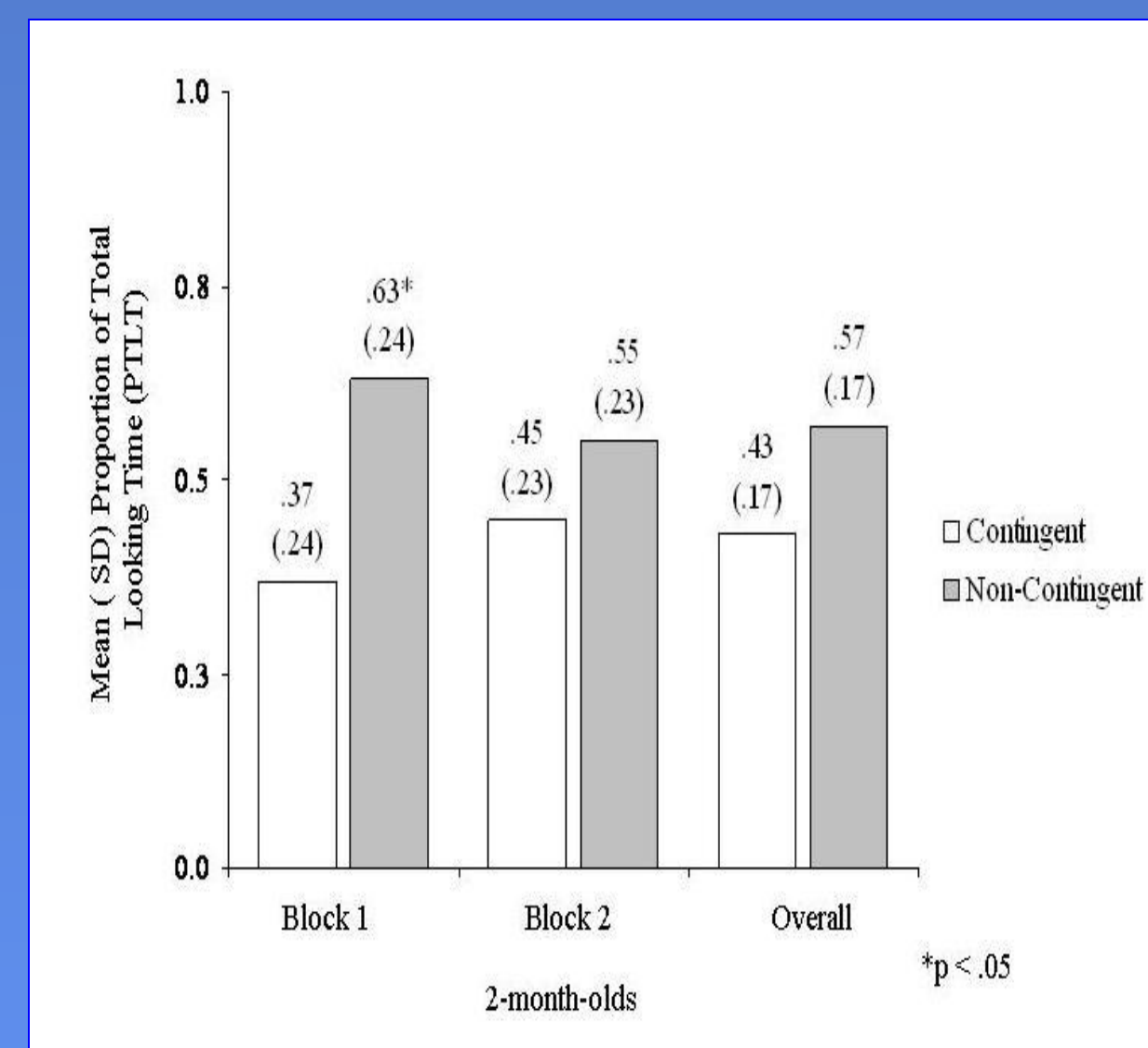


Figure 2: 2-Month-olds



Experiment 2: Method

Research Question: Can 5- and 9-month-old infants detect the contingency between proprioceptive and visual stimulation from self movement in the absence of featural information, when the spatial and temporal information is degraded?

16 5- & 16 9-month-olds wore socks with three luminescent dots (i.e., knee, ankle, and toes). We distorted the point light display by adding an "appendage" to each sock that extended outward from the calf, with two point lights each (Figure 4). Since the extensions were not rigidly attached to the calves they flopped and lagged behind the motion of the legs - disrupting the relationship between proprioceptive feedback and the temporal and spatial stimulation.



Figure 4

Distorted point light display

Results: Experiment 2

5-month-olds looked longer toward the non-contingent display during Block 2 ($M = .59$; $SD = .17$), $t(15) = 2.3$, $p = .039$ and across Blocks 1 & 2 combined ($M = .59$; $SD = .14$), $t(15) = 2.4$, $p = .028$.

Nine-month-olds looked longer to the non-contingent display ($M = .61$; $SD = .18$) during Block 1, $t(15) = 2.2$, $p = .041$, and across Blocks 1 & 2 combined ($M = .61$; $SD = .15$) $t(15) = 2.9$, $p = .011$.

Figure 5: 5-Month-olds

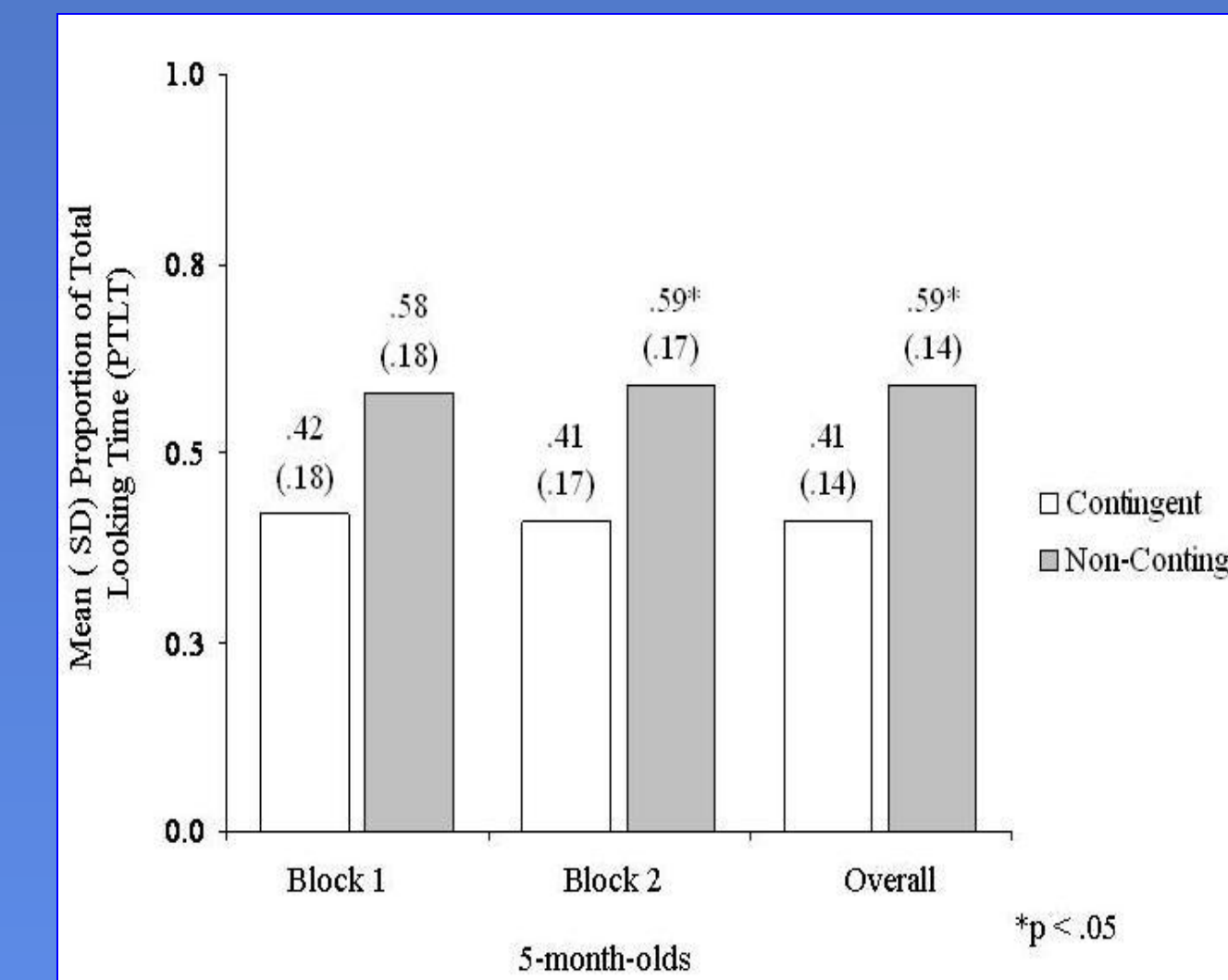
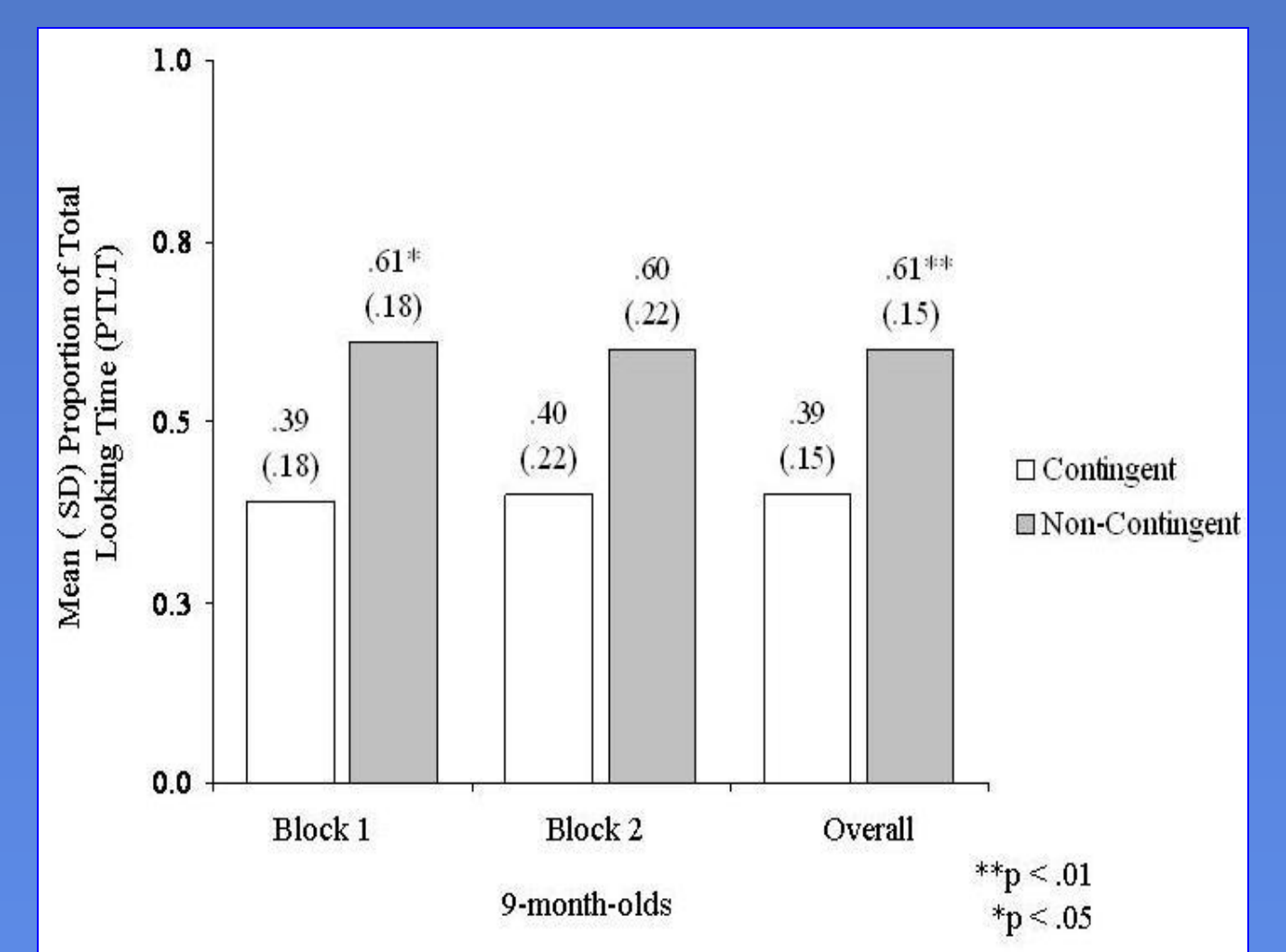


Figure 6: 9-Month-olds



Conclusions

Two-months is the youngest age, to date, infants have been shown to detect the perfect proprioceptive-visual contingency specifying self.

Further, 5- and 9-month-olds are able to detect this proprioceptive-visual contingency even when temporal and spatial information is degraded. This imperfect contingency is similar to the contingency provided by a social partner.

Together these findings suggest that infants have fundamental capabilities that distinguish self from social stimulation, even as young as 2-months of age.