The Perception of Self-Produced Leg Movement in Self- versus Object-Oriented Contexts by 3-5-Month-Old Infants

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Recent research in the domain of infant self-perception indicates that infants as young as 5 months are attuned to the temporal contingency of the visual-proprioceptive information available to them while looking at an on-line video image of their legs (Bahrick & Watson, 1985). In addition, Rochat and Morgan (in press) demonstrated that infants as young as 3 months are sensitive to the visual-proprioceptive spatial congruence of their own leg movements. In particular, they showed that infants preferred to look at the non-contingent/ non-congruent views of their legs rather than to the views that were contingent/congruent with their own movements. Such evidence demonstrates that infants detect intermodal (i.e., visual-proprioceptive) invariants associated with self-produced movements. Specifically, during self-exploration, when feeling their legs moving in a particular direction in space, infants expect to see their legs moving congruently.

Questions remain regarding how infants perceive the directionality of self-produced leg movement across different task domains. In particular, how does infants' sensitivity to changes in the visual-proprioceptive experience of their own legs differ within the context of perceiving self-oriented as compared with object-oriented movements? Using a paradigm similar to the one used in previous studies (Rochat & Morgan, in press), the present research was an attempt to answer these questions by introducing an additional experimental condition in which infants were oriented towards the goal of contacting an object that sounded when contacted by their leg.

Method

Infants were seated reclined, looking up at a large TV monitor. To ensure a full view of the legs on the TV, a successive looking paradigm instead of a side by side preferential looking paradigm was used. The results of Rochat and Morgan (in press) were replicated using this alternate mode of presentation (Morgan, 1994). Infants were presented successively with conditions in which they viewed an on-line image of their own legs, either with or without an object target to kick at. Because of their reclined position, they were prevented from seeing their own legs or the object directly: They saw their legs exclusively via the on-line TV.

In the No-object condition, a small microphone was placed under a sheet of paper on which the infant's legs were resting, in order to entice leg movements. The

microphone was connected to an amplified speaker affixed on top of the TV. Contingent to any leg movement, this device produced a rustling/scratching sound.

In the Object condition, the infant viewed both their legs and the object. However, the microphone was placed inside the object instead of under the infant's legs, so that a sound was produced only upon contact with the object. The object was always placed in front of either the baby's right or left leg. The infants was thus able to contact the object with the ipsilateral extended leg. The placement of the object ensured that the infant would only contact the object with an atypical movement, different from bouts of leg activity in which the legs are generally bent at the knees.

Within each condition, infants experienced two different situations. In one, infants viewed a spatially congruent on-line image of their legs from the waist down (Ego view). In the other situation, a modified camera, placed in the same position, provided the infant with a similar Ego view, except that there was a left/right reversal of the image on the TV screen providing a spatially non-congruent view of the legs (Reversed Ego view). In contrast to the first situation, movements on the TV in the Reversed Ego view were reversed in direction providing a visual-proprioceptive conflict.

Fifteen 3-5-month-old infants were successively presented with two 4-minute conditions (Object vs. No-object) in which the Ego and Reversed Ego situations were presented for two minutes each. The total testing time was 8 minutes. With respect to condition order, the testing session was only found to be engaging to the infants if the No-object condition was presented first. Therefore, after unsuccessfully testing 8 infants with the Object condition first, the No-object condition was presented first for all of the participants included in the final analysis ($N = 15$). Order of the situations within each condition (Ego vs. Reversed Ego) and the side of the object in the Object condition was counterbalanced among babies.

The rationale of the study was that if infants were able to discriminate between the different conditions, they would show differential looking and leg activity across the Object versus the No-object conditions. In addition, they would express differential behavior within the Ego or the Reversed Ego situations depending on the condition (Object vs. No-object). In particular, infants were expected to show increased looking and leg activity at the non-congruent view of their legs when there was no object present, as in Rochat and Morgan (in press). In contrast, because of the goal-oriented nature of the task in the situation where the object was present, it was predicted that infants would show the opposite pattern of looking and leg activity (i.e., increased activity when presented with the Ego view). The argument for this expectation was that congruent visual-proprioceptive feedback would facilitate contact with the object, the goal of the task.

Results

The audio and video recordings of the camera providing a close up of the infant's face were analyzed for the absolute duration (in s) and percent of overall looking at the
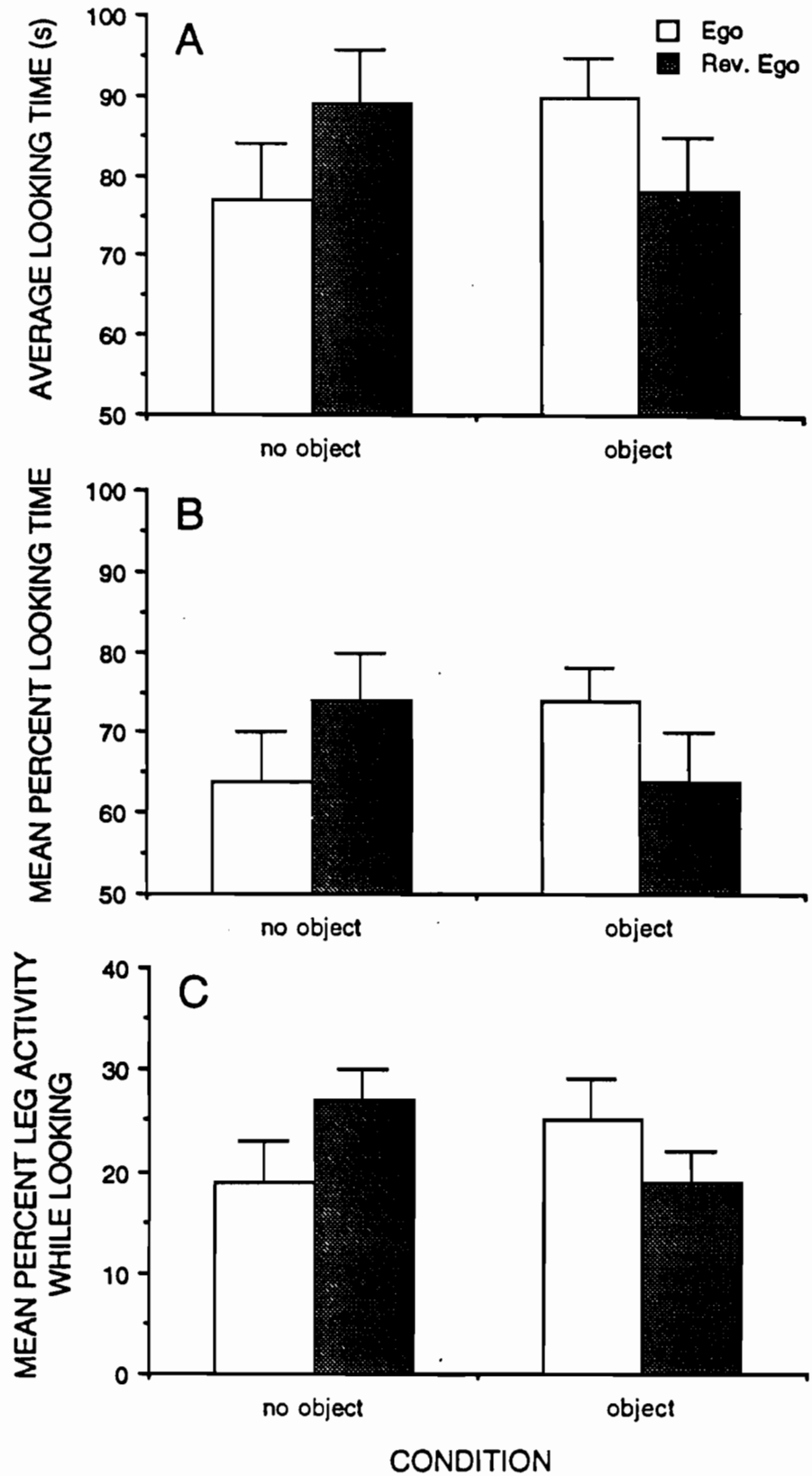
Figure 1. Results for Ego and Reversed Ego views under the Object and No Object conditions. Panel A: Average looking time. Panel B: Mean percent looking time. Panel C: Mean percent leg activity while looking.

display as well as for the co-occurrence of looking and leg activity produced by the infant for each of the 4 trials (Figure 1A, 1B, and 1C). Analysis of the looking times of the full 8 minutes of testing was conducted. A 2-way repeated measures ANOVA revealed a significant condition by situation interaction for both looking time measured in seconds ($F(1, 13) = 17.373, p < .001$) and percent looking at the display ($F(1, 13) = 15.148, p < .001$). A similar analysis conducted on the amount of leg activity while looking at the display in each trial also revealed a significant condition by situation interaction ($F(1, 13) = 18.037, p < .001$).

In the No-object condition, infants looked significantly more and showed significantly more leg activity in the Reversed Ego situation than in the Ego situation. The opposite effects were obtained in the Object condition.

Discussion

The results corroborate and extend the results of Rochat and Morgan (in press), which show that infants are sensitive to changes in the directionality of their own leg movements and that they prefer to examine this incongruence (Reversed Ego view) if the task is self-oriented in nature. However, if the task is object-oriented, a congruent view of the legs is preferred (Ego view). The results indicate that infants perceive the directionality of self-produced leg movements within a calibrated visual-proprioceptive space. Furthermore, they show that infants are using previously established expectations differently depending on the context of the task, in particular, on whether the task is self- versus object-oriented.

References

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