

The Role of Intersensory Redundancy in the Typical Development of Social Orienting Across Infancy: A New Hypothesis for Autism

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Background

Children with autism show impairments in social orienting and attention. Understanding these impairments requires understanding the typical development of social orienting across infancy, the period during which it likely develops. However, no research has systematically assessed changes in attention to social versus nonsocial events across infancy. According to the Intersensory Redundancy Hypothesis (IRH; Bahrick & Lickliter, 2000, 2002), infants show heightened attention to multimodal events that provide intersensory redundancy (e.g., synchrony, rhythm, and tempo common to audible and visible stimulation). Relative to nonsocial events, social events provide an extraordinary amount of intersensory redundancy (across face, voice, and gesture) that attract and maintain attention. We hypothesize that if sensitivity to intersensory redundancy underlies the development of social orienting, then infants should show differences in basic measures of attention across age as a function of redundancy. A slight disturbance of intersensory processing could then promote social orienting impairments characteristic of autism.

Objectives

We assessed the typical developmental trajectory of attention across the ages of 2 to 8 months to social and nonsocial events that provide intersensory redundancy (audiovisual) versus no redundancy (unimodal visual). We predicted that infants would display greater attention (more processing time, longer looks, and fewer disengagements) to events that provide intersensory redundancy (audiovisual) than to events that provide no redundancy (unimodal visual). We also predicted that audiovisual social events would elicit the most attention compared to other event types, given that social events typically provide a great deal of redundancy.

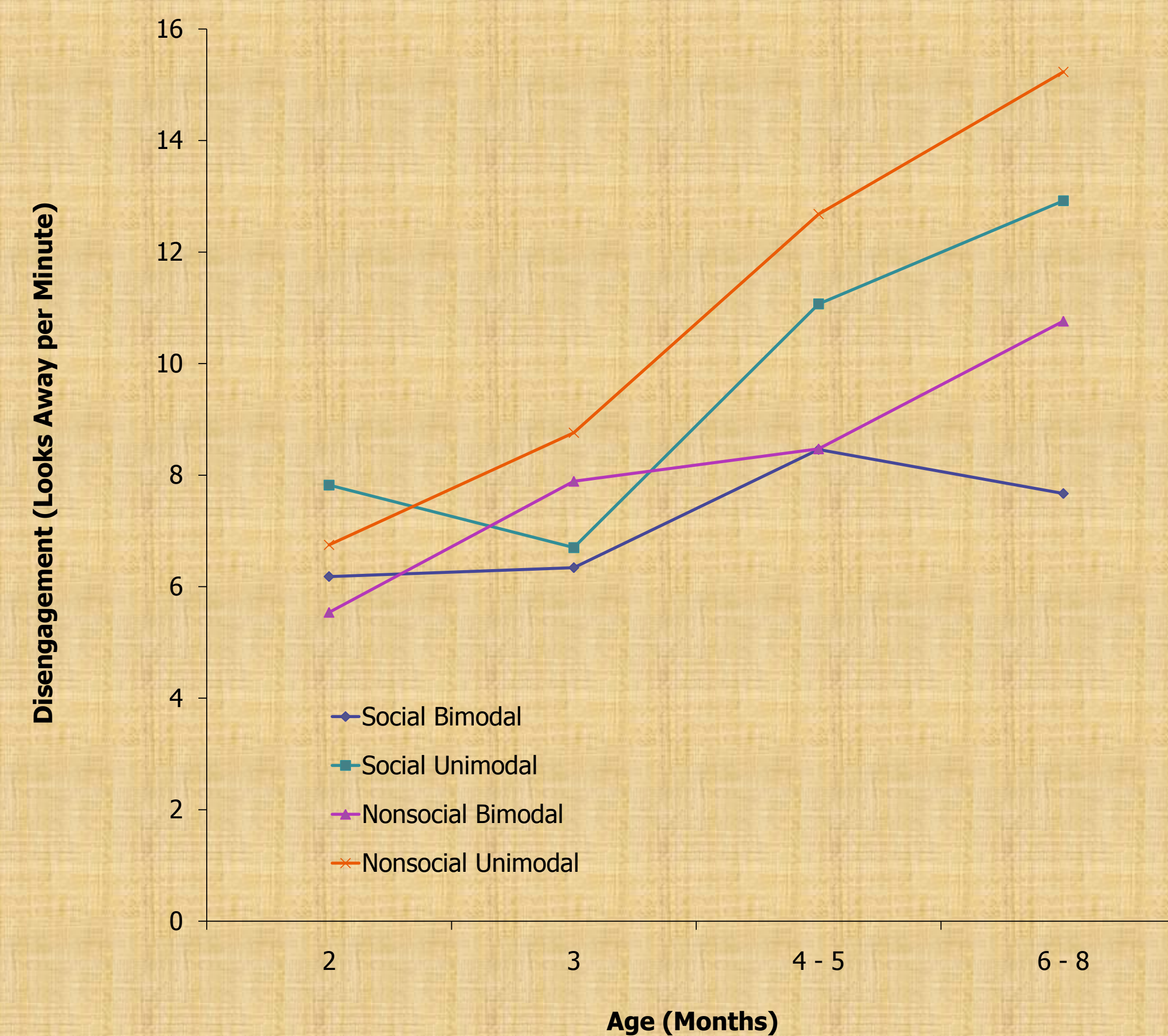
Methods

Data from 703 infants at 2, 3, 4-5, and 6-8 months of age (N = 150, 157, 227, and 169, respectively) were analyzed from a variety of infant-control habituation studies conducted in our lab. Infants were habituated to dynamic displays of bimodal audiovisual versus unimodal visual (silent) social events (i.e., women speaking in infant-directed speech) or bimodal audiovisual versus unimodal visual (silent) nonsocial events (i.e., a toy hammer tapping a rhythm). Three measures of attention were evaluated: mean number of looks away per minute (disengagement), mean length of time to habituation (processing time), and mean length of look.

Results

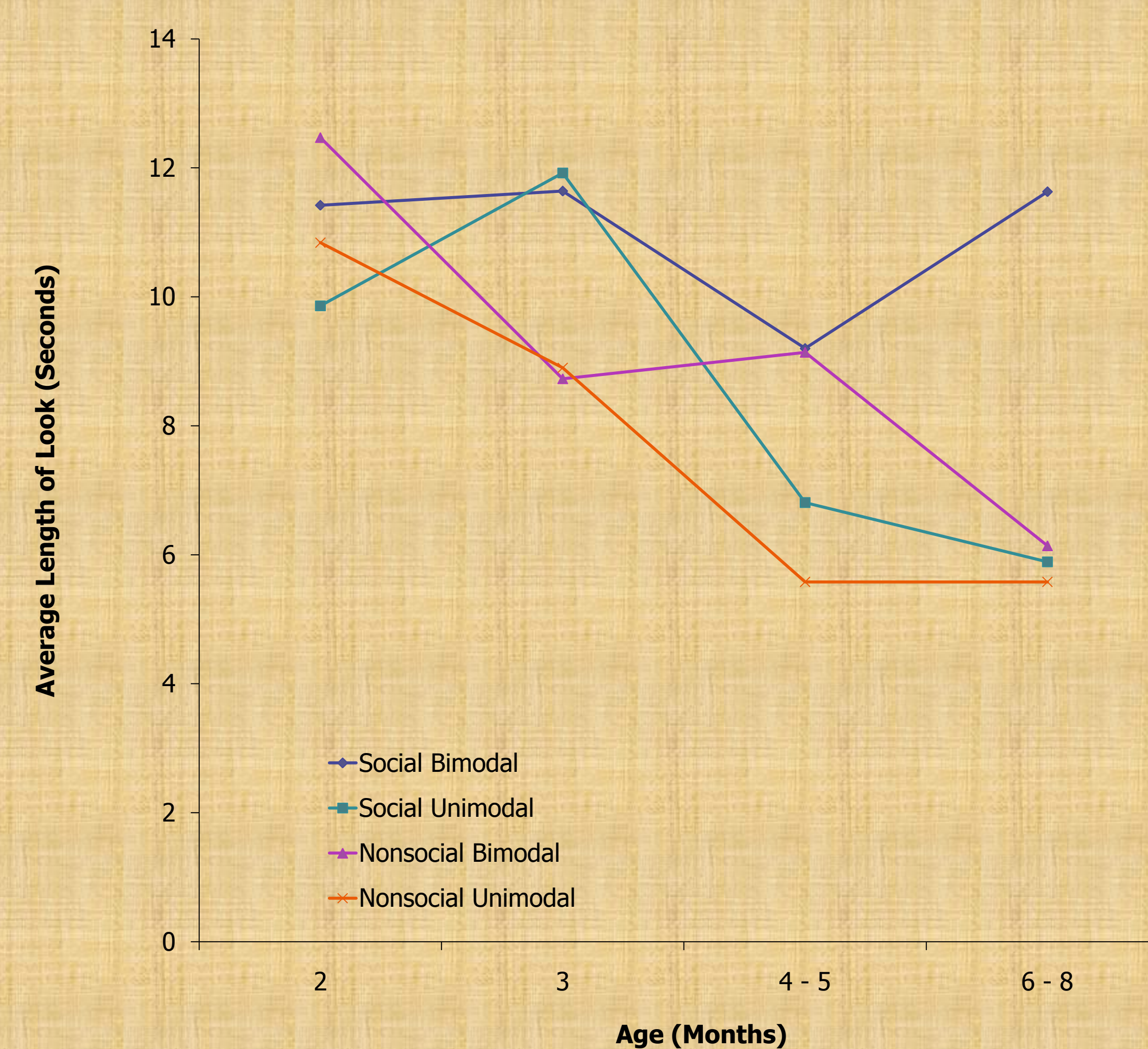
Age (2, 3, 4-5, 6-8 months) x event type (social, nonsocial) x condition (unimodal, bimodal) between subjects ANOVAs indicated main effects of age with decreasing processing time and length of look, and increasing disengagement across age, $p < .001$. Consistent with our predictions, main effects of condition and event type indicated longer processing time and length of look and fewer disengagements for bimodal redundant than unimodal nonredundant stimulation ($p < .001$) and for social than nonsocial events ($p < .005$). These main effects were qualified by interactions with age ($p < .01$) indicating that differences between conditions and event types were most apparent for older infants. Linear trend analyses indicated that interest (processing time) in audiovisual (redundant) social events was maintained across age ($p > .10$), whereas interest in all other event types decreased across age ($p < .01$).

Figure 1. Disengagement (Looks Away per Minute)



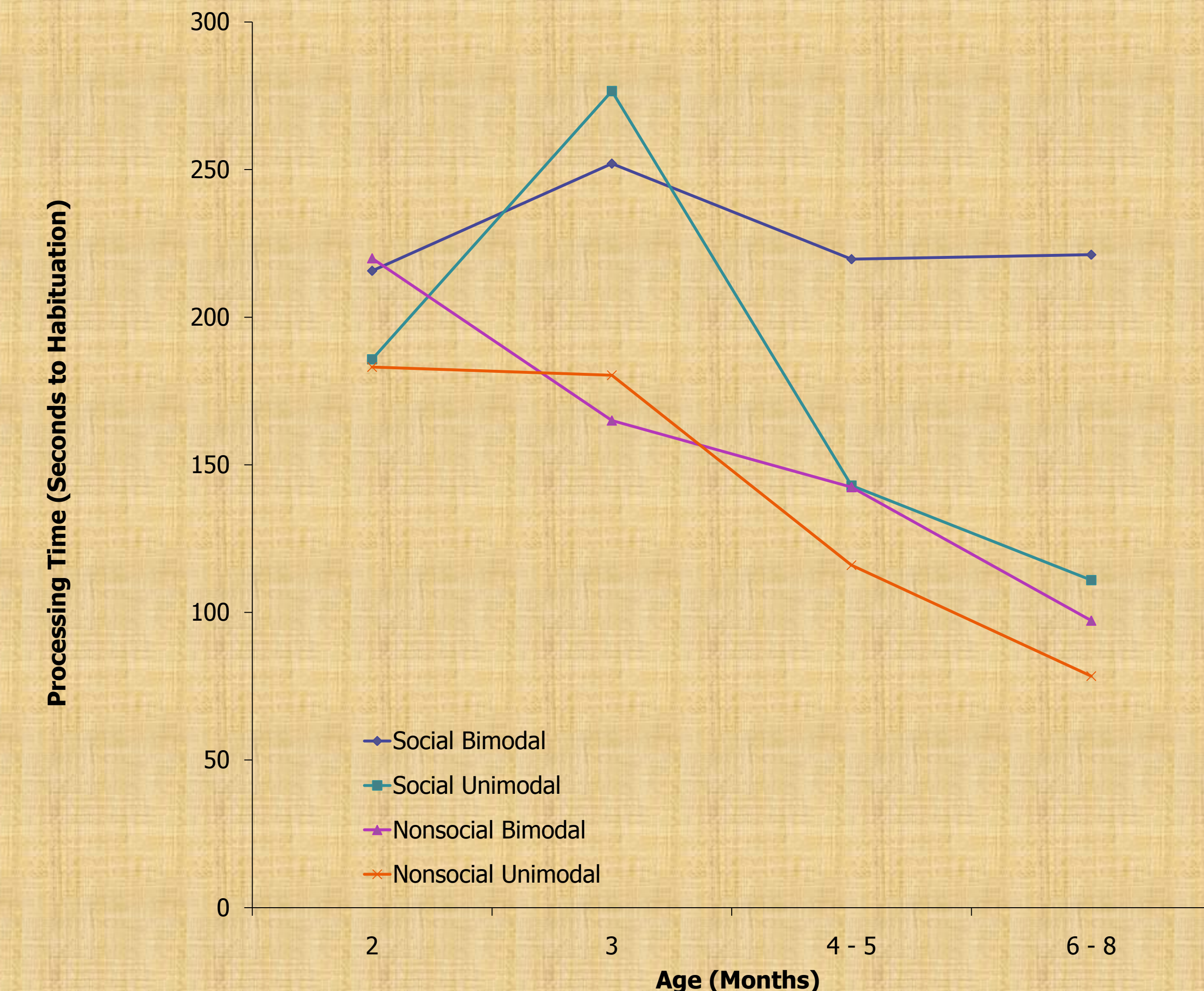
Main effect of age (2, 3, 4-5, 6-8): $F(3, 653) = 36.36, p < .001$
Main effect of condition (bimodal, unimodal): $F(1, 653) = 42.65, p < .001$
Main effect of event type (social, nonsocial): $F(1, 653) = 7.97, p = .005$
Interaction of age by condition: $F(3, 653) = 6.00, p < .001$
Interaction of age by event type: $F(3, 653) = 3.74, p = .01$

Figure 2. Average Length of Look

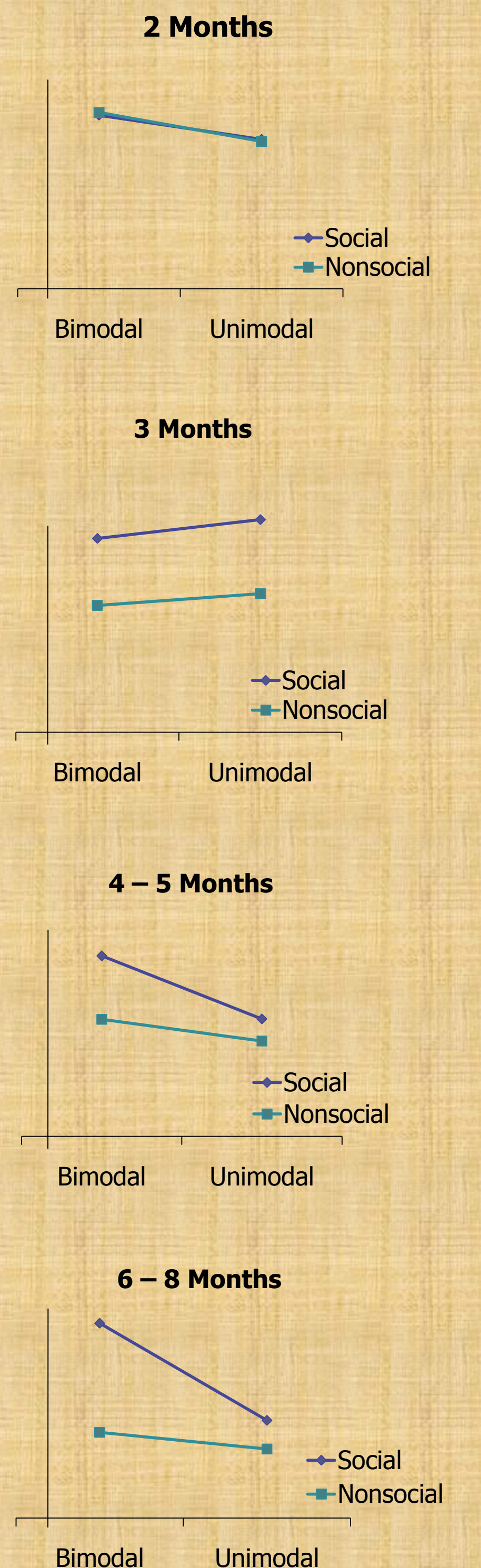


Main effect of age (2, 3, 4-5, 6-8): $F(3, 653) = 19.06, p < .001$
Main effect of condition (bimodal, unimodal): $F(1, 653) = 19.42, p < .001$
Main effect of event type (social, nonsocial): $F(1, 653) = 11.01, p = .001$
Interaction of age by condition: $F(3, 653) = 3.59, p = .01$
Interaction of age by event type: $F(3, 653) = 5.18, p = .002$

Figure 3. Processing Time



Main effect of age (2, 3, 4-5, 6-8): $F(3, 687) = 22.65, p < .001$
Main effect of condition (bimodal, unimodal): $F(1, 687) = 13.64, p < .001$
Main effect of event type (social, nonsocial): $F(1, 687) = 39.74, p < .001$
Interaction of age by condition: $F(3, 687) = 4.36, p = .005$
Interaction of age by event type: $F(3, 687) = 5.09, p = .002$



Conclusions

Consistent with predictions of the IRH, these findings demonstrate that infants show greater attention (more processing time, longer looks, and fewer disengagements) to events that provide intersensory redundancy (audiovisual) than those that do not (unimodal visual). Moreover, these findings demonstrate that attention to bimodal, social events, which provide an extraordinary amount of intersensory redundancy, is maintained across age from 2 to 8 months, whereas attention to unimodal and nonsocial events declines across this period. These findings are the first to suggest that social orienting develops gradually across infancy as a function of intersensory redundancy. These results are consistent with findings of impaired intermodal functioning in autism (e. g., Bebko, Weiss, Demark, & Gomez, 2006) suggesting an intermodal processing disturbance may underlie social orienting impairments in autism.

References

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