



INTRODUCTION

Infants who demonstrate preferences for novel objects relative to familiar objects tend to have higher IQ scores during childhood than infants who do not have a novelty preference (Rose & Feldman, 1995). As a result of this consistent research finding, there has been a great deal of attention given to individual differences and neural networks involved in infant attentional and memory processes. Individual differences in visual attention during the familiarization phase of infant memory paradigms have been highly correlated with the amount of time spent looking at a novel object during the testing phase when infants can choose to look at the familiarized or novel object. Posner (Posner & Raichle, 1995) has suggested that the vigilance attentional network of the brain is involved in effortful sustained processing of continuous visual stimuli. It may be that it is individual differences in the functioning of the vigilance attention network yield individual differences in infant novelty scores. However, temporal lobe function has classically been associated with the encoding, storage, and consolidation of explicit (and pre-explicit) memories (Nelson, 1995). For these reasons, our investigation focused on task-related activations at both frontal and temporal sites.

Brain-electrical activity was explored as a possible source of variance in the establishment and expression the encoding process. In this study, we examined the EEG activity of 85 10-month-old infants during baseline and the familiarization phase of the infant recognition memory paradigm. Measures of visual attention during familiarization, as well as novelty scores during the test phase were behavioral variables of interest. Visual preference was defined according to Fagan's criterion of 53% of the total time looking at the novel object during the comparison test.

We hypothesized that visual attention during the familiarization phase would correlate with novelty scores established during the test phase. In addition, we expected that novelty-preferring infants would further differ from infants with no visual preference in the pattern of electrophysiological activation during the familiarization phase.

PARTICIPANTS

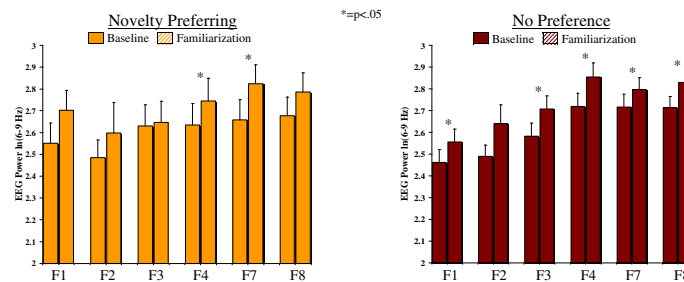


Participants in this study were 85 10-month-old infants recruited from the New River Valley of southwest Virginia. Infants were participate in 2 visits scheduled 24 hours apart. Infants were recruited if they were born within 2 weeks of expected due dates and experienced no prenatal or birth complications. All infants weighed at least 2,500 grams at birth, required no oxygen at birth, and had no neurological diagnoses.

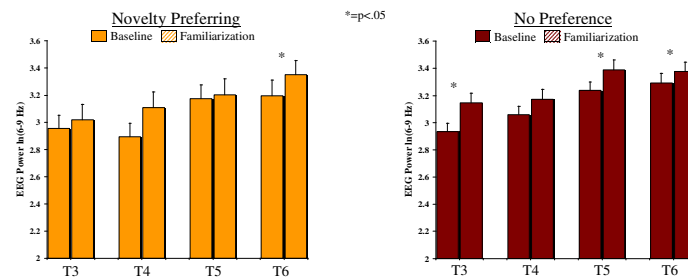
RECOGNITION MEMORY PROCEDURE

Electrode Application		With the infant seated on the caregiver's lap, the experimenter applied EEG and ECG electrodes as an assistant entertained the infant.
Baseline Recordings		Baseline physiology was collected as the experimenter manipulated an infant toy and tapped her fingernails for 60 seconds.
Familiarization		Infants encoded the familiarization puppet by accruing 4 looks, each separated by a 3-second look away from the puppet (Diamond, et al., 1997).
Retrieval		Approximately 20 minutes after familiarization, infants were allowed to look at both the novel and familiar puppets for 30 seconds to establish a visual preference.

FRONTAL CORTEX



TEMPORAL CORTEX



RESULTS

Behavioral Results

Using Fagan's criterion, in this sample, 24 infants (28%) were novelty-preferring, 61 were non-preferring. Additionally, novelty scores were not correlated with any measure of visual attention (percentage of time looking at the object, duration of first look, duration of longest look, or shift rate).

Physiological Results

A repeated measures MANOVA revealed an expected main effect for condition (Hotelling's Trace $F=23.44$, $p<.0001$), where EEG power values at 6-9 Hz increased from baseline to task. Not surprisingly, a main effect for region was also found (Hotelling's Trace $F=95.39$, $p<.0001$) where anterior scalp sites had progressively lower power values than posterior. Finally, we observed a Preference Group x Task Phase x Region x Hemisphere interaction (Hotelling's Trace $F=3.11$, $p=.02$). Group-wise analyses of the baseline-to-task-related patterns of EEG during the familiarization phase (first glove) indicated that, infants who went on to show a novelty preference showed limited activations scores at frontal (F4 & F7) and temporal sites (T6). However, infants who did not demonstrate a visual preference showed a more dispersed pattern of baseline-to-task activation across frontal (F1, F3, F4, F7, & F8) sites as well as temporal locations (T3, T6, & T6).

DISCUSSION

These results are of interest for several reasons. First, behavioral measures of visual attention were not correlated with novelty scores, as was expected, however, infants who did display a visual preference demonstrated different electrophysiological patterns during stimulus encoding. This finding supports the inclusion of physiological approaches to studying individual difference in infant cognitive processing.

A majority of the 10-month-olds in this sample did not demonstrate a visual preference for novelty. This is consistent with recent work by Colombo, Shaddy, Richman, Maikranz, & Blaga (2004) who indicated that although novelty preferences are intact for young infants (using a facial stimuli), these preferences degrade and eventually are absent by the end of the first year as stimuli may be categorized into a single class. It may be that this categorization rather than a novelty preference is the developmentally appropriate response at this age. Indeed, this response was supported by bilateral EEG activations involving several regions within the temporal and frontal cortices.

Further investigations will focus on the development and coherence of the frontal-temporal circuit which is thought to undergo important transitions during the second half of the first year of life. In addition, this bio-behavioral approach will be applied to investigations of memory and visual attention in younger infants where more stable novelty preferences are often reported.