

Same processing costs for encoding sameness and difference in the developing brain

An fNIRS study with 6-7-month-olds

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Abstract

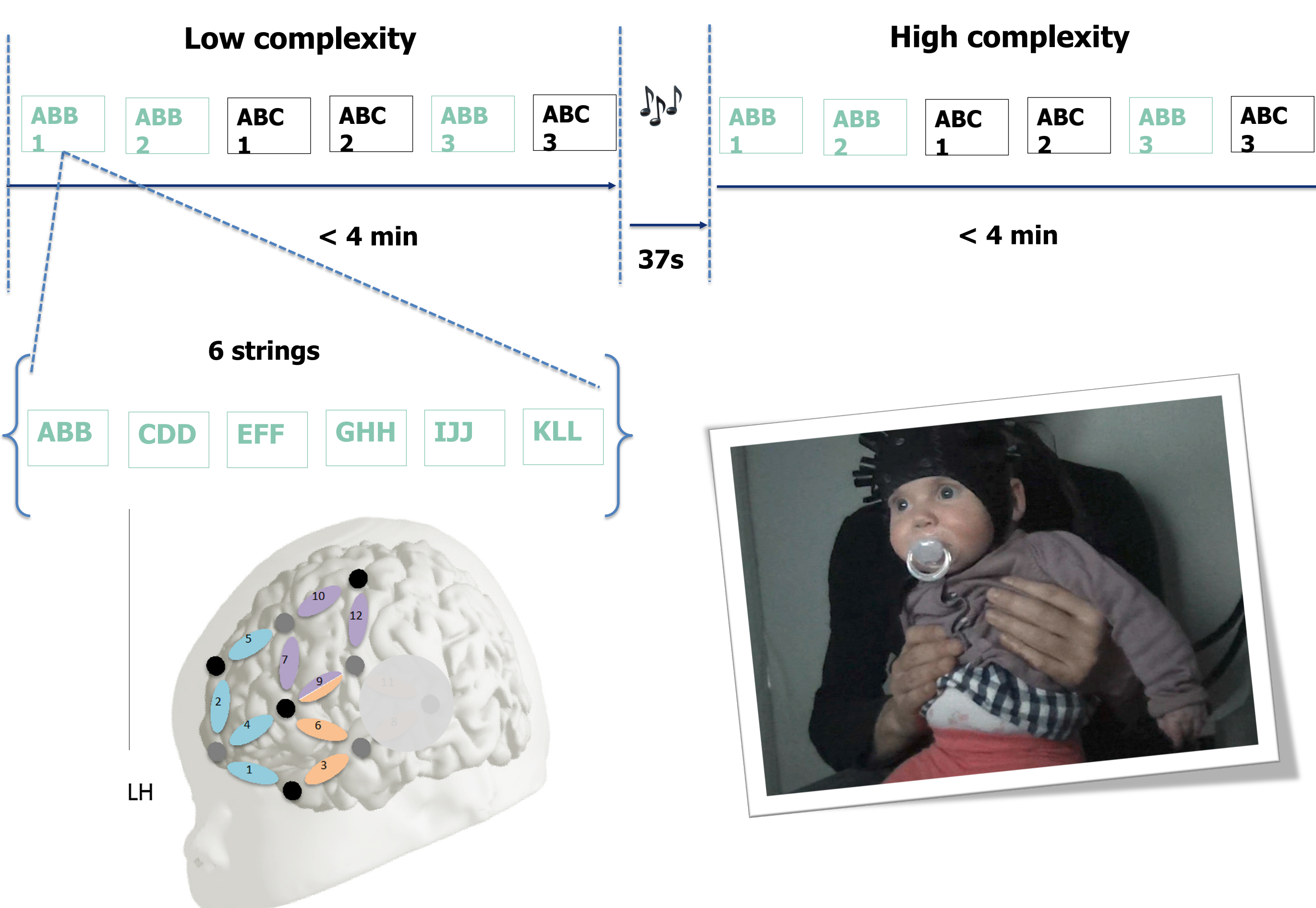
Previous research suggested different cognitive mechanisms, such as perceptual identity detection (Endress et al. 2007) and abstract rule learning (Marcus et al. 1999) to account for the encoding of repetition-based regularities. Here we tested whether and how 6-month-old infants, never tested before in such tasks, are able to discriminate repetition-based linguistic regularities (ABB, e.g. "bu ra ra") from random controls (ABC, e.g. "bu fa zo") and whether variability in the stimulus set impacts learning. In an fNIRS study, 6-7-month-old infants (n=21) were exposed to a low complexity grammar (9 ABBs & 9 ABCs, 2x) and a higher complexity grammar (18 ABBs & 18 ABCs, 1x). There was no significant difference between low and high complexity stimuli. We also found similarly high activation for the ABB and ABC grammars. This contrasts with findings that showed an advantage for repetition in newborns (Gervain et al. 2008), and suggest a developmental change in rule learning between birth and 6 months, when the encoding of difference comes online.

Research Question

- newborns show an increased response to repetition-based sequences (ABB) as compared to random ones (ABC)
 - do 6-7-month-olds also discriminate repetition-based regularities from random ones?
- does this depend on the variability in the input stimuli, as suggested by the less-is-more hypothesis (Newport 1990)?

Methods

- NIRS: 20 channels – NIRx NIRScout
- 6-7-month-old French infants (n = 21)
- **stimuli:**
 - low complexity (9 ABBs & 9 ABCs, 2x)
 - higher complexity (18 ABBs & 18 ABCs, 1x)



Results

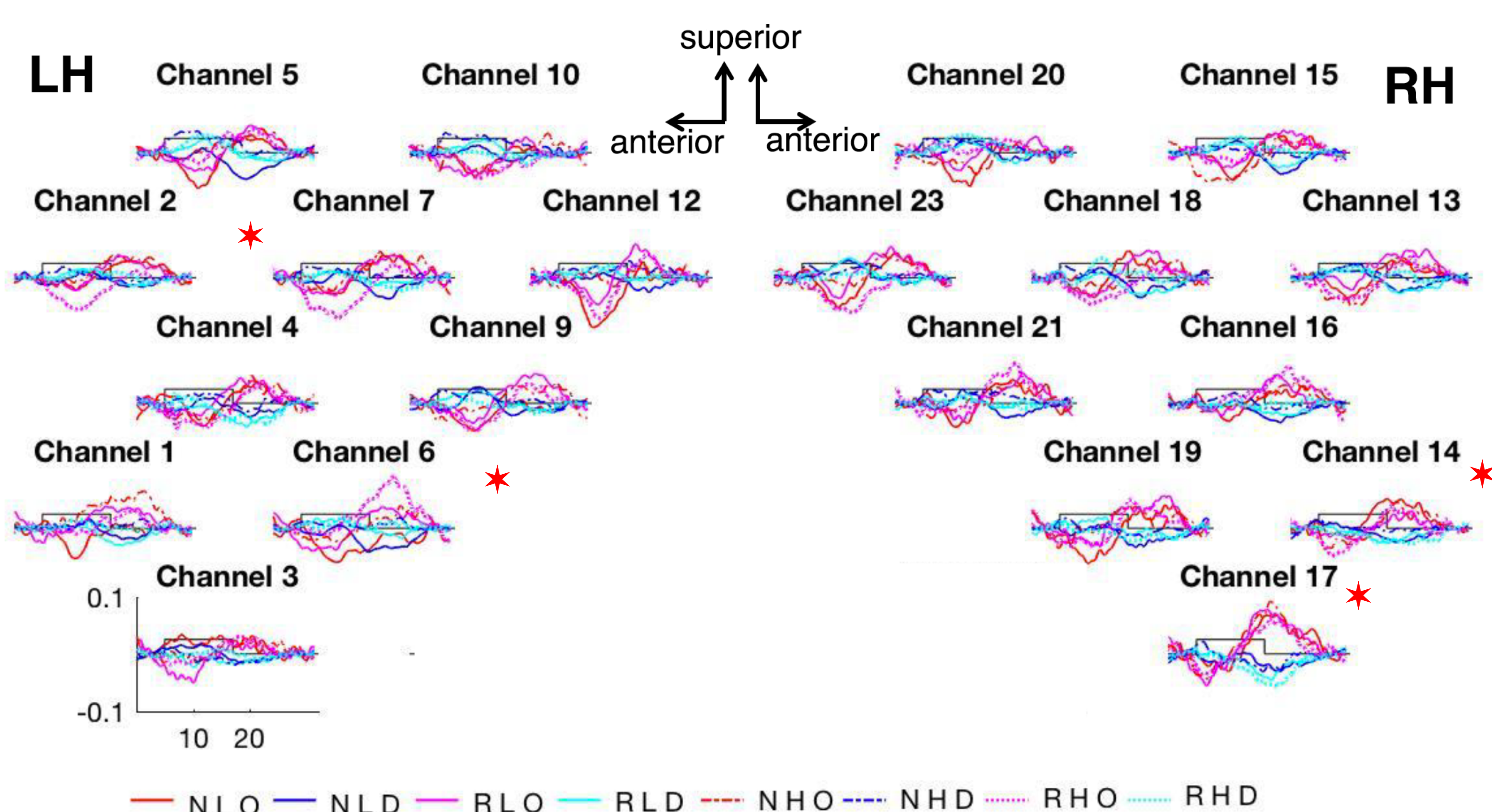


Figure 1. The NIRS responses obtained in the 4 experimental conditions. The x axis represents time in seconds, the y axis concentration change in mmol x mm. Legends: N: no repetition (ABC), R: repetition (ABB), L: low complexity, H: high complexity, O: oxyHb, D: deoxyHb

Discussion

At 6 months of age, infants respond to random sequences equally than to repetition-based sequences, suggesting a developmental shift between birth and 6 months, during which the encoding of difference emerges. This does not seem to be influenced by stimulus variability.