THE EFFECTS OF ATYPICAL PERINATAL SENSORY STIMULATION ON CONTINGENCY LEARNING IN BOBWHITE QUAIL

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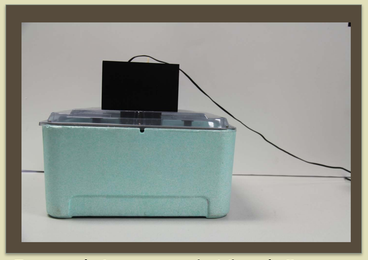
Introduction

- Preterm infants account for 12% of births in the United States. Following their early delivery, preterm infants in the NICU are routinely exposed to abnormally high levels of auditory and visual stimulation compared with the fetal environment.
- Given reports that preterm infants show deficits in contingency detection and learning when compared to full-term infants (e.g., Gekoski et al., 1984; Haley et al., 2006, 2008), it seems plausible that their exposure to atypical amounts of sensory stimulation might contribute to the reported deficits in these critical skills. What is not known is how and to what extent modifying the amount and type of perinatal sensory experience effects the emergence and development of contingency detection and learning.
- Since systematic manipulations of sensory experience is not possible with human fetuses or infants, comparative work with animal subjects provides a useful step in understanding early perceptual and cognitive development. Previous studies from our lab using bobwhite quail have shown that modifying the auditory or visual experience during the late stages of prenatal development can alter neural development, physiological regulation, as well as passive prenatal perceptual learning (Lickliter, 2005; Markham, et al., 2008).
- In the current study, we assessed whether increasing amounts of perinatal sensory stimulation would interfere with quail neonates' contingency detection and contingency learning in the days following hatching.
- Subjects were bobwhite quail embryos that received either: 1) greatly increased amounts of visual stimulation (*Visual*), or 2) greatly increased amounts of auditory stimulation (*Auditory*), or 3) no abnormal stimulation (*Controls*). We hypothesized that chicks that received the abnormal stimulation (either V and A) would fail to prefer the familiarized call, thus demonstrating poor retention of contingently presented information.

Methods

- In the *Visual* condition (n = 30), the embryos were exposed to a 15-W light pulsed continuously at 3 cycles per second, from 2 days prior to hatching until postnatal testing at 72 hours following hatching. Although the precocial avian embryo is responsive to prenatal visual stimulation (Heaton, 1981), the embryo does not ordinarily experience patterned visual stimulation until after hatching from the egg.
- In the *Auditory* condition (n = 31), embryos were continually exposed to white noise with gradually varying pitch and intermittent percussive sounds, presented at approximately 75 dB, from 2 days prior to hatching until they were tested at 72 hours following hatching.
- In the *Control* condition (n = 32), chicks did not receive any modified prenatal or postnatal sensory stimulation.
- All chicks were trained (without the supplemental auditory or visual stimulation present) at 48 hours following hatching using a contingency paradigm in which they were presented with a bobwhite maternal call contingent on their own vocalization on a FR1 schedule in a 5 minute-session, which was previously found to be effective at facilitating detection and learning of the familiarized call (Harshaw & Lickliter, 2007).
- Postnatal auditory preference for the familiarized call was evaluated using a simultaneous choice test between the familiarized call and a novel bobwhite maternal call at 72 hours of age (one day later). All chicks were tested only once and each trial was five minutes.
- The dependent measure of preference was the proportion of total duration (PTD) spent in proximity to the familiar call, which was calculated by dividing the duration of time the chick spent in the familiar approach area by the total duration spent in the familiar and novel approach areas.



Prenatal Augmented Visual Set up

Prenatal Augmented Auditory Set up

Prenatal Control Set up

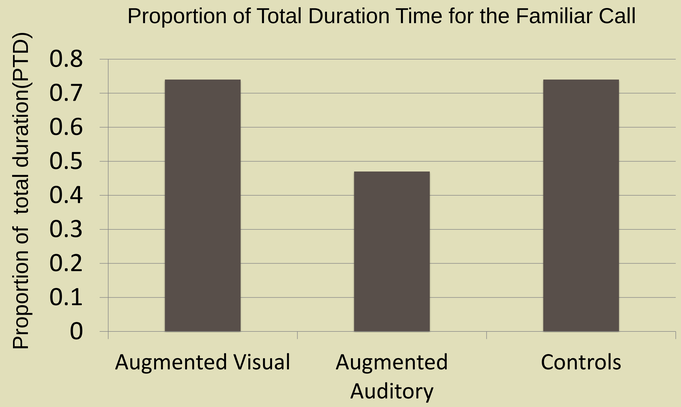
Postnatal Control Set up

Postnatal Augmented Visual Set up

Postnatal Augmented Auditory Set up

Results

- There was a statistically significant difference between groups as determined by one-way ANOVA at an alpha level of .05, $F(2, 90) = 8.148$, $p = .001$.
- A Tukey HSD test indcated that the mean PTD for the familiarized call for controls (M =.74 , SD = .27) was significantly greater than the mean PTD for the *Auditory* condition (M =.47 , SD = .29). Surprisingly, the mean PTD for the *Visual* condition (M =.74 , SD = .32) was not different from the controls.



Discussion

- Results reveal that elevated levels of visual stimulation provided during the perinatal period did not impair contingency learning. In contrast, increased perinatal auditory stimulation significantly impaired contingency learning during the early postnatal period.
- These preliminary results suggest that specific experiential factors can impair contingency detection and learning in early development and highlight the need for additional research on the influence of modified sensory experience during the perinatal period.

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