

The effect of independent locomotion, through the use of a robotic-assisted device, on infants' visual attention to a puppet stimulus

Self-Initiated locomotion provides new ways of experiencing the world and it is also thought to contribute to the enhancement of higher-order cognitive, self-regulatory, and attentional control processes underlying goal-directed behaviors, namely executive functions (EF). A potential indicator of the development of EF is visual attention, as measured by look duration (LD) during infancy. Peak look duration (PLD), longest look time at a stimuli, decreases between 2 and 7 months and then slightly increases or plateaus. This increase in PLD at about 7-months coincides with the development of endogenous, sustained attention, and the onset of independent locomotion through crawling.

We used an experimental design to examine the relationship between the independent locomotion and attentional behavior in infants. Because infants with limited mobility do not have the opportunity to navigate the environment freely (e.g., without help from an adult), the aim of this study was to determine whether pre-crawling infants who are given the opportunity to exercise independent locomotion using a robotic assisted device, would show changes in their behavioral regulatory capacity and, implicitly, in their sustained attention to visual stimulation. We hypothesized that infants who received independent robotic-assisted locomotion would show longer PLD to a visual stimulus than infants who did not experience independent robotic-assisted locomotion at 7 months of age.

Infants were randomly assigned to either a locomotor/experimental or non-locomotor/control group. The locomotor group learned to navigate the environment independently by operating the WeeBot, a novel robotic device (developed by Larin, Dennis, &

Stansfield, 2017) over 12 sessions, twice a week. The WeeBot is sensitive to infants' weight shifts and allows them to drive in the direction in which they lean. The non-locomotor group sat in a similar device, but their device was not equipped with movement capabilities. At 5-months and at 7-months, all infants participated in a visual attention test developed by Cuevas & Bell (2014). A glove puppet, adorned with facial features and bells attached to each fingertip was presented to infants in 4 trials, each trial terminating after infants looked away from the puppet for 3 seconds. The longest PLD of the 4 trials was used in the analysis.

Our results show that the locomotor and non-locomotor groups demonstrated different patterns of visual behavior at 7-months. Infants in the locomotor group showed a slight increase in PLD, a pattern usually observed in infants 7-months of age or older while the non-locomotor group's PLT decreased, as pattern often seen in infants 5-7 month of age.

Assisted locomotion might induce development of infants' regulatory abilities. The difference in looking duration between our locomotor and non-locomotor group is linked to the effect of independent locomotion on the development of attentional control.

This study contributes to our growing understanding of the effect of locomotor experience on cognitive development, in particular on the development of attentional control and it adds support to previous research linking infants' early mobility to a variety of cognitive, perceptual, and social skills. Our findings also have implications for interventions using robotic-assisted locomotion for infants with motor impairments.