Development of Experimental Paradigm for Measuring Early Cued Attention

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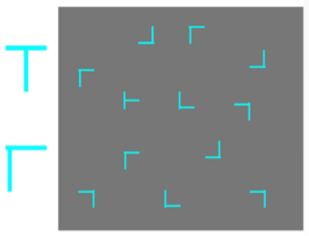
Background

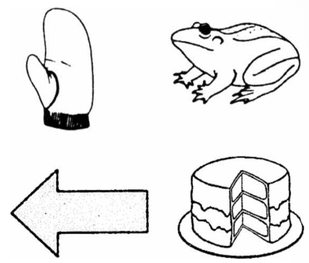
Contextual Cueing

When searching for a target object (e.g., the letter T in a field of multiple letter Ls), people's search time is reduced when configuration of distractors repeat (Chun and Jiang, 1998; Peterson and Kramer 2001). Contextual cueing effect depends upon the visual features rather than the semantic links to an object (Makovski 2018), and the effect has been speculated to involve implicit learning thus to emerge early developmentally. Indeed, similar learning has been reported with young children—8 to 12 months old infants learning associations between targets and contextual elements of the scenes (Bertels, San Anton, Gebuis, and Destrebecqz 2017).



Word Cueing

Words and sentences cue visual attention (Huettig, Quinlan, McDonald, and Altmann 2005, Altmann and Kamide 2007; Yoshida & Smith, 2005; 2011, Vales and Smith 2015). For example, simple word cues such as "spinach" can direct gaze to visually related (i.e., by color) object such as "frog" even though it is semantically inappropriate object (Dahan & Tanenhaus, 2005; Huettig & Altmann, 2004, 2007, Huettig, Quinlan, McDonald, and Altmann 2005). These are often documented in the language mediated attention literature and has also been explored in young children. When searching for an object of a certain color, three year old children fixated on objects which had the same color, such as a red plane while searching for a strawberry (Johnson and Huettig 2010).



Gap in the Literature

Though literature suggest that words and contexts both have immediate attention guiding effect, there have been much fewer attempts made to address how each cue—separately or together— direct attention in children. We know nothing about the robustness --- individual differences and developmental trajectories of this ability. However, there are no established paradigms that allow researchers to test young children's development of attention cuing effect.

Significance and Ultimate Goal

Effectively directing is developmentally important in every contexts one can imagine – from learning words, finding relevant aspect in a scene, to following instructions in a class-room. Building a developmentally appropriate experimental paradigm that allow researchers to systematically examine the fault-line of this ability will identify factors support and hinder the attentional cuing mechanism—critical information considering the early learning in general.

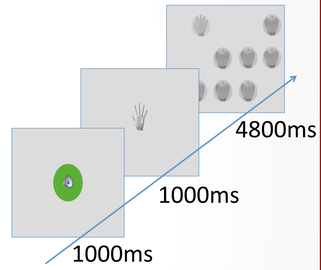
Study Aims

- Develop a developmentally appropriate experimental paradigm with which we can account for these two types of cuing effect with young children (20-months- to 36-months old).
- Explore how these cues (word and context) together or separately guide immediate attention
- Explore how the individual differences (memory and language knowledge) reflect upon the cuing effect and processes.

Method

Visual stimuli

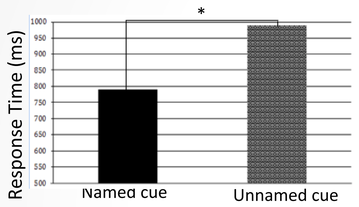
After two familiarization trials that provide children with easy version of the task, the testing trials begin. There is a fixation slide in between each testing trials. These presented a green circle in the middle of the screen expanding and shrinking to direct children's attention to the middle. The task contained 42 testing trials total. In each test trial, a gray digital photograph of an object (e.g., hand) was presented (1000 ms) followed by a slide containing of one target (hand) and seven color-matched distractor objects (apples) in circles (4800 ms). These circles were positioned in any of ten possible locations on a 5 x 3 grid, excluding the middle position on the grid and the four directly adjacent positions. In non-contextual-cuing trials, the target circle could appear in any of nine of these positions (excluding the position reserved for the contextual cuing trial). In the contextual cuing trials, the target always appeared in the second column on the bottom row.



Auditory stimuli

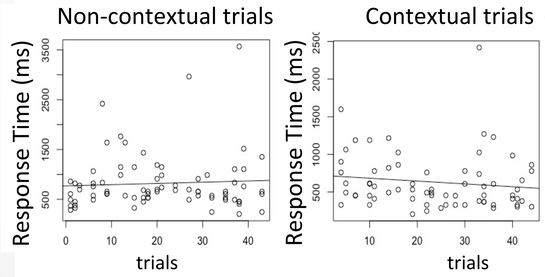
A female native English speaker in infant-directed speech prosody was used to label the target object during the a fixation slide. The auditory stimuli was to access the word cuing effect. The mean duration of the target word was 459-ms (range: 422-480-ms). In labeled trials, the carrier phrase "Look at the ___", preceded the target noun. On unlabeled trials, the target noun was not named, instead the phrase "Look at that one!" was presented.

Findings



Word cuing effect (N=14)

We presented children ages 18 to 24 months with a field of one target object and three distractor objects. Target objects were either named or unnamed in an auditory cue. We analyzed the response times of saccades to the target object, and duration of gaze on target object. Response times in named trials was significantly shorter than in unnamed (p=.033). The children fixated on target objects significantly longer in named versus unnamed trials (p=.047).



Contextual Cueing (N=5)

We looked at the contextual cueing effect. In the non-contextual cueing condition, we found an increase in response time to the target object of 2.462 ms per trial ($p < .001$). In the contextual cueing condition, we found a decrease in response time to the target object of 3.792 ms per trial ($p < .001$). The results suggest potential contextual cuing effect.

Discussion

Successful direction of naming effect validates the timing and the quality of the auditory stimuli. Also, the findings from the comparison between non-contextual and contextual trials indicates the potential effect of repeated spatial information. We aim to continue studying children with a wide range of age groups. We further plan to explore what effects age, socioeconomic status, and other demographic features may affect the development of word and contextual cueing to address potential individual differences.