**SOL Manuscript** [fast track at Psych Science then Developmental Science]

**Abstract**

**Introduction**

- Looking for language (eye movements critical in ASL)

- Incremental processing background work – English/ASL

- Current study – exploratory, proof of concept

**Method**

*Participants*

XX deaf and hearing children with native exposure to ASL (XX females, XX males, Mage = , range = 15-36 ) and 12 fluent adults were recruited from several locations by bicultural/bilingual researchers fluent in ASL. For all children, ASL was the primary mode of communication at home, and the majority attended a center-based early childhood education program in which ASL was the primary mode of instruction. Thus children were immersed in ASL both at home and in the classroom setting. An additional XX participants were tested, but not included in the analyses due to fussiness (n=), failure to fixate one of the stimulus pictures on at least 50% of trials (n=), experimenter error (n=) or parental interference during testing (n=). For some analyses, children were binned into two groups using a median split by age: Younger 15-24 months, Older 25-34 months.

TABLE 1*:* Demographic information

*Measures*

Vocabulary size

During the visit, parents completed a version of the MacArthur-Bates Communicative Development Inventory designed to be culturally and linguistically appropriate for children learning ASL. Vocabulary size was the number of reported signs produced.

ASL Processing

Efficiency in online comprehension was assessed using a version of the looking-while-listening procedure (Fernald *et al.*, 2006; Fernald, Zangl, Portillo & Marchman, 2008) adapted for ASL-learners, which we call the Visual Language Processing (VLP) task.

On each trial, children saw pictures of two familiar objects and a signer naming one of them. Figure 1 shows the stimuli and a timeline of one trial in the VLP task.

FIGURE 1: Stimuli and timeline of trial

Children’s gaze patterns were videotaped and coded frame-by-frame, yielding a high-resolution record of eye movements aligned with target noun onset. Inter-observer agreement within a single frame averaged XX% on reliability assessments.

*Stimuli:*

Since this was the first study to measure online ASL processing efficiency, the linguistic stimuli were designed to be comparable to those used in previous research and to allow for generalization beyond characteristics of a specific signer and sentence structure. To accomplish this, ASL stimuli were recorded by two different native ASL-users using two different but acceptable ASL sentence structures for asking questions:

* Sentence-initial *wh-*phrase: “HEY! WHERE [target noun]?”
* Sentence-final *wh-*phrase: “HEY! [target noun] WHERE?”

Before each sentence, the signer used a child-friendly hand-waving gesture, commonly used in ASL discourse, to get the child’s attention.

Four yoked pairs of eight target nouns (cat—bird, car—shoe, bear—doll, ball—book) were used. These nouns were selected such that they would be familiar to most children learning ASL at this age and have minimal phonological overlap. To prepare the stimuli, a female native ASL-user recorded several tokens of each sentence, matching them closely in prosody. These candidate stimuli were then digitized, analyzed, and edited using Final Cut Pro software. The final tokens were chosen based on naturalness and prosodic comparability. The mean duration of target nouns was XXX ms (range = XXX ms). Five filler trials were interspersed among the 32 test trials (e.g. “YOU LIKE PICTURES! MORE WANT?”). Images were digitized pictures presented in fixed pairs, matched for visual salience with 3–4 tokens of each object type. Side of target picture was counterbalanced across trials.

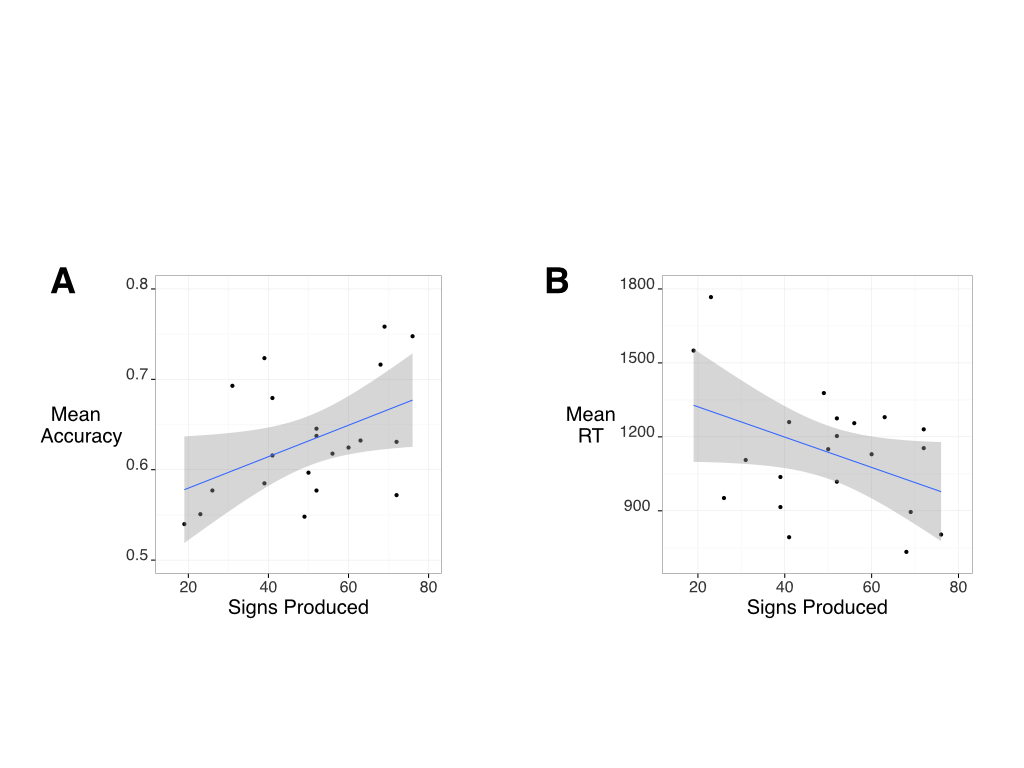
*Calculating linguistic processing efficiency*

Correct looking is a function of the child’s tendency to shift quickly away from the central signer to the target picture in response to the target sign, and also to stay fixating on the target picture. To determine the degree to which participants fixated the appropriate picture across trials, mean proportion looking to target was calculated for each participant at each 33 ms frame from the onset of the target noun. Accuracy was defined as the mean proportion of time spent looking at the target picture out of the total time spent on either the target picture, the distracter picture, or the signer from 300 to 2600 ms from target noun onset.

Reaction time (RT) corresponds to the latency to shift away from the signer to the target picture, measured from the onset of the target sign. Responses prior to 300 ms from noun onset were excluded because they presumably occurred before the child had time to process sufficient linguistic input and to mobilize an eye movement; responses slower than 2600 ms were excluded because these delayed looks are less likely to reflect a response to the target sign (see Fernald, Swingley & Pinto, 2001). Note that RT can be calculated only on those trials on which the child is looking at the signer at the onset of the noun and shifts correctly to the target picture within the designated time window. Since children vary in the likelihood that they will start out on the signer on a given trial, mean RTs are based on different numbers of trials across participants (M=6.3 trials, range=XX—XX). About XX% of all distracter-initial trials were excluded from the RT analysis, either because the child never shifted to the correct picture or because the shift occurred outside the 300-2600 ms window. Only those children with at least two RTs within the appropriate window (n=XX) were included in analyses of mean RT.

*Results*

Macintosh HD:Users:kmacdonald:Documents:Projects:SOL:SOL-GIT:plots:paper:acc-rt.pdfFIGURE 2: Accuracy and RT age-related changes

FIGURE 3: Relationship between processing efficiency and vocabulary size

**Discussion**