Word recognition in Developmental Language Disorders in Greek

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Abstract

To this day, characteristics of the online visual perception in DLD remain quite unexplored. This study aimed to investigate the dynamic recognition of spoken words for nouns and verbs in children with Developmental Language Disorder whose spoken language is Greek. 9 children with DLD participated in this pilot study and their eye movements were recorded as they searched among an array of pictures for the target picture in response to hearing a single. The results showed that children with DLD presented a stronger performance of recognition for verbs than nouns while the more the word information the quicker the recognition.

Keywords: Developmental Language Disorder, eye-tracking, word recognition

Introduction

The term Developmental Language Disorder (DLD) refers to persistent difficulties in acquiring, understanding, producing or using written and spoken language that arise during development and cause significant limitations in the communication abilities of the person. The language deficits of the disorder are not consistent with the individual's mental age and are not attributable to another neurodevelopmental or sensory disorder or other neurological condition (ICD-11, 2018). The areas of deficits cover the whole range of language, namely semantics, syntax, morphology, phonology and pragmatics (Leonard, 2014).

While language processing based on verb argument structure in children with DLD has been studied, this has been done mainly with off-line methodologies. *Visual world paradigm* (Tanenhaus et al., 1995 has made the online investigation of language feasible. This model basically makes use of eye-tracking while the child simultaneously sees an image and listens to the corresponding naming thus offering real-time measurements of language processing.

The aim of the present work is to investigate the dynamics of spoken word recognition for nouns and verbs in children with Developmental Language Disorder (DLD) as part of a pilot study which attempts to adapt and replicate the study of Andreu, Sanz-Torrent and Guardia-Olmos (2012). In particular, it will be studied if children with DLD show better performance in identifying verb and noun targets in response to auditory/visually presented words in the

Greek language and whether verbs with a larger number of arguments take longer to retrieve due to more complex encoding in the semantic lexicon.

Methods

All participants had Greek as their mother tongue, normal vision, hearing, mental ability and lack of neurological, sensory and emotional deficits. Nine (9) children (6 boys – 3 girls) with DLD and age ranging from 4;6 to 7;11 years took part in this study. A language assessment based on the standard criteria given by ICD-11 for the diagnosis of DLD was addressed by the researcher. The assessment included intelligence scales, language tests, temperament and socio-economic questionnaires, tests of psycho-emotional development and assessment of oral structure and motor function.

18 nouns and 18 verbs (six one-argument, six two-argument, and xix three-argument) made up the target words. Care was taken to weight number of syllables, frequency of occurrence and age of acquisition in words of the same category. Each word was paired with a corresponding image rated as highly visual by a group of adults. Each target image was then combined with 3 other images (distractors) so that the resulting set of four images always included 2 object images and 2 action images. The words were uttered and recorded by a native Greek speaker while they were placed in four square quadrants on the computer screen. The duration of the spoken target word was constant (i.e. 1 sec) and was embedded in a 4-sec mp4 file.

Participants were instructed to look at the picture that would be heard until it disappears from the screen. Familiarization tests preceded. A region of interest was defined for each target image based on screen coordinates to coincide with the rectangle surrounding the image.

Results

Figure 1 demonstrates that the proportion of no fixations is smaller to the more complex verbs. The proportions were calculated by excluding any trial track losses (i.e. events where the participants did not show any gaze to the picture) and then dividing the rest of the events to the total number of trials per word.

In figure 2. the proportion of successful trials over time is presented. 3 time windows are noted (i.e. 200-1000ms, 1000-2000ms, 2000-4000ms). Success was defined as a first fixation to the correct stimulus. The rate of increase was similar and linear across the different word types during the first and second time window. Nevertheless, for times larger than 2000ms the rate was smaller, implying that the time to first fixation was likely to be during the 2000ms and if the child failed to fixate on the correct picture, it was unlikely that would do so for times larger than 2000ms.

A Poisson regression accounting for child-specific clustering using random effects was performed. The main outcomes were fixation times and time to first fixation. 19% increased fixations in verbs of type 1 (1-argument) compared to

nouns was found. This increase was marginally significant. Another 21% of increased fixations on verbs of type 2 and 28% of increased fixations on verbs of type 3 compared to nouns were found and both increases were significant. Respectively, overall children needed approximately 5% less time to first fixation when it came to verb type 1 or verb type 2 compared to nouns, whereas same time to first fixation between a noun and a verb of type 3 was noted. In addition, there was a 17% decrease in the fixation counts when the word consisted of 3 or 4 syllables compared with 2-syllables words. This result was significant. Respectively, children with DLD needed 32% and 21% more time to first fixation to a word with 3 or 4 syllables compared with 2-syllable words. These results were significant.
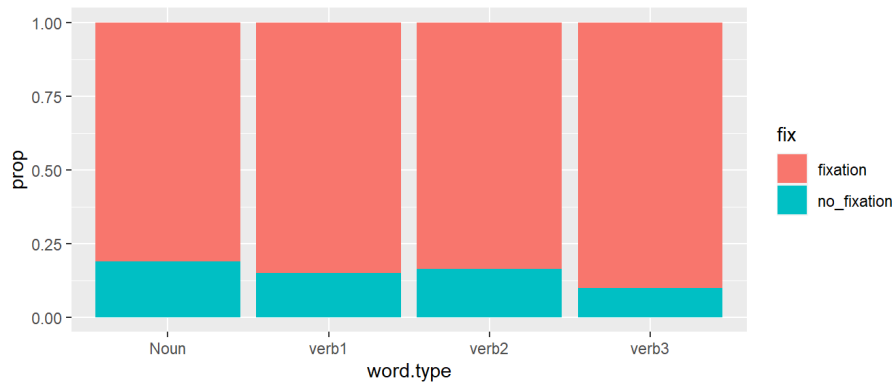

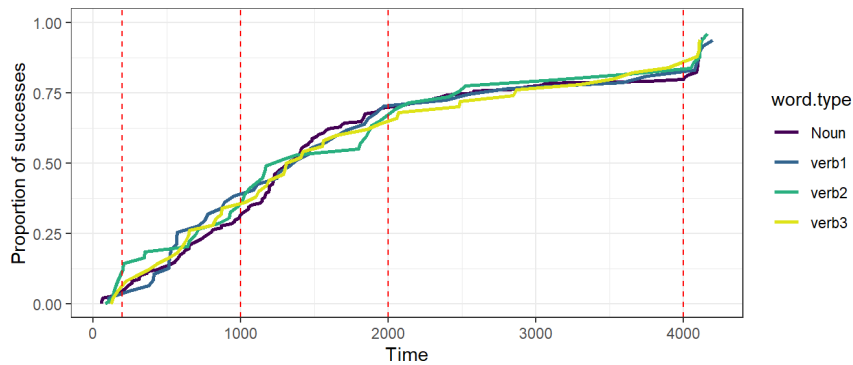Figure 1. Proportion of fixations and no-fixations for each word type.

Figure 2. Proportion of fixations to the nouns (no), one-argument (v1), two-argument (v2) and three-argument verbs over time from the video onset.

Accounting for age, sex, duration of speech therapy, Raven's PM scores and language scores, no effect of any was found. That meant that both the number of fixations and the time to first fixation did not change for any one unit in the language, cognitive or demographic scores.

Conclusion

The current work intended to collect data about the way Greek speaking children recognize nouns and verbs as measured by an on-line eye-tracking experiment. As a result, children with DLD demonstrated a tendency to recognize verbs in a faster way than nouns, while as the number of the verb arguments increased, the recognition was becoming faster. These findings not only did they not replicate the results the original study in Spanish speaking children with DLD offered, but also showed quite the contrary. Since Greek literature has not still offered rich data on the online understanding of words in the DLD population, this pilot study suggested that in some way the verb argument information helped children with DLD to achieve a quicker recognition of more complex words. That would be attributed to the more concrete semantic nature of verbs with more arguments (i.e. sell) as opposed to the more abstract nature of verbs with fewer arguments (i.e. cry) that were used in this study. Since the more the word information the quicker the word recognition, a significant role of the semantic links the children own may be arose. A control group as well as the enrollment of a bigger population will shed light on the initial research question invigorating the observation power of the current study.

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