Breaking the Ice between Idioms Processing and Population with Deafness.

How do adults with deafness process idiomatic expressions during reading?

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Idiom's comprehension appears to be related to reading skills in individuals with typical development. Even in adolescence, individuals with deafness demonstrate a lower performance in reading comprehension than typically hearing individuals. Little is known about how individuals with deafness process figurative language and in particular, idioms. This proposal describes an ongoing study in which a group of adults with deafness (N=13) and a group of college students with typical hearing (N=30) read idiomatic expressions embedded in a literal and a figurative context. During the reading, their eye movements on the text are monitored. Idiom's congruency is also manipulated by including a non-related word at the end of the idiomatic expression (target word). Additionally, participants completed a battery of language and reasoning tests. Preliminary data will be presented during the workshop.

CCS CONCEPTS • Human-centered Computing • Empirical Studies in HCI • HCI design and evaluation methods

Additional Keywords and Phrases: Figurative language, Reading, Eye-tracking, atypical population

1 INTRODUCTION

An idiom consists of a sequence of words with a fixed order (e.g., kick the bucket). Contrary to the literal interpretation of sentences, for idioms, the meaning differs from the dictionary definition of the individual words that compound the expression (kick the bucket – means to die rather than to throw a pail). Because idiomatic expressions appear very frequently in daily conversations and books, idioms are relevant for language understanding for both, for oral language

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and written language and therefore, they are relevant for academic achievement. Indeed, some studies have reported a positive relationship between idiom understanding and academic achievement [eg.,1].

1.1 The Relationship between Idioms Comprehension and Reading Comprehension.

One of the factors that influence idiom processing is context. The expression "to break the ice" has a literal meaning on the sentence "It was so cold that the climber had to use a tool to break the ice to continue his expedition", whereas the same idiomatic expression can have a figurative meaning on the sentence "Before beginning his speech John told a joke to break the ice with the congress audience". According to Oakhill et al. [2] during reading, context influences idiom comprehension in two ways: (1) While reading a text, the reader can find a mismatch between the literal and the figurative meaning of the idiomatic expression and the meaning of the text. Such mismatch may cause longer processing times for the idiom (2) When the reader derives the figurative meaning of the expression from the context, longer processing times for the expression may be found as well. The role of context during idiom processing was analyzed by Oakhill et al. [2] in two groups of typically developing students (from 3rd grade and 5th grade) using a self-paced reading task. Participants were asked to read silently 20 idiomatic expressions. Half of the expressions were embedded in a literal context (and therefore the meaning was literal) whereas the other half was embedded in a figurative context with an idiomatic meaning. Participants also read 20 sentences including idioms that had been translated from a different language (Italy), such idioms depicted the same figurative meaning as the English ones however, because they had a different form, they were novel to participants (all participants were English native speakers). Texts were presented to participants sentence-by-sentence. While participants read the sentences their reading times and their reaction times were registered. A comprehension question was presented after reading each sentence. The reading level of the participants (skilled vs. less skilled readers) was also computed during the analyses. Participants invested more reading time on items with a figurative meaning than on items with a literal meaning. This effect did not vary with age or reading skill; so, it can be concluded that texts conveying a figurative meaning were harder to process than those with a literal meaning. An interesting result emerged when analyzing reading times on novel idioms (those that had been translated to Italian). Whereas skilled readers invested more reading time on the figurative than on the literal condition for both novel (Italian) and familiar (English) idioms, less-skilled readers invested more time reading the figurative condition than the literal condition on the familiar idioms but not on the novel ones. Moreover, Oakhill et al. [2] reported a positive correlation between the number of correct responses on the comprehension questions and reading times on the unfamiliar condition. Therefore, skilled participants demonstrated a different, albeit adequate processing of novel idiomatic expressions than less-skilled readers. This study constitutes a good example of how reading level can be related to idiom comprehension and how figurative language appears more time-consuming than literal language at least for participants who have not fully mastered their reading skills yet. Because unfamiliar figurative expressions required participants to use context appropriately and demanded higher inferencing abilities, it suggests that text related difficulties such as inference elaboration and reading monitoring may be linked to figurative language comprehension. Besides reading comprehension, other factors have been found to correlate with figurative language comprehension. For example, Norbury [3] observed that age, language skills, and memory for story contexts predicted idiom comprehension in participants with ASD, language impairment and typically developing children from 8 to 15 years old.

1.2 Why might the population with deafness have difficulties with idioms processing?

There are several reasons to suspect that individuals with deafness have difficulties to understand idioms, most of them relate to the consequences of auditory deprivation and the reduced exposure to social interactions. Early language

experiences are impoverished in populations with deafness because of their hearing loss. The quality and frequency of such interactions are lower in the population with hearing loss in comparison to a population with typical hearing. Therefore, there are limited opportunities for children with deafness to engage in conversations that include different points of view or the use of mental-state terms [4]. Moreover, even during adolescence individuals with deafness tend to perform more poorly on text comprehension than individuals with typical hearing [5].

2 AIM OF THE STUDY

The general objective was to assess the differences in idiom processing between adults with deafness and adults with typical hearing. As the current proposal informs about a work-in-progress, only information related to the experimental paradigm and research questions can be developed by now.

3 METHODS

3.1 Participants

A group of participants with deafness a typical hearing control group is being recruited for the study. Thus, data collection and participants recruitment has not finished yet.

Group with Deafness or Hard-of-Hearing (DHH): Participants were recruited from associations of people with hearing loss in Valencia (Spain) and the Disability Unit of the University of Valencia. By the time of submitting the proposal, thirteen adults (Age range= 18-36 years) with hearing loss had participated in the assessments. All participants had bilateral severe-to-profound deafness and received a diagnosis of hearing loss before or at the age of five. Regarding hearing stimulation, participants were not homogenous in the type of prosthesis used (some of them wore bilateral or unilateral cochlear implants, whereas others wore hearing aids or received bimodal stimulation, that is, one hearing aid and a single cochlear implant). All participants reported to be enrolled or had finished post-compulsory studies. Participants received 20eur as compensation for their participation.

Group with Typical Hearing (TH): When submitting the proposal, 30 with typical hearing had participated in the study. All participants were completing a degree in psychology or speech therapy at the University of Valencia and were in their first or third year. Participants from this group received course credit to thank for their participation.

3.2 Experimental Task and Idioms Comprehension Assessment

The experimental materials consisted of a set of 20 idiomatic expressions. Idioms were embedded in sentences or contexts biased toward the figurative meaning in the idiomatic condition or toward the literal meaning in the literal condition. The material (idioms and contexts) was selected from a set of idioms that been created, piloted, and used in another study (Fajardo et al. in prep). Therefore, they had already been controlled and pre-tested in a set of parameters such as naturalness, predictability, familiarity, transparency, ambiguity, and syntactic structure. Each idiomatic expression was presented in 4 conditions: (1) Figurative – congruent condition: The idiomatic expression embedded in a figurative congruent context - *Como estaba tan nervioso en su primera conferencia, Rubén contó un chiste para romper el hielo y relajarse* (Since he was so nervous in his first conference, Rubén told a joke to break the ice and relax) (2) Literal – congruent condition: The idiomatic expression embedded in a literal context - *Como el frío endureció la nieve, el escalador utilizó un pico para romper el hielo y subir con seguridad.* (As the cold hardened the snow, the climber used a pickaxe to break the ice and climb safely). (3) Figurative – incongruent condition: The idiomatic expression was inserted in a figurative context but the target word (last word of the idiomatic expression – "ice" for the expression "break the ice") was

substituted by a semantically incongruent word: *Como estaba tan nervioso en su primera conferencia, Rubén contó un chiste para romper el pulpo y relajarse*. (Since he was so nervous in his first conference, Rubén told a joke to break the octopus and relax). (4) Literal – incongruent condition: The idiomatic expression was inserted in a literal context but the target word (last word of the idiomatic expression – "ice" for the expression "break the ice") was substituted by a semantically incongruent word: *Como el frío endureció la nieve, el escalador utilizó un pico para romper el pulpo y subir con seguridad*. (As the cold hardened the snow, the climber used a pickaxe to break the octopus and climb safely.). The manipulated items were distributed across 4 lists. Each list included an item in one of the conditions. Each participant read two lists and items were arranged in such a way that participants could not recognize the idiom twice, that is, if a participant read the figurative-congruent version of an idiom he/she would also read the literal- incongruent version of the same item, whereas another participant would read the same idiom but in the other two conditions (the figurative- incongruent version and the literal- congruent one). Participants read 40 idiomatic sentences while their eye movements were recorded. To avoid a strategic reading behaviour, 120 filler sentences were included. Therefore, participants read a total of 160 sentences (including fillers). To keep participants engaged with the reading task, almost half of the filler sentences were followed by a comprehension question with a yes-no response. Comprehension questions were only presented after the filler sentences. Sentences were presented in a randomized order and divided in 4 blocks. Blocks allowed participants to rest every 40 sentences. Participants were calibrated before the beginning of each block. Participants' eye movements during the experimental task were tracked using an SMI eye tracker with a recording sampling rate of 60Hz. A head-chin rest system was used to minimize head movements. Participants sat at 70-80 cm from the screen. In order to ensure a good recording, a 9-point calibration was used.

After the experimental task, participants completed a multiple-choice idiom comprehension questionnaire. The questionnaire tested their comprehension for the 20 idioms that had been presented on the experimental task. Each idiom was followed by a question and four interpretations: a correct idiomatic interpretation, a literal interpretation, and an unrelated interpretation. For example, for the idiomatic expression "break the ice". The sentence: "Since he was so nervous in his first conference, Rubén told a joke to break the ice and relax. "was followed by the question: "What did Rubén do?" and the options: "(a) Reduce the tension (Correct interpretation); (b) Break frozen water (Literal interpretation) and (c) Photograph a landscape (Unrelated option).

3.3 Additional Measurements

Participants completed a battery of language and reasoning tests. Data from these assessments were collected to describe the sample´s characteristics and to correlate them with the eye movement measures resulting from the experimental tasks: First, an adaptation of the Spanish version of the Daneman and Carpenter's [6] reading span test was used [7] in a computerized form to measure verbal working memory. Then, language skills were assessed using the vocabulary task from the PEALE battery [8] and the formulated sentences sub-test from the CELF-4 [9]. Participants written grammatical skills were also assessed using the Grammatical Structures Task I and the grammatical judgement task from the PROLEC-SE-R battery [10]. After that, participants text comprehension was assessed using the Expository Comprehension task from the PROLEC-SE-R [10]. Finally, participants completed an experimental lexical decision task.

4 RESEARCH QUESTIONS

We expect to answer the following questions: (1) Will adults with TH and DHH differ in terms of idiom comprehension accuracy and patterns of eye-movements? (2) Will the effect of congruence vary as a function of context (literal vs.

figurative) and group (adults with TH and DHH? (3) Will reading comprehension level predict differences, if any, between groups in terms of idiom comprehension accuracy and patterns of eye movements?

5 RESULTS

Preliminary data will be analysed and presented at the workshop.

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