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Deaf and Hard-of-Hearing Adolescents' Recognition of Category Names

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ABSTRACT

A series of studies by Li and his colleagues suggested that deaf and hard-of-hearing adolescents' recognition of category names can be influenced by the availability of processing time and by that of proper contextual information in cognitive tasks. Teachers should allow them to have a long processing time and/or provide as rich contextual information as possible when helping them to learn new words or requiring them to understand abstract words.

Keywords: Deaf and Hard-of-Hearing Adolescents; Recognition; Category Names

Introduction

Most deaf and hard-of-hearing (DHH) students mainly use sign language and do not begin to acquire written language until when they go to school. According to Kroll and Stewart [1], DHH students should learn words in written language with the help of sign-language words. However, they do not seem to have sign-language expressions for many words in written language. Although having sign-language words for many exemplars (e.g., lion and mouse) of the category animals, for example, there was no ready expression in sign language for the category name "animal" for the students in Guangzhou Deaf School, China [2]. After years of school education, DHH middle-school students are able to recognize written words such as category names that are quite abstract in meaning. Interestingly, however, they seem to have developed a particular mechanism in category-name recognition [3-5]. In Li [3], a cohort of Korean DHH students were required to decide whether or not the two sequentially presented words (a category name and an exemplar word of the category) were semantically related. The category name preceded or was preceded by the exemplar word, and the exemplar word was of a high or a middle level of typicality in a trial. Each word was presented for 250 ms (milliseconds) followed by a blank screen for 50 ms. Given the possibility of DHH adolescents' similar awareness of taxonomic relations between exemplars to that of hearing adolescents [6], the researchers expected a better performance in the high- than in the mid-typicality condition for the DHH participants.

The DHH adolescents did have been similar to the hearing adolescents in having significantly lower error rates for the high- than for the mid-typicality exemplar words when category names were presented first. When exemplar words preceded category names, however, they had significantly higher error rates in the high- than in the mid-typicality condition, which was different from their hearing counterparts. The researchers explained this anti-typicality effect with a theoretical proposition, which we would like to separate into a general hypothesis and a procedural hypothesis. By the general hypothesis we mean that DHH adolescents are able to recognize category names at a slow speed and tend to have a shallow processing of category names in a limited duration; by the procedural hypothesis we mean that there is a stage in which representations for mid-typicality exemplars are inevitably activated during DHH adolescents' early stage of category-name

recognition. Importantly, the general and the procedural hypotheses appeared to have been directly confirmed by Li, et al. [4] and Li, et al. [5], respectively, in which all the word stimuli were Chinese two-character words (2C words).

In a primed semantic categorization task, in which the participants were required to decide whether or not the target referred to a living thing, Li, et al. [4] manipulated SOA (stimulus onset asynchrony) and type of stimuli. There were three types of stimuli: a category-name primer followed by an exemplar-word target of the category, an exemplar-word primer followed by an exemplar-word target of the same category or an exemplar-picture primer followed by an exemplar-picture target of the same category. The DHH adolescents' reaction times (RTs) became gradually shorter as SOA increased from 87 ms to 237 ms by a step of 50 ms, when both the primer and the target were exemplar words or when they both were exemplar pictures. When the primer was a category name, however, their RTs did not become significantly shorter when SOA was increased from 137 ms to 187 ms or to 237 ms. Meanwhile, the DHH participants' RTs were significantly shorter at the SOA of 137 ms than at that of 87 ms, suggesting a certain depth of automatic processing of the category names. In other words, the DHH adolescents only seemed to have a shallow processing of the category name, as predicted by the general hypothesis.

According to the procedural hypothesis, DHH adolescents should have representation activations triggered for some of the mid-typicality exemplars in the duration of 137 ms. This argument seemed to have been directly confirmed by Li, et al. [5], in which a category name was presented at the screen center for 87 ms followed by a 50-ms blank screen. Then, two exemplar stimuli were presented for 87 ms at the horizontally left and right sides or at the vertically upper and lower sides of the place where the category name disappeared. The two exemplar stimuli in a trial were both of a high level of typicality or were both of a middle level of typicality; they were both words, or they were both pictures. After a blank screen of 50 ms, the participants were required to make a decision as to whether or not the category name referred to living things. The DHH adolescents' RTs did indicate an anti-typicality effect regardless of whether the two exemplar pictures both were from the target category (in Experiment 1) or one of them was from the target category and the other was from a non-target category (in Experiment 2).

The fact that an anti-typicality effect was consistently revealed in Korean [3] and Chinese [5] DHH adolescents' category-name recognition can be explained as follows. With no ready expressions for taxonomic categories of super-ordinate level available in sign language, DHH students may learn category names in written language by associating them with exemplars of middle typicality but not with those of high-level typicality. It is due to this kind of association that DHH adolescents' perception of category names results in activations of representations for mid-typicality exemplars. Indeed, this argument seems to receive confirmation from observations of children's category-name learning [7] and from conclusions on their conceptual development for taxonomic categories [8]. Different from the researchers' expectation, however, the DHH participants in Li, et al. [5] were similar to their hearing counterparts in showing the effect of typicality in RT scores in the exemplar-word condition. In other words, they seemed to have processed the category-name target more deeply in the exemplar-word than in the exemplar-picture condition. To understand this result, we may have a close look at the 2C-word recognition by Tsang and Chen [9].

In a primed lexical decision task at the SOA of 40 ms (in Experiment 2), the processing of the primer triggered representation activations for words that are only semantically related to the constituent character of the primer [9]. That is, perceptions of the constituent characters (e.g., "月" and "薪") of a 2C-word (e.g., "月薪") result in activations of the corresponding meanings (e.g. moon and month for "月" and salary for "薪") at the lemma level. The lemmas for the constituent characters jointly result in lemma activation for the word (e.g., "月薪" salary). DHH students are quite similar to their hearing counterparts in orthographic processing in Chinese word recognition [10]. They are able to develop a clear awareness that a 2C word consists of two constituent characters. It was likely that the DHH adolescents were able to perceive the words both as a whole and according to the constituent characters in a 137-ms duration in Li, et al. [4] and Li, et al. [5]. Their processing of a category name (e.g., "水果") may lead to activations for many mid-typicality exemplars of the category according to the procedural hypothesis and to activations for meanings (e.g., water and fruits) of the constituent characters (e.g., "水" and "果") according to Tsang and Chen [9]. Similarly, their processing of an exemplar word "苹果", for example, may result in activations for the exemplar itself (i.e., apple) and for the meaning (i.e., fruits) of second constituent character "果". With the findings of Li, et al. [4] and Li, et al. [5] taken into consideration together, we would further speculate that Chinese DHH adolescents may have two stages of lemma activations concerning the case of their recognition of category names (e.g., "水果" fruits) (See Figure 1). In the first stage, lemma activations are available at the constituent-character level as well as at the word level. Lemma activations are available for many mid-typicality exemplars (e.g., orange, pine-banana, pear and peach) at the word level, and those (e.g., water and fruits) at the constituent-character level. In the second stage, the category names are processed deeply enough and the lemma activations include those of both high- (e.g., apple, banana and watermelon) and mid-typicality exemplars of the category. The first stage of processing will only be improved to the second stage under one of two conditions: DHH adolescents have a motivation to process the category names as deeply as possible due to the task requirement, or they have the availability of enough contextual information.

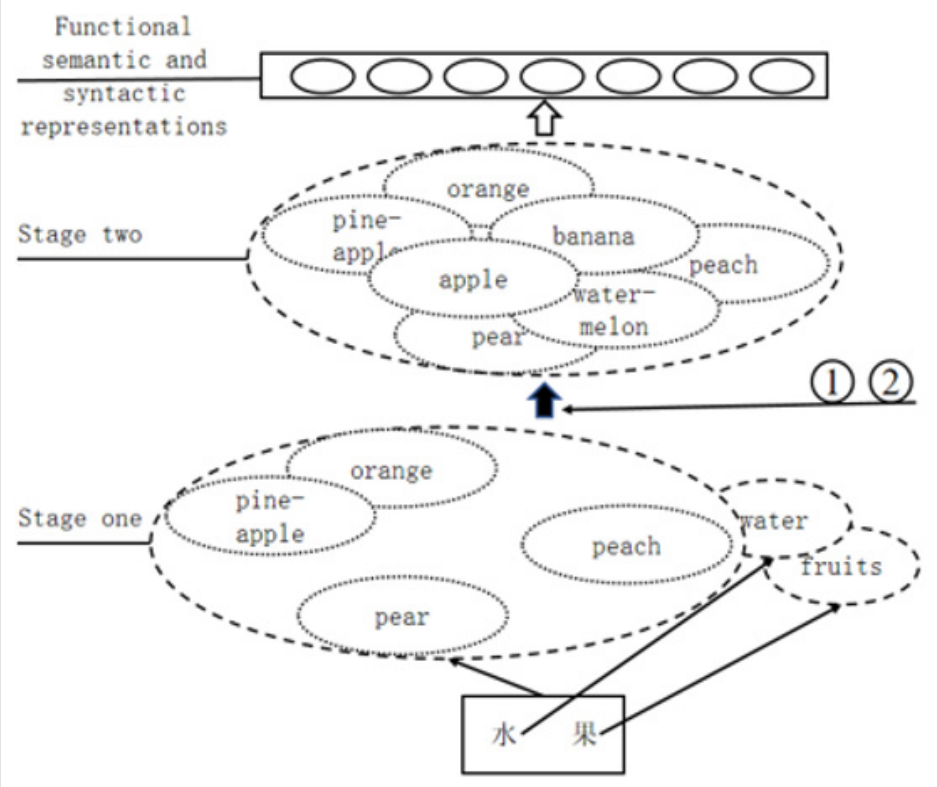

Figure 1: DHH adolescents' two-stage lemma activation of the category name "水果"(fruits) under the influences of ① (task requirement) and/or ② (contextual information).

In Li, et al. [4], the DHH participants had a shallow, automatic processing of the category-name primer, resulting in the first-stage of lemma activations. Since they were only required to respond to the exemplar target, their automatic processing of the category-name primer might have largely stopped even when SOA was increased from 137 ms to 187 or 237 ms. This is consistent with the conclusion that high school deaf students were able to instantiate exemplars of general nouns when asked to do so but did not do so spontaneously [11]. Similar to the case of Li, et al. [4], the DHH participants had processed the category name targets for 137 ms and resulted in the first-stage lemma activations in Li, et al. [5]. Since the category names were the targets, participants had to keep them in working memory until when they made responses as required. In the duration of the exemplar-stimulus presentation, they might have two lines of information processing at the same time: one for the target words and one for the newly presented exemplar stimuli. In the exemplar-word condition, the lemma activations for the exemplar word "苹果", for example, might include that at the word-level (i.e. apple) and the character-level lemma for the second character "果" (i.e., fruits). There was a possibility of semantic overlap in taxonomic categorization between the lemma activations for the exemplar words and those for the category-name targets. That is, the processing of the 2C-word exemplar words provided a strong context to enhance the lemma activations for the category names. In the exemplar-picture condition, however, there lacked such a context for the category-name target processing. As a result, the category-name targets were more deeply processed in the exemplar-word than in the exemplar-picture condition in Li, et al. [5].

Similar to the case of Li, et al. [5], the participants had to keep the two sequentially presented words in working memory before they made a response in a trial in Li [3]. Different from Li, et al. [5], the participants did not have the availability of contextual information. However, they had the availability of a long processing time when category names preceded exemplar words. As the result of more than 600 ms of processing, the well activated whole-word lemmas was available for the category names. Due to the limited time of processing of the category names in the condition when exemplar words were presented first, however, only the first-stage lemma activations were available by the time they made a response. In conclusion, DHH adolescents tend to have a shallow automatic processing of category names that are presented in isolation. In cognitive tasks in which they are required to make responses to the targets of abstract words such as category names, their depth of semantic processing of the targets can be ensured by the availability of a long processing time or of rich contextual information. Therefore, it is advised to avoid presenting new terms in isolation in teaching activities for DHH students. When helping them to learn new words or requiring them to understand abstract

words, teachers should allow them to have a long processing time and/or provide as rich contextual information as possible.

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