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The effect of illustrations on the reading process of tactile books:

: An exploratory study

Key words: tactile illustrated books, memorization, reading, illustration

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In tactile illustrated books, the reader has to explore the tactile picture, to interpret its meaning and to associate it with the text content. As is the case with sighted children (Carney & Levin, 2002), tactile illustrations could be beneficial for language and literacy development of children with visual impairment (Hatwell, 2001; Heller & Gentaz, 2014; Miller, 1985) and should help them in understanding and remembering the story (Stratton & Wright, 1991). However, the identification of tactile illustrations is not simple and varies according to the characteristics of the tactile pictures, the level of visual experience of the participants (Heller, 1989; Lebaz, Jouffrais, & Picard, 2012; Lederman, Klatzky, Chataway, & Summers, 1990; Thompson, Chronicle, & Collins, 2003, 2006), prior experience with tactile pictures (Theurel, Witt, Claudet, Hatwell, & Gentaz, 2013; Valente & Darras, 2013), and the task-demands (Picard & Lebaz, 2012).

Several studies showed that outlined 2D representations of objects can be hard to understand by children and adults with visual impairments (Heller & Gentaz, 2014; Heller, McCarthy, & Clark, 2005; Lederman et al., 1990; Picard & Lebaz, 2012). Indeed, the haptic system is very efficient in the processing of material properties of objects but less in the processing of spatial properties that characterized 2D illustrations (Klatzky, Loomis, Lederman, Wake, & Fujita, 1993; Lederman & Klatzky, 1987). Moreover, studies showed that blind children identify the object more easily through textured 2D illustrations than through outlined and thermoformed illustrations (Theurel et al., 2013; Thompson et al., 2006). Texture is a material property that helps the haptic identification of both 3D objects (Klatzky, Lederman, & Metzger, 1985; Klatzky et al., 1993; Morrongiello, Humphrey, Timney, Choi, & Rocca, 1994) and their representation.

The use of 3D manipulable objects might be another encouraging way to illustrate storybooks. In a study analyzing a book reading activity using 2D and 3D illustrations, Bara (2014) showed that children used a wider variety of exploratory procedures with 3D

illustrations than with 2D illustrations, which suggested that visually impaired children were able to collect more information with the former kind of illustration technique.

The aim of this study is to examine the effect of the presence or absence of illustration as well as the effect of the type of illustration on the processing of information in a short story. In this exploratory study, three six-year-old children with different levels of visual impairment participated in a joint book reading task. During the task the children needed to listen to the story and to explore the illustration. How the child interacted with the adult and with the book during reading and what he was able to recall about the story, were examined as clues to the process of understanding the story.

Method

Individuals with visual impairments

Three six-year-old children, recruited from a local center for visually impaired individuals participated in this study. All of them were included in a general education school and were supported by specialist teachers and educators, who intervene in the class or at the center. They were enrolled in the school grade expected for their chronological age (first grade). Teacher's regular assessments at school did not show any differences between the three children in language, verbal comprehension and reasoning. None of them presented any known cognitive or psychiatric disabilities. They had infrequent use of illustrated books, never at home and infrequently at school.

Written consent was obtained from the parents of each child participating in the study and from the educator. This research respects ethical principles for research involving human subjects (World Medical Association Declaration of Helsinki) and was approved by the center for blindness and visual impairment as well as by the University.

Insert table 1

Material

The three books used contained 10 pages. They were distinguished from one another by the types of illustrations (see table 2. Material). Three stories were made up, based on the original story of Claude Boujon *La chaise bleue* (The Blue Chair). In the original story, two characters (a wolf and a dog) find a simple object (a chair), which is transformed into a world of fantasy and becomes a house, a boat, a castle... where to play. The game is stopped by a third character at the end of the story. Table 2 presented the characters and the transformations of the object for each book tested:

Insert table 2

In a preliminary control study, the vocabulary used in each story was evaluated by the teachers as easily understandable based on their knowledge of the children's language level.

Procedure

The books were read by the same educator in charge of the three children, to avoid variability in how the books were read. Before each page of the book was read, the child was encouraged to explore the illustration once to make an idea of what it contains. The child was free to explore the illustration as long as he wanted and to ask questions or make comments during the reading. After the reading phase, the child was invited to freely recall the story with as many details as possible. Each child participated in three individual reading sessions, one for each book with an interval of one week between each session. The order of books was different for each child. The reading sessions were video-taped and analyzed.

Two research assistants, unaware of the purpose of the experiment, coded the videos. They transcribed the verbal exchanges between the child and the educator during reading and the recall of the story. For each story they rated the match between the text and the manual exploration. The text was split up into 29 propositions that could be matched with a tactile exploration. For example when the text mentioned “the girl” it was expected that the child touched or held the girl illustration. One point was awarded each time the child touched the correct part of the illustration (2D illustration) or when he held the correct character or made the appropriate action (3D illustration). The number of verbal comments during reading, the number of matches between the text and the manual exploration, and the number of story elements recalled by the children were collected. Each child received a matching text-exploration score based on the concordance between what was read and what part of the illustration he explored. Each child also received a score for his recall of the story based on the number of details he spontaneously gave about the characters (their name, the color of the object...), the object transformations, and other details present in the story. The percentage agreement between the two coders was 100% for the verbal interactions, 88% for the text-exploration match and 96% for the recall scores. For the propositions the two coders disagreed with, the video was watched again and discussion between the two coders and the researcher led to agreement.

Results

Table 3 presents the number of verbal interactions, the percentage of correct text-exploration match, and the number of correct details recalled for the three children:

Insert table 3

Taking into account their specificity (same age but different visual impairment level), we analyzed each case independently. This descriptive analysis allowed us to have an

accurate view of what happen during the reading sessions and of what the children memorized about the story.

Case 1 : B.

B. made more verbal comments with the presence of illustrations. With 2D illustrations, verbal comments allowed him to anticipate the transformations and to suggest a possible use for the object. With the 3D illustrations, the verbal comments allowed him to explain how to transform the object.

The match between text and manual exploration was higher with 3D illustrations than with 2D illustrations for the characters.

Concerning his recall of the story, there was no noticeable difference between the three illustration conditions. The 2D illustrations led to recall of additional details about the story.

Case 2 : M.

When the story was not illustrated M. made no verbal comments. With 2D illustrations, the verbal comments were used to show that he understood the transformations or to verify that he correctly understood the illustrations. With 3D illustrations, his comments showed that he understood the transformations, and he explained what to do with the objects (“Yes, he has to jump”)

There were no noticeable differences between the two kinds of illustrated books concerning the text-exploration match.

The number of story details recalled was slightly higher with the 3D illustration condition in comparison to the two other conditions.

Case 3 : E.

When the story was not illustrated, E. made no verbal comment. With 2D illustrations, he asked some vocabulary questions to better understand some words (“hammock,”

“parachute”) or to better understand the illustrations. With 3D illustrations, few verbal comments were made. He manipulated the objects but did not speak at the same time.

The text-exploration match was high in both conditions, which means that the child understood what happened in the story and what the illustrations represented.

The number of details recalled was higher with the 3D illustrations, especially for the object transformations. There were no noticeable difference between the condition with no illustration and the condition with 2D illustrations. Note that one of the two transformations that were not understood during reading was recalled.

Discussion

Overall results showed that the absence or presence of illustration influenced the number of verbal interactions between the child and the reader. When no illustration was provided, the three children listened to the story quietly and most of the time asked no questions to the adult. When exploring illustrations of both kinds (2D or 3D), children were more active, adding verbal comments while exploring the illustration or making the actions with the miniaturized objects.

Concerning the free recall of the story, the number of items recalled was slightly lower when no illustration was provided, especially for recall of the object transformations. On one hand, as is the case for sighted children, we can expect that the redundancy of the verbal and the pictorial information strengthen memory traces and facilitate recall. On the other hand, processing of the tactile and verbal information at the same time might increase the memory load and, in turn, decrease the performance. The illustrations may have helped memorization but the effect was not as large as could have been expected.

As showed by other studies, different illustration techniques make the identification more or less easy (Theurel et al., 2013; Thompson et al., 2006). Our results suggest that the children were able to identify quite accurately the 2D and the 3D illustrations. B. was able to

anticipate the text content by exploring the 2D illustrations pictures. For the other two boys, some tactile illustrations were not perfectly understood, and they asked the reader about the link between the text content and the illustration. Overall, the 3D illustrations were well understood and the three children were able to reproduce all the transformations with the objects.

Individuals with low vision are often at an advantage in the perception and interpretation of tactile displays because of their familiarity with pictures and increased haptic skills (Heller, McCarthy, & Clark, 2005). This difference might explain why the 3D illustration technique was effective for the child who was congenitally blind, who exhibited a high level of recall with this technique.

Some limitations of the research need to be pointed out. First, what we observed with only three children might be hardly generalizable. However, an original methodology has been validated and could be used in a future study with larger sample in order to help designers to improve tactile books. Second the stories were repetitive. The same structure was chosen in order to control the kind of story in the three reading conditions. The children might have been familiar to this text structure and might have anticipated the text. Even if the order of the books was not the same for the three children, this might have impacted the results. Third, the kind of story and the assessment lean towards memory processes more than understanding. The children were asked to recall the story not to make links between the parts of the text.

Conclusions

There is no doubt that illustrations in storybooks are beneficial for understanding and remembering the stories. However, it is important to think about how to illustrate tactile books and to precisely assess the effects of the illustration techniques on reading and understanding. Few tactile illustrated books exist and are often inadequate as they are mainly

based on a visual approach (converting a visual picture into bi-dimensional tactile representation). We advise practitioners to try to add 3D elements children can interact with (for example miniaturized object, pop up settings). In our point of view, these 3D illustrations that are based on real touch experiences, available both to children who are sighted and to those who are blind, could create communication bridges between these two communities during share book reading activities in class.

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