Can Exhibit-Explanations in Sign Language Contribute to the Accessibility of Aquariums?

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Abstract. In this study, we aimed at improving the information accessibility of aquariums based on universal design and design for all. We designed the contents using sign language for the visitors who are Deaf and Hard-of-Hearing. We prepared QR codes in front of water tanks, so the visitors could access the content by using their mobile phone and/or tablet-PC easily.

We conducted a demonstration experiment at an aquarium with the university students who are Deaf and Hard-of-Hearing and gathered their opinions using a questionnaire. One opinion obtained was that the explanation was more impressive in sign language than in writing. As a result of our video analysis, when there was sign language content, the communication between visitors increased. It was highly appreciated to watch the fish while watching commentary in sign language. However, sign language content requires time to finish playing. In order to convey the comments in a short time, sign language as well as visual information, needs to be designed appropriately.

Keywords: Aquarium · Sign language · Accessible design

1 Introduction

People spend a lot of time outside of school in their lives. So, independent science learning outside of a school is important [1, 2]. In particular, places such as museums are important organizations of lifelong learning. Recently, access to buildings and information of the museums has been greatly improved with legal maintenance [3, 4]. The concept called "universal accessibility for the global citizen" is necessary at museums [5, 6]. In actuality, some museums prepare the barrier-free checklists [7] and the accessibility program for visitors and the universal guidelines for an exhibition. For example, the Smithsonian National Museum also prepare universal design manuals and specialized posts [8]. Some museums conduct tours for the impaired [9, 10], that has an inclusive design whereas others have displays and hands-on devices in sign language [11].

Unfortunately, there are few museums taking such actions in Japan. Most of the content for people with visual and/or hearing disabilities is insufficient from a viewpoint

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of universal design and accessible design. So we tried to improve information accessibility for the visitors who are Deaf and Hard-of-hearing at the aquarium as the first step to achieve this goal.

2 Research Question

What kind of disadvantages do deaf people face in an aquarium? By attempting to answer this, we suggest solutions to the problems and inspect the effect of their implementation through an experiment.

3 Method

3.1 Basic Research at the Aquarium

Ibaraki prefectural Oarai aquarium "Aqua World" tries to be barrier-free. However, barrier-free information does not consider the hearing-impaired.

Therefore, we researched what kind of disadvantages the hearing-impaired face in the aquarium through the simulated experience of the staff. We considered solutions to solve problems and implemented it in the aquarium (Fig. 1).

Fig. 1. Discovery from simulated experience: What is the disadvantage of hearing-impaired visitors in the aquarium? (Cut off external sound with white noise and ear muffs)

1. Experience Learning
   The experimental lesson is available in the Discovery room. Everyone can touch the creatures in the discovery room. However, the voice of the guide is often not noticed when visitors watch the tank during observation and concentrate on it. Therefore we prepared water-proof instruction cards in the aquarium and sank them underwater. This method was very effective for everyone.
2. Face-to-Face Commentary
   As for the commentary given by the aquarium, the hearing-impaired cannot get information mainly by sound. Even for the non-impaired person, it is hard to take information at the crowded place in particular. Therefore, I installed a directional speaker in this situation and improved the ease of information collection by sound (Fig. 2).

Fig. 2. Left: Attention card sunk in the water; Center: Face-to-face learning with directional speakers; Right: Text conversion by automatic speech recognition

3. Explanatory information using a microphone
   Speech to text conversion on devices converts a digital recording of a sound into written words. When a sound recorded beforehand is played on a speaker, this system is suitable. However, there are many ad libs at a live show. Therefore, we connect the microphone to the machine translation system and converted the sounds into written words.
4. Dolphins and California Sea Lion show
   The scenario of the Dolphins and California Sea Lion show changes according to the health condition of the dolphins and sea lions. Because there is so much reflection in the pool, we tried real-time, abstract note-taking. We will present the result of these practice experiments in ICOM.

3.2 Designing Multilingual Content

The aquarium contains a voice-guide system. The system can inform the visitor of the content of the displays at 47 places in the aquarium in Japanese, English, Chinese, and Korean. However, the voice guide is not useful to the hearing-impaired.

We assumed that the websites are a popular tool for many people to get information. Thus, we designed the web content by incorporating Japanese sign language. First, we noted the technical terms spoken in an aquarium audio tour. Then, we created the sign language video for each technical term and discussed them with the hearing-impaired. We thus designed the web content using sign language (Fig. 3).

Fig. 3. Screenshot of the sign language content

3.3 Field Experiment (27th Nov 2018)

We chose 20 exhibitions out of 47 places with audio guides and prepared water-proof cards in which the QR code in front of a fish tank and commentaries are printed.

We watched the sea creatures while reading the explanations in sign language gestures. We recorded it by using a video camera and investigated how sign language was used in the aquarium. We divided eight participants into two groups. Group A used the sign language content through an iPhone in the first half and used card commentaries in the latter half. Group B used card commentaries in the first half and the sign language contents through the phone in the latter half. Then, the questionary survey and the aquarium quiz were conducted (Fig. 4).

Fig. 4. Snapshot of the experiment (participants watching sign language animation)

4 Result and Analysis

4.1 Attributes of Participants and Their Communication Method

Eight experiment cooperators (average age: 21) were daily sign language users. Their communication methods with the hearing people are residual hearing ability and lipreading. All the members had the experience of visiting an aquarium, with either their school group, friends, or family. We asked about the likes or dislikes of the aquarium. Six of them answered “I like aquariums”. Two of them answered “I’m not sure which side I am in”. The number of visits ranged from 2 to 23 (the average was 8.1 times and the standard deviation was 7.9). The reasons to go to the aquarium were “the creature which I could not usually watch was seen (6 people)” and “New knowledge about a creature was provided (3 people)”.

4.2 Post-questionnaire

We performed usability evaluations after the field experiment. Participants responded on a six-step Likert scale about Effectiveness, Efficiency, Learnability, and Satisfaction (1: Strong disagree, 2: disagree, 3: Weak disagree, 4: Weak agree, 5: Agree, and 6: Strong agree). "I enjoyed it" was 5.4 points. "I want to experience again" was 4.9 points. "Sign language commentary is good" was 4.4 points. Five people answered, "Mobile phone is better". The remaining three answered, "A commentary card is better".

We asked the participants about the effectiveness of sign language commentaries at an aquarium. They answered on the six-step Likert scale described above. "Sign language is necessary" is 4.1 points, "Sign language is useful" was 4.25 points, "I want to use sign language commentary" was 4.38 points, "I was able to gain new knowledge" was 5.0 points, "I could learn new sign Languages" was 3.25 points. About Satisfaction of the web content by incorporating Japanese sign language, "I was satisfied with the contents" was 4.13 points, "I want to introduce this website" was 4.75 points.

And next, we question the efficiency by using the same Likert scale, the participants answered the following. "Screen was easy to see" was 4.5 points, "Sign language was easy to see" was 4.5 points, "I got information easily" was 4.75 points, "I could use the QR code instantly" was 4.88 points, "I was able to operate the website without stress" was 5.38 points.

Finally, we asked about learnability, they answered that "Sign language was easy to understand" was 5.0 points, "Text is easy to understand" was 4.6 points, "Photos were effective" was 4.6 points, "Sign language promoted my understanding" was 4.5 points.

"I can gain new knowledge about creatures" being the reason for going to the aquarium with sign language commentary increased to 7 people; before the experiment, only 3 people gave this reason.

In their comments, five people answered that "it was fun because I could obtain information I did not know". There was also a comment saying, "I think that sign language commentary will be a tool to enjoy the aquarium". On the other hand, some commented that it took time to finish the explanation in sign language, so they worried that they might be causing trouble for other people.

In the quiz of a total of 20 points, group A scored an average of 16.25 (SD = 1.1), group B scored an average of 17.5 (SD = 0.5), and there was no significant difference between the groups, $t(6) = 1.85$, $p = .12$.

5 Discussion and Conclusion

Conducting a demonstration experiment at the aquarium for deaf and hard-of-hearing people, we gathered their opinions using a questionnaire. There was also an opinion that the explanation in sign language is more impressive than the written explanation. The video analysis showed that sign language content increased the communications between visitors. The people highly appreciated being able to see fish while watching the commentary in sign language. However, since sign language content takes time to finish playing, sign language as well as visual information should be designed appropriately to convey the content.

Cooperating with the aquarium staff, we clarified the disadvantages the hearing impaired faced in the aquarium and suggested solutions. In this study, we inspected the effect of sign language content with experimental proof.

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References

1. Falk, H.J., Donovan, E., Woods, R.: Free-Choice Science Education. Teachers College Press, New York (2001)
2. Abell, K.M., Lederman, G.M.: Handbook of Research on Science Education. Lawrence Erlbaum Associates, Hillsdale (2007)
3. Hamraie, A.: Building Access: Universal Design and the Politics of Disability, 3rd edn. University of Minnesota Press, Minneapolis (2017)
4. Paciello, M.: Web Accessibility for People with Disabilities, 1st edn. CRC Press, Boca Raton (2000)
5. Smith, M.J., Salvendy, G. (eds.): Human Interface 2007. LNCS, vol. 4558. Springer, Heidelberg (2007). https://doi.org/10.1007/978-3-540-73354-6
6. The inclusive museum. https://translate.google.com/translate?hl=de&sl=de&tl=en&u=https%3A%2F%2Fwww.museumsbund.de%2Finklusion%2F. Accessed 29 Mar 2019
7. https://www.lmb.museum/de/fach-und-arbeitsgruppen/ag-barrierefreiheit-ausstellungen/barrierefreiheit/. Accessed 29 Mar 2019
8. Smithsonian Guidelines for Accessible Exhibition Design. https://www.si.edu/Accessibility/SGAED. Accessed 29 Mar 2019
9. American Museum of Natural History. https://www.amnh.org/plan-your-visit/accessibility. Accessed 29 Mar 2019
10. Science Museum in London. https://www.sciencemuseum.org.uk/visit-us/accessibility. Accessed 29 Mar 2019
11. The National Palace Museum in Taipei. https://www.npm.gov.tw/en/Article.aspx?sNo=02007003. Accessed 29 Mar 2019