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Reference:

Sviridova Aleksandra, Everaerts Stefanie, Tas Laura, Yachchou Salma, van Hoofstat Lotte, Verlinden Jouke.- The role of auditory description in comprehension of demonstrators : a pilot study

Advances in Creativity, Innovation, Entrepreneurship and Communication of Design : proceedings of the AHFE 2021 Virtual Conferences on Creativity, Innovation and Entrepreneurship, and Human Factors in Communication of Design, July 25-29, 2021, USA / Markopoulos, E. [edit.] - ISSN 2367-3389 - Cham, Springer, 2021, p. 530-538

Full text (Publisher's DOI): https://doi.org/10.1007/978-3-030-80094-9_63

To cite this reference: <https://hdl.handle.net/10067/1832520151162165141>

The Role of Auditory Description in Comprehension of Demonstrators: a Pilot Study

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Abstract. Demonstrator can be described as a versatile concept combining design, art and engineering and can be used in many aspects from decision-making to creating an impact on different innovation markets. This paper focuses on a communication side of a demonstrator on the example of one recently designed for a local research institute Flanders Make to highlight advantages of their new optimization algorithm. A pilot study was conducted to evaluate how effective this message can be conveyed by using a combination of verbal and non-verbal communication types. A comparison of three different lengths of audio descriptions accompanying the visuals was made to identify the equilibrium point at which the explanation enhances the understanding without distracting from the video.

Keywords: Demonstrator · Verbal communication · Exhibition · Human-exhibition interaction

1 Introduction

A demonstrator of advantages of using a new optimization algorithm was built in the laboratory at Product Development of University of Antwerp for an external research institute called Flanders Make. It was supposed to be part of an exhibition during their annual symposium and highlight a novel optimization method developed by their engineers.

Thus, the demonstrator can be considered as a medium tool between them and their auditory. Since the conveyed message about the idea and principles of the algorithm is very abstract, it was decided to convert this information into visuals by means of a race metaphor. This metaphor also refers to one of the possible areas of application of the algorithm, which is automotive design.

The animation shows two cars that represent different algorithms. Before the race begins, the components of the cars are modified according to the external circumstances these algorithms base themselves on. What the metaphor wants to convey, is that under certain weather conditions you have the best chance of success when opting for the new algorithm.

Designers wanted to balance utter abstraction of the algorithm with concrete physical interaction with the project. Therefore, the demonstrator consists of two parts: a physical part, engaging to interaction and a projected animation, explaining the new technology and entertaining (Fig. 1).



Fig. 1. The demonstrator rendered view and an example of the projected animation appearance.

Due to the Covid situation, the planned exhibition was changed to guided tours, when one of the engineers accompanying visiting groups provides the detailed information about the project.

Thus, it was not possible to conduct a field experiment and it was decided to combine the visuals with an audio explanation and show it to target groups in order to assess the effectiveness of the demonstrator as message conveyor.

2 Theoretical Framework

2.1 The role of auditory description in a human-exhibition communication process.

Communication can be considered as an activity that is performed [1] or as the transmission of a message from a sender to a receiver via a medium of transmission [2]. Hence, it can be viewed as intended interactions. It also works the other way around. This process can be described in the terminology of the extended framework of human-exhibition interaction suggested by Wang and Xia [3], where Flanders Make is client (sender), exhibition visitors are audience (receivers) and demonstrator is medium, transmitting the message encoded by designers (Fig. 2).

Hall developed a model which explained that message-transforming is the encoding and decoding of a message [4]. Before a message can have an ‘effect’, it must be decoded [5] so that the message that is interpreted is meaningful [6]. For this research, the effect is ‘understanding’, which in this respect can be considered as the process of finding a configuration of schemata which offers a representation of a situation [7].

People have schemata for various topics, which ultimately form the basis for understanding. However, there is the difference between ‘knowing’ and ‘understanding’ [8]. When someone knows something, they can tell the knowledge or demonstrate the skill upon demand. Understanding is more ambiguous and complex matter, which

goes beyond knowing. It means being able to do various thought-demanding activities with the topic, such as explaining, generalizing, or analyzing it [9].

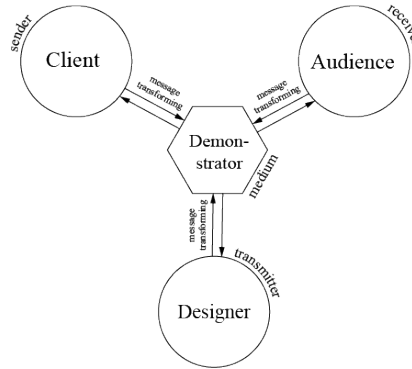


Fig. 2. Basic framework of communication process between stakeholders.

Some mediums are more effective in successfully transporting the message [10]. In terms of preferred input mode, reading-while-listening was considered the most comfortable by most subjects; a sizable minority favored reading-only, while no one explicitly favored listening-only [11]. Auditory descriptions are also considered to be more enjoyable and enhancing understanding [12].

2.2 Development of a Hypothesis

Due to the high abstractness of the transmitted message there was a risk that auditory will not understand it without additional audio explanation. However, since there will be no expert around the spectators, this explanation has to be clear, comprehensive and yet not overwhelming. The research question is as follows: “How short can you make your audio description accompanying the video and still make the respondents understand the message behind the demonstrator?”

To see how people react on the length of the audio-message, three types of videos were created. The first video contains an introduction, a middle and an ending. In the second one, the audio is shortened and the third video is cut to the chase with its audio description. In all cases the video remains the same. The names of the videos are respectively the long-explained video, mid-long explained video and short-explained video. The hypothesis is that the long-explained video guarantees the best comprehension, while the short-explained one gives a wrong vision of the algorithm.

3 A Pilot Study

3.1 Participants

115 students coming from fields of Engineering, Design, Physics, Technical and Economical Science, Business management and Computer Science were surveyed.

For the experiment, all participants completed an online questionnaire on a voluntary basis after watching one of three randomly arranged videos. As the study investigates the understanding of the algorithm presented in the animation, there was no preference in age, sex or particular level of professional experience. Due to the cancellation of the exhibition, the research was conducted among available auditory from relevant professional areas with main focus on general understanding.

3.2 Data acquisition

The survey was driven online by Qualtrics and included one of three different videos followed by a questionnaire about the principles and applicability of the algorithm. Each contained the same visuals and are of equal length, the only variable is an audio description. In the first video the essence of the race cars is clear, but it is accompanied with extensive additional information. The second video is an intermediate video that captures the essence but talks more about the cars metaphor. Finally, the third video has a limited amount of audio description and only captures the essence of the race car-metaphor.

Participants started with a pre-questionnaire that asked two personal questions. Basically, it was needed to validate the sample. To pre-test the knowledge, each respondent was asked one multiple choice question. The pre-questionnaire also contained three questions of an ITQ-test. The post-survey consisted of three parts. The first part contained seven multiple-choice questions to test the knowledge of the respondent after watching the video. The multiple-choice test is a standard, prompted recognition four-choice test with the correct meaning and three distractors. The subjects were asked to indicate the answer they thought was referring the best to what the video explained of the algorithm.

Besides a multiple-choice test, there were two more types of questionnaires: one open question gives the point of view of the user, while a set of five Likert-scale questions provides with a clear overview of the perception of the respondents and their comprehension. After the pre-and post-survey, points were given accordingly to the answers. The data was analysed using SPSS. The understanding rate was set from 0 to 12. To compare the groups and their level of understanding on SPSS, a cross tabulation was performed.

The percentages of correctly answered questions were measured to measure the respondents' comprehension. When comparing these percentages between the different video's, it is desired to see a linear correlation between correctly answered questions and the length of the audio description. In percentages, 50% of correctly answered questions is seen in this research as a sufficient level of comprehension of the message. A result of 70% correctly answered questions is seen as an optimal level of comprehension.

4 Results

4.1 The Correlation of the Level of Comprehension and the Amount of Given Information

To see if the level of comprehension increases with the length of given information, a cross tabulation was used to measure the scores of each respondent with the given video. The results of comprehension were calculated into a mean score for each video. For video 1 (long-explained) the average score was 8,29; for Video 2 (mid-long explained) it was 8,63; and for video 3 (short-long explained) it was 7,58 (Fig. 3).

In this research, the short-long explained video did not suffice as much as the other two videos for reaching the same level of comprehension. However, the results of this survey are not strong enough to conclude that with the amount of given information increases the level of comprehension of the topic.

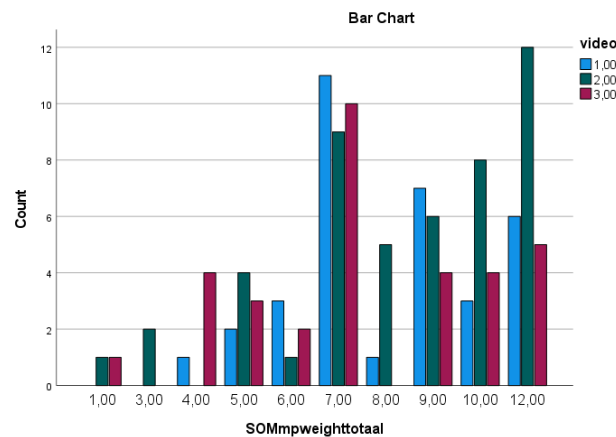


Fig. 3. Number of respondents visualized per score out of twelve, per video.

4.2 Sufficient (50%) and Optimal Levels (70%) of Comprehension Depending on the Length of the Audio Description

Based on the bar chart presented above, the amount of people that scored more than 50% and 70% can be calculated. The number of participants that had at least 50% of all the answers correct is relatively high for all three videos. The best results are found for the mid-long video. For the comprehension of this topic, the short-long video was not as sufficient in gaining comprehension as the others. The difference in percentage of the long and mid-long length videos is insignificant; therefore, no strong conclusion can be made which one is the most successful in providing a sufficient level of comprehension.

4.3 A Correlation between the Results on the Post-Test and Respondents' Own Perception of Comprehension

To explore if the participants' actual comprehension of the video corresponds with their own evaluation their score on the post-test is compared with their answer by Likert scale question "After watching the video, I felt like it was not enough to feel like I understood it". What is remarkable is that people who indicated that they strongly agreed with it, had an average score of 10.3 out of 12 which is quite a high score. People who agreed or somewhat agreed with it, had a little lower score around 7.8 out of 12. The average scores are all around 7 or 8 out of 12, even for respondents who indicated that it felt like it was not enough to understand it. People who indicated to strongly disagree or disagree with it, still had an average score of 8.142 out of 12 and even 8.9 out of 12. Similar results were obtained with questions "After watching the video, I understood it directly without hesitation" and "After watching the video, I felt like I missed the essence of the message".

Table 1. Answers to the question "After watching the video, I understood it directly without hesitation"

	strongly disagree	disagree	somewhat disagree	neither agree nor disagree	somewhat agree	agree	strongly agree
Long-explained audio	12	8	7.86	7	8.5	9	7.75
mid-explained audio	/	9	8	5.83	8.8	10.27	7.8
short-explained audio	6	6.75	7.27	8	8	8.38	7
mean 3 videos	9	7.92	7.71	6.94	8.43	9.22	7.52
total mean	9	8.07	7.63	6.55	8.52	9.35	7.7

These results can mean that the message was received in an implicit way, probably through the metaphorical narrative of the animation [13], because metaphors work as linking mechanism sensorimotor domains with domains of subjective experience [14].

Table 2. Number of respondents per score out of twelve and their answer afterwards on the question "After watching the video, I as a future stakeholder see potential in the algorithm Murphy".

		1,00	3,00	4,00	5,00	6,00	7,00	8,00	9,00	10,00	12,00	Total
Likert scale about perception - After watching the video, I as a future stakeholder see potential in the algorithm Murphy	Strongly disagree	0	0	1	0	0	1	0	1	0	2	5
	Disagree	0	0	1	1	0	1	0	0	1	1	5
	Somewhat disagree	0	0	2	0	2	2	0	3	2	2	13
	Neither agree nor disagree	1	2	1	1	1	4	0	2	4	2	18
	Somewhat agree	0	0	0	2	3	8	3	4	3	8	31
	Agree	1	0	0	5	0	11	1	7	4	8	37
	Strongly agree	0	0	0	0	0	1	1	0	0	0	2
	999	0	0	0	0	0	2	1	0	1	0	4
Total		2	2	5	9	6	30	6	17	15	23	115

The answers to the question “After watching the video, I as a future stakeholder see potential in the algorithm Murphy.” can be found in table 2. Regardless the respondents’ indication, the average scores on the post-test were between a 7.33 and 8.8 out of 12. It means that the demonstrator, in total, was effective in drawing interest to such an abstract concept as optimization algorithm.

4.4 Discussion

The aim of this research was to explore possible directions in understanding and evaluating performance of demonstrators. Due to the possibility of being involved in an ongoing process of designing one, the authors of this paper had an opportunity to plan and conduct an experiment assessing the effectiveness of a demonstrator as medium in communication process in exhibition design.

To do so, they focused on its’ message conveying aspects from a comprehension perspective. To study possible correlations between audio description accompanying the video and its understanding by the auditory, an online survey driven by Qualtrics was conducted. Students or people who have just started their working career between 18-28 years old were selected as participants. The research was divided in three phases: a pre-test, the video, a post survey. The respondents were split in three groups. Each group was assigned to one of the three different audio-length description videos. Each response was evaluated on a scale from 1 to 12, where 12 means full understanding. After gathering the results of the post-test, it was possible to see how many subjects comprehended the message and scored above 50% and 70%. The mid-long audio description gave the best result, in spite of the stated hypothesis that the long video would be the best.

This result also means that with the right balance of input modes, even a very abstract notion of a novel optimization algorithm can be understood by a broad scope of people with no prior knowledge about such concepts.

5 Conclusions, Implications and Further Research

This study shows a first indication of the possible tools and methods that can be used for evaluating an effectiveness of demonstrators as new media. A combination of different communication types such as tactile, verbal and non-verbal that inherent to a versatile essence of demonstrators make them an effective boundary object to engage and provide shared understanding among stakeholders in cases where there is not yet a complete product or if this product is too abstract or difficult to be understood without prior knowledge.

The results of the conducted experiment show a high level of understanding the underlying message by the auditory. Together with the demonstrator appealing appearance, it opens new perspectives in enhancing exhibition design from both business and art perspectives [15].

Further research should be conducted to investigate the effectiveness of other aspects of demonstrator such as its attractiveness, economical effectiveness, technological advantages and so on. In line with the current findings, it can highlight more options of using demonstrators and give knowledge of how to effectively design them.

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