An Empirical Lab Study Investigating If Higher Levels of Immersion Increase the Willingness to Donate

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Abstract

Technological innovations have a growing relevance for charitable donations, as new technologies shape the way we perceive and approach digital media. In a between-subjects study with sixty-one volunteers, we investigated whether a higher degree of immersion for the potential donor can yield more donations for non-governmental organizations. Therefore, we compared the donations given after experiencing a video-based, an augmented-reality-based, or a virtual-reality-based scenery with a virtual agent, representing a war victimized Syrian boy talking about his losses. Our initial results indicate that the immersion has no impact. However, the donor's perceived innovativeness of the used technology might be an influencing factor.

Index Terms: J.4 [Computer Applications]: Social and Behavioral Sciences—Psychology

1 Introduction

In recent years, new technologies have shaped the way we perceive and approach digital media of all kinds. Besides becoming a powerful tool in scientific applications, augmented reality (AR) and virtual reality (VR) have moved out of their niche role into mainstream customer mindsets. Both technologies are increasingly used across different industries, e.g., in design and product development for virtual prototyping and simulation, in marketing for product presentations (e.g., [18]), in traditional commerce and E-commerce for interior layout configurations (e.g., [12]) or virtual fittings (e.g., [3]), as well as in games for education (serious gaming) and entertainment.

On the basis of this new technologies, areas like *Immersive Journalism* emerged, allowing first person experiences of mainly different geographic locales by means of documentary films and news reports (e.g., [4, 13]). A widely-known example is the documentary *Clouds over Sidra*[1], an award-winning VR film about the Syrian refugee crisis. By immersing an audience into the respective sceneries, e.g., the refugee camp Zaatari in Jordan, the audience members have a feeling of being physically present at these visualized locations. This improves the understanding of the communicated information, and due to induced effective moods, people can more easily empathize, e.g, with the affected persons about their living conditions (cp., link between presence and emotions in VR in [14]).

To this end, one application for improving the lives of many with these technologies are charitable donations. By utilizing AR and VR in this domain, small individual donors but also wealthy philanthropists can safely be confronted with the harsh reality of everyday life in war-torn countries or for other reasons disadvantaged territories. While strolling down a shopping promenade, potential donors can be solicited for donation via innovative AR and VR technologies, possibly increasing the willingness to donate money. Because of the growing relevance of technological innovations for donations, this study aims to show, how a higher degree of immersion for the potential donor can yield more donations for non-governmental organizations.

The remainder of this paper is structured as follows: We present the study design and hypothesis in Section 2, summarize the main results in Section 3, discuss them in Section 4 and give a short summary and outlook in Section 5.

Figure 1: A virtual, war victimized Syrian boy talking about his losses.

2 User Study

In this work, we investigate the impact of technology on the human willingness to donate. To gain the relevant insights, we conducted a between-subjects user study with the following three different technologies: (a) the traditional communication medium video (d_{Video}) and the new technologies (b) AR (d_{AR}) and (c) VR (d_{VR}). In all three treatments, subjects experienced a computer-controlled, virtual agent of a war victimized boy, telling them shortly about his loss in war and his current living conditions. Afterwards, subjects were offered the possibility to donate parts of their attendance allowance to one or two non-governmental charity organizations supporting children in developing countries and countries devastated by war.

Previous research indicates a link between immersion and emotions (e.g., [14]) and that people who can identify themselves with a victim and its environment are more willing to donate money [22]. Furthermore, research indicates that people react realistic with respect to physiological, emotional and behavioral responses in plausible and immersive scenarios [16, 17]. Thus, we assume that a higher degree of immersion increases the chance to identify oneself with the experienced situation. To this end, we expected to see the following order of donation amounts $d_{Video} < d_{AR} < d_{VR}$ and hypothesized:

H1 *The higher the degree of immersion of the technology is, the greater is the willingness to donate.*

2.1 Setups

The study was conducted with three different technical setups: For d_{VR}, subjects were equipped with the HTC Vive Pro to experience the agent within the virtual scene.

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[1]https://youtu.be/mUosdCQsMkM

Table 1: Information given by the virtual, war victimized Syrian boy.

"My name is Hakim. I am a small boy from Syria. My family was poor, but happy and fine. I was six years old, when my world was destroyed. I remember playing outside our little house in that remote village that has no name anymore. It was quite in the valley. My sister was playing with the chickens, and my parents were working on our small farm. Suddenly, the world was darkened. I looked up and saw a massive number of airplanes in the sky. My parents were screaming, but I didn't know what happened. The last thing I saw, were huge explosions with stones and dust flying around. *When I woke up, I was in the hospital. I looked for my family, but the doctor told me, that I have to be strong. I am alone now, living in a children's home with other kids, who also have no family anymore. I am sad, but at least there are some people, who care about me.* *If you want to help me and other kids that suffer because of the war, you can help us."*

For d_{AR}, subjects were asked to wear the Microsoft HoloLens, displaying solely the virtual agent. In order to create the war-time setting present in d_{VR} and d_{Video}, a large printed canvas with the dimensions $0.841m \times 1.8m$ $(w \times h)$ showing a high-quality rendering of the virtual scene was set up and subjects were asked to position themselves directly in front of it. Without the canvas, we'd just have a boy in the study location, separated from the actual war environment.

For d_{Video}, subjects perceived the study scene as a full-screen video on an 24" screen. The video was pre-rendered from the perspective of a VR user. As this traditional medium does not allow for interactive experiences, we also modeled d_{VR} and d_{AR} without any interaction.

As we are merely interested in the changes caused by technology and not in the impact the agent's realism has, we consciously excluded a video condition displaying a real child in a real war scenario.

2.2 Virtual Environment and Charities

Our study environment is displayed in Figure 1 and the video of the d_{Video} treatment is presented online[2]. The scene contains an entire street of abandoned houses with several piles of rubble, floating dust and a darkened sky, raising the impression of a town devastated by war. Low gunshot and explosion sounds contribute to the impression as well. A virtual agent, representing a young, war victimized Syrian boy, is placed in the middle of the street. We render the agent as non-photo-realistic, allowing subjects to clearly identify him as unreal. Based on research projects such as Bravemind [15] – an exposure therapy to relief post-traumatic stress symptoms by experiencing a simulated, yet witnessed war scenario with embedded virtual agents in a comparable rendering style – we argue that subjects can nevertheless connect with the agent and his situation. The character model is generated in iClone and animated by means of the Unity Game Engine. In order to display a reserved and eventually sad boy, the agent never looks at the audience directly and stands fairly restless while talking. Utterances in slightly broken English (cp., Tab. 1) are pre-generated using an online tool[3] (settings: English, United States, voice "Andi") and for the lip sync, Unity's SALSA is used. The chosen voice may potentially be not perceived as having a sad emotion. As a consequence, this may have reduced the effect of experiencing a highly unpleasant situation and thus the feeling of a required financial support by the subjects. However, as the voice and the agent were the same in all three study conditions, we argue that the potential negative impact based on the voice is neglectable for this study. For follow-up studies however, we recommend to consider the voice more carefully.

In order to control for negative sentiments for a specific charity, we chose two, international, and non-governmental charities who support children in developing countries and countries devastated by war: *Save the children*[4] and *unicef | for every child*[5]. Although both charities are well-known, we provided subjects the charities' logos and a short description of their focus of work. Furthermore, we stated clearly that all subjects' donated money will be forwarded without any deduction to the respective organization after the end of the study.

2.3 Experimental Design and Data Collection

We designed a between-subjects study with the display technology (d_{Video}, d_{AR}, and d_{VR}) as independent variable, resulting in three treatments. In each treatment, subjects experienced the same agent in the same environment, talking about his loss with exactly the same behavior and utterances. Only the display differed, as described before.

In the beginning, subjects were asked to listen to the virtual agent's story. Afterwards, they were offered the possibility to donate parts of their attendance allowance to two charity organizations.

In order to evaluate our hypothesis, we gathered the following data: We tracked the amount of donated money per subject and charity. Furthermore, thirteen standardized questionnaires were used to assess the

1. subjects' thoughts on the virtual environment,
   (Presence questionnaire [5]; Social Presence Survey (SPS) [1]; Uncanny Valley to rate the human likeliness [10], Classic Aesthetics [9], Enjoyment [20], and Involvement surveis [6])
2. the experienced technique, and
   (test on using technology for awareness [8])
3. the subjects' personal attitudes with respect to several criteria.
   (empathic concern survey [7]; attitude towards helping others and charitable organizations [21] and refugees [2]; subjectively rated own innovativeness [19] and technology anxiety [11])

In order to have a consistent terminology throughout the study, we adapted the individual items if applicable, adressing clearly the boy experienced in the respective treatment.

2.4 Procedure

Subjects were informed about the general study procedure. After they gave their informed consent, they were either placed in front of a 24" screen or were equipped with the AR or VR device. After listening to the virtual agent for about 1:40 minutes, subjects were brought to a neighboring room. Here, they were asked fill out a questionnaire consisting of demographic items and the standardized questionnaires listed in Section 2.3. Finally, they were handed over €5 in small coins and two empty envelopes, one per charity, as well as the charity descriptions. To avoid a conformity bias, the experimenter left the subjects alone. Then the subjects donated none, parts, or even their complete attendance allowance to one or both charity organizations. Before leaving, subjects placed the envelopes (either empty or filled with the amount of money they were willing to donate) into two prepared donation boxes.

2.5 Subjects

Sixty-one volunteers from the student pool of the Laboratory for Experimental Economic Research at our university participated in the study (19 ♀, 42 ♂, ages M=21.93, SD=3.01). All volunteers had normal or corrected-to-normal vision and were fluent in English. They were randomly assigned to one of the treatments: d_{Video} and d_{AR} were experienced by twenty subjects each, while twenty-one subjects experienced d_{VR}. As our recruitment mail only invited the students to a user study without specifying the study's goal or settings, all subjects were naïve to the purpose of the study on their registration. After entering our study location, they were informed that the study was about *acceptance of technology*. However, they were not introduced to all conditions except the one they were assigned to.

[2] https://youtu.be/kcXYEkp1Nt0

[3] https://www.cereproc.com/

[4] https://www.savethechildren.net/

[5] https://www.unicef.org/

Table 2: Perceived presence, social presence, and human likeliness with respect to the treatments.

Treatment	Presence		Social Presence		Human Likeliness	
	M	SD	M	SD	M	SD
d_{Video}	2.59	0.62	17.25	2.96	5.83	1.15
d_{AR}	2.77	0.61	20.5	3.68	6.73	1.31
d_{VR}	3.44	0.53	20.48	3.85	6.06	1.84

Table 3: Subject's ratings on their attitude towards helping others (AHO) and towards charitable organizations (ACO).

Treatment	AHO		ACO	
	M	SD	M	SD
d_{Video}	5.38	1.07	4.19	1.11
d_{AR}	6.20	0.91	5.338	0.47
d_{VR}	5.99	0.72	4.68	1.15

Table 4: Subject's ratings on whether the technique used is useful to raise awareness, and their rated own innovativeness.

Treatment	Awareness		Innovativeness	
	M	SD	M	SD
d_{Video}	4.94	1.26	4.85	1.19
d_{AR}	5.48	1.23	5.28	1.51
d_{VR}	5.62	1.23	5.73	1.13

3 Results

We evaluated the standardized questionnares as proposed in the literature. One exception is SPS [1]. Here, we used an adapted 7-point Likert scale (1=strongly disagree to 7=strongly agree) to be more consistent with the other scales. Furthermore, we inverted the SPS' items 3 and 5 during the summation, to balance the inverted robot-like/human-like scale of those two compared to the other three SPS items.

If applicable, we used Kruskal-Wallis tests with a significance level of 0.05 to test whether the means of the subjects' ratings differ with respect to our three treatments. Some results will be presented here, while tables give the respective means *M* and standard deviations *SD*.

For the perceived presence (see Tab. 2), we see a clear difference: while d_{VR} is highly significantly higher compared to d_{Video} ($p<.001$) and significantly higher compared to d_{AR} ($p=.012$), there is no difference between d_{Video} and d_{AR} ($p=.835$). For the perceived social presence (see Tab. 2), the results are as follows: d_{AR} and d_{VR} do not show a significant difference, however d_{Video} is significantly different to d_{VR} ($p=.017$) and to d_{AR} ($p=.015$). For the human likeliness (see Tab. 2), however, no significant difference was found.

As subjects were randomly assigned to one of the treatments, their general tendency to help or donate is of interest to see if a certain treatment is biased. Table 3 gives an overview. For the attitude to help others we found a significantly higher score for d_{AR} compared to d_{Video} ($p=.011$), while there was no significant difference for the other two combinations (d_{Video} to d_{VR} with $p=.238$; d_{AR} to d_{VR} with $p=.704$). For the attitude towards charitable organizations we found the same results (d_{Video} to d_{AR} with $p=.002$, d_{Video} to d_{VR} with $p=.441$; d_{AR} to d_{VR} with $p=.136$).

Furthermore, we analyzed whether subjects' rate the technique used as useful to raise awareness for the boy's situation (see Tab. 4). No significant difference could be shown between the three mean scores. The same is true for the subjects' ratings on their own innovativeness (see Tab. 4).

Finally, Table 5 shows the received donations.

Table 5: Amount of donations ($\sum$) and number of donors (# don) per charitable organization with respect to the treatments.

Treatment	Save the children		unicef		Total	
	$\sum$	# don	$\sum$	# don	$\sum$	# don
d_{Video}	€13	4	€17	5	€30	9
d_{AR}	€15	7	€30	8	€45	15
d_{VR}	€22	8	€5	2	€27	10

4 Discussion

Based on our results, presence is the highest for d_{VR}, followed by d_{AR} and then by d_{Video}, while for the later two there is no significant difference. Interestingly, ordering the treatments based on the donation amount, results in the following order for decreasing donation amounts: $d_{AR} > d_{Video} > d_{VR}$, showing that the subjects donated most in d_{AR}. This contradicts **H1**. Thus, there seems to be one to several other factors impacting the potential donor's willingness to donate.

Our data, however, does not provide a suitable insight for identifying these factors. Based on the results and the study's framework conditions, we assume two possible, probably linked, explanations for the outcome.

One very likely explanation for the highest donation amount being measured in d_{AR} is, that this treatment's subjects have a (significantly) higher attitude towards helping others as well as supporting charitable organizations. Having d_{Video} ranked second might be due to fact, that we conducted the study shortly before Christmas, a time well-known for giving. So participants may have been in a general, generous mood facilitating receiving donations on the traditional way. To this end, we intend to repeat the study with more homogeneous treatment groups with respect to the two attitudes and in a more "neutral" time frame of the year.

While we see no differences in the subjects' personal innovativeness, (highly) significant differences for aspects like presence and social presence have been found, showing better results for the new technologies d_{AR} and d_{VR}. Having d_{AR} outperforming d_{VR} in terms of donation amount, might be due to the perceived innovativeness of the technology itself. This is our second possible explanation. We assume, that our subjects, mainly younger students (M=21.93 years), are more familiar with VR technology due to VR-based gaming or immersive journalism. Thus, AR may have been seen as the more innovative approach, yielding higher donations. To this end, we intend to conduct a follow-up study using a more diversified participant group across ages, while using suitable questionnaires to further investigate the technologies' innovativeness.

5 Conclusion

In this work, we presented some first insight onto the technologies' impact on the human's willingness to donate by comparing the traditional communication medium video (d_{Video}) to two new technologies, namely AR (d_{AR}) and VR (d_{VR}). While our current results do not indicate that a higher degree of immersion would lead to higher donation amounts, the perceived innovativeness of the used technology may be an important factor.

For future work, we plan to investigate this link more closely, by using a more diversified subject sample across ages, while counterbalancing the three groups with respect to their helping attitudes. As our experimental setting itself seemed to work good, neither technical requirements, nor the experimental procedure, nor stimuli require an adjustment and can be reused. However, we intend to conduct the follow-up study in a "neutral" time frame of the year.

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