INFLUENCE OF STIMULUS FORMAT ON VIRTUAL CHARACTER PERCEPTION

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Abstract

The expansion of the implementation of virtual characters has led to their use both in the expected framework of video games and in additional areas of entertainment, marketing, banking, healthcare, and education. Content using virtual characters is available in various formats, including still images, gifs, and videos. As part of this research, an analysis of the impact of the stimulus format (pictures or videos) on the perception of likability, naturalness of appearance, and confidentiality of virtual characters was carried out. In the experimental part of the research, respondents were shown four virtual characters (two female and two male) in two formats: image and video. The respondents' task was to evaluate the likability, naturalness of appearance, and trustworthiness of each depicted character according to the Likert scale in the survey. In order to determine the influence of the stimulus format on the respondents' reactions regarding likability, naturalness of appearance, and character confidentiality, a paired samples T-test was conducted, as well as a post-hoc Wilcoxon rank test to determine the degree of variation of the results, and then a T-test of independent samples to determine the equality of the obtained results. It was determined that statistically significant differences occur with one character in the context of likability and trust and one character in the context of naturalness of appearance.

Key words: virtual character, image, video, likeability, naturalness, trust.

1. Introduction

When displaying different types of content, the question is often raised whether the way the content is displayed impacts the perception of it. As early as

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the 1950s, research was conducted to determine the impact of the stimulus format on the perception of different information (Fan et al., 2020). It is generally believed that video as a dynamic display format has an advantage over static images. However, this theory is not always correct. Videos fulfill most of the characteristics associated with static images, such as the ability to standardize, and are therefore often claimed to be even more helpful. Unlike static images, videos are dynamic and considered more similar to real life. Their technical elements (camera movement, editing, sound) can emphasize actions and their emotional meaning (Mikunda, 2002; Uhrig et al., 2016). The most common field of research on the impact of stimuli on perception is found in psychology. Numerous research has been conducted to determine whether there is a difference in the perception of emotions depending on the type of stimulus format. Still, images are consistently as effective and sometimes more effective than video in eliciting human emotion (Fan et al., 2020; Uhrig et al., 2016). One of the disadvantages of using video as a stimulus is the so-called frozen face effect (FFE), which occurs when the video is paused. It is believed that this phenomenon can significantly impact the perception of the likeability and attractiveness of the observed stimulus, whether it is an animated character or a person from the real world (Post et al., 2012). It was also shown that when using computer- generated facial animation, the presence of additional movements of the character had an impact on the feeling of likability, and attractiveness is associated with the amount of movement of the observed character (Knappmeyer et al., 2002; Morrison et al., 2007). However, it is interesting that this phenomenon does not occur in people from the real world. When comparing the likeability of videos of a person speaking and static images selected from videos, no differences in attractiveness ratings were found between static and dynamic face stimuli (Rubenstein, 2005; Roberts et al., 2009; Penton-Voak & Chang, 2008). What was finally established is that the ratings of static images and dynamic videos can be strongly positively correlated. It is essential to emphasize that the strength of this correlation depends on whether the same or different rater assigns the two ratings for both stimuli, whether the raters are of the same or opposite sex, and the context in which the videos were recorded. It is also pointed out that the likeability of a static face is a good indicator of the attractiveness of the same person when moving (Roberts et al., 2009).

2. Experimental

Since it is considered that there is a difference in the perception of the displayed content depending on whether it is marketed as a video or a static image, this research aimed to examine precisely this hypothesis. This research is based on analyzing the influence of the stimulus format on the perception of virtual characters by the respondents, focusing on the aspects of likability, naturalness of appearance, and confidentiality.

2.1 Methods

The primary tool for collecting respondents' reactions was a three-part survey. The first section related general information about the respondents, including gender and age. The second and third sections recorded the respondents' reactions to stimuli in the context of likability, naturalness of appearance, and trustworthiness of character. These two sections were divided so that stimuli were shown in static images in the second section, while in the third section, the stimuli were in video format.

The three evaluation parameters are according to the Likert scale from -5 (do not agree at all) to 5 (completely agree):
- P1 – likability of the character;
- P2 – the naturalness of the character's appearance;
- P3 – confidentiality of character.

To thoroughly examine the influence of the stimulus type on the respondents' reactions, we employed two statistical tests. The T-test of paired samples was used to compare the means of two related groups, while the post-hoc Wilcoxon rank test was used to determine the degree of variation in the results. Additionally, a T-test of independent samples was conducted to check for equality among the obtained results. Finally, the Eta square was calculated to determine the size of the influence.

2.2 Stimuli

Characters created with the help of MetaHuman Creator software were used as stimuli. A library of available characters was used as a starting point for character creation, adjusted according to needs. Four characters were created—two female and two male (Figure 1).

Figure 1: Created characters

The characters were shown to the respondents in two formats—static images and videos with accompanying audio. Two audio recordings were used—one for

both female characters and the other for both male characters. The video is generated so that the characters' gestures follow the audio content.

3. Results and Discussion

The survey group comprised 59 respondents (38 women and 21 men) aged between 18 and 25.

When analyzing the respondents' ratings, it was observed that in the context of the naturalness of the character's appearance, a higher average rating for each character was assigned to the stimuli of static images. Regarding likability and trustworthiness, the video stimuli were rated with a higher average rating for both female and male characters. In the case of the second male character, images as stimuli were rated more positively in the context of all three evaluated parameters.

In order to determine the statistical significance of the difference in responses in relation to the stimulus format, we employed a paired-sample T-test. This test allowed us to determine that a statistically significant difference in the respondents' answers occurred in only three questions out of a total of 12 analyzed (Table 1). This level of detail and precision in our research process instills confidence in the validity of our findings.

Table 1: Paired samples t-test results

Pairs	N	Mean	Std. Deviation	Std. Error Difference	Sig. (2-tailed)
F1p1IMAGE – F1p1VIDEO	59	-1.339.	2.411	0.314	0.000
F1p2IMAGE – F1p2VIDEO	59	0.322	1.870	0.243	0.191
F1p3IMAGE – F1p3VIDEO	59	-1.831	2.743	0.357	0.000
F2p1IMAGE – F2p1VIDEO	59	-0.186	1.978	0.258	0.472
F2p2IMAGE – F2p2VIDEO	59	0.153	1.981	0.258	0.557
F2p3IMAGE – F2p3VIDEO	59	-0.017	2.055	0.268	0.950
M1p1IMAGE – M1p1VIDEO	59	-0.271	2.476	0.322	0.404
M1p2IMAGE – M1p2VIDEO	59	0.068	2.333	0.304	0.824
M1p3IMAGE – M1p3VIDEO	59	-0.237	2.231	0.290	0.417
M2p1IMAGE – M2p1VIDEO	59	0.203	2.219	0.289	0.484
M2p2IMAGE – M2p2VIDEO	59	1.322	2.569	0.334	0.000
M2p3IMAGE – M2p3VIDEO	59	0.153	2.180	0.284	0.593

The influence of the stimulus format on the perception of all three examined parameters - likability, naturalness of appearance, and trustworthiness of the character - was evaluated using the t-test of paired samples. A statistically significant difference was found in the perception of the first female character in the context of likeability when comparing the image (M = -0.22, SD = 2.221) and the video (M = 1.12, SD = 2.614), t (58) = -4.265, p < 0, 0005. The mean difference in likability was -1.339, while the 95 percent confidence interval extended from -1.967 to -0.711. The value of the eta square (0.19) shows that the influence of the stimulus format is large. With the same character, a significant statistical difference also

occurs in the rating of the confidentiality parameter between the image (M = -0.93, SD = 2.538) and the video (M = 0.90, SD = 2.611), t (58) = -5.126, p < 0.0005. The average difference in character confidence was -1.831, while the 95 percent confidence interval extended from -2.545 to -1.116. The effect of the stimulus format was marked as significant based on the eta squared value (0.29). When it comes to male characters, the only statistically significant difference was observed for the second male character in the context of naturalness of appearance when comparing the image (M = 0.86, SD = 2.323) and the video (M = -0.46, SD = 2.459), t (58) = 3.952, p < 0.0005. The value of the eta square (0.12) shows that the influence of the stimulus format is moderate.

The Wilcoxon Signed Rank Test was conducted to confirm the results as a post- hoc non-parametric alternative. This test confirmed the results obtained by the paired samples T-test (Table 2).

Table 2: Wilcoxon Signed Rank Test results

Pairs	z	p	r
F1p1IMAGE – F1p1VIDEO	-3.967	0.000	0.36
F1p2IMAGE – F1p2VIDEO	-1.218	0.223	0.11
F1p3IMAGE – F1p3VIDEO	-4.486	0.000	0.41
F2p1IMAGE – F2p1VIDEO	-0.916	0.359	0.08
F2p2IMAGE – F2p2VIDEO	-0.006	0.995	0.0005
F2p3IMAGE – F2p3VIDEO	-0.920	0.358	0.08
M1p1IMAGE – M1p1VIDEO	-0.915	0.360	0.08
M1p2IMAGE – M1p2VIDEO	-0.627	0.531	0.06
M1p3IMAGE – M1p3VIDEO	-0.747	0.455	0.07
M2p1IMAGE – M2p1VIDEO	-0.771	0.441	0.07
M2p2IMAGE – M2p2VIDEO	-4.199	0.000	0.39
M2p3IMAGE – M2p3VIDEO	-0.387	0.699	0.04

Wilcoxon Signed Rank Test revealed a significant statistical difference when analysing the attractiveness results of the first female character according to the stimulus format z = -3.967, p < 0.0005 with a large difference in results (r = 0.36). Regarding confidentiality of the same character, a statistically significant difference was observed concerning the stimulus format z = -4.486, p < 0.0005, with a large difference in results (r = 0.41). When analysing the results of the second male character, a statistically significant difference was observed in the parameter of naturalness of appearance z = -4.199, p < 0.0005 with a large difference in results (r = 0.39).

After analysing the previously obtained results, a T-test of independent samples was conducted to determine the equality of the results of the likability parameters, naturalness of appearance, and character confidentiality in the two stimulus formats (image and video). The results of this test showed that the variances were equal in 11 out of the 12 examined cases, while statistical significance was observed in three cases (Table 3).

Table 3: Independent-samples t-test results

	N	Levene's Test for Equality of Variances (Sig.)	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
F1 likeability	59	0.469	-2.999	0.003	-1.339	0.447
F1 naturalness	59	0.128	0.717	0.475	0.322	0.449
F1 confidentiality	59	0.951	-3.861	0.000	-1.831	0.474
F2 likeability	59	0.927	-0.447	0.656	-0.186	0.417
F2 naturalness	59	0.075	0.349	0.728	0.153	0.437
F2 confidentiality	59	0.275	-0.040	0.968	-0.017	0.425
M1 likeability	59	0.027	-0.614	0.541	-0.271	0.442
M1 naturalness	59	0.935	0.135	0.893	0.068	0.502
M1 confidentiality	59	0.078	-0.510	0.611	-0.237	0.465
M2 likeability	59	0.667	0.477	0.635	0.203	0.427
M2 naturalness	59	0.325	3.002	0.003	1.322	0.440
M2 confidentiality	59	0.788	0.347	0.729	0.153	0.440

The t-test of independent samples was used to compare the tests of likeability, naturalness of appearance, and trustworthiness of characters within images and videos. A statistically significant difference was observed for the first female character for the likability parameter between the picture (M = -0.22, SD = 2.221) and the video (M = 1.12, SD = 2.614), t (59) = -2.999, p = 0.003. The difference between the mean values of the features by groups (mean difference = -1.339, 95% CI: -2.223 to -0.455) was moderate (Eta square = 0.08). For the confidentiality parameter of the same character, a significant statistical difference was observed when comparing the image (M = -0.93, SD = 2.538) and video (M = 0.90, SD = 2.611), t (59) = -3.861, p < 0.0005. The difference between the mean values of the features by groups (mean difference = -1.831, 95% CI: -2.769 to -0.892) was large (Eta square = 0.15). The naturalness of the other male character's appearance also showed statistical significance when comparing the picture (M = 0.86, SD = 2.323) and the video (M = -0.46, SD = 2.459), t (59) = -3.002, p = 0.003. The difference between the mean values of the features by groups (mean difference = 1.322, 95% CI: 0.450 to 2.194) was moderate (Eta square = 0.08).

The Mann-Whitney U test was performed as a post-hoc non-parametric method to confirm the results obtained by the independent samples t-test (Table 4).

The Mann-Whitney U test confirmed the results of the t-test of independent samples. It revealed a statistically significant difference in the likeability of the first female character for the image and video (U = 1129, z = -3.318, p = 0.001, r = 0.3). Similar results were obtained regarding the confidentiality of the same character (U = 1045.5, z = -3.766, p < 0.0005, r = 0.35). Statistical significance was also observed in the naturalness of the appearance of the second male character (U = 1189.5, z = -2.987, p = 0.003, r = 0.27).

Table 4: Mann-Whitney U test results

	z	p	r
F1 likeability	-3.318	0.001	0.3
F1 naturalness	-0.551	0.582	0.05
F1 confidentiality	-3.766	0.000	0.35
F2 likeability	-0.528	0.597	0.05
F2 naturalness	-0.280	0.779	0.03
F2 confidentiality	-0.424	0.672	0.04
M1 likeability	-0.511	0.610	0.05
M1 naturalness	-0.135	0.892	0.01
M1 confidentiality	-0.675	0.500	0.06
M2 likeability	-0.537	0.592	0.05
M2 naturalness	-2.987	0.003	0.27
M2 confidentiality	-0.155	0.877	0.01

4. Conclusions

This research aimed to analyze in detail the influence of the stimulus format (pictures or videos) on the perception of virtual characters. The results showed that statistically significant differences were present only in a limited number of cases. Notably, the stimuli format had a statistically significant effect in cases of likability and trust for a female character, and in the naturalness of the appearance of a male character. These findings underscore the importance of carefully considering stimulus formats when creating virtual features, particularly in the context of communication and user interaction goals. However, it's crucial to note that in most cases, no statistically significant difference was observed between image and video formats in the perception of virtual characters. This suggests that while stimulus format may influence perception, this difference is not consistent or certain. In other words, in most cases, the perception of virtual characters does not significantly change between image and video formats. It's important to remember that the results of this research are specific to certain virtual characters, and variations in perception are inevitable depending on the context and characteristics of the target user group.

Further research could explore additional factors that may influence the perception of virtual characters in different formats, as well as a more detailed consideration of specific characteristics of characters that may have a fundamental impact on perception. Consideration of the mentioned factors can be crucial for optimizing the perception of virtual characters to achieve the desired communication and interaction with users. Such research could provide a deeper understanding of the complexity of the interaction between the stimulus format and the perception of virtual characters, which could find practical application in the design and application of virtual systems in various fields.

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