YouTubers Versus VTubers: Persuasiveness of Human and Virtual Presenters in Promotional Videos

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11 **Abstract**

12 With the recent advances in motion tracking technologies and three-dimensional computer graphics
13 software, communication through avatars has become increasingly popular. Can avatars be
14 sufficiently persuasive, when compared to traditional forms of interpersonal communication? What
15 factors contribute to the persuasiveness of virtual influencers? Existing literature has studied the
16 differences in persuasiveness between human and virtual speakers extensively, particularly in
17 education. However, few studies have been conducted on product promotion. Therefore, in this
18 study, we investigated the characteristics of persuasiveness for humans and virtual influencers, as
19 well as the differences between them in this regard in a more modern and practical situation: product
20 introduction videos used in influencer marketing. Specifically, we recruited participants to watch
21 product introduction videos on YouTube, presented by either humans or avatars. The videos were
22 similar, except for the appearance of the presenter. Before and after watching the videos, the
23 participants were asked to complete a questionnaire about their willingness to purchase the products
24 and the characteristics of presenters' persuasiveness. The results show that although promotion via
25 avatars can increase the participants' willingness to purchase, human influencers were more
26 persuasive. However, VTuber was more persuasive for certain product domain. VTubers who can
27 change their appearance to match the product domain have potential for future applications. We also
28 attempted to construct a model of persuasiveness in this pragmatic context based on the Dyson's
29 persuasiveness rating scale and the overall impression about the video. Additionally, the degree of
30 persuasiveness was found to be related to the presenters' likability, whether the presenter was a
31 human or an avatar, the degree of familiarity between the presenter and the audience, the presenters'
32 trustworthiness, and the quality as well as the entertainment level of the video. This model is helpful
33 for the successful promotion on YouTube. Our findings verify that avatars can be fairly persuasive in
34 some situations, including promotional videos. These findings contribute to the future development
35 of communication through avatars.

36 **1   Introduction**

37 Since the establishment of the online video-sharing platform YouTube in 2005, "YouTubers"—
38 people who post and stream videos on the platform—have become increasingly popular. More
39 recently, with advances in three-dimensional computer graphics (3DCG) software, virtual YouTubers
40 (VTubers), who post and stream videos using 3DCG avatars that are similar to characters in anime,
41 have also gained widespread popularity (Liudmila, 2020). The 3DCG software captures the facial
42 expressions and movements of VTubers and maps them into a 3D model, thus animating the
43 VTubers' avatars and enabling them to record videos with natural-looking 3D animations.

44 YouTube's Culture and Trends Report noted that VTubers have grown to over 1.5 billion views per
45 month by October 2020 (Allocca, 2020). According to the ranking of earnings on YouTube, known
46 as Super Chat, in 2021, 8 of the top 10 YouTube video contributors worldwide were VTubers
47 (Playboard, 2022). Currently, "Gawr Gura" has more than 4 million subscribers, making them the
48 VTuber with the largest following. In particular, VTubers have the advantage of controlling avatars
49 that are character-like and do not have to show their own faces or reveal their true physical
50 appearance; however, it is difficult for them to show delicate facial expressions and movements.
51 Thus, it is not clear in what situations videos made by VTubers using avatars can be as convincing to
52 viewers as those performed by real people (YouTubers), or in what ways they differ.

53 In conventional corporate advertising, companies promote their products directly using mass media
54 advertising, such as television, newspapers, and magazines. In contrast, YouTubers and VTubers
55 introduce the product from the users' perspective, sharing their experiences with products and
56 services with the users to build a more intimate and personal relationship (Freeman and Chapman,
57 2007). This type of influencer marketing alters consumer behavior by disseminating information on
58 social media (Brown and Hayes, 2008; Jin et al., 2019; Hudders et al., 2020; Vrontis et al., 2021).
59 Therefore, researchers have been interested in studying factors affecting influencer marketing, such
60 as perceived credibility (Xiao et al., 2018).

61 In particular, product promotions have been on the rise on video-sharing platforms, such as YouTube
62 and TikTok, as videos provide more information than text on Twitter or photos on Instagram. Unlike
63 text and photos, videos can convey changes in facial expressions and movements, as well as provide
64 detailed instructions on how to use a product. Although the persuasive effect of such videos has been
65 attracting considerable attention, no specific research has been conducted on the topic. However,
66 from a marketing perspective, investigating the persuasive effect of such videos is imperative, as it
67 can serve as a guideline for how YouTubers (humans) and VTubers (avatars) can be utilized, and
68 what presenter types should be used to effect changes in purchasing decisions when introducing
69 products. Further, such investigation is also meaningful in terms of studying persuasion and in
70 practical situations.

71 In the field of marketing, numerous studies have investigated the effects of corporate advertising on
72 consumers' willingness to purchase diverse products (Krugman, 1965; Park and Young, 1986).
73 Recent marketing studies have also shown that TV, print, and other advertising, as well as celebrity
74 endorsements, influence purchase intentions (Arshad and Aslam, 2015). Moreover, advertising
75 entertainment, advertising familiarity, social imaging, and advertising spending influence purchase
76 behavior (Haider and Shakib, 2018). Research on smartphone advertising has also shown the
77 importance of contextual advertising and other types of advertising that are location- and time-
78 specific (Lee et al., 2017).

79 Prior research has studied persuasion in the context of purchase decisions on websites and other
80 sources (Hopkins et al., 2004). Moreover, several studies have suggested that the use of avatars

81 representing companies and products on websites can improve attitudes toward products and improve
82 user satisfaction, as well as willingness to purchase (Choi et al., 2001; Holzwarth et al., 2006).
83 However, prior studies have not examined the differences in persuasiveness between human and
84 avatar presenters in product promotional videos using experimental designs that are similar to real
85 environments.

86 Therefore, this study investigates the persuasive effects of using YouTubers or VTubers in product
87 promotional videos (i.e., videos introducing specific products) using an experimental design that is
88 similar to the actual video promotion and viewing environment. Specifically, we attempt to
89 determine whether YouTubers or VTubers exhibit persuasive effects, such as influencing purchase
90 decisions, identify which factors contribute to their persuasiveness, and highlight the differences
91 between them. This study clarifies the differences in persuasive effects between humans and avatars
92 in the modern and practical setting of product promotion through YouTube videos. As the existing
93 evidence suggests that avatar attractiveness affects the favorability perceived by users, and
94 favorability affects persuasiveness, we also explore the role of favorability in this study (Keeling et
95 al., 2010; Khan and Sutcliffe, 2014).

96 We must note that prior research has investigated the impact of interaction with salespeople using
97 avatars on product promotion. Various studies have attempted to determine whether avatars (in the
98 form of interactive agents on websites) can affect purchase decision (McGoldrick et al., 2008;
99 Keeling et al., 2010). For example, multimodal interactions between users and avatars providing
100 product information have been shown to enhance the enjoyment of the online shopping experience
101 (Jin and Bolebruch, 2009). Moon et al. (2013) have demonstrated that interactions between users and
102 salespeople and peers in virtual stores can increase users' social presence, shopping enjoyment,
103 positive attitudes toward brands, and willingness to purchase. Nevertheless, this study examines the
104 impact on purchase decisions in the practical setting of video promotion.

105 Persuasion is also one of the key themes in psychology, with various studies investigating persuasion
106 in many domains, not limited to purchase decisions. For example, research has been conducted on the
107 differences in persuasiveness between humans and avatars in the field of education. Some studies
108 have shown that nonverbal expressions are also important for the persuasive ability of robots
109 (Chidambaram et al., 2012). The influence of eye gaze has also been studied in terms of persuasive
110 strategies using robots (Ham et al., 2015). In terms of learning effectiveness in expressive education,
111 several studies have investigated whether study participants change their minds when exposed to a
112 lecture (Zanbaka et al., 2006). In these studies, the experimental setting was such that participants
113 were directly persuaded regarding a single solution to a problem on which they were divided (Baxter
114 et al., 2017; Hashemian et al., 2019; Jamy, 2015).

115 The current study, however, uses content that includes entertainment elements in addition to the
116 persuasive content, that is, product promotion. In other words, not all of the video content is related
117 to persuasion. Additionally, in this study, we use professional-quality videos that are similar to actual
118 YouTube promotional videos.

119 Against this backdrop, we intend to see if we can be persuasive through our avatars by studying
120 whether VTubers (avatars) can be used to promote products on YouTube. Because this study uses a
121 practical experimental environment, it is significant as an empirical study in marketing and as a study
122 of persuasion in psychology.

123   To determine whether YouTubers (human appearance) or VTubers (avatar appearance) are more
124   persuasive when promoting products, which factors contribute to this difference, and in what way, a
125   human YouTuber wearing a motion-capture suit under his clothes filmed a product promotion video.
126   By utilizing the captured motion, we were able to produce a product promotional video for the
127   VTuber. We asked a group of viewers to watch these videos with the same audio, composition, and
128   other conditions, except for the presenters' appearance, and compared the differences in
129   persuasiveness through a questionnaire. In the questionnaire, based on previous research on
130   persuasion, users were asked about the impressions they had of the videos and presenters after
131   viewing the promotional videos (Mullennix et al., 2003).

132   Our study aims to answer the following two research questions:

133   1. How do YouTubers and VTubers influence their persuasiveness and viewers' purchase decisions
134   when promoting products using videos, and what are the differences between them?

135   2. What are the mechanisms through which the impressions about the promotional videos and video
136   contributors influence their persuasiveness (i.e., persuasiveness structural model)?

137   **2   Materials and Methods**

138   **2.1   Participants**

139   Using a social media application (Twitter), we recruited 318 participants—mostly students from
140   Kwansei Gakuin University and Osaka University—without gender segregation. The cases of
141   participants excluded from the study are discussed later.

142   **2.2   Research Design**

143   We employed a between-subjects experimental design. Immediately after submitting the application,
144   the respondents were asked to complete a pre-questionnaire to gauge their state of mind. The
145   participants were then randomly divided into groups to watch a product promotional video presented
146   by either a YouTuber or a VTuber. Afterwards, the participants in each group watched promotional
147   videos for two different product categories (tapioca drinks and game apps). After viewing the videos,
148   they were asked to complete a post-questionnaire about their impressions of the presenter and the
149   video content, as well as their willingness to purchase the product. The participants were paid a
150   gratuity of 1,500 Yen.

151   This study was reviewed and approved by the Research Ethics Review Committee of Kwansei
152   Gakuin University's "Behavioral Research on Human Subjects." Informed consent was obtained
153   from the participants by means of written informed consent forms.

154   **2.3   Materials**

155   For the experiment, product promotional videos were created that differed only in the appearance of
156   the presenter (i.e., a human or an avatar). We created videos for two product categories (i.e., tapioca
157   drinks and game apps) because they are familiar to young people. We struck a balance by selecting
158   the two products from different product categories: food and beverages (tapioca drinks) and
159   entertainment (game apps). As VTubers are avatars, they cannot really consume tapioca drinks. The
160   intention was also to check if this would make a difference.

161   Specifically, the YouTuber introduced the product in a filming studio, which was then edited to
162   create a video of a human (YouTuber) introducing the product. However, this presenter was wearing
163   a tracking suit, and his body position and movements were recorded in the same chronological order
164   by the tracking system in the filming studio. In addition, a 3DCG model of an avatar of a character
165   based on this presenter was created in advance. By moving and recording this avatar model in the
166   same manner as actual human movements, a product promotional video involving the avatar
167   (VTuber) was also created. To make it viewer-friendly, the avatar was designed by a well-known
168   professional Japanese character designer. This was because existing literature demonstrates that
169   avatars with realistic human appearances may seem "creepy" (Tinwell et al., 2011). The videos were
170   also edited with the help of a major VTuber studio.

171   To ensure that the videos would not look out of place when posted on YouTube as actual YouTuber
172   and VTuber videos, the product promotional videos were produced by a professional team and studio
173   that actually produces and delivers YouTuber and VTuber videos. Perception Neuron Pro was used
174   as the tracking suit, Unity was used as the software to manipulate the 3DCG models, and Adobe
175   Premiere was used for video editing.

176   The two product promotional videos differed only in the appearance of the presenter. However, the
177   content of speech, audio, and video composition were identical, as shown in Figure 1. The length of
178   the videos was approximately nine and six minutes for the tapioca drink and game app, respectively.

179   **2.4   Procedure**

180   As noted above, participants were recruited through social media. They were then asked to complete
181   a pre-survey generated on Survey Monkey. Following this, after a period of one to two weeks, they
182   were asked to watch the source video. Immediately following the viewing, participants were asked to
183   complete a post-questionnaire. The following subsection describes the content of the questionnaire.

184   **2.5   Questionnaire Summary**

185   The pre-questionnaire included items measuring participant demographics and their willingness to
186   purchase the tapioca drinks and game apps. The post-questionnaire did not ask for any information
187   about the user, but asked the same questions about their willingness to purchase the products, using
188   exactly the same format as in the pre-questionnaire. Both the VTuber and YouTuber groups
189   responded to the same questionnaire.

190   The post-questionnaire was more voluminous than the pre-questionnaire. Dyson's persuasiveness
191   rating scale was employed as the primary rating instrument (Mullennix et al., 2003). This
192   persuasiveness rating scale measures effectiveness of the product promotion, perception toward the
193   message, and perception toward the presenter. To compare with the synthesized persuasiveness index
194   that was calculated later, the perceived persuasiveness toward the presenter was directly evaluated
195   using one question item.

196   The participants were also asked about their overall impression, including the favorability felt toward
197   the presenter, perceived trustworthiness of the presenter, eye contact felt with the presenter, closeness
198   between the presenter and the participants, and qualities of the product promotional video.

199   The post-questionnaire response time was measured to determine if the entire video was viewed
200   appropriately. This included the time spent watching the video and the minimum response time to the
201   questionnaire. Further, we included a brief set of questions to ascertain whether the video was

202 watched. These questions were designed to exclude respondents who either did not watch the video
203 or did not take the video seriously.

204 **2.6 Questionnaire Details**

205 The pre-questionnaire asked for information about the user (sex, personality traits, anime viewing
206 preferences, and familiarity with VTubers and YouTubers).

207 The purchase decision was examined by ranking the products the participants would like to purchase.
208 For each tapioca drink and game app, seven different products were prepared. Participants were
209 asked to rank the products in the order in which they would like to purchase them. They were asked
210 to rank the seven products in the pre-questionnaire and to repeat the process in the post-questionnaire
211 to measure how the rankings varied. This was based on a questionnaire used in an existing agent
212 persuasion study (Ogawa et al., 2009).

213 To assess persuasiveness, we used Dyson's persuasiveness rating scales, which are used as a measure
214 of an agent's persuasiveness (Mullennix et al., 2003). Effectiveness of the product promotion was
215 rated on a 9-point Likert scale for multiple adjective pairs provided to the participants for each
216 subscale. Perception toward the message and the presenter was rated on a 7-point Likert scale. Each
217 adjective pair is shown below (adjective pairs marked with an asterisk "*" are reversal items).

218 Effectiveness of the product promotion: Bad—Good, Foolish—Wise, Negative—Positive,
219 Beneficial—Harmful, Convincing—Unconvincing, Effective—Ineffective.

220 Perception toward the message: Flamboyant—Conservative, *Stimulating—Boring, Vague—
221 Specific, Unsupported—Supported, Complex—Simple, *Convincing—Unconvincing, Boring—
222 Interesting.

223 Perception toward the presenter: Unintelligent—Intelligent, *Straightforward—Evasive, *Active—
224 Inactive, *Qualified—Unqualified, *Sincere—Insincere, Meek—Forceful, Incompetent—Competent,
225 *Honest—Dishonest, Unassertive—Assertive, Uninformed—Informed, Untrustworthy—
226 Trustworthy, Timid—Bold, Loud Voice—Soft-Spoken Voice, Deep Voiced—Squeaky Voiced, Fast
227 Speaking—Slow Speaking, Heavy Accent—Faint Accent, Talked Too Long—Did not Talk Long
228 Enough, Heavy Nasality—Faint Nasality, Monotone—Lively.

229 The overall impression included questions on favorability felt toward the presenter, the perceived
230 trustworthiness of the presenter, eye contact felt with the presenter, and closeness between the
231 presenter and the participants. Each item was evaluated directly using one question, as provided
232 below, following which the responses were obtained on a 7-point Likert scale.

233 - How favorable was your impression of the presenter?

234 - How trustworthy did you think the presenter was?

235 - To what extent did you feel that the presenters looked at you when they talked to you?

236 Closeness refers to the degree of similarity between the participant and the presenter, as perceived by
237 the participants. To evaluate closeness, we employed the Inclusion of Other in the Self Scale (Aron et
238 al., 1992). This scale indicates the degree of overlap between representations of self and others, as

239 indicated by the overlap of the two circles. In this study, the assessment was obtained using a 7-point
240 Likert scale.

241 To estimate impressions of the videos, we included the following questions about the likability,
242 completeness, and interestingness of each viewed video. The responses were obtained using a 7-point
243 Likert scale.

244 - How much did you like the product promotional video that you watched?

245 - How good was the quality of the video for product promotion?

246 - How interesting was the content of the product introduction video?

247 **2.7   Data Analysis**

248 For the actual analysis, participants (those who watched the videos till the end and responded) were
249 filtered using the following procedure. First, we selected the respondents who spent more than 20
250 minutes, or at least longer than the length of the video, answering the questionnaire. The 20 minutes
251 was decided based on the results of time measurements on a pilot sample of about 10 people, which
252 is slightly longer than the minimum time to have watched all of the videos. Then, the respondents
253 who correctly answered questions that could be easily answered if they had watched the video (e.g.,
254 the episode played in the game app video, the flavor of the drink featured in the tapioca drink video)
255 were picked.

256 In this study, Dyson's measure of persuasiveness consisted of three categories: effectiveness of the
257 product promotion, perception toward the message, and perception toward the presenter. Cronbach's
258 alpha coefficients were used to confirm consistency within these measures. For the analysis of
259 Research Question 1, we conducted a two-factor analysis of variance (ANOVA) between participants
260 in the YouTuber and VTuber groups and the pre- and post-questionnaire. For subsequent analyses,
261 these measures were combined using principal component analysis to create a synthesized
262 persuasiveness index. The validity of this index was confirmed by checking the contributions of the
263 principal components, as well as by correlating them with the overall impression of the presenter's
264 persuasiveness, which had been answered beforehand.

265 In addition, the impressions respondents had of the videos and presenters for the tapioca drink and
266 the game app were obtained separately. Therefore, we could verify whether the impressions
267 significantly differed by product category. Specifically, we tested the possibility that the participants
268 might have thought that the avatar was not consuming the tapioca drink, thus affecting the results.
269 Using the cosine similarity measure, consistency (similarity) was calculated to evaluate the
270 consistency of the respondents' impressions of the presenter in each video. Taking the responses to
271 each impression item as a vector value, the inner product of the vector of impressions from the
272 tapioca drink video and the vector of impressions from the game app video was divided by their
273 norm. If the measure was close to 1, then the respondents had the same impression, regardless of the
274 video content. Conversely, if it was close to 0, the respondents' impressions varied greatly,
275 depending on the video content. Cosine similarities were determined for each participant and their
276 means were calculated.

277 To use Dyson's measure of persuasiveness (i.e., the synthesized persuasiveness index) as the
278 objective variable in the multiple regression analysis of Research Question 2, its principal
279 components had to be valid. The explanatory variables included the overall impressions (the

280   presenter's favorability, presenter's trustworthiness, presenter's eye contact, closeness with the
281   presenter, likability of the video, completeness of the video, and interestingness of the video) and
282   whether a VTuber or a YouTuber was featured in the video.

3   Results

284   As mentioned above, 318 participants were initially recruited. Then, to filter the data, we only
285   included in the analysis those who had responded to both the pre- and post-questionnaires, which
286   resulted in 248 participants for analysis. Following this, unserious respondents were excluded from
287   the analysis, and the number of participants was reduced. Specifically, we excluded those who
288   responded to the post-questionnaire in less than 20 minutes (13 respondents) and those who gave
289   incorrect answers to simple questions measuring whether they had watched the videos properly (39
290   respondents). In the end, 196 respondents were included in the analysis.

291   In addition, we checked the consistency of the main evaluation measure of this study: Dyson's
292   measure of persuasiveness ratings. Specifically, we checked the Cronbach's alpha coefficients for
293   each measure across participants in the YouTuber and VTuber groups and for each product category
294   (tapioca drinks and game apps). The values were greater than 0.7 under both conditions, confirming
295   the consistency of the responses.

296   Next, we discuss the results for each research question.

297   *1. How do YouTubers and VTubers influence their persuasiveness and viewers' purchase decisions*
298   *when promoting products using videos, and what are the differences between them?*

299   First, we measured the effect of the product promotional videos on the respondents' willingness to
300   purchase. The participants were asked to rank several product groups, including those promoted in
301   the videos, according to their willingness to purchase, both before and after watching the videos. For
302   each product, the change in ranking was calculated by subtracting the pre- from the post-ranking. We
303   averaged the rankings for each participant and used ANOVA to compare the results of the VTubers
304   and YouTubers. Although the mean was higher for YouTubers (median ± standard deviation:
305   0.712±1.787) than for VTubers (0.644±1.629), we found no significant differences in the variation in
306   the rankings [$F_{(0, 195)} = 0.076$, p = 0.7829].

307   Then, we analyzed the differences by product category. As illustrated in Table 1 and Figure 2, the
308   participants' rankings of the tapioca drinks and game apps were analyzed using ANOVA to measure
309   the differences between the VTuber and YouTuber groups and before and after viewing. For the
310   tapioca drinks, the results showed a main effect for pre- and post-ranking, with a significant increase
311   in purchase intent ranking [$F_{(1, 194)} = 44.4$, $p < 0.001$]. There was also an interaction effect [$F_{(1,}$
312    $_{194)} = 10.3$, $p < 0.005$]. Then, a back-test showed that the changes in rankings for participants in
313   both VTuber [$F_{(1, 194)} = 48.7$, $p < 0.001$] and YouTuber groups were significant [$F_{(1, 194)} = 5.96$, p
314   = 0.016]. By contrast, there was no main effect for game apps. However, there was an interaction
315   effect [$F_{(1, 194)} = 8.85$, $p < 0.005$]. Further, a back-test demonstrated that participants in the
316   YouTuber group experienced more changes in rankings, as compared to the VTuber group [$F_{(1, 194)}$
317   = 9.8, $p < 0.005$].

318   In terms of persuasion details, the respondents were asked about their impressions of the promotion
319   in the videos they watched, the content of the messages, and the presenters, with 6, 7, and 19 items,
320   respectively. The detailed data of the persuasiveness rating scale are shown in Table 2. The ANOVA
321   revealed that VTubers sounded more conservative in their messages than YouTubers. Additionally,

322   we found that the YouTubers' messages were supported more than that of the VTubers, and that the
323   YouTube presenters' speech did not seem like it was longer than that of the VTubers'. We then
324   synthesized indicators of persuasiveness to ascertain and identify the differences in persuasiveness
325   between the VTuber and YouTuber groups, and to serve as one objective variable in the multiple
326   regression analysis. We combined the respondents' impressions of multiple items (32 items) in three
327   categories (i.e., effectiveness of the product promotion, perception toward the message, perception
328   toward the presenter) into a single index, as shown in Figure 3. Specifically, a principal component
329   analysis was conducted to synthesize the impressions held about both videos and summarize the
330   impressions held about these categories. The contribution of the first principal component (the
331   synthesized persuasiveness index) was 0.833, which was sufficiently representative. Meanwhile, the
332   contribution of the second principal component was only 0.053, which mainly accounted for the
333   respondents' impressions of the presenters. The loadings of the promotional videos, message, and
334   presenters on the persuasiveness index were 0.726, 0.553, and 0.409, respectively. For the
335   synthesized persuasiveness index, we used the average scores of the tapioca drinks and game apps.

336   Meanwhile, by considering each item for each video as a vector (32-dimensional vector with 32
337   items as elements in three categories), we could calculate how close (i.e., consistent) the impressions
338   formed based on the tapioca drinks video were to the impressions created based on the game apps
339   video, in terms of cosine similarity. The cosine similarity was calculated as the inner product of the
340   vector of impressions formed based on the tapioca drink video and the vector of impressions created
341   based on the game app video, divided by their respective norms. For each participant, it is possible to
342   determine whether each vector group of impressions perceived in the tapioca drinks video matches
343   each vector group of impressions perceived in the game apps video. The cosine similarities were
344   mostly close to 1, as shown in Table 3. As the impressions formed based on both videos are very
345   similar, their average can be used to create a measure of persuasiveness. However, there was a
346   difference between the YouTuber and VTuber groups in terms of consistency of their impressions
347   about the two promotional videos, with the YouTuber group being more consistent in their
348   perceptions than the VTuber group [$F(1, 194) = 4.68$, $p = 0.032$]. The perceptions about the message
349   and presenters showed no differences in consistency.

350   Figure 4 shows the differences between the VTuber and YouTuber groups on the synthesized
351   persuasiveness index, with the YouTuber group showing significantly more perceived persuasiveness
352   [$F(1, 194) = 7.31$, $p = 0.0075$]. The overall evaluation also included an item directly measuring the
353   presenters' perceived persuasiveness. The correlation coefficient between this item and the
354   synthesized persuasiveness index was 0.70, implying a high correlation. Additionally, the correlation
355   coefficient with the aforementioned ranking—that is, change in the willingness to purchase—was
356   0.45, indicating a correlation trend.

357   *2. What are the mechanisms through which the impressions about the promotional videos and video*
358   *contributors influence their persuasiveness (i.e., persuasiveness structural model)?*

359   With the synthesized persuasiveness index as the objective variable, we conducted multiple
360   regression analysis using the following explanatory variables: the overall impressions (the presenters'
361   favorability, presenters' trustworthiness, presenters' eye contact, closeness with the presenter,
362   likability of the video, completeness of the video, interestingness of the video) and whether the
363   presenter was a VTuber or a YouTuber. In the multiple regression analysis, presenter type (YouTuber
364   or VTuber) was used as the explanatory variable. The results of the multiple regression analysis
365   revealed that persuasiveness was explained by the participants' favorability toward the presenter,

366 closeness with the presenter, presenters' trustworthiness, completeness of the video, and presenter
367 type (a VTuber or YouTuber), as illustrated in Figure 5.

368 Particularly influential was the favorability of the video contributor (presenter; coefficient: 0.41),
369 followed by presenter type (a VTuber or YouTuber; coefficient: 0.36); the higher the favorability of
370 the presenter, the more persuasive. The model is well represented with an adjusted coefficient of
371 determination of 0.61.

372 For the purposes of subsequent discussion, we also analyzed the differences for each item of the
373 overall evaluation. The results are listed in Table 4. For the aforementioned indicators, there were no
374 significant differences between the YouTuber and VTuber groups in the presenters' favorability [$F(1,$
375 $194) = 0.001$, $p = 0.971$], presenters' trustworthiness [$F(1, 194) = 1.857$, $p = 0.175$], completeness of
376 the video [$F(1,194) = 0.969$, $p = 0.326$], and interestingness of the video [$F(1, 194) = 0.203$, $p =$
377 0.653]. Meanwhile, the presenter's eye contact and closeness with the presenter were significantly
378 higher among respondents in the YouTuber group than those in the VTuber group, with [$F(1, 194) =$
379 $17.7, p < 0.001$] and [$F(1, 194) = 17.7, p < 0.001$], respectively.

380 **4   Discussion**

381 **4.1   Research Question 1**

382 First, referring to Ogawa et al.'s (2009) study on product promotion by robots, we conducted an
383 experiment to examine the changes in purchase decisions. We found a main effect for the changes in
384 the willingness to purchase tapioca drinks, with a significant improvement in ranking. We also
385 identified an interaction effect, with a significant change in ranking for viewers of both VTubers and
386 YouTubers when back-testing was conducted. In contrast, there was no main effect for the game app;
387 however, there was an interaction effect, with the YouTuber group reporting significantly greater
388 fluctuations in ranking than the VTuber group. For the game app video, the results of the analysis of
389 individual items also showed that the respondents formed more positive impressions about the
390 promotional videos and the content of the messages presented by human YouTubers compared to
391 VTubers (avatars).

392 When the averages of the tapioca drinks and game videos are compared, the average for YouTubers
393 is higher. However, the results of the change in the ranking for tapioca drinks is greater for VTubers
394 than for YouTubers. This suggests that some products are better or worse in certain domains than
395 others. However, one possible problem with the experimental design is that the questionnaire for the
396 ranking changes was administered after viewing the product introduction video for THE ALLEY (the
397 target brand), which may have led the participants to believe that the experimenter expected an
398 improvement in THE ALLEY's ranking. It is also possible that it would have been difficult for the
399 participants to sort through the pictures of each brand of tapioca drink and the text of its
400 characteristics and ask them about their attitudes toward the ambiguous sensation of taste. We plan to
401 analyze the changes in attitude and behavior induced by persuasion by conducting further
402 experiments in the future.

403 However, this does not mean that human influencers are always effective in persuasion, while virtual
404 ones (avatars) are ineffective. Indeed, our results showed that promotional videos presented by both
405 humans and avatars can cause a change in purchase intent depending on the product category (or
406 video content).

407   Further, Dyson's measures of persuasiveness, which assessed the impressions about the effectiveness
408   of the product promotion, perception toward the message, and perception toward the presenter, were
409   synthesized using principal component analysis. The contribution ratio of the synthesized
410   persuasiveness index was 0.833, indicating good representation of persuasiveness. This was used as
411   an evaluation index for persuasiveness in the multiple regression analysis described below. The
412   second principal component loaded heavily on the impression about presenters; however, its
413   contribution ratio was 0.053, indicating that it could not represent persuasiveness to a great degree.
414   For comparison, the overall evaluation also directly explored impressions about persuasiveness, and
415   the correlation coefficient with the persuasiveness index was highly correlated at 0.70. When this
416   persuasiveness index was used to compare the VTuber and YouTuber groups, respondents in the
417   YouTuber group were more significantly persuaded about the product. In other words, humans have
418   greater persuasive power than avatars.

419   Previous studies have compared the persuasive power of humans and avatars, and found that virtual
420   characters can be similarly persuasive (Zanbaka et al., 2006; Zanbaka et al., 2007). In particular, they
421   pointed out that androids can be as persuasive as humans (Ogawa et al., 2009;). Using the YouTube
422   environment, our results do not differ significantly from theirs. However, we show that differences
423   are affected by the content of the video and the experimental environment setting.

424   The loadings of the effectiveness of the product promotion, perception toward the message, and
425   perception toward the presenter on the synthesized persuasiveness index were 0.726, 0.553, and
426   0.409, respectively; this indicates that the quality of the video, the message articulated, and the
427   viewer's impression about the presenter, in that order, affect persuasiveness.

428   In addition, we used cosine similarity to estimate the consistency of the respondents' impressions
429   about videos involving the two product categories: tapioca drinks and game apps. Most of the cosine
430   similarities were close to 1, as shown in Table 3, indicating that the impressions formed based on the
431   two videos are very similar. Thus, the average of the tapioca drinks and game apps could be used to
432   create a measure of persuasiveness. However, there were differences in the consistency of
433   impressions about the promotion videos, with the VTuber group experiencing less consistency in the
434   impressions about the two video promotions. It is possible that the impression of a conservative
435   explanation was helpful in introducing the tapioca drink, while the impression of a well-explained
436   and reasoned explanation was helpful in introducing the game. One possible reason is the fact that
437   the respondents experienced a less informative facial impression from the avatar compared to that
438   from the human presenter.

4.2   Research Question 2

440   In this study, the persuasiveness structural model and the underlying mechanisms were examined
441   through multiple regression analysis using seven items as explanatory variables: the overall
442   impressions (the presenter's favorability, presenter's trustworthiness, presenter's eye contact,
443   closeness with the presenter, likability of the video, completeness of the video, and interestingness of
444   the video), and the presenters' appearance (human or avatar). Indeed, the objective variable was an
445   index of persuasiveness that had been examined using a principal component analysis and other
446   methods, and the validity of this index as being representative of persuasiveness was discussed in the
447   previous section.

448   The results of the multiple regression analysis showed that persuasiveness was explained by the
449   presenter's favorability (coefficient: 0.41), presenter type (VTuber or YouTuber; coefficient: 0.36),
450   presenter's trustworthiness (coefficient: 0.20), closeness with the presenter (coefficient: 0.16), and

451 completeness of the video (coefficient: 0.16). As the coefficient of determination was 0.61, the model
452 was considered to be reasonably well represented.

453 Specifically, the presenter's favorability has the greatest impact on persuasiveness, which is
454 consistent with previous studies (Keeling et al., 2010; Khan and Sutcliffe, 2014). Additionally,
455 whether the presenter is a VTuber (avatars) or a YouTuber (humans) also has a significant impact,
456 with humans having more persuasive power. Persuasiveness is also likely to vary depending on trust
457 in the presenter, degree of closeness to the presenter, and the quality of the video. Thus, we suggest
458 that designing avatars with a high level of trustworthiness and closeness to the audience may increase
459 persuasiveness. While it is difficult to create or change human appearance so that it is highly
460 trustworthy and highly relatable, it is easy to change the appearance of avatars. Further, the viewers'
461 degree of closeness to the presenter is significantly higher for YouTubers than for VTubers,
462 suggesting that there is room for improvement in the future. What constitutes a reliable avatar, and
463 what type of avatar one perceives as relatable are issues that should be investigated by future studies.

464 Some studies have found that people feel more favorability and trust toward virtual agents that mimic
465 participants' head movements than those that do not (Verberne et al., 2013). Hence, in the future,
466 presentations by avatars should be partially automated, with the possibility of generating on-the-fly
467 videos that mimic the user and gradually change their behavior. Such innovations may aid in
468 developing more persuasive promotional videos by avatars.

469 Owing to some technical aspects, the YouTuber made the audience feel that he was looking at them
470 significantly more than the VTubers in terms of the presenter's eye contact. However, the impact on
471 persuasiveness was limited.

4.3 Limitations

473 For both humans and avatars, the study has a limitation in that only one male presenter was
474 considered. As research has shown that women are more easily persuaded by male avatars and men
475 are more easily persuaded by female avatars (Zanbaka et al., 2006), we intend to conduct further
476 experiments with female YouTubers and VTubers.

477 Moreover, avatar designs were created by professional designers, with general digital avatars (anime-
478 style avatars) familiar to Japanese participants. In the future, we intend to expand on this research
479 using multiple presenters, as outside Japan, YouTubers and VTubers are in demand in different ways,
480 and the results may vary.

5 Conclusions

482 This study examined the characteristics of persuasiveness for human and avatar presenters and the
483 differences between them in this regard, in the setting of product promotional videos on YouTube.
484 Although the findings show that humans are more persuasive than avatars, the persuasive effect can
485 vary, depending on the product category. Further, it is possible that different avatar design techniques
486 can increase persuasiveness.

487 Using a between-subjects experimental design, with the assistance of professional character designers
488 and video creators, we created videos with exactly the same audio, angle of view, and composition
489 for a YouTuber with a so-called human appearance and a VTuber using an avatar with a character-
490 like 3DCG model. After viewing the videos, the participants were asked to complete a questionnaire
491 about their impressions of the presenters and the videos related to persuasiveness, as well as overall

492 impression measures, such as favorability and trustworthiness. Changes in willingness to purchase
493 the products presented in the videos were also measured before and after the experiment.

494 Although there were differences depending on the product category, humans were more likely than
495 avatars to alter participants' willingness to purchase. However, product promotions by avatars also
496 influenced the willingness to purchase in the case of tapioca drinks. Regarding persuasiveness, the
497 presenter's favorability and presenters' appearance (human or avatar) had a significant impact. The
498 results also suggested that persuasiveness could be enhanced by designing avatars that are more
499 trustworthy and closer to the audience. In this regard, future research should explore how to design a
500 more persuasive appearance through variation in avatar appearance or using techniques that generate
501 spontaneous movements by the avatars in response to the user.

6   Conflict of Interest

503 The authors declare that the research was conducted in the absence of any commercial or financial
504 relationships that could be construed as a potential conflict of interest.

7   Author Contributions

506 HS designed the experiments, compiled the data, wrote the first draft of the paper, performed the
507 analyses, and contributed to fundraising. AH and MM performed the experiments, performed the
508 analyses, and contributed to preparing the manuscript. CK supported the experiments and data
509 analyses. YH designed the experiments and contributed to the experimental design and preparing the
510 manuscript.

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10   Ethics Statement

519 This study was reviewed and approved by the Research Ethics Review Committee of "Behavioral
520 Studies on Human Subjects" at Kwansei Gakuin University. Informed consent was obtained from
521 participants by means of written informed consent forms.

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611   **12   Data Availability Statement**

612   Please contact the authors for the raw data used in this study.

613

614   **Figure Captions**

615   Figure 1. Product promotional videos (left: Tapioca Drink; right: Game App)

616   Figure 2. Effects of the promotional videos by VTubers (Virtual YouTubers) and YouTubers on
617   participants' willingness to purchase

618   Figure 3. Results of principal component analysis on the synthesized persuasiveness index

619   Figure 4. Differences in synthesized persuasiveness between VTubers (Virtual YouTubers) and
620   YouTubers

621   Figure 5. Mechanisms of persuasiveness for YouTube product introduction videos (results of the
622   multiple regression analysis)

623 **13   Tables**

624   Table 1. Changes in rankings of the two product domains

	Tapioca Drinks (M±SD)		Game Apps (M±SD)	
	Pre-Ranking	Post-Ranking	Pre-Ranking	Post-Ranking
VTuber	4.247±2.220	2.660±1.559	3.371±1.841	3.670±2.228
YouTuber	3.717±2.137	3.162±1.846	3.869±2.048	3.000±2.000

625   *Note:* M = median; SD = standard deviation; VTuber = Virtual YouTuber

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628   Table 2. Data from the persuasiveness rating scales

	Presenter (M±SD)		Contrast	
	VTuber	YouTuber	F	p
Effectiveness of the product promotion				
Good	4.740±1.333	4.566±1.296	0.78	ns
Wise	4.186±1.334	4.333±1.287	0.62	ns
Positive	4.773±1.351	5.040±1.279	2.00	ns
Harmful	4.866±1.503	4.495±1.449	2.99	+p < 0.10
Unconvincing	4.660±1.338	4.596±1.449	0.10	ns
Ineffective	4.402±1.352	4.495±1.431	0.22	ns
Perception toward the message				
Conservative	3.660±1.243	3.192±1.032	8.16	**p < 0.01
Boring	3.804±1.462	3.838±1.454	0.03	ns
Specific	3.876±1.501	4.040±1.524	0.57	ns
Supported	3.691±1.417	4.182±1.720	4.70	*p < 0.05
Simple	5.402±0.991	5.222±1.069	1.47	ns
Unconvincing	4.381±1.280	4.182±1.438	1.04	ns
Interesting	4.103±1.696	3.778±1.703	1.78	ns
Perception toward the presenter				
Intelligent	3.928±1.667	4.121±1.423	0.75	ns

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Evasive	4.907±1.437	5.242±1.102	3.33	+p < 0.10
Inactive	4.010±1.396	3.889±1.449	0.35	ns
Unqualified	4.299±1.507	4.141±1.470	0.54	ns
Insincere	5.051±1.271	4.879±1.008	1.10	ns
Forceful	3.670±1.146	3.889±1.413	1.40	ns
Competent	4.155±1.230	4.364±1.185	1.45	ns
Dishonest	5.268±1.312	5.475±1.001	1.52	ns
Assertive	3.577±1.299	3.768±1.347	1.00	ns
Informed	4.062±1.314	4.323±1.582	1.56	ns
Trustworthy	4.271±1.373	4.404±1.490	0.64	ns
Bold	3.784±1.245	3.818±1.201	0.04	ns
Soft	3.784±1.160	3.980±1.442	1.09	ns
Squeaky	3.804±1.012	3.990±0.732	2.15	ns
Slow	5.196±1.154	5.404±1.053	1.72	ns
Unaccented	5.897±1.272	5.586±1.231	2.00	+p < 0.10
Not Long	4.134±1.660	4.626±1.508	4.68	*p < 0.05
Less Nasal	4.773±1.702	4.657±1.478	0.26	ns
Lively	2.959±1.399	3.051±1.553	0.19	ns

629 *Note:* M = median; SD = standard deviation; VTuber = Virtual YouTuber

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632   Table 3. Cosine similarity between the two domains

	Effectiveness of the product promotion (M±SD)	Perception toward the message (M±SD)	Perception toward the presenter (M±SD)
VTuber	0.936±0.062	0.939±0.043	0.951±0.040
YouTuber	0.953±0.041	0.947±.0034	0.956±0.033

633   *Note:* M = median; SD = standard deviation; VTuber = Virtual YouTuber

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636   Table 4. Ratings for overall impression

	The presenter's favorability (M±SD)	The presenter's eye contact (M±SD)	The closeness with the presenter (M±SD)	The presenter's trustworthiness (M±SD)	The completeness of the video (M±SD)	The interestingness of the video (M±SD)
VTuber	4.10±1.49	3.45±1.32	1.81±0.79	4.46±1.32	4.07±1.32	3.78±1.57
YouTuber	4.11±1.51	4.26±1.36	2.27±1.28	4.46±1.17	4.26±1.34	3.69±1.39

637   *Note:* M = median; SD = standard deviation; VTuber = Virtual YouTubers