

# Avatar Communication Provides More Efficient Online Social Support Than Text Communication

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## Abstract

Online communication via avatars provides a richer online social experience than text communication. This reinforces the importance of online social support. Online social support is effective for people who lack social resources because of the anonymity of online communities. We aimed to understand online social support via avatars and their social relationships to provide better social support to avatar users. Therefore, we administered a questionnaire to three avatar communication service users (Second Life, ZEPETO, and Pigg Party) and three text communication service users (Facebook, X, and Instagram) ( $N = 8,947$ ). There was no duplication of users for each service. By comparing avatar and text communication users, we examined the amount of online social support, stability of online relationships, and the relationships between online social support and offline social resources (e.g., offline social support). We observed that avatar communication service users received more online social support, had more stable relationships, and had fewer offline social resources than text communication service users. However, the positive association between online and offline social support for avatar communication users was more substantial than for text communication users. These findings highlight the significance of realistic online communication experiences through avatars, including nonverbal and real-time interactions with co-presence. The findings also highlighted avatar communication service users' problems in the physical world, such as the lack of offline social resources. This study suggests that enhancing online social support through avatars can address these issues. This could help resolve social resource problems, both online and offline in future metaverse societies.

## Introduction

Social support improves mental health (Cohen and Wills 1985; Rethon et al. 2011). This is also true online (online social support) (Mesch and Talmud 2006; Chung 2013; Choudhury and De 2014; Trepte, Dienlin, and Reinecke 2015; Cole et al. 2017; Sharma and De Choudhury 2018; Reblin et al. 2018; Takano and Tsunoda 2019; Yokotani and Takano 2021a; Pierce et al. 2020; Takano and Yokotani

2022). Online social support is particularly practical for people who lack social resources because of the anonymity of online communities (Kang, Dabbish, and Sutton 2016; Choudhury and De 2014). Detailed disclosure facilitates the reception of greater social support in cases of negative experiences and emotions (Choudhury and De 2014). The characteristics of online communication facilitate disclosure (Kang, Dabbish, and Sutton 2016; Choudhury and De 2014) by decreasing listeners' fears of rejection (Mesch and Talmud 2006; Küster, Krumhuber, and Kappas 2015; Andalibi et al. 2016). This is helpful that people face issues that are difficult to disclose in the physical world owing to stigma and prejudice (sexual minorities (Yokotani and Takano 2021a), bullying victimization (Cole et al. 2017; Takano and Tsunoda 2019; Takano and Yokotani 2022), sexual abuse (Andalibi et al. 2016), suicidal feelings (Choudhury and De 2014), and mental health problems (Sharma and De Choudhury 2018)).

Nonverbal communication is essential for social support because socioemotional cues play a crucial role in emotional support and are conveyed nonverbally (Mehrabian 1970; Manusov and Patterson 2006). Previous studies (Ledbetter and Larson 2008; Trepte, Dienlin, and Reinecke 2015; McCloskey et al. 2015) have highlighted the lack of nonverbal communication in online text communication. Interactions using online tools are less satisfactory than face-to-face interactions (Kock 2005; Vlahovic, Roberts, and Dunbar 2012). Although people have invented emotional expressions under the constraints of text media, such as emoticons and emojis, the effects of online social support are limited (Ledbetter and Larson 2008; Trepte, Dienlin, and Reinecke 2015; McCloskey et al. 2015).

By contrast, avatar communication, in which individuals with virtual bodies can display facial expressions and gestures in a virtual space, enables nonverbal and real-time interactions with online co-presence (Antoničević 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011; O'Connor et al. 2015; van der Land et al. 2011). Avatar actions realize emotional expressions when talking about bullying in the physical world, such as the painfulness of bullying and empathy for painfulness, in the avatar communication application Pigg Party (Takano and Tsunoda 2019). In

the metaverse, users' social presence tends to increase because of the avatar's spatial presence (van der Land et al. 2011). Oh et al. (2023) indicated that a high social presence increases online social support, which mitigates loneliness in two metaverse platforms (ZEPETO and Roblox). Proxemic behavior in the online virtual world game Second Life has been observed to evoke feelings similar to those experienced in the physical world (Antonijevic 2008) and to facilitate communication in social support groups (alcoholics anonymous and cancer caregivers) (Green-Hamann, Campbell Eichhorn, and Sherblom 2011). These avatar communication features provide improved social support (Green-Hamann, Campbell Eichhorn, and Sherblom 2011; Takano and Yokotani 2022).

Therefore, online social support through avatars is necessary for those who lack social resources in the physical world. Online social support will play an essential role in future metaverse societies. We aimed to understand online social support via avatars and their social relationships to provide better social support to avatar users. We compared three avatar communication services (Second Life, ZEPETO, and Pigg Party) with three text communication services (Facebook, X, and Instagram).

While there are several previous studies for online social support, most of them focus on a single application (E-mail: (Ledbetter and Larson 2008), Reddit: (Choudhury and De 2014; Andalibi et al. 2016; Sharma and De Choudhury 2018), Facebook: (McCloskey et al. 2015), World of Warcraft: (O'Connor et al. 2015), Second Life: (Antonijevic 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011), Pigg Party: (Takano and Tsunoda 2019; Yokotani and Takano 2021a; Takano and Yokotani 2022)) or compare text communication applications with each other (Facebook, Instagram, Snapchat, and Twitter (Phua, Jin, and Kim 2017)) or avatar communication applications with each other (ZEPETO and Roblox (Oh et al. 2023)). As far as the authors know, no studies compare multiple avatar and text communication applications on the same basis. Although there have been studies examining the effects of text and avatars on self-disclosure in controlled environments using applications developed specifically for psychological experiments (Yuan et al. 2025), there is a lack of research investigating self-disclosure and social support on applications used in everyday life. In this context, two significant gaps need to be addressed: First, how do social relationships differ quantitatively between text-based communication applications and avatar-based communication applications? Second, despite their unique specifications, design, and user types, are there common characteristics shared within every kind of application? For these research gaps, the comparison between the two types of applications can provide essential insights into the perspective of generalizing the findings from previous research.

First, we examine the following hypotheses:

- **H1:** Online social support is practical in avatar communication services compared with text communication services.

Second, we considered the stability of the relationships

in each communication service. Real-time interaction with online co-presence in avatar communication (Antonijevic 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011; O'Connor et al. 2015) restricts the time and online location compared with asynchronous text communication because avatar communication requires users to be in the same place simultaneously for communication. This indicates that they have stable social relationships. Therefore, we propose the following hypothesis:

- **H2:** The users of avatar communication services have stable relationships compared with text communication services.

Examining this hypothesis is important for understanding online social support features via avatars because stable relationships are essential for social support. Stable and close relationships provide rich social support (Westmyer and Myers 2009; Kendrick, Jutengren, and Stattin 2012; Roberts et al. 2014), and several relationships offer opportunities to receive social support. In addition, online social support can be reinforced in virtual worlds by improving online ego network structures (Pérez-Aldana et al. 2021; Takano and Yokotani 2022). People tend to disclose their emotions and sensitive information in a closed cyberspace with friends (not strangers) (Jaidka, Guntuku, and Ungar 2018; Takano and Tsunoda 2019).

Third, we focused on the relationship between online and offline social support. Positive correlations have been frequently observed between online and social support in the physical world (offline social support) (Trepte, Dienlin, and Reinecke 2015; Lin et al. 2018; Takano and Yokotani 2022). This finding is significant because it suggests that online social support enhances social support in the physical world (McKenna and Bargh 1998; Lin et al. 2018; Thomas, Orme, and Kerrigan 2020). This is because receiving online social support facilitates offline social activities, thereby increasing the number of relationships that provide offline social support (Lin et al. 2018). Consequently, high levels of social support in the virtual world can mitigate loneliness by mediating social support in the physical world (Thomas, Orme, and Kerrigan 2020) and might decrease bullying victimization. Therefore, we propose the following hypothesis:

- **H3:** The users of avatar communication services have offline social resources (high offline social support, low loneliness, and less likely to be bullied) if H1 is true.

The contributions of this study are as follows:

- This is the first study comparing multiple avatar and text communication applications on the same basis.
- Avatar communication service users received more online social support than text communication service users (H1 was supported).
- They maintained more stable social relationships than text communication service users (H2 was supported).
- They had fewer offline social resources than text communication service users (H3 was not supported), i.e., their social resources tended to be lacking.
- Their association between online and offline social resources was higher than that of text communication

Service	Gender	N	Mean	Std. Dev.
Second Life	Female	522	38.56	11.30
	Male	960	45.21	12.15
	Other	13	34.46	13.57
ZEPETO	Female	584	38.98	12.38
	Male	890	44.78	11.45
	Other	17	37.88	12.82
Pigg Party	Female	605	38.87	11.72
	Male	869	45.66	12.21
	Other	19	42.68	12.82
Facebook	Female	619	46.82	12.69
	Male	859	48.35	12.53
	Other	3	28.00	7.21
X	Female	697	39.43	13.36
	Male	787	40.19	12.17
	Other	7	30.71	6.52
Instagram	Female	1,017	38.45	13.26
	Male	472	40.34	13.64
	Other	7	41.14	15.91
Total	-	8,947	42.20	12.90

Table 1: Gender and age of each service participant

users. This suggests that improving their online social support may solve the problem of a lack of offline social resources.

We expect to contribute to the resolution of social resource problems in future metaverse societies.

## Methods

### Participants

Participants were recruited from a panel managed by Cross Marketing, Inc., consisting of individuals living in Japan. The survey was conducted in Japan and administered in Japanese, so most participants were presumed to be native Japanese speakers residing in Japan. Thus, the impact of cultural differences arising from the regions of the application providers (for example, Zepeto in South Korea and Pigg Party in Japan) on the analysis results seems small. First, they answered questions about the services they used and their frequency of use from the three avatar communication services and three social media/social networking services. If they used any of the services at least once a month, they were assigned to one of them and answered the items described later. There was no duplication of users for each service. Participants were equally divided in terms of age and gender. Table 1 summarizes the basic statistics of each service.

### Communication Services

**Avatar Communication Services** We surveyed users of three metaverse/avatar communication services: Second Life, ZEPETO, and Pigg Party (Fig. 1). This allows them to create avatars, explore virtual worlds, and interact with others through their avatars using text and voice chats. Second



(a) Second Life



(b) ZEPETO



(c) Pigg Party

Figure 1: Screen shots of avatar communication services (image sources: Second Life: <https://community.secondlife.com/blogs/entry/14709-season's-greetings-from-linden-lab/>, ZEPETO: [https://x.com/zepeto\\_official/status/1617327573234589698](https://x.com/zepeto_official/status/1617327573234589698), and Pigg Party: Yokotani and Takano (2021b)).

Life provides realistic 3D avatars, Pigg Party provides fancy 2D avatars, and ZEPETO provides an intermediate between the two avatars. Several researchers have studied human behavior in the metaverse and gained various insights based on data from Second Life: Antonijevic (2008); Green-Hamann, Campbell Eichhorn, and Sherblom (2011); Greiner, Caravella, and Roth (2014); Mitra and Golz (2016); Messinger et al. (2019), ZEPETO: Lee, Lee, and Bae (2023); Aris et al. (2023); Ko and Kim (2024); Hur and Baek (2024); Lee et al. (2024), and Pigg Party: Takano and Tsunoda (2019); Yokotani and Takano (2021a); Takano and Yokotani (2022);

Yokotani and Takano (2022); Yokotani, Takano, and Abe (2024).

Second Life, operated by Linden Research, Inc. (US), has provided metaverse services since 2003. It has approximately 900,000 active monthly users<sup>1</sup>. In 2009, 1.3% of its users were Japanese<sup>2</sup>.

ZEPETO, operated by Naver Z (South Korea), is a metaverse application launched in 2018. It boasts of 20 million monthly active users<sup>3</sup>, 70% of whom are females aged from 10 to early 20s. Japanese users are estimated to comprise 5–10% of the total user base<sup>4</sup>.

Pigg Party is a social avatar community app operated by CyberAgent, Inc. (Japan), which was launched in 2015. A previous study reported on at least 550,000 active players over six months (Yokotani and Takano 2021b). Pigg Party players were predominantly young women, with a female ratio of 61% and a teenage ratio of 65% (Takano and Tsunoda 2019).

**Text Communication Services** We conducted a survey with X, Facebook, and Instagram users as major social media and social networking services. These services provide three types of communication methods (sending direct messages, posting one's feed, and replying to posts). Each service has hundreds of millions of users. Several researchers have studied online human behavior in these services.

## Measure

**Perceived Online/Offline Social Support** We examined two types of social support (emotional and instrumental) (Fukuoka and Hashimoto 1997) and three sources of social support (family, offline friends, and online friends) because these types and sources influence the buffering effects of social support on mental health (Malecki and Demaray 2003; Semmer et al. 2008; Rothon et al. 2011; McCloskey et al. 2015; Oriol et al. 2017; Wills and Shinar 2015; Trepte, Dienlin, and Reinecke 2015; Liu, Wright, and Hu 2018). We categorized family and offline friends as sources of offline social support and online friends as sources of online social support.

We classified social support into emotional and instrumental support (Declercq et al. 2007; Shakespeare-Finch and Obst 2011; Tsuboi, Hirai, and Kondo 2016; Obst et al. 2019). This classification is the most comprehensive despite the availability of various definitions of social support (Shakespeare-Finch and Obst 2011; Obst et al. 2019).

In addition to online friends as sources of social support, we considered the relationships between recipients and sources, including family and offline friends. These relationships are broadly applicable across different contexts, unlike teachers and classmates, who are specific to student surveys.

<sup>1</sup><https://nwn.blogs.com/nwn/2020/06/sl-mau-pandemic-june-2020.html>

<sup>2</sup><https://www.itmedia.co.jp/news/articles/0703/07/news074.html>

<sup>3</sup><https://www.kedglobal.com/metaverse/newsView/ked202203040009>

<sup>4</sup><https://xtrend.nikkei.com/atcl/contents/casestudy/00012/00921/>

We selected these types because the participants had diverse backgrounds.

We performed a confirmatory factor analysis using maximum likelihood estimation for this perceived social support scale. Cronbach's  $\alpha$  values for emotional and instrumental social support from family were 0.940 and 0.937, those from offline friends were 0.940 and 0.921, and those from online friends were 0.949 and 0.959, respectively.

In this study, we used the results of a principal component analysis (PCA) for perceived emotional and instrumental social support for each source type according to a previous study (Takano and Yokotani 2022). This approach was selected because emotional and instrumental support are often highly correlated (Semmer et al. 2008; Shakespeare-Finch and Obst 2011; Tsuboi, Hirai, and Kondo 2016; Obst et al. 2019; Takano and Yokotani 2022), which can lead to multicollinearity in mental health regression analyses (Tsuboi, Hirai, and Kondo 2016). The correlations between the two types of social support were 0.939 (family), 0.889 (offline friends), and 0.772 (online friends).

The PCA identified the same two principal components of social support: family, offline friends, and online friends. The first principal component represented the overall strength of perceived social support by integrating the two types of social support. For all social support sources, the coefficient of this component was 0.707. The second principal component represented the relative strength of perceived emotional support compared to perceived instrumental support. For all social support sources, the coefficient of this component was  $-0.707$ . The first principal component was used to represent the strength of perceived social support.

**Online Relational Mobility** Yuki et al. (2007) developed a scale to measure relational mobility or the general number of opportunities to form new relationships, when necessary, in a given society or social context. They identify two factors in meeting new people and selecting interaction partners for relational mobility. We used meetings with new people on each online communication service to measure online relational mobility. This would be negatively correlated with the stability of social relationships. We performed a confirmatory factor analysis using the maximum likelihood estimation of this scale. Cronbach's  $\alpha$  value for online relational mobility was 0.846.

**Loneliness** We used the Japanese three-item loneliness scale (TIL scale) (Igarashi 2019), which is based on the TIL scale (Hughes et al. 2004). We performed a confirmatory factor analysis using the maximum likelihood estimation of this scale. The Cronbach's  $\alpha$  value for loneliness was 0.831.

**Bullied Experience in the Physical World** We used a Japanese bully/victim questionnaire (Yokotani and Takano 2021a) based on the Revised Olweus Bully/Victim Questionnaire (Olweus 1996) to evaluate offline victimization. We performed a confirmatory factor analysis using the maximum likelihood estimation of this scale. The Cronbach's  $\alpha$  value for offline victimization was 0.960.

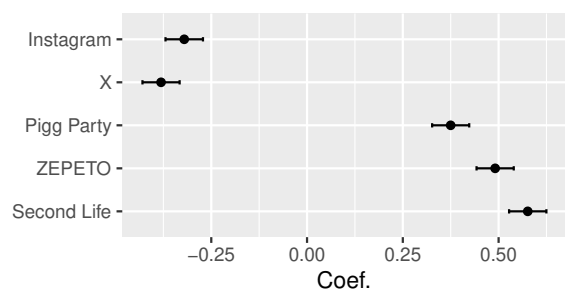


Figure 2: Result of ANOVA for perceived online social support, where  $F(5, 8937) = 130.899$ ;  $p$ -value  $< 0.001$ . Points show coefficients and error bars show standard errors, with Facebook as a reference category. The following figures also indicate the same presentation of this figure.

**Control Variables** The participants provided their demographic information (gender (female, male, and others) and age (18 years or older) and usage frequency of services (six levels: almost every day, 4–5 days per week, 2–3 days per week, a day per week, 2–3 days per month, and a day per month). These were used as control variables.

### Ethics Approval Statement

This study was approved by the ethics committee of Cyber-Agent, Inc (CAE-2023-07). All procedures were performed in accordance with the guidelines for studies involving human participants and the ethical standards of the Institutional Research Committee.

Participants provided informed consent to participate in the survey and could stop at any time (refer to Fig. A1). Participants were also allowed to withdraw their responses after completing the survey. This informed consent form included an inquiry contact form for requests for disclosure and withdrawal of responses.

Quantitative data outputs are presented at the aggregate level, indicating that no identifying information is presented.

## Results

We revealed the features of the social relationships of avatar communication services compared with text communication services.

### Perceived Online Social Support (H1)

To examine H1, we compared perceived online social support between avatar and text communication service users. Fig. 2 shows the results of variance (ANOVA) for perceived online social support with controlling age, gender, and usage frequency, where Facebook was used as the reference category (that is,  $Coef. = 0$  shows Facebook). All avatar communication service users displayed more online social support than text communication users. Refer to Table A1 in the appendix for the statistical tests. We also obtained the following ANOVA results in the same settings:

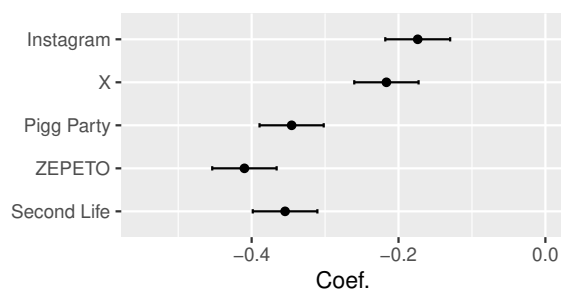


Figure 3: Result of ANOVA for online relational mobility, where  $F(5, 8937) = 43.81$ ;  $p$ -value  $< 0.001$

### Online Relational Mobility (H2)

To examine H2, we compared online relational mobility between avatar and text communication service users. Fig. 3 shows the results of ANOVA for online relational mobility while controlling for age, gender, and usage frequency. All avatar communication service users exhibited lower online relational mobility than text communication service users; specifically, they had more stable relationships than text communication service users. See Table A2 in the appendix for the statistical tests.

### Offline Social Support, Loneliness, and Bullying Victimization (H3)

To examine H3, we compared perceived social support from social relationships in the physical world (family and offline friends), loneliness, and bullying victimization between avatars and text communication service users. Figs. 4, 5, 6, and 7 show the result of ANOVA for perceived social support from family and offline friends, loneliness, and bullying victimization, respectively, after controlling for age, gender, and usage frequency. Refer to Tables A3, A4, A5, and A6 in the appendixes for statistical tests. Avatar communication service users displayed less social support from family and offline friends, more loneliness, and more victimization than text communication users, excluding X user's social support from offline friends and X users' loneliness. In contrast to H3, the social resources for avatar communication users are lacking. Note that X users were also lacking compared with Facebook and Instagram users.

### Association Between Online Social Support and Offline Social Support

The above analysis suggests a negative association between online and offline social support inter-services. To mitigate the lack of offline social resources, we analyzed the association between online and offline social support intra-services.

Figs. 8 and 9 show the coefficient of regression for each service, where independent variables were social support from family and offline friends, and the dependent variable was online social support, with controlling age, gender, and usage frequency. Refer to Tables A7 and A8 in the Appendix for the statistical tests.

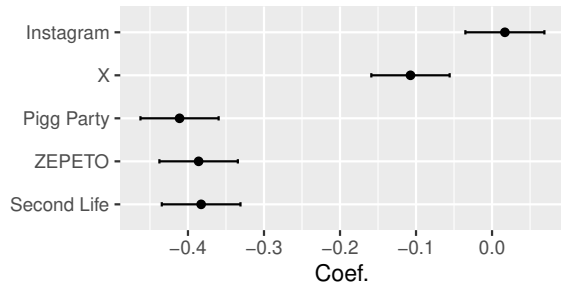


Figure 4: Result of ANOVA for perceived online social support from family, where  $F(5, 8937) = 42.631$ ;  $p$ -value  $< 0.001$  and  $F(5, 8937) = 16.391$ ;  $p$ -value  $< 0.001$ , respectively

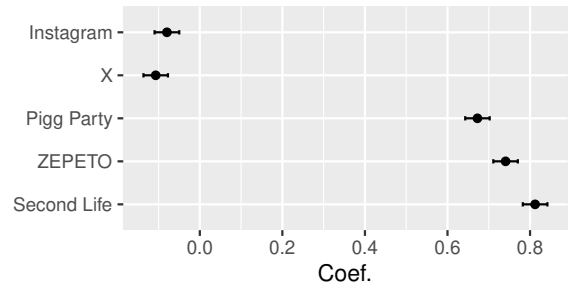


Figure 7: Result of ANOVA for bullying victimization, where  $F(5, 8937) = 465.833$ ;  $p$ -value  $< 0.001$

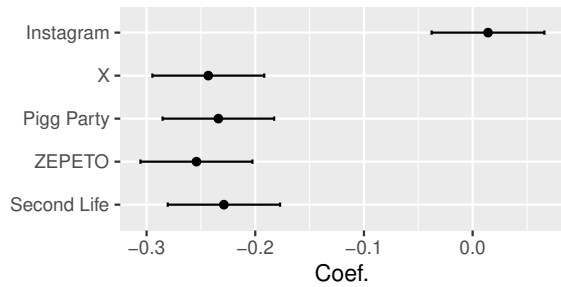


Figure 5: Result of ANOVA for perceived online social support from offline friends, where  $F(5, 8937) = 42.631$ ;  $p$ -value  $< 0.001$  and  $F(5, 8937) = 16.391$ ;  $p$ -value  $< 0.001$ , respectively

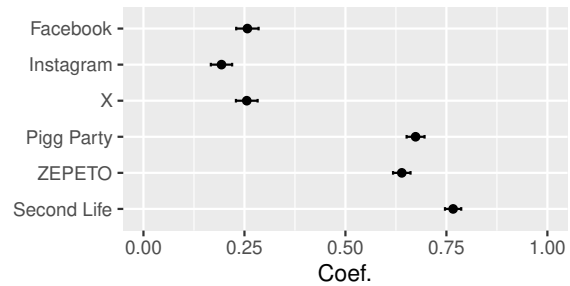


Figure 8: Association between online social support and social support from family

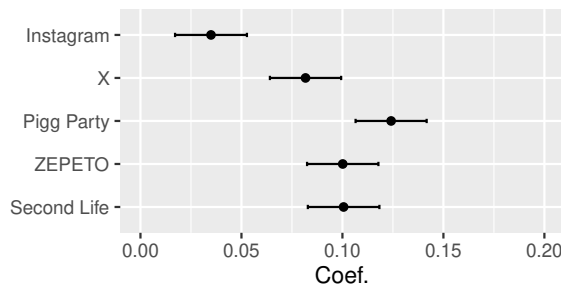


Figure 6: Result of ANOVA for loneliness, where  $F(5, 8937) = 19.299$ ;  $p$ -value  $< 0.001$

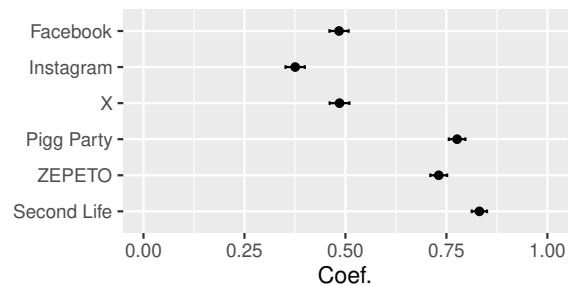


Figure 9: Association between online social support and social support from offline friends

All the services exhibited positive associations between online and offline social support. Avatar communication services exhibit stronger associations than text communication services.

### Discussion

We examined three hypotheses to understand the characteristics of online social support via avatars by comparing them with text communication services.

Avatar communication users perceived online social support more than text communication services. H1 was supported. This suggests that the similarity of communication via avatars to face-to-face communication (nonverbal expressions, real-time interaction, and co-presence (Antonijevic 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011; O'Connor et al. 2015)) is essential for online social support and that social relationships in avatar communication services are suited to online social support. This is because these characteristics contribute to conveying emotions and facilitate social support (Antonijevic 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011; Takano and Tsunoda 2019). Although online communication is inferior in terms of emotional interaction and social

support (Kock 2005; Ledbetter and Larson 2008; Vlahovic, Roberts, and Dunbar 2012; Treppe, Dienlin, and Reinecke 2015; McCloskey et al. 2015), avatar communication may eliminate this issue.

Avatars can enhance online social support (Green-Hamann, Campbell Eichhorn, and Sherblom 2011; Takano and Yokotani 2022). Takano and Tsunoda (2019) analyzed bullying consultation conversations on Pigg Party, highlighting online social support through avatars. The study found that bullying victims often used avatar actions to express emotions and self-disclose. Recipients also used emotional expressions through text and avatars. For instance, victims used words like “distress,” “cutting-off,” and “suicidal feelings,” along with avatar actions like “wailing” to show their suffering. Listeners responded with similar words and avatar actions to show empathy.

Avatar communication users had more stable relationships than text communication service users; that is, H2 was supported. This seems to be because the characteristics of avatar communication (real-time interaction with online co-presence (Antonijevic 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011; O’Connor et al. 2015)) require simultaneous communication. Such stable relationships can be fundamental to constructing a society where people have close relationships (Roberts et al. 2014). However, text communication services tend to develop weak bonds that help bridge online communities (Ahmad, Soroya, and Mahmood 2023). Therefore, the formation of social networks and social interactions may differ between avatars and text communications.

We found these differences in social relationships between avatar and text communication applications despite each application group having different specifications, avatar appearances, and user demographics. This suggests that social relationships created on the applications are qualitatively different due to the kinds of communication, i.e., via avatars or texts. Comparison between two groups with different communication styles on the same basis enabled us this finding.

Online social support facilitates offline social resources. However, avatar communication service users who received more online social support than text communication service users tended to lack social resources. Their perceived offline social support was lower, they felt lonely, and they tended to experience bullying victimization. Thus, H3 was not supported. This may be because there are people using avatar communication services as escape places (Yokotani and Takano 2021a; Lee, Lee, and Bae 2023; Hur and Baek 2024). These findings suggest that avatar users may require additional offline social resources and highlight differences in user segments and motivations for use (e.g., seeking information or alleviating loneliness). Future longitudinal studies are required for the separation of such predisposition from the effects of the application usage.

Note that X users also tend to lack offline social resources (low offline social resources and high loneliness). This may be because Japanese X users tend to think of socializing as bothersome compared with Facebook and Instagram users (Watanabe 2019).

However, the association between online and offline social support was positive in the intraservice context, which is consistent with the findings of previous studies (Treppe, Dienlin, and Reinecke 2015; Lin et al. 2018; Takano and Yokotani 2022). This association was stronger for avatar communication services than for text communication services. X, which tended to lack offline social resources similar to avatar communication services, did not exhibit such a strong association. Previous studies have shown that receiving online social support can enhance offline social support (McKenna and Bargh 1998; Liu and Yu 2013; Thomas, Orme, and Kerrigan 2020), suggesting that avatar communication services can enhance offline social resources for those who lack offline social resources. Actually, social relationship construction via avatars in Pigg Party reduces social anxiety of sexual and gender minorities in the physical world (Yokotani, Takano, Abe, and Kato 2024).

These findings were shared among three avatar communication services offering different avatar creatives, such as realistic or fancy and 3D or 2D. In other words, the fundamental effects of avatar communication were unrelated to avatar creativity, as revealed by our research findings. It will also be valuable to indicate the relationship between avatar creativity and the psychological effects on communication by comparing several types of avatars.

On the other hand, text communication applications also have advantages in online social support. Since they are asynchronous communication, people can post their self-disclosure and responses whenever they want, and it is easier for both the self-discloser and the supporter to communicate after careful consideration. For instance, on Reddit, there are subreddits where people with depression feelings can write, and their stories are heard, effectively providing online social support (Choudhury and De 2014). Additionally, social media platforms like X, Facebook, and Instagram are suitable for bridging relationships (Phua, Jin, and Kim 2017; Takano 2018) (weak ties (Granovetter 1973)). Therefore, while avatar communities excel in providing emotional support such as empathy and respect, text media has advantages in terms of obtaining new information and perspectives. For example, individuals whose parents did not graduate from college can interact with college graduates on Facebook, gain information about universities, and improve their chances of attending college (Wohn et al. 2013). These differences might generate variations in the motivations for using each application.

What can platforms do to enhance the offline resources of avatar communication service users? Improving ego networks for increasing sharing friends, that is, belonging to a densely-connected community, can increase social support (Kim and Stiff 1991; Roberts et al. 2014). This is also true of online social support (Takano and Yokotani 2022; Hygen et al. 2024). It seems crucial for platforms to facilitate communities in virtual worlds and help users feel that they belong to them.

Three approaches can be considered to improve ego networks: The first involves friend recommendations to increase sharing among friends. Several online communication platforms, including avatar communication services,

provide potential friend recommendations (Tang, Hu, and Liu 2013). The friend-of-friend algorithm, which increases the number of friends shared between users, is a major approach for friend recommendations.

The second aspect is the sharing of places of communication. The co-presence of avatar communication requires sharing of places among users. These shared places facilitate the formation of partnerships within a community (Godinho et al. 2015; Bhatt and Bhatt 2020) by creating densely connected communities (Takano and Nakazato 2021). Therefore, it would be effective for the platform to create a place where users wish to gather and a mechanism for them to become attached to that place.

Third, social interactions can be indirectly facilitated through avatar interventions. Avatar customization increases avatar identification (Birk et al. 2016; Mancini, Imperato, and Sibilla 2018; Takano and Taka 2022) and high avatar identification enhances sociality and belonging to a community (Vasalou, Joinson, and Pitt 2007; Van Reijmersdal et al. 2013; Kao and Fox Harrell 2018; Takano and Taka 2022). In particular, avatar customization, as in real life (e.g., mimicking a friend's clothes and changing hairstyle), reinforces avatar identification (Takano and Taka 2022). Users who design avatars to reflect their desired attractive selves have become sociable (Messinger et al. 2008, 2019). Therefore, it would be effective for platforms to hold campaigns that facilitate avatar customization, such as in real life and making wishful avatars. For instance, the Halloween campaign can allow users to dress up their avatars and interact with online friends, similar to how they would in the physical world. This would enhance avatar identification in the virtual world and likely increase communication.

We also expect these approaches, which facilitate communication (Birk et al. 2016; Birk and Mandryk 2019; Takano and Taka 2022), to improve the platforms' key performance indicators because they enhance user engagement. In other words, the facilitation of online social support by platforms benefits not only the users but also the platforms themselves. Platforms can conduct this through as friend recommendations or seasonal campaigns, which approaches are extensions of the existing functionalities of the application. This implies that such promotion of online social support can be a seamless and acceptable approach for both platforms and their users.

Furthermore, the existence of users who used avatar communication services as escape places suggests that avatar communication services can provide psychological safety places for people lacking offline social resources. Actually, sexual and gender minorities who tend to lack offline social resources acquire social resources in Pigg Party (Yokotani and Takano 2021a). Facilitating avatar communication services for those lacking offline social resources can improve their online social resources and mental health.

Finally, we summarize our theoretical contributions as follows. First, we indicated the importance of online nonverbal communications for online social support with outer validity, although previous studies (Antonijevic 2008; Green-Hamann, Campbell Eichhorn, and Sherblom 2011; O'Connor et al. 2015; Takano and Tsunoda 2019; Takano

and Yokotani 2022) investigated this topic in one platform. This study contributes to the psychology of nonverbal communication.

Second, the nature of online social networks may differ significantly between avatars and text communication platforms. This difference affects the quality of online social support. Online communication provides communication partners with impressions different from those in offline communication (Kock 2005; Vlahovic, Roberts, and Dunbar 2012; Burke and Kraut 2016). People use these methods depending on their communication purposes and partners (Burke and Kraut 2014). Consequently, qualitative differences emerged between online and offline social networks (Takano 2018). This may be because, in the hierarchy of social relationships (the Dunbar circle (Zhou et al. 2005; Dunbar 2018)), the level of social relationships that an individual can make depends on the means of communication. Online communication via avatars in the virtual world may have forms similar to offline communication, such as online text communication. This will contribute to social network theory and social psychology regarding friendships.

Third, we found that the relationship between online and offline social support depends on avatar or text communication. Previous studies (McKenna and Bargh 1998; Liu and Yu 2013; Thomas, Orme, and Kerrigan 2020) have indicated that online social support can enhance offline social support. We demonstrated that online social support via avatars had stronger associations with offline social support than with text. This study contributes to the field of social support psychology.

## Limitations and Future Works

We obtained our findings by examining and comparing three avatars and three text communication services. The mechanism of these findings must be analyzed using detailed user behavioral log data. Additionally, qualitative research, such as interviews, can provide deeper insights into online social support via avatars.

This study investigated three avatar communication applications and three text communication applications. There are many ways to communicate online, e.g., avatars in virtual reality and online bulletin boards. Recent advancements in AI technology have made it possible to create avatars that look very similar to the user and synchronize facial expressions and gestures. By conducting similar studies on these diverse communication methods and ultra-realistic avatars, such as Vasa-1, Live Portrait, or Hallo, we can better understand the scope of our findings.

The participants in this study were Japanese speakers living in Japan, which limits cultural diversity. Verifying our findings across multiple cultures would help clarify their applicability.

We studied the associations between online social support, online relational stability, and offline social resources in avatars and text communication services. An experimental study to improve online social support by manipulating social relationships, virtual communication locations, and avatar customization should be conducted to determine the intervention outcomes for ego networks.

High avatar identification enables users to enjoy games and communication in the virtual world (Van Reijmersdal et al. 2013; Birk et al. 2016; Kao and Fox Harrell 2018). However, it has also been shown to increase the risk of game addiction (Mancini, Imperato, and Sibilla 2018). Therefore, we have to clarify not only how to facilitate online social resources but also the relationship between this and addiction risks.

Our study builds on previous research (McKenna and Bargh 1998; Lin et al. 2018; Thomas, Orme, and Kerrigan 2020) and aims to shed light on the effects of online social support on offline social support, thereby potentially deepening our understanding of this relationship. On the other hand, we can also consider that individuals with high sociality receive high levels of online and offline social support. Examining the causality of this phenomenon is also required in avatar communication.

This study deals with communication between humans through avatars. One possible approach to further enhance this is the introduction of AI-powered communication agents. For example, an AI agent could participate in human conversations to facilitate smooth dialogue and suppress aggressive remarks, thereby maintaining a psychologically safe environment and enhancing online social support between humans.

## Conclusion

To understand online social support through avatars, we examined three hypotheses regarding online social support, online relational mobility, and offline social resources based on comparisons between avatars and text communication services. Our findings indicate the importance of realistic online communication experiences (nonverbal and real-time interactions with co-presence) and avatar communication service users' problems in the physical world (lack of offline social resources). In addition, it is suggested that these problems can be resolved by enhancing online social support through avatars. This could contribute to online and offline social resource problems in future metaverse societies.

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## Paper Checklist

1. For most authors...
  - (a) Would answering this research question advance science without violating social contracts, such as violating privacy norms, perpetuating unfair profiling, exacerbating the socio-economic divide, or implying disrespect to societies or cultures? [Yes, in the Ethics Approval Statement section.](#)
  - (b) Do your main claims in the abstract and introduction accurately reflect the paper's contributions and scope? [Yes.](#)
  - (c) Do you clarify how the proposed methodological approach is appropriate for the claims made? [Yes, in the Methods section.](#)
  - (d) Do you clarify what are possible artifacts in the data used, given population-specific distributions? [Yes, we controlled demographic information on statistical analysis in the Results section.](#)
  - (e) Did you describe the limitations of your work? [Yes, in the Limitations and Future Works section.](#)
  - (f) Did you discuss any potential negative societal impacts of your work? [Yes, in the Limitations and Future Works section.](#)
  - (g) Did you discuss any potential misuse of your work? [Yes, in the Limitations and Future Works section.](#)
  - (h) Did you describe steps taken to prevent or mitigate potential negative outcomes of the research, such as data and model documentation, data anonymization, responsible release, access control, and the reproducibility of findings? [Yes, in the Ethics Approval Statement section.](#)
  - (i) Have you read the ethics review guidelines and ensured that your paper conforms to them? [Yes, in the Ethics Approval Statement section.](#)
2. Additionally, if your study involves hypotheses testing...

- (a) Did you clearly state the assumptions underlying all theoretical results? **Yes, in the Introduction.**
- (b) Have you provided justifications for all theoretical results? **Yes, in the Discussion section.**
- (c) Did you discuss competing hypotheses or theories that might challenge or complement your theoretical results? **Yes, in the Limitations and Future Works section.**
- (d) Have you considered alternative mechanisms or explanations that might account for the same outcomes observed in your study? **Yes, in the Limitations and Future Works section.**
- (e) Did you address potential biases or limitations in your theoretical framework? **Yes, in the Limitations and Future Works section.**
- (f) Have you related your theoretical results to the existing literature in social science? **Yes, in the Discussion section.**
- (g) Did you discuss the implications of your theoretical results for policy, practice, or further research in the social science domain? **Yes, in the Discussion section.**
3. Additionally, if you are including theoretical proofs...
- (a) Did you state the full set of assumptions of all theoretical results? **NA**
- (b) Did you include complete proofs of all theoretical results? **NA**
4. Additionally, if you ran machine learning experiments...
- (a) Did you include the code, data, and instructions needed to reproduce the main experimental results (either in the supplemental material or as a URL)? **NA**
- (b) Did you specify all the training details (e.g., data splits, hyperparameters, how they were chosen)? **NA**
- (c) Did you report error bars (e.g., with respect to the random seed after running experiments multiple times)? **NA**
- (d) Did you include the total amount of compute and the type of resources used (e.g., type of GPUs, internal cluster, or cloud provider)? **NA**
- (e) Do you justify how the proposed evaluation is sufficient and appropriate to the claims made? **NA**
- (f) Do you discuss what is “the cost“ of misclassification and fault (in)tolerance? **NA**
5. Additionally, if you are using existing assets (e.g., code, data, models) or curating/releasing new assets, **without compromising anonymity...**
- (a) If your work uses existing assets, did you cite the creators? **NA**
- (b) Did you mention the license of the assets? **NA**
- (c) Did you include any new assets in the supplemental material or as a URL? **NA**
- (d) Did you discuss whether and how consent was obtained from people whose data you’re using/curating? **NA**
- (e) Did you discuss whether the data you are using/curating contains personally identifiable information or offensive content? **NA**
- (f) If you are curating or releasing new datasets, did you discuss how you intend to make your datasets FAIR (see FORCE11 (2020))? **NA**
- (g) If you are curating or releasing new datasets, did you create a Datasheet for the Dataset (see Gebru et al. (2021))? **NA**
6. Additionally, if you used crowdsourcing or conducted research with human subjects, **without compromising anonymity...**
- (a) Did you include the full text of instructions given to participants and screenshots? **Yes, in Fig. A1 in the Appendixes.**
- (b) Did you describe any potential participant risks, with mentions of Institutional Review Board (IRB) approvals? **Yes, in Fig. A1 in the Appendixes.**
- (c) Did you include the estimated hourly wage paid to participants and the total amount spent on participant compensation? **No. Our survey was conducted by Cross Marketing, Inc. Hourly wage is not disclosed. Note that they surveyed along with the Japanese Marketing Research Code of Conduct (<https://www.jmra-net.or.jp/rule/principle/>). This code of conduct provides compliance with the ICC/ESOMAR International Code on Market and Social Research.**
- (d) Did you discuss how data is stored, shared, and deidentified? **Yes, in the Ethics Approval Statement section. We handled this dataset in accordance with the security policy of CyberAgent, Inc. This was deidentified. This was not shared according to the recommendation of the Ethics Review Committee due to concerns about privacy violations caused by Sensitive personal information.**

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PaperChecklist](https://neurips.cc/Conferences/2021/PaperInformation/PaperChecklist).

## Appendixes

Avatar	Text	Coef.	Std. Err.	p-value	
Second Life	Facebook	0.5761	0.0487	<0.001	***
	X	0.9572	0.0502	<0.001	***
	Instagram	0.8967	0.0508	<0.001	***
ZEPETO	Facebook	0.4910	0.0486	<0.001	***
	X	0.8721	0.0499	<0.001	***
	Instagram	0.8116	0.0503	<0.001	***
Pigg Party	Facebook	0.3749	0.0484	<0.001	***
	X	0.7560	0.0497	<0.001	***
	Instagram	0.6955	0.0501	<0.001	***

Table. A1: Result of Tukey's range test in analysis of variance (ANOVA) for perceived online social support with controlling age, gender, and usage frequency, where  $F(5, 8937) = 130.899$ ;  $p$ -value < 0.001. Positive coefficients indicate that avatar communication services exhibit larger coefficients than text communication services. The following tables also indicate the same presentation as this table.

Avatar	Text	Coef.	Std. Err.	p-value	
Second Life	Facebook	-0.3545	0.0440	<0.001	***
	X	-0.1380	0.0454	0.0285	*
	Instagram	-0.1806	0.0459	0.0012	**
ZEPETO	Facebook	-0.4098	0.0439	<0.001	***
	X	-0.1934	0.0451	<0.001	***
	Instagram	-0.2360	0.0454	<0.001	***
Pigg Party	Facebook	-0.3456	0.0437	<0.001	***
	X	-0.1291	0.0449	0.0467	*
	Instagram	-0.1717	0.0453	0.0021	**

Table. A2: Result of Tukey's range test in ANOVA for online relational mobility with controlling age, gender, and usage frequency, where  $F(5, 8937) = 43.81$ ;  $p$ -value < 0.001.

Avatar	Text	Coef.	Std. Err.	p-value	
Second Life	Facebook	-0.3827	0.0517	<0.001	***
	X	-0.2754	0.0534	<0.001	***
	Instagram	-0.3996	0.0540	<0.001	***
ZEPETO	Facebook	-0.3860	0.0516	<0.001	***
	X	-0.2787	0.0530	<0.001	***
	Instagram	-0.4029	0.0535	<0.001	***
Pigg Party	Facebook	-0.4111	0.0514	<0.001	***
	X	-0.3038	0.0529	<0.001	***
	Instagram	-0.4280	0.0532	<0.001	***

Table. A3: Result of Tukey's range test in ANOVA for Perceived Social Support from Family with controlling age, gender, and usage frequency, where  $F(5, 8937) = 42.631$ ;  $p$ -value < 0.001.

Avatar	Text	Coef.	Std. Err.	p-value	
Second Life	Facebook	-0.2289	0.0517	0.0001	***
	X	-0.0144	-0.0533	0.9998	
	Instagram	-0.2430	0.0539	<0.001	***
ZEPETO	Facebook	-0.2541	0.0515	<0.001	***
	X	-0.0109	0.0530	0.9999	
	Instagram	-0.2683	0.0534	<0.001	***
Pigg Party	Facebook	-0.2339	0.0513	<0.001	***
	X	-0.0093	-0.0528	1.0000	
	Instagram	-0.2481	0.0532	<0.001	***

Table. A4: Result of Tukey's range test in ANOVA for perceived social support from offline friends with controlling age, gender, and usage frequency, where  $F(5, 8937) = 16.391$ ;  $p$ -value < 0.001.

Avatar	Text	Coef.	Std. Err.	p-value	
Second Life	Facebook	0.1006	0.0177	<0.001	***
	X	0.0189	0.0183	0.9071	
	Instagram	0.0657	0.0185	0.0050	**
ZEPETO	Facebook	0.1001	0.0177	<0.001	***
	X	0.0184	0.0182	0.9131	
	Instagram	0.0652	0.0183	0.0048	**
Pigg Party	Facebook	0.1241	0.0176	<0.001	***
	X	0.0424	0.0181	0.1770	
	Instagram	0.0892	0.0182	<0.001	***

Table. A5: Result of Tukey's range test in ANOVA for loneliness with controlling age, gender, and usage frequency, where  $F(5, 8937) = 19.299$ ;  $p$ -value < 0.001.

## このアンケート調査にあたって

1.本調査は株式会社クロス・マーケティングが、株式会社サイバーエージェントからの委託を受けて実施致します。回答にかかる時間の目安は15～20分程度です。

**目的：**この調査は「オンラインコミュニケーションによって利用者個人が抱える問題を緩和・解消をする」ことを目的とした学術研究の一環として実施されます。本調査では皆様のオンラインコミュニケーションが皆様のリアル(現実)の社会関係や皆様自身の状態・問題にどのように関連しているかを調査するものです。その結果は学術研究に用いられ論文や学会発表などを通じて社会に還元されます。

**質問項目：**研究目的の達成のため、本調査ではオンライン(ネット)やリアル(現実)での体験や社会関係の他に、セクシャリティ・いじめ被害経験・精神的健康/社交不安・ご家庭の状況についてお伺いする箇所が含まれております。

**手順：**このページの末尾の質問に「同意して回答する」と回答した上でこの調査にご参加いただくことで、本文書の内容にご同意いただいたことになります。

**匿名性：**回答データはクラウドデータベースに蓄積され、データの閲覧者は株式会社サイバーエージェント学際的情報科学センターの研究担当者とその共同研究者に限定されます。研究担当者・共同研究社は回答者のデバイスや回答者自身を追跡することはできません。回答結果は統計的分析によって全体的な傾向を把握するために用いて、個々の回答者の特徴を明らかにするような分析の実施や公表は一切いたしません。

**参加の任意性：**参加は任意で、拒否や辞退は自由です。回答をしたくないと判断された場合はお手数ですが、「同意しません(回答をやめる)」ボタン、あるいはブラウザを閉じて、アンケートを終了してください。また、回答している最中に回答したくないと判断された場合も、ブラウザを閉じて、アンケートを終了してください。

**研究成果の公表：**学術的・社会的に有用な結果が得られた場合、国内外の学会での口頭発表や、学術誌への投稿を行うことがあります。なお研究成果を公表する際には、匿名化されているデータをさらに統計処理して個人が特定されないように配慮します。

上記に同意いただける方は「同意して回答します」を選択して回答を始めてください。回答をしたくないと判断された場合はお手数ですが、「同意しません」を選択、あるいはブラウザを閉じて、アンケートを終了してください。また、回答している最中に回答したくないと判断された場合も、ブラウザを閉じて、アンケートを終了してください。

調査開始後あるいは終了後、あなたに万一不利益が生じたときあなたが判断されたときは、その内容を弊社研究責任者もしくは研究倫理相談窓口に申し立てることができません。その際は下記までご連絡ください。

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株式会社サイバーエージェント 研究倫理相談窓口(e-mail: ethics\_info@cyberagent.co.jp)

Fig. A1: The screenshot of the informed consent on this research survey (original Japanese version).. See also Fig. A2 for the English version.

### **About this Survey**

Cross Marketing Inc. will conduct this survey on behalf of CyberAgent, Inc. It is estimated that it will take 15-20 minutes to complete.

**Purpose:** This survey is conducted as part of an academic research project to "alleviate or eliminate the problems that individual users face through online communication.

The purpose of this survey is to investigate how your online communication relates to your real-life social relationships and your own conditions and problems.

The results will be used for academic research and returned to society through articles and conference presentations.

**Questionnaire:** In order to achieve the purpose of the research, the survey will include questions about online and real life experiences and social relationships, as well as **questions about** bullying victimization,

**Instructions:** By participating in this survey, you agree to the terms of this document by answering "I agree and will answer" to the questions at the end of this page.

**Anonymity:** Response data will be stored in a cloud database, and data access will be limited to researchers and their collaborators at CyberAgent, Inc.

The researchers and collaborators cannot track the respondent's device or the respondent himself/herself.

The survey results will be used for statistical analysis to determine overall trends. They will not be analyzed or published in any way that would reveal the characteristics of individual respondents.

**Voluntary:** Participation is voluntary, and you can refuse or decline.

If you decide that you do not wish to respond, please click the "I do not agree (stop responding)" button or close your browser and exit the survey.

Also, if you do not want to respond while still answering, please close your browser and exit the survey.

**Publication of research results:** If we obtain useful results both academically and socially, we may present them orally at a domestic or international conference or submit them to an academic journal.

When publishing research results, we will statistically process anonymized data so that individuals will not be identified.

If you agree with the above, please select "I agree and will answer" to begin answering.

If you do not wish to respond, please select "I do not agree" or close your browser and exit the survey.

If you decide not to respond while you are still answering, please close your browser and exit the survey.

Suppose you feel that you have been disadvantaged after the survey has started or ended. In that case, you may report the matter to our principal investigator or to the Research Ethics Consultation Service.

Please contact us at the following address.

Principal investigator: Masanori Takano (e-mail: [takano\\_masanori@cyberagent.co.jp](mailto:takano_masanori@cyberagent.co.jp))

CyberAgent, Inc. Research Ethics Consultation Service (e-mail: [ethics\\_info@cyberagent.co.jp](mailto:ethics_info@cyberagent.co.jp))

Fig. A2: English version of the screenshot of the informed consent on this research survey.. We did not use this version because all survey were conducted in Japanese.

Avatar	Text	Coef.	Std. Err.	p-value	
Second Life	Facebook	0.8123	0.0298	<0.001	***
	X	0.9191	0.0307	<0.001	***
	Instagram	0.8920	0.0311	<0.001	***
ZEPETO	Facebook	0.7407	0.0297	<0.001	***
	X	0.8476	0.0305	<0.001	***
	Instagram	0.8204	0.0308	<0.001	***
Pigg Party	Facebook	0.6726	0.0296	<0.001	***
	X	0.7794	0.0304	<0.001	***
	Instagram	0.7523	0.0306	<0.001	***

Table. A6: Result of Tukey's range test in ANOVA for bullying victimization with controlling age, gender, and usage frequency, where  $F(5, 8937) = 465.833$ ;  $p$ -value < 0.001.

Avatar	Text	Diff.	p-value	
Second Life	Facebook	0.5093	<0.001	***
	X	0.5108	<0.001	***
	Instagram	0.5734	<0.001	***
ZEPETO	Facebook	0.3822	<0.001	***
	X	0.3838	<0.001	***
	Instagram	0.4464	<0.001	***
Pigg Party	Facebook	0.4164	<0.001	***
	X	0.4179	<0.001	***
	Instagram	0.4805	<0.001	***

Table. A7: Comparison of the regression coefficients of social support from family in avatar and text communication services using Student t-test with controlling age, gender, and usage frequency

Avatar	Text	Diff.	p-value	
Second Life	Facebook	0.3475	<0.001	***
	X	0.3462	<0.001	***
	Instagram	0.4560	<0.001	***
ZEPETO	Facebook	0.2469	<0.001	***
	X	0.2456	<0.001	***
	Instagram	0.3554	<0.001	***
Pigg Party	Facebook	0.2923	<0.001	***
	X	0.2910	<0.001	***
	Instagram	0.4009	<0.001	***

Table. A8: Comparison of the regression coefficients of social support from friends in avatar and text communication services using Student t-test with controlling age, gender, and usage frequency