Investigating the Possibility of Using an AR Mask to Support Remote Psychological Counseling

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Mental health problems are prevalent issues in modern society. While psychological counseling has been a traditional solution, it faces such barriers as negative societal perceptions and limited accessibility. To overcome these, researchers have explored remote counseling via video/voice calls. Despite its advantages of accessibility, convenience, and anonymity, the lack of personal interaction continues to be a drawback. This study investigates the feasibility of using an augmented reality (AR) mask in remote counseling and whether it could increase the level of self-disclosure—which is often used to measure the effectiveness of counseling—while maintaining anonymity. We conducted a controlled experiment and a qualitative user study to assess the effects of AR masks on counselees' level of self-disclosure during remote counseling. The results suggest that AR masks can increase this level more effectively for people with a low disposition for self-disclosure.

1 INTRODUCTION

Mental health is of the utmost importance to public well-being, with recent reports revealing that almost 1 billion people live with a mental disorder [52, 54] and over 50% of US citizens will be diagnosed with a mental illness at some point in their lifetime [53]. According to the World Health Organization, depression is a mental condition that greatly interferes with daily life and social life, giving rise to low mood, loss of motivation and worth, sleep and appetite disorders [1, 26, 28, 56]. Consequently, neglecting mental health issues is likely to lead to much more serious and long-lasting consequences, which could result in poor quality of life, substance abuse problems, and unemployment, to name but a few issues [54]. Therefore, such concerns must be appropriately addressed to not only provide proper treatment, but to also prevent suffering further [54].

Although mental well-being is key to living a healthy and balanced life, its importance is often overlooked when compared to physical health [57, 58]. Recent studies have shown that only one in eight of adults with mental health

problems receive mental health treatment [59, 101]. Among the one in eight adults who receive mental health treatment, only 3% receive psychological counseling in the UK [101]. Not treating mental illness can lead to several other health-related problems, such as diabetes, heart disease, and strokes [60, 61, 62]. The serious consequences associated with mental health issues and the global rise in cases every year highlight the urgent need to examine the current methods of treatment and provide appropriate interventions to the affected populations [63].

Psychotherapy has been a traditional method for various mental health problems. Among various methods of psychotherapy, in-person counseling has been a widely popular solution for mental health treatment for a long time [8, 10, 11]. While counseling has been shown to be a highly effective treatment method, there are several barriers which hinder people's access to it, such as financial status, time constraints, associated stigma, pessimism regarding the effectiveness of treatments, and limited access to counselors (particularly in rural areas) [2, 6, 38, 102]. There are various barriers; however, social stigma such as particularly negative beliefs and attitudes and social norms also significantly contribute to the low rates of treatment [104, 105, 106, 107]. As an attempt to increase the accessibility of psychotherapy, many researchers have focused on supplying new methods for providing counseling services to larger populations [27, 31, 44].

One such approach is remote counseling, offering various methods to facilitate psychotherapy from a distance, including text-based, audio-based, and video-based approaches [18, 38]. These methods remove geographical barriers, provide anonymity, and improve accessibility [18, 31, 44]. Text-based and audio-based counseling have also gained popularity due to their ability to offer privacy and anonymity, especially when compared to video-based counseling [110]. However, they lack the ability for counselors to observe non-verbal cues, which are crucial for understanding the counselee's condition and establishing a strong connection [95, 96, 111].

Video counseling, on the other hand, has been found to be the most effective method as it allows counselors to detect non-verbal gestures and enhance the counseling process [4, 17]. Although video-based remote counseling offers a higher level of connection, it often compromises counselee's anonymity, which is a key strength of remote counseling [17]. Moreover, video counseling still faces challenges in building therapeutic rapport and achieving effective outcomes, mainly due to the limited interaction and connection compared to in-person sessions [94, 95, 96]. Therefore, finding a way to enhance interaction and connection in video-based counseling while maintaining counselee's anonymity is crucial to promote higher levels of self-disclosure and improve the effectiveness of remote counseling through increased interaction between counselor and counselee.

The field of Human-Computer Interaction (HCI) has been actively involved in addressing a wide range of mental health problems by designing and developing technological interventions tailored to the unique needs of individuals with different mental health conditions [92, 93, 97, 98, 99, 100]. However, there has been limited exploration in the realm of remote psychotherapy. To our knowledge, there is no prior work in HCI that focuses on increasing the level of human interaction to promote counselor-counselee rapport and enhance the human interaction while maintaining anonymity. Addressing the lack of human interaction in video-mediated counseling is crucial to expanding the scope of mental health support and providing alternative solutions for widely practiced counseling. Therefore, this study aims to bridge this gap by leveraging Augmented Reality (AR) technology to enhance human interaction while preserving anonymity in remote counseling. Specifically, we aim to investigate the following research questions: (1) Can AR-aided remote counseling serve as a viable alternative method for delivering remote counseling? (2) How does an AR mask affect one's level of self-disclosure during remote counseling sessions? (3) How does AR-aided counseling influence individuals' experiences and perceptions of counseling?

To investigate our research questions, we conducted two studies: a controlled experimental study (Study 1) and a qualitative user study simulating remote counseling sessions (Study 2). Study 1 aimed to investigate the effectiveness of

applying AR filters during video counseling by examining the impact on self-disclosure levels. Study 2 involved participants engaging in consecutive remote counseling sessions with AR filters to observe their effect on self-disclosure in a real-life setting. Both studies measured participants' predispositions for self-disclosure and addressed our research questions.

This research aims to explore the potential application of augmented reality (AR) technology in the context of remote counseling to address the problem of limited human interaction and connection between counselees and counselors while providing anonymity to the counselees, with the hopes of lowering the barriers of counseling. Specifically, the study investigates the effects of AR filters on self-disclosure during counseling sessions, examining the potential benefits of using AR masks to both conceal and express oneself during counseling. The study seeks to contribute to the HCI community by addressing the under-explored area of remote psychotherapy and providing insights and design opportunities for AR-aided counseling in remote settings, with a focus on self-disclosure facilitated by the anonymity provided by AR as a key aspect.

2   RELATED WORKS

2.1   Remote counseling as a Computer-Mediated Communication

The field of HCI has been a no stranger in researching and designing technology-enabled mental health interventions to help solve the global problems of mental health. To make mental health treatment more accessible to people, HCI community has been extensively researching to create technology-enabled solutions to mental health problems [78, 79, 80, 81, 82, 83, 84, 85]. A variety of ways have been introduced to tackle mental health problems, including emotional regulations, digital community support, chat-bot based support, cognitive behavior technique interventions, in-situ technologies, and so on. However, the field of counseling within the mental health still has aspects to be explored. The potential effects of remote counseling have been already discussed from the 90s [89, 90, 91]; therefore, experts expected that remote counseling will grow more in popularity in the future [89]. Recently, remote counseling has been introduced as an alternative solution to traditional face-to-face counseling [18, 38].

Remote counseling increases accessibility by providing access to treatment for those in rural areas, and people facing mobility, financial, or time constraints [18, 38]. Although more than 300 million people worldwide suffer from depression [23, 41, 52, 54], the percentage of people seeking for help is low due to factors such as negative societal perceptions of receiving counseling, low accessibility, high fees, and social stigma such as unwillingness to disclose sensitive personal information [6, 38, 47, 104-106, 110, 111]. Thus, to overcome the traditional barriers of availability, accessibility, and receptiveness associated with face-to-face counseling [6, 47], recent attempts in the field of psychology and HCI have incorporated the latest information communication technologies into remote counseling such as video-, voice-, and text-based counseling [6, 26]. The increase in these approaches has lowered the barrier to counseling, thereby raising the likelihood of counseling [44] due to convenience [18], high accessibility [38], and anonymity [50]. The time flexibility that it provides for counselors and counselees is beneficial, and the stigma people may face for seeking treatment can be reduced. When mobility is limited, remote counseling is a viable substitute for connecting the counselor and the counselee [44]. Moreover, it provides access to treatment in an environment that is comfortable, familiar, and convenient to counselees while preserving their anonymity [8].

Although remote counseling provides several advantages, concerns have been raised regarding its limited human interaction, particularly in text-based or phone-based counseling [15, 22, 64]. Some researchers argue that remote counseling is less effective than traditional counseling because non-face-to-face counseling lacks human interaction [22,

36]. Researchers say that therapeutic process factors such as accountability may be more prominent in traditional face-to-face treatment than digital health interventions [15]. However, a voice and text-based counseling affect the accountability as there is a lack of human interaction between counselees and counselors. Moreover, voice and text-based counseling does not allow counselors to detect non-verbal communications of a counselee, which is an important factor in an effective counseling session [18, 28]. Video-based counseling is known to be more effective than voice or text-based counseling as it enables more human-interaction between the counselee and counselor, allowing for non-verbal communications to be detected [4, 17]. However, it has its disadvantages that counselees need to reveal their faces, failing to maintain the anonymity of a counselee [50]. Maintaining the high level of flexibility and accessibility of remote counseling, while creating a higher level of accountability and anonymity in a counseling session, an alternative tool needs to be considered. For example, Avatar-Mediated Communication (AMC) can be an excellent supporting tool for counseling. Recently, AMC has been an emerging technology to facilitate communication in virtual setting, most commonly through virtual reality or augmented reality technologies. Due to its rising popularity and usage in multiple digital platforms, HCI researchers have also begun examining and evaluation the effects of AMC in certain settings to investigate its potentials to be a communication medium in virtual settings [55, 56]. Similar to text-, voice-, and video-based counseling, AMC uses voice and text as well. However, there are differences in terms of anonymity, the level of self-disclosure, and nonverbal processes. For instance, anonymity could add depth to AMC counseling sessions [49], and therefore may provide greater access to counseling to even those sensitive to revealing their identities [50]. Moreover, there is a link between anonymity and higher rates of self-disclosure [47].

2.2 Self-disclosure and Anonymity in Counseling

Self-disclosure has been defined as an individual's revelation of personal information (thoughts, feelings, experiences, etc.) to others, and is the basis for forming social relationships [1, 18, 21, 25]. It is deeply integrated into multiple aspects of life, such as the development of interpersonal relationships, coping behaviors, intimacy, and trust building [1, 25]. Disposition for self-disclosure has been explored in counseling research and has been found to be highly relevant to the therapeutic process and forming counselee–counselor relationships [69]. In psychotherapy, counselees' self-disclosure of personal experiences and feelings is necessary for positive change and growth [7, 21]. Within this study, we refer to those with high dispositions as participants with high dispositions for self-disclosure (PHDs) and those with relatively low dispositions as participants with low dispositions for self-disclosure (PLDs) (Refer to Appendix A). Studies have shown that the authentic self-disclosure of thoughts, traumatic experiences, and emotions can aid in psychological adjustment and resilience [70]. Resilience is the ability to have positive responses in the face of adversity, and individuals with higher levels of psychological resilience tend to report greater overall well-being compared to those with lower levels [70]. Studies have also shown that a lack of self-disclosure during difficult life experiences can lead to a wide range of negative psychopathologies [71]. Therefore, counselors actively try to employ a variety of techniques to prompt higher levels of counselee self-disclosure [37]. A variety of factors influence self-disclosure due to its complex association with the development, maintenance, and dissolution of close interpersonal relationships. Furthermore, the ability to build interpersonal relationships through virtual settings has drastically changed what factors influence self-disclosure [1, 71]. For example, previous studies on self-disclosure in commercial social VR found that the age of one's interlocutor, the level of privacy the virtual environment offers, group size, activity context, and personal goals all influence whether or not people choose to disclose personal information [72].

The emergence of new computing technologies has created new ways for people to disclose information anonymously, which is one of the reasons why communication and interpersonal relationships have drastically changed in the new era [24]. Researchers have found that individuals feel more disinhibited when anonymous, thus raising their levels of self-disclosure [50, 73]. Anonymity can change one's behavior in digital settings through a concept known as the remote disinhibition effect, which refers to the decrease in inhibitions and increase in self-disclosure when anonymous on the internet [50, 74]. There are a variety of ways in which one can be anonymous, such as through visual anonymity by choosing not to disclose one's face [73]. Discursive anonymity, on the other hand, refers to when verbal communication cannot be attributed back to the source [73, 75]. With anonymity, individuals may be more inclined to express one's authentic self when free from stress and social stigmas related to how they present themselves [73, 76]. This means that providing anonymity to counselees in remote counseling settings may lead to positive outcomes [32, 76]. Our study examines how using AR masks to conceal their faces in remote counseling can affect their level of self-disclosure due to feelings of anonymity.

2.3 AR technology in Mental Health

Technological advances are continuing to accelerate in the era of the Fourth Industrial Revolution, leading to many new technologies implemented in the field of mental health [30]. Currently, AR technology is being implemented in mental health to treat posttraumatic stress disorder (PTSD) or specific phobias [37, 38, 114, 115, 118-127]. Phobias have been traditionally treated in a real environment where the patient's fears are present [48, 49]. However, in an AR treatment, these phobias are not physically present, thus decreasing the level of fear [48, 118, 119]. Moreover, while the counselors cannot fully control the variables in real-life treatments, AR treatment allows for the manipulation of certain variables [48]. Besides phobias, counselors also use AR in augmented reality exposure therapy (ARET), which is a digitally assisted psychotherapy treatment for PTSD which involves increasing a patient's sense of presence during the therapy [50, 124-127]. There is a lack of research on using AR in counseling to protect counselee's anonymity from increasing counselor–counselee interactions and enhancing the effectiveness of remote counseling. However, researchers have discussed AR's potential in counseling [8, 46]. Indeed, AR can be easily used through mobile and computer platforms, and thus does not require one to purchase new and expensive devices [47]. The AR mask detects and tracks the focal points of the user's face to augment the mask on top of the overlapping image in real-time. Moreover, the AR mask can capture one's face in real-time to detect expressive facial movements. The user's face could overlap with a real or virtually created image [30, 47]. Apple's "Memoji" allows users to create a character modeled after their face. Therefore, using the AR mask, a counselee could maintain anonymity while showing non-verbal cues (e.g., facial expressions, nodding, and gestures) communicated to the counselor. Such advantages could likely increase counselor-counselee interactions, thus making counseling more effective [95, 96, 111].

Although there has been much HCI research on mental health, the potential use of AR technology, such as AR masks, has not been fully explored in the domain of remote psychotherapy. As such, we seek to contribute to the field by exploring the possibility of using AR masks in remote counseling. Such use could well be beneficial to people who feel uncomfortable with exposing their faces when discussing taboo subjects or deeply personal issues. Along with the several benefits provided by remote counseling, such as convenience and accessibility [18, 38], it could also be an alternative way in which people seek help for mental health issues. In this paper, we suggest that the AR mask, through providing anonymity, could be a potential tool for increasing self-disclosure.

3 METHODS AND STUDY DESIGN

In this section, we provide an overview of our study design process using diagrams. Detailed methodologies for each study can be found in their respective sections.

Firstly, we conducted a preliminary survey to gain an understanding of people's perceptions and experiences regarding counseling and AR technology. This preliminary survey aimed to assess the potential of AR-aided counseling but does not contribute to the overall findings of the main studies. Its purpose was to gather preliminary insights before conducting the main studies. After confirming the need for our study through the preliminary survey, we designed two studies (Study 1, Study 2) to address our research questions.

We designed both Study 1 and Study 2 to address the RQ1: *Can AR-aided remote counseling serve as a viable alternative method for remote counseling?* In particular, Study 1, a Controlled Experiment, was designed to address *RQ2: How does an AR mask affect one's level of self-disclosure during remote counseling sessions?* The aim of Study 1 is to validate the potential of AR-aided counseling by investigating the effects of AR masks on one's self-disclosure level. Given that the aim of Study 1 is validation of its potential, after validating its effectiveness, we conducted Study 2, Simulating Remote Counseling Sessions, which allowed us to explore more deeply how AR-aided counseling influences one's experiences in a counseling session to address the RQ3: *How does AR-aided counseling influence individuals' experiences and perceptions of counseling?*
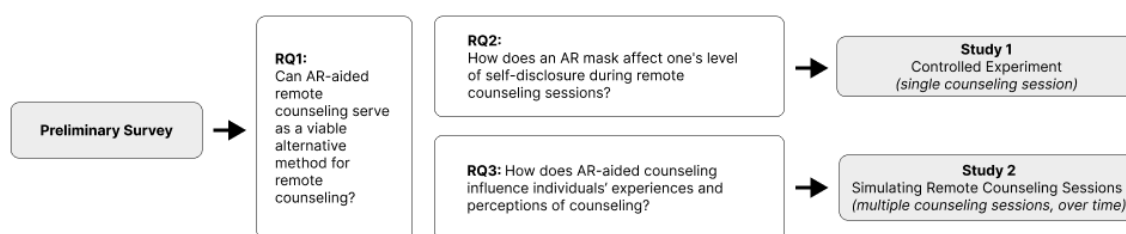

Diagram 1. Study Diagram with Research Questions

3.1 Preliminary Survey

In order to gather a preliminary glimpse of people's perceptions and experiences regarding counseling and augmented reality (AR) technology, a preliminary survey was conducted prior to the main research. The purpose of this preliminary survey was to gather initial insights into the target population, specifically focusing on their past encounters with counseling, their expectations and preferences for counseling, as well as their perceptions of AR technology. It is important to note that the findings from this initial study do not form part of the main research. It serves as an essential preliminary step undertaken to inform and guide the subsequent studies. We recruited 88 participants (aged between 14–42) from South Korea through social media sites and flyers posted throughout school campuses. The participants were asked to complete an online Google Forms survey. Study details and a note informing them that they could opt out of the survey at any time were clearly displayed on the survey's welcome page. The survey included a total of 41 questions: 28 on their perceptions on counseling, 9 on their perceptions on AR, and 4 on general demographic. All questions were created with the help of a professional counselor. Responses were measured on a 7-point Likert scale ranging from disagree to agree. After collecting the responses, we conducted qualitative analyses through "open coding" by looking at each response to each question. Once the codes were generated, they were verified by a trained counselor.

We found that people generally held favorable views towards counseling but were uncertain about its efficacy when dealing with personal issues. A little over half of the participants reported that they had never attended an in-person counseling session and 74.8% considered it to be their last resort when dealing with personal problems. However, 64.8% of participants reported holding positive attitudes toward counseling. We also found that 71.4% of those that had never received remote counseling said that they would prefer in-person to remote counseling. From the data obtained, we concluded that the participants did not have high expectations for remote counseling due to their assumption that its in-person equivalent would be more interpersonal. It could be that they thought that the lack of non-verbal communication in a shared space between two physically present individuals could hinder the quality of counselor-counselee interactions. This implies that making remote counseling sessions feel more interpersonal could improve the quality of such interactions.

The responses also showed that the majority of participants were familiar with AR technology (97% reported having experience with it and 63.6% claimed to use it regularly). In particular, we found that participants generally agreed that AR technology could be a versatile tool for regulating self-expression for communication. Of its many uses, 76.5% of participants reported using AR technology to communicate with their friends, 36.4% for entertainment, and others reported that it helped to conceal or express themselves. For some, avatars could be used to remain visually anonymous or to look more physically appealing (e.g., Instagram filters that partially cover the face). On the other hand, people may wish to portray their personality in unique ways through the use of emojis or avatars.

From the initial study, we found that AR technology is already popular and frequently used for communication. We also found that, while people have positive feelings toward counseling, they have concerns over remote counseling's lack of interpersonal connection, and the depth and quality of its communication.

4 STUDY 1: CONTROLLED EXPERIMENT

4.1 Hypothesis

The Study 1 is designed to explore whether AR_aided remote counseling can serve as a viable alternative method for remote counseling (RQ1) and more specifically, exploring how an AR mask affect one's level of self-disclosure during remote counseling session (RQ2). Based on our findings from the preliminary survey and previous works, we developed the following hypotheses addressing RQ2:

H1	In psychological counseling, there will be differences between the participant groups (no AR, animal AR mask, humanoid AR mask) that influences on how much the participants disclose (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues.
H2	In psychological counseling, the participants' disposition to self-disclosure will influence how much they disclose about (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues.

H3	In psychological counseling, there will be a significant interaction effect between AR mask use and participants' disposition for self-disclosure on (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues depends on AR mask use.

The first and second hypotheses examine how two independent variables, mask type (no mask, animal AR mask, humanoid mask) and disposition to self-disclosure (high, low), influence the dependent variable, the participants' level of self-disclosure during counseling sessions, respectively. Additionally, the third hypothesis focuses on exploring the potential interaction effect between the two independent variables.

To understand the effects of two independent variables on a single dependent variable, we employed a 2·3 mixed factorial design and used a two-way ANOVA to test the statistical relationships.

4.2 Methodology

4.2.1 Study design

The quantitative experiment tested whether participants' disposition to self-disclosure influenced AR masks' effects on the depth of self-disclosure. For our controlled experimental study, we employed a 2x3 mixed factorial design to test and analyze the effects that the two factors—disposition to self-disclosure (high, low) and mask-type (no mask, animal AR mask, humanoid mask)—had on the participants' level of self-disclosure during counseling. And we used a two-way ANOVA method to analyze the effects of two factors on a single dependent variable. Apple's "Animojis" were used for the animal AR masks and "Memojis" were used for the humanoid AR masks. The participants were free to choose their mask type and faced no restrictions on selecting AR filters. In order to measure how much participants disclosed, we categorized self-disclosure based on the four relevant topics: personal issues, emotions, opinions, and family or friend issues. We aimed to use the results obtained to examine the possibility of using AR technology (and its unique benefits) to increase the efficacy of remote counseling. The framework of this study is shown in Figure 1. This study does not make any treatment recommendations or diagnostic claims. All participants gave informed consent to participate, and ethical approval was acquired from the Institutional Review Board.
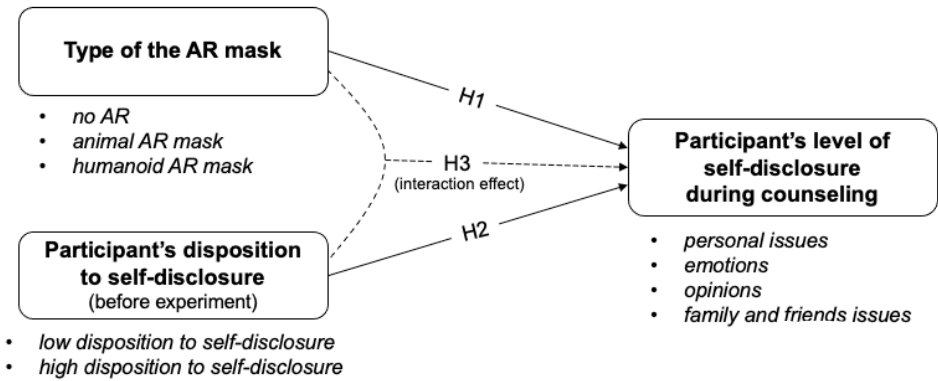
Figure 1. Research framework

4.2.2 Recruitment

A total of 30 participants (22 female and 8 male), aged 18–24 years, were recruited in Seoul, South Korea, via social media, digital messengers, and offline advertisements in multiple locations on a university campus. Originally, 40 participants were recruited, but 10 had to be excluded for not meeting the following criteria: (1) must be open to receive remote counseling (both AR-aided or video-based), (2) must not currently have, or have been diagnosed with, a mental health problem; and (3) must feel comfortable using AR technology (previously: must not be reluctant being in an AR environment. We selected these criteria with the aim of considering the impact of the experiment on the participants. We excluded individuals with severe mental health issues due to ethical concerns regarding the use of an unverified tool that could potentially have unforeseen consequences on their preexisting mental health conditions. Our research focus was primarily exploratory, aiming to assess the feasibility of using AR-aided counseling as a remote counseling option, rather than evaluating its medical effectiveness. As a result, we deliberately excluded individuals who were genuinely in need of medical care. Although the participants had never been diagnosed with a mental health problem, we measured their mental health status and needs for counseling. The participants were made fully aware that the experiment was a "real setting of a remote counseling session with a counselor" in the recruitment phase. A pre-questionnaire that measured disposition to self-disclosure was given to the participants. We recruited one counselor via email who met the criteria of having (1) a certificate in counseling and (2) at least 200 hours of counseling experience. We recruited only one counselor to reduce the possible variability that several different counselors could have on the results. The participants received 8.4 USD (10,000 KRW) per hour for their time, whereas the counselor received an hourly rate of 12.6 USD (15,000 KRW).

4.2.3 Study conditions

We randomly assigned the participants to one of the three study conditions: no AR mask, animal AR mask, and humanoid mask (Fig. 2). Apple's Animojis[1] were used for the animal AR masks and Memojis[2] were used for the humanoid AR masks.

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[1] Animoji is animal-like animated emoji introduced by Apple

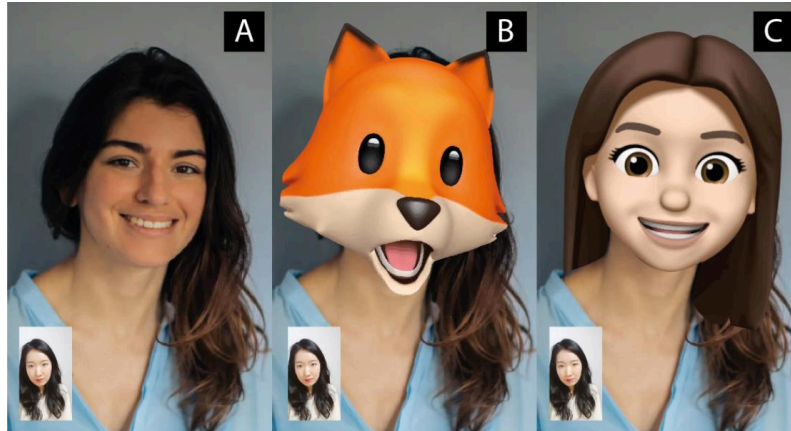[2] Memoji is humanoid-like animated emoji introduced by Apple

Figure 2: Examples of the experimental conditions: counseling (A) no AR mask, (B) an animal AR mask, and (C) using a humanoid AR mask

4.2.4 Procedure

During the introductory session before the experiment, participants were informed about the purpose and procedure of the study. After receiving their consent, we asked the participants to complete a pre-questionnaire consisting of 18 questions, 6 questions each regarding their disposition for self-disclosure, perception of counseling, and perception of AR masks. Based on their responses, we categorized them as either PHDs or PLDs.

4.2.5 Experiment

After completing the pre-questionnaire, participants were randomly assigned to one of the experimental conditions: AR mask (n=10), animal AR mask (n=10), or humanoid AR mask (n=10). Among the participants, 11 were PLDs and 19 were PHDs. Those who were randomly assigned to one of the AR mask conditions were given instructions on how to use the mask and participants in the humanoid AR mask condition were also given instructions on how to design their Memoji character. We used the Facetime app for the real-time remote counseling sessions, each of which lasted for approximately 40 minutes. The participants were asked to come to a usability testing lab, where they would join the counseling session. The counselor joined from an office of their choosing. The participants were not introduced to the counselor prior to the experiment in order to eliminate any confounding variables. Furthermore, to accurately measure self-disclosure without adding the pressure of being watched, we decided not to record the sessions, and made this clear to the study participants. As peoples' behaviors change when recorded, thus could have altered their self-disclosure. We tried to establish a realistic and comfortable remote counseling environment by giving participants enough freedom to discuss personal issues, such as work-related stress or college difficulties. In order to encourage discussion during the sessions, the participants were introduced to four topics used to measure self-disclosure. Topics that were not brought up in the discussion were set as zero in the results. In other words, we deemed that choosing a particular topic itself demonstrated the depth of self-disclosure.

4.2.6 Post-intervention questionnaire and interview for counselors

After each session, the counselor measured participants' level of self-disclosure by completing a post-intervention questionnaire based on discussions of personal issues, emotions, opinions, and family or friend issues. We set the

independent variables as the participants' disposition to self-disclosure (high or low) and the dependent variables as the four dimensions of self-disclosure: a, b, c, and d. We also conducted an in-depth interview with the counselor in order to examine if there was a change in their perceptions of using AR technology within remote counseling sessions. Both the post-intervention questionnaire and interview took roughly 10 minutes each. The responses to the open-ended interview questions were coded using transcriptive analysis. Moreover, with the counselors' consent, the interviews were audio-recorded and answers to the questionnaires were transcribed for qualitative analysis.

4.3 Measures

The pre-questionnaire given to the participants included a variety of questions on the perception of self-disclosure and counseling, and on previous AR knowledge. The post-intervention questionnaires were conducted to see how counselors would rate participants' level of self-disclosure. We adapted the questionnaire from Wheeless (1976) in order to measure the counselor's perceptions of the participants. The questionnaire was partially adopted to fit the scope of the study and it included 18 statements with a 7-point Likert-type scale, ranging from 7 (completely agree) to 1 (completely disagree) (Table 1). The final questionnaire was validated by a professional psychologist. It should be noted that some questions were reverse-coded, as in the original questionnaire [47]. The questions were classified into four topics (personal issues, family and friend issues, emotions, and opinions) and three dimensions of disclosure (core, intermediate, and peripheral) [1]. The questions were reordered, and we collected the participants' responses on the same questionnaire for further analysis.

Table 1. Questions and their disclosure dimensions

Topic	Item	Question	Dimension of self-disclosure
Personal issue	1	The participant expresses their beliefs.	Core disclosure
	2	The participant reveals personal information about their personal life.	
	3	The participant often talks about what they do on weekends.	
	4	The participant seldom talks about themselves.	
	5	The participant presents their attitudes toward events occurring on campus.	
	6	The participant often talks about themselves.	
	7	The participant seldom expresses their beliefs.	
Emotion	8	The participant discusses their feelings.	
	9	The participant only discusses class-related material.	
	10	The participant rarely discusses their personal life.	
	11	The participant is open with the class about their feelings.	
Opinion	12	The participant often gives their opinions about current events.	Intermediate disclosure
	13	The participant shares their dislikes and likes.	
Family and friends issue	14	The participant uses their family or friends as classroom examples.	Peripheral disclosure
	15	The participant often gives personal examples in class.	
	16	The participant seldom discusses family or friends.	
	17	The participant gives their opinion about events in the community.	
	18	The participant often talks about their family and friends.	

Table 1. Questions and their disclosure dimensions

4.4 Results

To analyze the result, the two-way ANOVA method was performed using IBM's SPSS Statistics 25 software. The two independent variables are mask type (no mask, animal AR mask, humanoid mask) and disposition to self-disclosure (high, low), and the dependent variable is the participants' level of self-disclosure during counseling sessions. A significance level of 5% was employed as the threshold for determining the statistical significance of the results.

Before the two-way ANOVA, we conducted a factor analysis with orthogonal rotations so as to investigate the dimensionality of the measuring instruments. This analysis aimed to assess whether the questions used effectively captured and represented the dependent variables in a coherent manner. For that, each factor was required to have one item loaded at .50 or above, with no secondary loadings at .50 or above. To see if the samples were suitable for factor analysis, we firstly checked the Kaiser-Meyer-Olkin (KMO) value and conducted Bartlett's test of Sphericity. KMO test measures the suitability of data for factor analysis in terms of the sample size. Meanwhile, Bartlett's test of Sphericity shows whether the variables are correlated enough for factor analysis. As a result, the KMO value of .641, which indicated that the adequacy of the sample size is acceptable (> .6), and Bartlett's test resulted in a significance probability of <0.001 so a factor analysis may be worthwhile for the data set [129].

From the factor analysis, it was checked which questions in the questionnaire are suitable to be analyzed in the two-way ANOVA. According to the results of the factor analysis, it was found that all questions except for question 6 demonstrated sufficient factor loadings (more than .50) to be used in the two-way ANOVA. So, through the orthogonal rotation, question 6 was removed; therefore, 17 items remained, with a total variance of 72.572% (Table 2). We used the average of the items in each factor for the two-way ANOVA.

Table 2. Results of factor analysis and reliability analysis

| Topic | Item | Factor Loading | | | | Cronbach's α |
		Factor 1	Factor 2	Factor 3	Factor 4	
Personal issues	1	.659				.876
	2	.624				
	3	.866				
	4	.599				
	5	.623				
	7	.829				
Emotions	8		.521			.640
	9		.696			
	10		.804			
	11		.577			
Opinions	12			.556		.594
	13			.877		
Family and friends issues	14				.864	.873
	15				.703	
	16				.607	
	17				.765	
	18				.813	
Eigenvalue		7.576	2.003	1.465	1.285	-
% of variance		44.564	11.784	8.620	7.599	-
Cumulative %		44.564	53.348	64.968	72.527	-

Table 2: Results of factor analysis and reliability analysis

Table 3 displays the results of the two-way ANOVA. First, we investigated the main effect of the AR mask and the participant's disposition for self-disclosure on their level of self-disclosure during the session. Regarding H1a–d, we found a significant difference between the three mask conditions in their self-disclosure level on personal issues (H1a) at the 10% significance level (F=2.551, p=.099). However, for the other three topics, there was no significant difference between the three groups (H1b: F=1.241, p=.307; H1c: F=1.592, p=.224; and H1d: F=0.278, p=.760). However, in terms of the participant's disposition for self-disclosure, no significant influence was found (H2a: F=2.266, p=.145; H2b: F=.016, p=.091; H2c: F=.300, p=.589; and H2d: F=1.059, p=.314).

Second, we analyzed the interaction effect between the AR masks and the participant's disposition. The analysis revealed that the level of self-disclosure of a personal issue and emotion increased when a PLD used an AR mask. However, when a PHD used an AR mask, the combination of both conditions negatively impacted the level of self-disclosure. The results showed that two of the dependent variables, disclosure of personal issues and emotion, were jointly affected by the AR mask and disposition to self-disclosure (H3a: F=4.750, p=.018 and H3b: F=2.662, p=.090), whereas the other two variables were not (H3c: F=1.016, p=.377 and H3d: F=0.158, p=.855). In terms of the dimensions, a significant interaction effect was only found for core disclosures (personal issues and emotions) at the 10% significance level.

Figure 3 shows how the AR mask affected the self-disclosure of PLDs and PHDs from the viewpoint of the four topics. As mentioned earlier, for personal issues, we found a significant difference between the participants with different dispositions for self-disclosure at the 5% significance level (Figure 3(a)). For PLDs, levels of self-disclosure increased when using an animal or humanoid AR mask, while those of PHDs remained the same or slightly decreased in said conditions. For example, among PLDs, the two groups using an AR mask showed a higher degree of disclosure about personal issues ($M_{animalAR}^{Low}$=6.033; $M_{humanoidAR}^{Low}$=6.500) than those who did not (M_{noAR}^{Low}=4.267). For PHDs, the group using the animal AR mask showed a slightly higher level of disclosure about personal issues ($M_{animalAR}^{High}$=6.557) than the group without an AR mask (M_{noAR}^{High}=6.286), and the group using the humanoid AR mask recorded the lowest level of disclosure compared to the other two ($M_{humanoidAR}^{High}$=5.680).

Table 3. Results of two-way ANOVA

Factor	Dependent variable (Level of self-disclosure)	SSR	Degree of freedom	MSR	F	P
AR mask (no mask, animal AR mask, humanoid AR mask)	Personal issues	4.942	2	2.471	2.551	0.099*
	Emotions	1.650	2	0.825	1.241	0.307
	Opinions	1.219	2	0.609	0.278	0.760
	Family and friends issues	7.115	2	3.557	1.592	0.224
Disposition to self-disclosure (PLDs and PHDs)	Personal issues	2.195	1	2.195	2.266	0.145
	Emotions	0.010	1	0.010	0.016	0.901
	Opinions	2.320	1	2.320	1.059	0.314
	Family and friends issues	0.671	1	0.671	0.300	0.589
AR mask * Disposition to self-disclosure (PLDs and PHDs)	Personal issues	9.202	2	4.601	4.750	0.018**
	Emotions	3.540	2	1.770	2.662	0.090*
	Opinions	0.691	2	0.345	0.158	0.855
	Family and friends issues	4.541	2	2.270	1.016	0.377
Error	Personal issues	23.247	24	0.969		
	Emotions	15.959	24	0.665		
	Opinions	52.571	24	2.190		
	Family and friends issues	53.638	24	2.235		

Note: ** = statistically significant at the 5% level (p < 0.05).
* = trending towards significant (0.05 < p < 0.1).

Table 3: Results of two-way ANOVA

Interestingly, emotion (another topic of core disclosure) also exhibited the same interaction effect. In conversations related to emotion, the AR mask had significantly contrasting effects depending on the participants' disposition for self-disclosure at the 10% significance level (Figure 3(b)). For PLDs, the two groups using an animal and humanoid AR mask showed a higher degree of disclosure about their emotions ($M_{animalAR}^{Low}$=6.700; $M_{humanoidAR}^{Low}$=6.360) than those who used no masks (M_{noAR}^{Low}=5.433). In contrast, for PHDs, the group without h*umanoidAR noAR* scored the highest level of emotional self-disclosure M_{noAR}^{High}=6.414), followed by the groups using the animal AR mask $M_{animalAR}^{High}$= 6.300) and then humanoid AR mask ($M_{humanoidAR}^{High}$ = 5.660). For the other two topics of self-disclosure, i.e., opinion (intermediate disclosure) and family and friend issues (peripheral disclosure), the interaction effects of the AR masks and participants' disposition to self-disclosure were not statistically significant at the 10% level. However, we can observe some positive effects of the AR mask on the level of disclosure from Figures 3(c) and 3(d). On family and friend issues, a larger increase

from using an AR mask was found among PLDs (M_{noAR}^{Low}=3.400; $M_{animalAR}^{Low}$=4.733; $M_{humanoidAR}^{Low}$=5.400), while PHDs exhibited a smaller positive difference (M_{noAR}^{High}=4.457; $M_{animalAR}^{High}$=5.429; $M_{humanoidAR}^{High}$=4.600). In terms of opinion, we noted a difference for the low-disposition to self-disclosure groups (M_{noAR}^{Low}=4.000; $M_{animalAR}^{Low}$=4.500; $M_{humanoidAR}^{Low}$==4.600), but a group of PHDs exhibited almost no change with the AR mask (M_{noAR}^{High}=4.929; $M_{animalAR}^{High}$=4.643; $M_{humanoidAR}^{High}$=5.300).
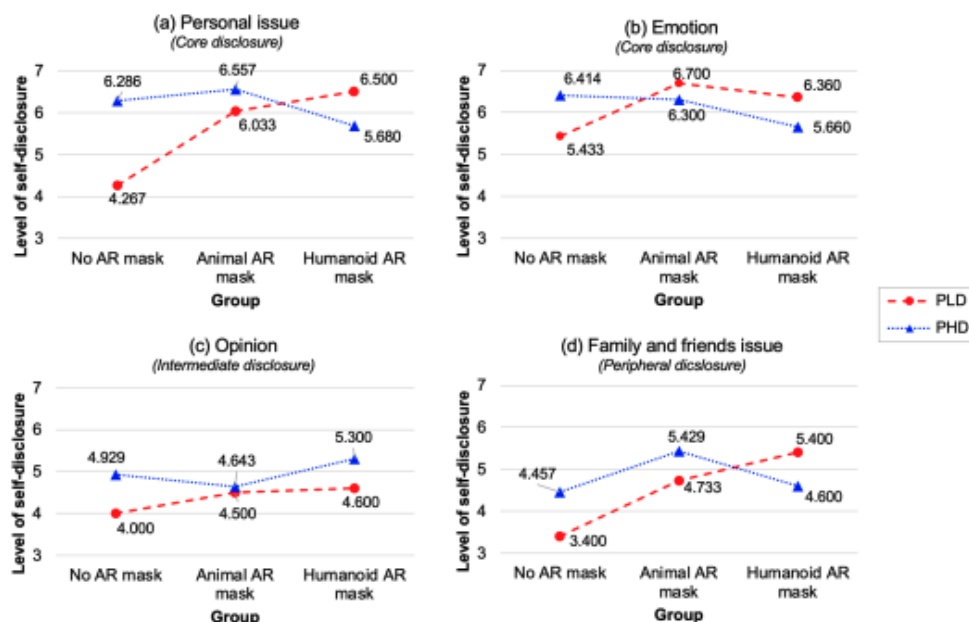

Figure 3: The self-disclosure level of the three groups (no AR mask, animal AR mask, and humanoid AR mask) during the session in terms of (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues.

In terms of mask type, we found a contrasting effect between an animal and humanoid AR mask in personal issues and family and friend issue. For PHDs, the level of self-disclosure tended to decrease when using a humanoid AR mask, while that of PLDs increased. For example, in personal issues, the self-disclosure level of the group of PHDs using a humanoid AR mask was .606 lower than the group using an animal

AR mask ($M_{humanoidAR}^{High}$=5.680; $M_{animalAR}^{High}$=6.557). In contrast, among PLDs, the self-disclosure level of the group using a humanoid AR mask was .972 higher than that of the group using an animal AR mask ($M_{humanoidAR}^{Low}$=6.500; $M_{animalAR}^{Low}$==4.267). In summary, H1 was supported only in topic (a), but rejected in topics (b), (c), and (d). H2 was rejected. For H3, (a) and (b) were supported, while (c) and (d) were rejected. We found that the more sensitive the information, the greater the interaction between AR masks and disposition for self-disclosure (PLDs and PHDs). We did not force all contents to be covered within the counseling session, as in freer counseling session, counselees tend to self-disclose about core dimension topics [1].

	Hypotheses	Test Results
H1	In psychological counseling, there will be differences between the participant groups (no AR, animal AR mask, humanoid AR mask) from the viewpoint of how much the participants disclose (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues.	*Partially Supported* (a) personal issues
H2	In psychological counseling, the participants' disposition to self-disclosure will influence how much they disclose about (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues.	*Rejected*
H3	In psychological counseling, there will be a significant interaction effect between AR mask use and participants' disposition for self-disclosure on (a) personal issues, (b) emotions, (c) opinions, and (d) family and friends issues depends on AR mask use.	*Partially Supported* (a) personal issues (b) emotions

Table 4. Hypotheses Supported/Rejected Table

5 STUDY 2: SIMULATING A REMOTE COUNSELING SESSION

Study validated that AR-aided counseling has the potential to increase the level of disclosure, particularly for individuals with PLDs. Based on these findings, we designed Study 2 as a qualitative study to primarily address RQ2. The aim of Study 2 was to create a more realistic counseling environment and explore the experiences and perceptions of AR-aided counseling. To achieve this, we conducted multiple counseling sessions and gathered data through pre- and post-counseling surveys and interviews with both the participants and the counselor.

5.1 Methodology

5.1.1 Recruitment

In order to recruit participants for Study 2, we used flyers posted on a South Korean university campus. Recruitment requirements included the desire to receive counseling remotely and a weekly availability of one hour for three weeks. We maintained the same participant selection criteria as in Study 1, as our primary research objective remains exploratory, focusing on evaluating the possibility of employing AR-aided counseling for remote counseling rather than assessing its medical effectiveness. These criteria were: (1) being open to receiving remote counseling, whether it is AR-aided or video-based; (2) not currently having or having been diagnosed with a mental health problem; and (3) feeling comfortable using AR technology (previously stated as not being reluctant to be in an AR environment). A total of 9 participants (7 female

and 2 male) between the ages of 21 to 26 were recruited from the end of July to mid-August 2020. Those who wanted to receive three remote counseling sessions (one per week) were asked to contact us for further information. While there were no age restrictions, the pool consisted of students in their 20s due to the fact that the recruitment took place on campus.

We recruited three counselors for the counseling sessions. Each counselor conducted sessions for 3 participants (selected at random). We also contacted the counselor from Study 1 as we thought it would benefit the study to recruit counselors familiar with remote counseling sessions with AR masks. However, we did not recruit the same participants from Study 1. Throughout the experiment, we also had discussions with the counselors in order to confirm and help our preparation of the questionnaire and interview questions. After the recruitment period, we thoroughly explained how the research would proceed. We then received consent forms from each participant due to the sensitive nature of the counseling sessions. While the participants were not asked about sensitive topics, the open-ended nature of the discussions and questions allowed a diverse range of issues to be, which made it necessary to obtain consent forms.

5.1.2 Procedure

For Study 2, the participants were randomly assigned to two conditions: AR mask, and no AR mask. Three were randomly assigned into the no AR filter group, and six to the AR filter group. Although we aimed to see the effects of AR masks, we still designed the experiment in such a way as to compare the mask and maskless groups. While the comparison cannot be generalized, we aimed to acquire a basic understanding of the differences between the two groups.

Those who were assigned AR masks had the option to select any mask of their choosing. Apple's Animojis were used for the animal AR masks and Memojis were used for the humanoid AR masks (Fig. 2)

Prior to the start of the experiment, we gathered participants' data with a survey that included 28 questions regarding their personal information, prior experience of counseling, and self-assessment of individual self-disclosure levels. Counselors were informed which participants would wear an AR mask and which would not. While most of the insights of the participant's progress, emotional, and mental states were assessed through the counseling sessions, we thought it pertinent to obtain pre-questionnaire data in order to examine their own perceptions of their levels of self-disclosure. As a result, we had two PHDs and one PLD in no AR filter group, and one PHD and four PLDs in AR filter group.

We asked the counselors to complete a survey regarding self-disclosure levels in order to better understand the participants' counseling experiences and compare any differences in self-disclosure levels from the first and last sessions between both groups. The counselors informed us that, in traditional psychological counseling sessions, self-disclosure levels are typically measured by the counselors, not the participants. For this study, we report the participants' results in order to provide a fuller picture of their experiences, while we analyze and report the counselors' results as primary findings.

5.1.3 During the counseling session

Participants took part in three 60-minute counseling sessions with 1 counselor each. The sessions were flexible and open-ended, meaning that the counselor was asked to enact the first three counseling sessions as they normally would with new participants. This gave participants the freedom to discuss any prevalent personal, relationship, familial, or job-related issues with the counselor. These sessions were recorded with permission from the participants, but we did not listen to them if they expressed their desire for privacy.

5.1.4 After the counseling session

After the first and the last counseling sessions, both the participants and counselors were asked to complete a survey on their perceived effectiveness of counseling. A combination of three measurement questionnaires (which were confirmed prior to the study by counselors) were used for the post-counseling surveys. We also recorded 15–20-minute post-counseling interviews with their permission. As self-disclosure levels are typically measured by professional counselors, we thus gathered post-counseling surveys from the counselors in order to analyze the effectiveness of the counseling and compare the self-disclosure levels (i.e., the participant's and counselor's perceptions). These surveys allowed both the participants and us to attain a more in-depth understanding of the participants' experiences during the sessions.

5.2 Results

We here present the qualitative findings from the surveys and interviews with the 12 participants (9 participants and 3 counselors). Our findings emerged from the main themes identified in the analysis.

To protect participants' anonymity, we refer to them as PARs for "participants with an AR mask" and PNOs for "participants with no AR masks," followed by a participant number. (e.g., PAR1, PNO1) Moreover, their disposition to self-disclosure level is provided after their participant number in parentheses (e.g., PAR1 (PHD)).

5.2.1 Overall, AR-aided counseling increased the level of self-disclosure for PLDs more than PHDs

The results of Study 1 were echoed in Study 2, which also showed that having an AR mask on during counseling sessions for visual anonymity (covering the face) helped increase the level of self-disclosure more for PLDs than for PhDs. In Study 2, participants found that AR-aided counseling was effective in increasing the level of anonymity and self-disclosure, particularly for PLDs. For PhDs, the AR-aided counseling was beneficial for different reasons, such as helping them immerse and focus more on the sessions, providing a high level of comfort. However, it is important to note that two out of the three PHD participants did not wear AR masks, which could have influenced the results as they did not experience counseling with the AR mask itself.

PNO3(PHD) shared her perspective on how the AR mask influenced her self-disclosure level. She stated, "I don't think covering my face itself helped with opening up more, but the fact that I did not need to think about how I looked helped me open up. Because there were less things to worry about."

PNO2(PHD) did not specifically mention the need to conceal his face with an AR mask in relation to opening up. However, he explained, "The fact that counseling was very low-effort as it was done at home at my convenient time allowed me to immerse in it much more. I wish to continue the sessions at least 15 times."

In contrast, PNO1 (PLD), who was the only PLD participant in the group, expressed a desire for an AR mask to be worn, especially when she was crying, as she felt embarrassed and uncomfortable and had the urge to hide her face. She further explained, "I wished an AR mask would be on, especially when I was crying because I felt very embarrassed and uncomfortable. I had the urge to hide my face. I think having a face concealed with an AR mask could have helped me be more open about myself."

These findings suggest that AR masks specifically influenced the self-disclosure level of PLDs, which is consistent with the results of Study 2. In the following sections, we provide further details on the results that emerged from the AR-aided counseling sessions.

5.2.2 AR masks provide a layer of anonymity

We observed that wearing an AR mask provided a sense of anonymity to the participants with a low disposition for self-disclosure. Indeed, numerous PLDs reported that having an AR mask to cover their faces was very helpful for disclosing more personal matters.

PAR12(PLD) stated "I felt more comfortable sharing about myself because she doesn't know who I am." Similarly, PAR9(PLD) shared that "With an AR mask covering my face, I was able to be much more honest and talk about deeper topics. I feel safer and more comfortable when I am anonymous." PAR10(PLD) added to this opinion by sharing that "I was able to talk much more in detail compared to other sessions I had in the past. I think it's because it was anonymous, and I felt safer to share things about myself." Moreover, PAR11(PLD) said that "I don't think I would have been able to share the things I shared if my face was showing and it was not anonymous, because I shared very personal things." Four out of seven PLDs with AR masks mentioned specifically how the masks' anonymity contributed to their sharing more about themselves during the sessions.

5.2.3 Increased level of anonymity with AR masks helps people feel more comfortable during counseling

We observed that a layer of anonymity highly influenced the level of comfort participants felt during the sessions. The word "comfortable" was repeatedly mentioned during the participant interviews, regardless of the presence of AR masks. The concept of comfort was frequently introduced in relation to the anonymity provided by AR masks.

Both groups emphasized finding video counseling to be highly convenient as it does not require readying oneself to go outside. Moreover, they reported that it provides a high level of comfort due to the ability to participate in sessions from comfortable surroundings. In particular, seven of the nine participants specifically expressed that having an AR mask provided more comfort due to their not having to worry about their visual presentation. PAR12(PLD) expressed that "I was in comfy clothes at home, just woken up, so I did not want to show my face. It was comfortable that I did not need to get ready and look good." PAR2 (PLD) also added that "I could talk comfortably because my face was not showing. I just felt more comfortable." Additionally, PAR11(PLD) stated that "The mask was used as a tool to cover my shyness and it helped me share more." Similarly, PAR12(PLD) stated that "It helped me to talk more freely and comfortably, since I did not need to worry about my facial expressions."

PAR13(PLD) shared a similar opinion that, without the mask, she would have been worrying about how her looks and that it would have felt like watching herself in a mirror. Interestingly, she also pointed out that, with her face covered, she did not have to consciously make facial expressions in order to be polite to the counselor. PAR9(PLD) also stated that "I did not need to worry about how my looks since the counselor could not see my face anyway. I did not even need to dress up, put makeup on, or look socially presentable."

From the analysis, we noticed that participants repeatedly mentioned how their comfort level increased due to the presence of AR masks covering their faces, which added a layer of anonymity. PLDs repeatedly cited how being anonymous with an AR mask helped them feel more comfortable and at ease during the counseling sessions.

5.2.4 AR masks help participants focus more on the counselors as long as the masks stay on

Compared to in-person counseling, remote counseling has been criticized for lacking a high level of immersion due to insufficient counselor–counselee connection and interaction as counselor-counselee connection plays a critical role in the outcome of remote counseling [94, 95, 96]. While we do not have sufficient data to conclude that AR-aided video

counseling is more (or equally) immersive than in-person counseling, we observed that AR masks certainly help participants stay focused during the counseling sessions as long as the masks do not accidentally disappear.

Participants using AR claimed that they were able to focus on the counselors and the session itself, while those who did not use them reported being occasionally distracted by their physical appearance and presentation. Participants with AR masks repeatedly expressed how relieving it was to not have to care about their facial expressions during the sessions, which consequently enabled them to engage in them more fully. Indeed, PAR9(PLD) stated that "I did not need to worry about how I appeared on camera, which was much more relieving than I thought it would be. I think it definitely helped me get fully immersed in the counseling."

PARs aside, a participant who did not wear an AR mask and had a high disposition for self-disclosure expressed how she would have preferred to wear an AR mask. PNO3(PHD) said that "I would prefer having an AR mask on because, during the counseling session, I was concerned about how I looked in the video, like maybe I have a double chin now, so I kept looking at my face, and it was a bit distracting." Similarly, PNO2(PHD) said that "I wish I had an AR filter on when I was crying. I felt embarrassed but also I just did not want to show that on camera. It would have been much better if my face would have been hidden. I would have been able to focus on the session more than worrying about how I look."

Although AR masks are beneficial in helping participants stay less distracted and more focused on the counseling, two participants with AR masks mentioned that it caused them discomfort and frustration when the masks accidentally came off. When participants touched their faces, the AR masks would disappear, which would catch them off guard. The participants' expressions feeling high levels of discomfort when their faces were unintentionally revealed. In order to avoid this, participants would have to intentionally keep their hands away from their face and move as little as possible. PAR8(PHD) said that "sometimes it was a bit frustrating because I had to make sure that the filter remained on my face. So I was trying to not touch my face." PAR12(PLD) added to this opinion by saying that "I really felt safe and comfortable when my face was hidden. But there were one or two occasions when the mask came off for a short second, which startled me. After that, I tried to stay still so it wouldn't come off."

5.2.5 Increased comfort level helps people be more honest, which leads to a higher level of self-disclosure

With AR masks covering participants' faces, participants found the counseling environment to be more comfortable and safer, which led to a higher level of self-disclosure. PAR11(PLD) said that "The fact that my face was hidden actually made me say certain things out loud, which was really unexpected but helpful. I just felt safe enough to do that." P13(PLD) stated that "I was initially really concerned about unconsciously making negative facial expressions but having the mask on really helped me feel safe in expressing myself because it wouldn't be shown." She also added that "Even after just the first session, I opened up much more than I thought I would, because of the mask."

Moreover, we collected a survey regarding self-disclosure levels to gain a fuller understanding of each participant's counseling experience, as well as to compare any differences in these levels from the first and last sessions between the mask and maskless groups. Every question was measured on a scale of 1 to 5, and we calculated the average results for the AR and no AR groups.

The participant survey results revealed a huge difference between the two groups for the questions related to expressing emotions (e.g., "I was able to express my emotions appropriately" and "I expressed my emotions thoroughly"). For the first question, the AR group's average score rose from 3.5 to 4.3, while the no AR group's score remained at 4.3. For the second question, the AR group's average score increased from 3.5 to 4.0, while the no AR group's score decreased from 4.0 to 3.7.

Moreover, for the questions related to disclosing personal information (e.g. "I disclosed personal information without intending to do so" and "I shared intimate and personal stories of myself without hesitation"), we observed a sizeable difference between both groups. For the first question, the AR group's score increased from 4.2 to 4.3, while the no AR group's score significantly decreased from 3.3 to 2.3—which, it should be noted, was already much lower than the AR group to begin with. For the second question, the AR group's score rose from 3.8 to 4.7, while the no AR group's score fell from 4.0 to 3.3. In general, the AR group disclosed their personal, intimate stories and information much more freely and easily over the three sessions than the no AR group.

We asked the counselors to complete a survey on the participants' self-disclosure levels. The resulting data also revealed significant differences between the AR and no AR groups. For the question "I feel that participants gained confidence in sharing their deep thoughts and emotions," the AR group's average score increased from 4.0 to 4.4, while the no AR group's score remained at 4.0. For "I feel that participants shared deep, personal stories about themselves during the session," the AR group's score increased from 3.7 to 4.4, while the no AR's score remained at 4.0. The counselors also answered the same questions as the participants regarding disclosing personal information without intending to do so, or unhesitatingly (see the above paragraph). The results were very much in accordance with those of the participants. For the first question, the AR group's score increased from 2.7 to 3.0, while the score decreased from 3.3 to 2.7 for the no AR group. For the latter question, the AR group's score rose from 3.2 to 4.2, while the no AR group's score increased slightly from 3.3 to 3.7.

From these sets of qualitative and quantitative data, we observed that AR masks in video counseling may lead to a higher level of self-disclosure in participants. AR masks preserve anonymity through covering the face, which provides participants with physical and emotional comfort, thus helping them to open up.

6   DISCUSSION

6.1   Visual anonymity provided by AR masks presentation

The qualitative results from Study 2 highlight the potential benefits of visual anonymity provided by AR masks, especially for those who are self-conscious about how their physical appearance. PLDs felt less self-conscious about their appearance due to the anonymity provided by the AR masks because the AR masks. Moreover, PLDs in the PAR group expressed that they felt more comfortable self-disclosing personal topics. For example, several participants revealed that the AR masks reduced the burden of looking presentable because they did not have to constantly worry about having to make socially appropriate facial expressions when responding to counselors. These results are particularly interesting as they show that the visual anonymity provided by AR masks can reduce unnecessary discomfort in counselees, which can improve the perceived quality of counseling sessions. Unlike face-to-face counseling (where a counselee's entire body is visible), most attention in video counseling is focused specifically on the face. During video calls, both counselees and counselor may exert greater mental effort in trying to control their behavior and pay attention to each other's reactions while being acutely aware of their own appearance. Compared to video counseling, AR-aided remote counseling can minimize the mirror effect, which increases self-awareness due to one having to look at one's own on-screen image. This can cause self-consciousness in those worried about how they are viewed, which is why AR masks could benefit those uncomfortable at seeing their own reflection on the screen.

6.2 Remote counseling using AR masks can be an alternative to face-to-face counseling, as well as to such other forms as video and teletherapy counseling

The results from Studies 1 and 2 lead us to conclude that remote counseling using AR masks can be an alternative method of counseling to other forms (e.g., face-to-face or video counseling), especially for those with a low disposition for self-disclosure and experiencing increased barriers to counseling. When participants were asked to share their overall experience of the counseling, they all expressed wishing to continue to receive sessions after the experiment and that they had experienced unexpected changes from the counseling. Regardless of certain negative aspects participants emphasized regarding counseling, all participants stated that they found the sessions to be helpful in some form. In describing how they felt after each counseling session, participants most commonly used words such as "helpful," "feeling better," "feeling supported," "feeling relieved," and "feeling more confident."

In Study 2, we analyzed video counseling sessions which incorporated AR mask technology in order to examine whether this facilitated more fruitful counseling sessions. Participants in the AR mask group commented that the visual anonymity and comfort the masks provided increased the overall satisfaction with the sessions. They also mentioned that they were able to self-disclose more personal details, which can be partially attributed to both visual anonymity and comfort. Those with low dispositions for self-disclosure may benefit from the anonymity, focus, and comfort that AR masks provide. Furthermore, in AR-aided counseling, non-verbal cues, such as hand gestures or body posture, can be detected while counselees' anonymity is preserved.

6.3 AR mask-mediated counseling can be a privacy enhancing tool, but it is important to ensure that particpants feel safe on the digital platform

Last, but by no means least, we emphasize the importance of establishing strict safety measures for video-mediated counseling, regardless of the presence of AR masks. We found that AR masks served as a privacy enhancing tool for most of the participants, especially those with lower dispositions for self-disclosure. We observed that AR masks protected participant's privacy, and increased their levels of comfort and security, thus leading them to disclose more personal and intimate information.

However, three participants pointed out that, in the absence of such a service, they would prefer to choose the counselor themselves prior to the session. PNO2(PHD) stated that "I would like to know about the counselor before the session." PAR12(PLD) added that "I would not want to be assigned to a random counselor. I would like to have the option to choose." PAR13(PLD) more specifically expressed her preference that she would like to have information regarding the counselor's expertise, gender, and background in advance. For the experiment, the counselors were randomly chosen, but we agree that it could benefit counselees to have both access to prior information and the freedom to choose the counselor. Since the counseling takes place on an remote platform, it is critical to have strict safety measures so as to protect the sensitivity of the information disclosed and help both parties feel more at ease. These safety measures may include an alert system for any recording in progress to avoid any privacy violations.

6.4 Differences between counselors' evaluations on the participants' self-disclosure levels and the participants' own evaluations

In both the first and second experiments, our core focus was on the self-disclosure level. Unlike in the first, the second experiment gathered surveys from both participants and counselors regarding self-disclosure levels. We asked the participants to complete a survey examining their own level of self-disclosure after the first and last sessions. We asked the counselors to complete a survey on their opinions of participants' self-disclosure. It is critical to note that the

participants' own perceived self-disclosure levels were not obtained for a clinical analysis, but instead only to explore the differences between their perceptions and those of the counselors.

We identified a clear gap between the counselors' evaluations and the participants' own perceptions. For most of the questions regarding self-disclosure level, participants evaluated their own level to be slightly lower than the counselors' did. For instance, such questions as "I feel more confident in sharing my deep thoughts" or "I opened myself up much more through counseling sessions" allowed us to determine that the counselors' scores were higher than those of the participants. We evaluated the counselors' scores to draw conclusions regarding self-disclosure level, but we observed a deeply interesting aspect that participants' own perceived self-disclosure levels can have different definitions, scores, and meanings than those of the counselors'. Moreover, regarding the responses to the quality of the counseling, we examined a sizeable difference between the counselors and participants' scores. For example, for "I feel like the counseling has given me appropriate solutions for my on-going problems," the participants again scored themselves lower than the counselor's did. When participants were asked to share their overall experience of the counseling, they all expressed their desire to continue the sessions post-experiment and that they had experienced unexpected changes from the counseling.

7 DESIGN IMPLICATIONS

In this section, we present the design implications that should be taken into consideration when designing and developing an AR-aided counseling service in real-world settings. These implications are derived from the concerns and insights that emerged from the study results.

Unintentional disappearance of AR masks: A screen that promptly pauses or obstructs the display to ensure anonymity.

As reported in Study 2, participants often felt a sense of discomfort when the AR mask suddenly disappeared. For example, both PAR10(PLD) and PAR11(PLD) expressed their frustration regarding thus and emphasized that the counseling would have been much smoother without these technical issues. Participants mentioned feeling anxious when this occurred and thus tried to remain motionless so as to avoid the issue. One counselor reported that she would immediately avert her gaze when a participant's mask disappeared so as to reduce the associated anxiety.

Considering how such technical failure affects the counseling and participants' comfort levels, we strongly recommend that alternatives should be provided to protect counselees' anonymity amid system failures. For example, a functionality that immediately blocks the screen with a black screen or pauses the screen when an AR mask is taken off from the counselee's face would be necessary in guaranteeing their anonymity and helping both the counselee and counselor fully focus on their conversation.

Unstable internet connections: Implementation of a pre-session internet connectivity checking system for remote counseling.

Several participants also mentioned the PNO1(PLD) mentioned that she experienced issues of unstable Wi-Fi connection. She mentioned that it interrupted the counseling and she found it difficult to re-engage. Moreover, PNO2(PHD) also mentioned that it was very difficult to re-immerse himself after being disturbed by poor internet connectivity.

Based on our observations and analyses, technical errors are extremely critical as they impact counselor–counselee interaction. In face-to-face sessions, counselors and counselee have a safe, secure physical space (typically a counselor's

office), designed to be free from interruption. Since remote counseling takes place in a virtual space, it is highly important to ensure that the session will not be interrupted by technical errors such as internet connectivity. Even minor technical failures can negatively affect the counseling session and cause counselee to easily lose focus.

In order to avoid such situations, we suggest the implementation of a pre-session internet connectivity checking system prior to commencing counseling sessions. For instance, the platform could perform a brief assessment of internet stability, providing both counselees and counselors with information regarding the quality of their internet connection. If the connection is deemed poor, the system can offer suggestions such as "poor connection: please move closer to the router" or provide relevant advice to the user.

Unfamiliarity with AR-aided counseling: Option to explore AR filters prior to joining the session.

During initial counseling sessions, four PARs expressed being distracted by observing how AR filters worked on their faces beginning of the very first counseling session. PAR13 mentioned, "It was fun to see how the AR filter expressed my emotions. I got used to it quickly, but I kept looking at how it translated my expressions at first." Other PARs shared similar views, stating that AR filters were initially captivating and caused a brief distraction in the first session.

Given that AR-aided counseling may be unfamiliar to many people, we recommend the implementation of an AR tutorial call or session where individuals can experiment with AR filters on their faces before their counseling sessions. For instance, similar to Zoom calls, it would be highly beneficial if the platform allows counselees to preview themselves with the masks on prior to joining the call, enabling them to test the functionality before the actual session begins.

Lack of freedom in counselor selection: Offering the choice to select a preferred counselor

In line with section 6.3, it is important for AR-aided counseling services to provide counselees with the option to choose their own counselor, akin to the practice in traditional in-person counseling. As highlighted earlier, several participants expressed a specific desire to have the ability to select a counselor rather than being assigned randomly. To ensure counselees feel secure and comfortable, it is recommended to provide them with pertinent information about the counselors, such as their names, gender, and age range, prior to the session. Many individuals have preferences regarding their counselor, including factors like gender, age, or sexuality [128]. Hence, extending the freedom of choice in AR-aided counseling is necessary.

Importance of ethical considerations: Maintaining trust through confidentiality and privacy assurance

In the context of AR-aided counseling, it is imperative to address various ethical considerations to establish counseling sessions that are ethically safe and secure. Typically, in-person counseling sessions take place within the secure and private environment of a counselor's office, without the involvement of third parties. However, in the case of remote AR-aided platforms, the platform itself acts as a third party. Consequently, it is crucial to implement robust protocols that prioritize safety and privacy, ensuring the protection of session data, such as session dates and durations.

Furthermore, it is essential for the service to assure both counselees and counselors that their sessions will neither be recorded nor stored for any purposes. This commitment to confidentiality is paramount in upholding the privacy and trust within the counseling session. By implementing a safe and private protocol, the AR-aided counseling platform can uphold ethical standards and reinforce user confidence in the security and confidentiality of their counseling sessions.

Additionally, we highly recommend implementing strong authentication measures to ensure the security of AR-aided counseling sessions. For example, a secure login procedure is needed to allow only authorized individuals to access any data and use the service. However, it is important to ensure that these measures do not create burdensome procedures that

lower the accessibility of the service, as accessibility is crucial in providing mental health treatment without unnecessary barriers.

8 LIMITATIONS AND FUTURE WORKS

The approach and models investigated herein have certain limitations. First, for Study 1, we did not record the counseling sessions to completely ensure anonymity. Therefore, relying on post-counseling interviews and surveys made it difficult to determine the exact point at which participants began to disclose information about themselves. Tracking the exact timing of self-disclosure without invading the participants' privacy by listening to their sessions would help future researchers to understand the effects of AR more deeply on self-disclosure. For the second user study, we implemented a new system to track the self-disclosure level with more exact measures through post-surveys and interviews. Moreover, in case the surveys and interviews provided insufficient data to analyze, we recorded most of the sessions with the participants' permission on the condition that we would only listen to them if necessary.

While an important advantage of using the AR mask was the visual anonymity it provided, the masks did occasionally disappear, which caused the participants anxiety. For example, when a participant cried or briefly left the screen, the mask was unable to continue tracking them and so revealed their face. In such moments, the participants tended to feel more anxious and became disinclined to continue. This technical shortcoming calls for an improvement in future research. Furthermore, we would suggest increasing the sample size of the participants as well as the duration of the sessions for a more effective experiment. One counselor commented that the number of counseling sessions required to build rapport between counselor-counselee varies according to the individual and that AR masks should only be used until the counselee wants to progress beyond them. Our study included a total of 39 counselees participants and conducted 57 counseling sessions to explore the possibility of AR-aided counseling as an alternative method for remote counseling. However, for future studies of implementing such tool in reality, a bigger sample size would be recommended. Lastly, all counselors mentioned that AR masks could be more effective if they were to be fine-tuned to catch micro-muscle movements and if they could continue to cover the face without disappearing. These limitations suggest new directions by shedding light on potential improvements for later studies. For future research, we aim to implement our findings into creating a prototype for a platform which aids counseling that uses AR technology that detects micro-muscle movements with minimal technical errors.

9 CONCLUSION

Our research explores the potential of using AR-aided counseling as an alternative approach to remote counseling. Specifically, we focus on utilizing AR masks in video-based sessions to maintain counselees' anonymity while also enhancing the interaction between counselors and counselees through the detection of non-verbal cues. We investigate the impact of AR-aided counseling on self-disclosure levels quantitatively (Study 1) and explore experiences and perceptions qualitatively (Study 2).

In our study, involving 57 counseling sessions with 39 counselees and 4 counselors, we found that individuals with low self-disclosure tendencies tend to disclose more personal information when using AR masks. Conversely, for those with high self-disclosure tendencies, the masks had a smaller or negative effect on self-disclosure. Study 2 further revealed that AR-aided counseling is effective for individuals with a low disposition for self-disclosure, as it promotes anonymity and facilitates self-disclosure. For individuals with a high disposition for self-disclosure, the use of AR masks enhances immersiveness and focus by concealing the face.

In conclusion, our research highlights the potential of AR-aided counseling as a viable alternative for remote counseling, particularly for individuals with a low disposition for self-disclosure. The anonymity provided by the AR masks promotes higher levels of self-disclosure and facilitates a greater level of interaction between counselors and counselees. By reducing the psychological barriers associated with opening up, we hope that this tool can support many people who have a tendency for low levels of disclosure, encouraging them to seek the support they need.

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APPENDIX A

Terms	Definitions
Psychotherapy	Psychotherapy is a high-level term used to describe psychological therapy. In this context, counseling is considered a part of psychotherapy.
Counseling	A professional licensed psychologist provides counseling sessions, and the term "counseling" is used instead of therapy to avoid implying specific techniques.
Counselor	(1) A professionally licensed psychologist who provides counseling sessions (we are avoiding the term "doctor" or "psychiatrist" to avoid medical connotations as this study is not conducted in a medical setting). (2) In the context of Study 1 and Study 2, a counselor refers to professionally licensed psychologists who were recruited as counselor-participants in the studies.
Counselee	An individual who undergoes counseling treatment (we are avoiding the terms "patient" or "client" in the context of counseling to avoid medical connotations, as this study is not conducted in a medical setting. However, the term "patient" is used a few times when referring to medical conditions and treatment).
Participant	The term "participant" explicitly refers to the counselees recruited for the studies, and the terms "client" or "patient" are avoided as these studies are not conducted in a medical setting.
Participant with Low Disposition to Self-disclosure (PLD)	Participants in the study who scored "low" for predisposition to self-disclosure
Participant with High Disposition to Self-disclosure (PLD)	Participants in the study who scored "high" for predisposition to self-disclosure
Participant with an AR mask (PAR)	Participants who wore an AR mask during the counseling session in the Study 2
Participant with NO AR mask (PNO)	Participants who did not wear an AR mask during the counseling session in the Study 2

Terminology Table: Frequently Used Terminology

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