Conversational Agents to Support Teenage Emotions

- A Study on Machine Properties -

청소년들의 정서적 안정을 위한 대화형 에이전트

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- A Study on Machine Properties -

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Abstract

As mental health loses its stigma more teenagers than ever are admitting that they have trouble managing their stress. There have been attempts to solve this problem through technological methods, using conversational agents (CAs); however, these efforts have generally been confined to making CAs as human as possible. This heavy use of anthropomorphism, although effective to some degree, has led researchers to overlook the inherent characteristics of CAs, namely, their machine properties. Due to this shortsightedness, there has been insufficient literature exploring the role of machine properties in the communication between teenagers and CAs, and how the interaction unfolds. This paper aims to investigate how machine properties are important in the CAs designed to support teenagers emotionally and to develop CAs with user-centered design methods to understand the interaction between teenagers and CAs.

This paper discusses two consecutive studies which were undertaken to achieve its aims. First, a study on user needs was conducted with 20 teenagers to understand their expectations of CAs. After in-depth interviews, it was discovered that they were willing to accept consolation and advice from CAs because they expected them to be "good listeners," keep their secrets, and provide data-based, proven information.

Next, a participatory design study was conducted at a workshop attended by 24 teenagers. Through role-playing, participants

volunteered suggestions about what they would plausibly say to CAs and what responses would be comforting or helpful. By analyzing their expressions, it was found that teenagers expressed their emotions according to particular intents they had in mind. Moreover, they expected the role of machine properties in the responses of CAs. Finally, teenagers wanted CAs that spoke casually, encouraged them to explore their emotions, and empathized with them.

This study contributes to existing literature in that it explores the potential of CAs in the mental health domain from a different perspective and investigates the dialogues teenagers developed through participatory design.

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Chapter 1. Introduction

1. Study Background

Teenage stress is increasing, leading to hazardous effects on teenagers. High school students in South Korea suffer from a highly competitive environment for entering prestigious universities (Moon, 2006). The amount of sleep they get at night is lower than ever (Park, 2015). Because of this, the level of stress teenagers experience is higher than any other age groups in Korea (Korean Statistics, 2018). Besides academic stress, factors such as peer relationship, boyfriend/girlfriend, and family issues also contribute to stress among teenagers. Many studies point out that the high level of stress among teens results in severe physical and mental problems, with some going as far as dropping out of high school and even suicidal ideation (Park, 2011). Furthermore, the level of stress likely leads to difficulty in emotion regulation, which results in many psychological and physical problems (Moon, 2008). Accordingly, dealing with teenagers' stress levels and emotional well-being seems more crucial than ever.

In order to address this growing issue, there have been efforts both commercially and academically to handle the issue of teenage mental health through technology, some utilizing conversational agents (CAs). Many studies have sought to manage mental well-being of adolescents and young adults through technological interventions (Lee et al., 2018; O'Leary et al., 2018). In this respect, CAs have emerged as a means to mitigate stress and improve mental well-being. That the

CAs can resolve isolation of clients suffering from depression and lethargy, the ability to respond immediately to problems (Elmastri et al., 2016), and convenience of the interaction (Jennifer, 2017) have been reported as features of CAs that enabled them to support emotional well-being of humans. Studies have demonstrated that such agents can actually succeed in improving the mental health of patients with quantitative evaluation. For example, Fitzpatrick et al. (2014) created a chatbot named 'Woebot' to emotionally support depressed students, finding that the symptoms of depression were significantly lowered after two weeks of interaction with Woebot.

However, the majority of studies on CAs have focused on anthropomorphic qualities. They argue that making machines more similar to humans would increase empathy and trust between human and the machine (Kopp et al., 2015; Venkatesh et al., 2017). For example, social robots have often been designed to make human-like movements such as waving hands or nodding (Rajan et al., 2001). Researchers also have attempted to integrate a sense of humor into chatbots to generate feelings of empathy and likability from users (Fitzpatrick, 2014). This drive for anthropomorphism has led researchers to focus relatively less on the innate qualities, or "machine properties," of CAs.

While anthropomorphic qualities remain an important issue for CAs, machine properties should also be considered, given that they are the qualities that define machines and, therefore, cannot be separated from CAs. In fact, there have been studies that try to show

how machine properties may prove useful in addressing teenage emotional stability without directly using the concept of machine properties. For example, a study demonstrated that humans talk differently to machines compared to humans because of their innate qualities (Venkatesh et al., 2017). Especially teenagers, due to their high level of technological literacy (Braun, 2007), may have different needs and intentions from those of adults when it comes to conversation with CAs.

As such, exploration of how machine properties aid in the emotional conversation between teenagers and CAs is necessary. Despite recent studies on machine properties (Shechtman et al., 2003; Venkatesh et al., 2017) problems remain in that these studies have failed to empirically analyze how machine properties of CAs can impact teenagers' emotions. Even more, these studies have not extended their studies to developing the agents based on the needs of the users themselves. Since correct utterance data of the future can be drawn from the current users, a participatory workshop to design such CAs is necessary. The utterance and the responses they make can give hints to what kind of agents they try to build and the role of machine properties along the design process.

2. Purpose of Research

Therefore, this paper aims to investigate how and why machine properties of CAs can tend to teenage emotions by allowing users to develop CAs that handle emotional needs. To do so, this study

explores the initial needs of teenagers towards CAs, as in what they would want from CAs and why. Then, this study investigates how CA prototypes should be built for communicating emotions through a user-centered participatory workshop and analyze the utterances and responses teenagers provide to CAs to derive their actual needs towards them.

3. Research Contents

In order to achieve the research objectives as above, a two-day participatory workshop was conducted with 20 teenagers in order to understand the needs of adolescents towards CAs. Then, another workshop was conducted to explore the types of dialogue and the dialogue mechanism teenagers would like to have with CAs regarding emotions through role-playing. Through this user-centered approach, insights on the design strategies for building prototypes were gathered.

This study contributes to the HCI field in three aspects. First, in a scholarly sense, it explores the potential of CAs and their machine properties in a mental health domain, an area not yet explored by many scholars. Next, in a social sense, this study helps to solve the imminent problem through an unconventional and innovative method using artificial intelligence. Finally, in a convergence sense, this study tries to solve a problem initially based on a clinical psychological area through engineering science, adopting knowledge from the psychological domain in the process.

Chapter 2. Related Works

Cases of utilization of conversational agents in the mental health domain are appearing in the medical and the HCI field. This section illustrates the prevalence of adolescent stress in Korea, technological methods used to solve the issue, conversational agents and their machine properties, and emotion-focused therapy, which is used as a therapeutic method for CA dialogue in this study.

1. Mental Health Issues of Korean Teenagers and Proposed Technological Solutions

Many researches have sought to identify the underlying causes of teenage stress. This section is an overview of such studies and examines what kind of studies have tried to solve the issue using technological methods.

1.1. Stressors of Korean Teenagers and their consequences

There is a large body of papers and articles on the hardship that teenagers of South Korea face and academic stress stands out as the foremost cause for stress among many others. Due to the social perception that high school students ought to pursue their academic careers in college (Choi et al., 2011), the competition among the students is severe. This leads students to spend extra time in cram schools almost every day (Cho, 2014). More than 70% of teenagers go

to at least one cram school a week, which increases with their family's socio-economic status (Cho, 2014). This amount of incessant studying naturally ends up in the students' stress piling up, leading the academic stress to become one of the major factors of teen stress in Korea (Lee et al., 2000).

Beyond the academic sphere, students also encounter stress from other factors such as family or peer relationships (Yoo et al., 2004). Lee et al. (2011) revealed how stress stemming from dysfunctional communication between teenagers and their parents affected suicidal ideation through depression. Ah et al. (2010) also showed that family conflict was an inducting factor for internet addiction of teenagers, which is correlated with mental and physical problems such as offensiveness and depression.

1.2. The importance of emotional support from families and friends and its deficiency among teenagers

There have been extensive researches on the positive effect of emotional support from families and friends. A study examined how emotional stability can be gained through talking about the stress they face to people in close social relationships such as family or friends (Macgeorge et al., 2005). Emotional support from families has a positive effect on promoting healthy behaviors of adolescents (Kim et al., 2014). Maternal emotional support is also important in improving the achievement motivations of adolescents (Koo et al., 2009).

Despite the importance of emotional support and emotional communication, teenagers in South Korea usually lack someone they can talk to about it. Due to teenagers' desire to be independent of their parents, lack of time spent at home stemming from the amount of studying outside (Oh et al., 2008), and "self-concealment," as in hiding their true feelings to family or friends (Komiya et al., 2000), teenagers in South Korea are not receiving sufficient emotional support. They also spend so much time at school that they lack the time at home to talk with their family members (Oh et al., 2008), which also contributes to their lack of social support. This deficiency in emotional support suggests that adolescents may benefit from talking to machines about their emotional problems, rather than having no one beside them to do so.

1.3. Technological solution to the mental health problems

A growing number of studies have sought to mitigate such mental health problems through technology. O'Leary et al. (2018) designed an online chat system that utilized effective forms of talk therapy to reduce anxiety in students. The result was that the anxiety levels decreased significantly from pre-test to post-test.
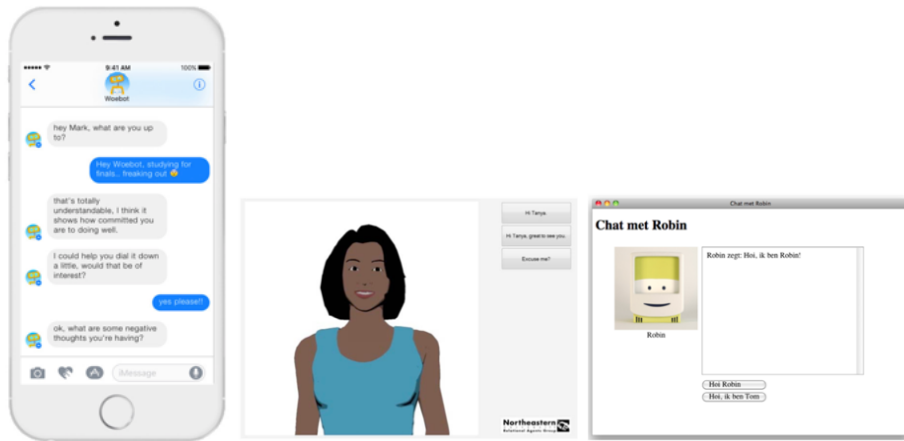
Figure 1. CAs for mental health

Studies utilizing CAs as a medium for lessening stress factors and depression levels have also appeared. For example, Woebot serves to mitigate students' stress and depression levels through regular check-ups and playful dialogues (Fitzpatrick, 2014). Moreover, Bickmore et al. (2005) developed a CA named Lisa to have dialogues with the elderly for a month. The researchers found that after a month, the level of loneliness decreased, and the level of positive affect increased among the participants. Zwann et al. (2010) also created a CA in the computer to provide social support for children who have suffered cyberbullying and it turned out to be able to provide a limited amount of social support. Figure 1 depicts the actual CAs in their usage. As can be seen from the figure, these agents are limited in that they are chat-based, not voice-based, to prevent system errors and resulted in an unnatural experience. Also, the conversation is mostly option-based and therefore do not allow for free and natural dialogue of users. Many other studies involving CAs have focused on increasing their human imitation, such as waving of hands (Rajan et al, 2001), a

sense of humor (Augello et al., 2011) or different facial expressions. The benefits of having a natural conversation with machines stemming from their machine properties have certainly been overlooked.

2. Conversational Agents and Machine Properties

2.1 CASA Paradigm and Human-Machine Relationship

CASA paradigm refers to the characteristic of people to respond to machines as though they are human, despite knowing that they are actually machines (Nass et al., 1994). Due to this characteristic, people input personalities into computers and machines (Nass et al., 1995) and even ascribe norms of politeness to them (Nass et al., 1999). This has even extended to other areas such as trust (Lee et al., 2010), humor (Nijholt, 2007), and education (Veletsianos et al., 2014) to investigate how human-computer communication can be reinforced through humans' perception of computers as social actors.

This paradigm led researchers to delve into two aspects of relationship towards machines. The first perspective is that because people respond to computers in the same way as humans, anthropomorphism is crucial in developing the relationship between humans and machines. Cassel and Bickmore (2000) suggested that anthropomorphism can increase the trust level towards computer agents. Anthropomorphic cues can drive people to treat computers as social actors. These cues include using language, having its own voice, a face, emotion manifestation, interactivity, and even human gesture (Nass, 2004). Empirical studies have followed to validate this claim

and show how human-likeness of agents influence the beliefs and emotions towards CAs (Nass et al., 1999; Numnamaker et al., 2011).

However, another perspective that challenges this view is human-machine perspective of HCI. The literature surrounding this perspective, mainly automation bias, suggests that although humans are deemed imperfect, machines are not so. People believe that machines are superior to humans in terms of rationality, reliability, and objectivity (Mosier & Stitka, 1996). Empirical studies have shown how people perceive computational systems as more skillful in performing specific tasks (Stitka et al., 1999). This perception leads to higher trust level in the decision aids of computers, as shown by Dzindolet et al. (2003). Thus, the related literature of this view suggests that the trust level and the relationship between humans and computers are influenced by their perception about the expertise and perception of computers. They posit that specific concentration of tasks and perfection constitute the value of machines and also that anthropomorphism can rather be detrimental in the relationship because it signals the imperfection of humans instead of preciseness of algorithms. This stream of literature sets the groundwork for this paper. Although the past works have focused mostly on completion of tasks, this paper focuses on the emotional side of machines.

2.2 CASA Paradigm and Conversational Agents

The CASA paradigm extended from mere computers towards conversational agents because the agents' outward appearance,

language, attitudes and behaviors resemble that of humans (Nass et al., 2000). Due to their proximity to humans, CAs and ECAs (embodied conversational agents) were widely studied to explore whether agents that resemble humans would also increase the perception of them as social beings. Nass et al. (2000) discovered that people are more likely to engage with "beautiful agents" than those that are not. They were more convincing and obtained greater compliance from the users.

Moreover, as the technology has currently moved towards voice assistants, studies on the relationship between machine-generated voice model and CASA paradigm have appeared. These studies indicate that people's perception towards machine-generated voice differs according to its human-like traits. For instance, people felt more social presence with a voice that seems similar to their own or extroverted type of voice rather than that was not similar or introverted (Lee et al., 2005). Partala et al. (2004) explored how an anthropomorphic agent was able to influence affective experiences such as intimacy and arousal. This trend has led researchers to view CAs as those that need anthropomorphic qualities in order to obtain the perception of social beings. This study, however, tries to argue that anthropomorphic qualities are not the sole important factors when the agents are used by teenagers to support their emotional needs.

2.3 Conversational Agents and Anthropomorphic Qualities

A conversational agent is a bot system that utilizes text-to-speech and/or chat interfaces (chatbots) (Portela et al., 2017). With the recent

proliferation of artificial intelligence based on machine learning (Lee et al., 2017), the utilization of CAs is spreading widely to various sectors, such as museum guides (Kopp et al., 2005), healthcare assistants (Nguyen et al., 2007), and mental health interventions (Lee et al., 2017). However, there is no general agreement on how a CA should be designed, with mainly two approaches toward the issue. Some studies focus on producing a dialogue as close to human as possible. The idea behind this anthropomorphism in creating CAs is that being human-like give rise to positive emotions within users. These studies argue that human-like behaviors (e.g., social robots waving hands, a sense of humor in chatbots) have been observed to increase trust, perceived intelligence, and likability. Another branch of HCI research suggests that CAs being human-like is not necessarily the main purpose (Huber et al., 2018). They target a more specific kind of goal, such as creating rapport (Jonathan et al., 2007), trust (Bickmore et al., 2001), or being informative (Marilyn et al., 1997).

Up to these days, many studies on CAs have focused on their anthropomorphic qualities. In the context of the conversation, researchers sought to make the conversation of CAs as human-like as possible. Sloman (1999) evaluated his prototype based on the criteria of "how human-like the agents are." Rajan et al. (2001) also developed CAs that included human-like gestures and facial expressions. CAs inside robots have also endeavored become more like humans. Moubayed (2013) built a CA with a face and neck that resemble those of humans.

2.4 Conversational Agents and Machine Properties

Despite such trend, some recent works have briefly touched on the benefits of conversation with machines by recognizing their machine properties, but none has addressed the role of machine properties directly, nor have they considered them in the lights of emotional interaction between CAs and teenagers. Studies have pointed out that the conversation with machines is much more efficient compared to with humans in that it takes less effort and time (Shechtman et al., 2003). It is also beneficial emotionally because the conversation with humans can evoke negative emotions, whereas that with machines cannot (Shechtman et al., 2003). Venkatesh asserted that conversations with a socialbot can be different from those with humans in that there is a lack of fear of affecting the relationship with machines (Venkatesh et al., 2017). It is also suggested that after a user builds trust with a system, the user requests opinions from conversation bots, indicating a need for companionship (Venkatesh et al., 2017). However, a gap exists in the current literature in that they have overlooked the relationship between machine properties and emotional support of CAs. Therefore, this study aims to fill this gap.

3. Emotion-Focused Therapy

The psychological tool that this study involves designing CA to emotionally support teenagers is emotion-focused therapy (EFT). EFT is a type of therapy used to help people become aware of their

emotions and transform negative emotions into positive ones. This therapy was adopted in this study for two reasons. First, as the past related works demonstrate, it is important for the adolescents to understand their emotions and release them in order to lessen their stress. Next, because this study deals with CAs, it is necessary to have a therapy that involves a particular set of dialogues. Whereas other talk therapies are much dependent on the clinicians, emotion-focused therapy is relatively less dependent on the discretion of the humans, thereby allowing the conversation for emotion to be possible.

3.1 Two phases of Emotion-Focused Therapy

Emotion-Focused Therapy (EFT) is a psychological therapy technique developed by the psychologist L.S. Greenberg (Greenberg, 2004). Therapists who practice EFT are called emotion coaches, who help people become aware, accept, and clarify their emotional experience through conversations. Emotion coaching entails two phases: arriving and leaving.

The first phase, arriving, is dedicated to being aware of one's emotion. People are encouraged to describe in words their feelings and the situation that caused such emotions. People need to accept and be aware of their emotions in order to solve them. The important point in the arriving stage is to recognize their primary feelings, the emotion that they feel strongest, in certain events. The arriving stage is important because EFT therapists believe that emotions can only leave the body after recognizing and accepting them.

The second phase, leaving, focuses on utilization or transformation of emotions after both the coach and the person evaluate together whether those emotions are healthy or unhealthy. If a certain emotion is healthy, it can be utilized as a guide to action. Emotion transformation involves converting the maladaptive and unhealthy emotions into positive and healthy ones. A variety of strategies are suggested from the literature, such as a shift in attention, positive imagery, or the coach expressing the anger or sadness the person is unable to express.

This paper utilizes some of the key concepts from EFT such as arriving and leaving. Mainly, the prototypes serve to accept and become aware of the teenagers' emotion and then transform negative emotion into positive ones through ventilation. The prototypes also incorporate transformation strategies to provide emotional support for teenagers.

3.2. Clinical usage of Emotion-Focused Therapy

EFT has been used widely in the clinical psychology field as a means to improve emotional state of clients, such as romantic couples, families, and teenagers. Foroughe (2018) conducted a study where parents of children and adolescents with mental health issues completed an EFT intervention program. After the intervention, the children and adolescents experienced recovery from symptoms. Karaminezhad (2017) discovered that EFT has a significant influence on emotion regulation of adolescents suffering from love trauma.

Studies point out that this therapy is especially important for teenagers. Teenagers are emotionally unstable and immature, which necessitates a full understanding of their own emotions. Since EFT centers on the awareness and regulation of emotions, teenagers will benefit from being involved in such a therapeutic process.

Chapter 3. Research Questions

This section illustrates the research questions derived to solve the problem of adolescents. From the research background and the related works, further research on the machine properties of CAs and how they can serve to promote the mental health of adolescents is necessary.

Therefore, this paper aims to examine the role of machine properties on the interaction between teenagers and CAs and discover how teenagers want to add such characteristics in the CA design. The research questions designed to address this goal are as follows.

1. What are the machine properties that stimulate the emotional needs of teenagers towards CAs?

    1-1. How are the needs of teenagers towards CAs divided into different categories?

    1-2. How do teenagers expect machine properties to tend to the emotional needs of teenagers?

2. How should conversational agents for emotional conversations be designed?

    2-1. What are the dialogues and intents of teenagers when discussing emotions with conversational agents?

    2-2. What are the strategies teenagers use when designing conversational agents that respond to emotional needs?

2-3. What are the responses of conversational agents that teenagers expect to receive from them?

Chapter 4. Research Methodology

This section illustrates the research methodology utilized in this study. As in Figure 2, this study is composed of two main parts.
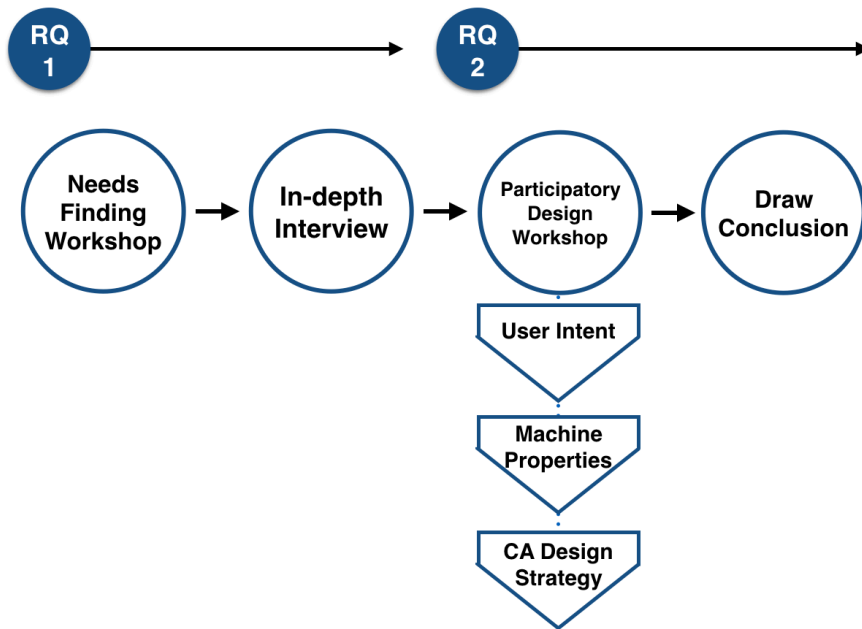
Figure 2. Research Methodology Diagram

The first phase is about understanding the needs of adolescents towards CAs and how machine properties are related to the needs. This phase includes a workshop with adolescents and in-depth interviews following the workshop. The findings from this phase provide the answer to the first research question.

The second phase is about understanding how to design CAs that can support the emotional needs of teenagers. This phase is implemented with another workshop with teenagers. Users' utterances, their intents, and responses for the utterances were

gathered. The data were analyzed to provide findings for the utterance and response types, related machine properties and strategies for the dialogue design.

Chapter 5. Study 1- Teenager Needs Study

A teenager needs study was conducted under two objectives: (1) to find out what teenagers want and need from conversational agents, and (2) what kind of machine properties are important for them to have such needs. Mainly, this study is focusing on the expectations of teenagers towards CAs.

1. Participants

20 teenagers, aged between 16 to 18, participated in the workshop, and six of them participated in in-depth interviews. The 20 students were volunteers from the summer camp hosted by Advanced Institutes of Convergence Technology. They were all interested in HCI and AI technology.

Since the workshop was implemented over two days, ten students participated in the workshop on each day. The six participants for the interviews were volunteers from the workshop.

2. Methodology

A three-hour-long workshop was conducted over the course of two days to understand the types of interactions teenagers expected from CAs in a broad context. In the workshop, students had the chance to get familiar with the current technology of conversational agents through two steps. First, they were given the opportunity to talk to

different types of CAs such as Naver Clova, Apple Siri, and Samsung Bixby. Students were allowed to talk to different types of CAs for five minutes and figure out their functions, personalities, and strengths/weaknesses. This process was intended to limit the students' expectations of the CAs, so that they would not have unrealistic expectations.

Next, after becoming familiar with the CAs through conversations, they built a CA on their own, using IBM Watson API. This process was necessary for students to understand the back-end system of CAs in detail. (Figure 3)

Finally, students filled out a questionnaire that required them to come up with ten situations and describe how they would like the CA to help them in those situations. (Figure 4) The questionnaire process was necessary to openly gather the needs of teenagers towards CAs. Among the needs, it was necessary to find out what kind of emotional needs there were and by how much. All the answers were transcribed and used for the analysis.

Figure 3. Familiarization process with CAs

I want VUI to	
When I	

Write down what you would want VUI to do in certain situations. What do you need?

Figure 4. Understanding the situation and needs of teenagers

After the workshop, in-depth interviews with six participants were conducted to gain deeper insights into why and how machine properties of CAs can deal with the emotional needs of teenagers. Questions related to what kind of consoling and advice teenagers would want from CAs and why were incorporated in the interview. All the interviews were face-to-face except for one case due to the distance issue. The interviews were based on a semi-structured guideline and the questions are described in Table 1. Interviews took an average of an hour and were recorded under the participants' consent for further analysis.

1.	What kind of stress do you have these days?
2.	Who do you usually talk to when you have stress?
3.	What kind of stress would you like to talk about if you had the opportunity to share your stress with CAs? Why?
4.	What are some situations that would invite you to talk about stressful events with CAs?
5.	What would you like to say in those situations?
6.	How are CAs different from (the answer from Question 2)
7.	What are some functions that would be effective in doing so?
8.	What do you think about CAs? What do you think they are?
9.	Do you think machines have emotions?
10.	Do you think machines can read your emotions?

Table 1. In-depth interview questions for study 1

3. Analysis

The answers from the questionnaire and the interview transcripts were transcribed in Microsoft Excel for further analysis. A qualitative analysis was conducted through thematic analysis (Braun et al., 2006). The thematic analysis was conducted using Optimal Workshop Reframer. Reframer is used in qualitative analysis by highlighting and summarizing the relationship between themes that appear from interviews (Figure 5). The inter-rater reliability (Cohen's kappa) was 0.83.
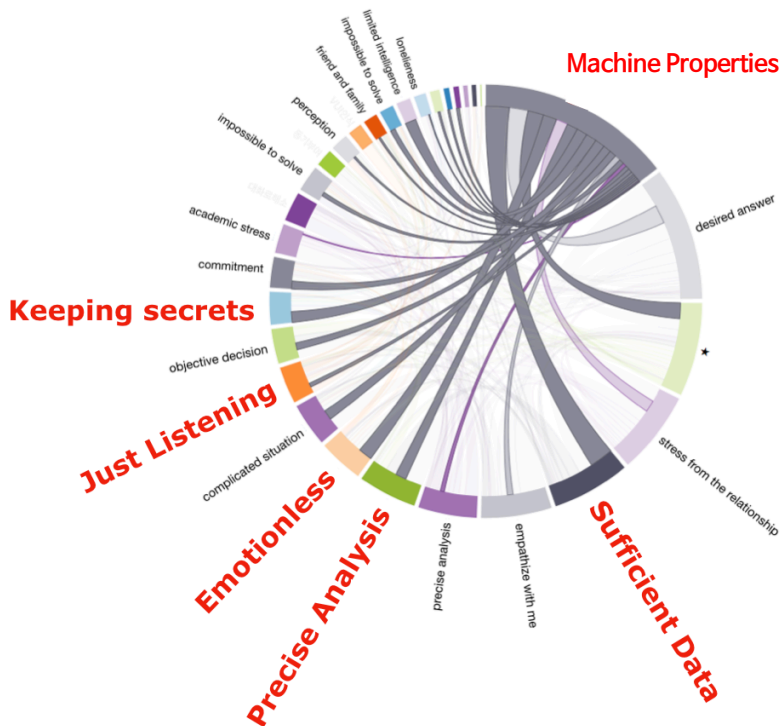
Figure 5. Optimal Workshop Reframer results

4. Findings

4.1 The needs of teenagers towards CAs

Needs	Category	Frequency	Percentage
Do this for me	Functional	30	20.5%
Be smarter	Characteristic	27	18.5%
Play with me	Emotional	21	14.4%
Help me	Emotional	18	12.3%
Counsel me	Emotional	15	10.3%
Inform me	Functional	13	8.9%
Guide me	Functional	9	6.2%
Recommend me	Functional	8	5.5%
Others	Others	5	3.4%
SUM		146	100.0%

Table 2. The categorized needs of teenagers towards CAs

The needs were categorized according to their needs and overall themes (Table 2). Functional needs covered approximately 41% of total needs. Emotional needs were 37%. Characteristic needs are those that teenagers want CA to understand their languages well or understand more than two commands at the same time. Since this was neither functional nor emotional, it was categorized as the characteristics of CAs.

It was surprising that the proportion of emotional needs were almost equal to that of functional needs, given that most smart speakers these days only focus on functional aspects. Rather than think of different functional aspects of CAs, teenagers wanted the console and emotional help from CAs. Examples of the mentioned

emotional needs are "consoling me when I'm in trouble," "helping me when I feel depressed," or "giving me advice when I need one." In order to discover the underlying reason behind these emotional needs and explore how machine properties play their role in such expectations, in-depth interviews were conducted with six participants. Three main findings from the interviews are as below.

4.2 The expectation of a good listener

Participants expected that machines could be a "good listener" because machines do not have real emotions. It was analyzed that these characteristics have three meanings. (1) Machines can listen continuously without being tired, (2) machines can listen without emotional transference, and (3) machines can respond actively to users while listening to their worries.

Firstly, participants pointed out that CAs do not have real feelings, which lead them to listen to anything teenagers say without complaining. This characteristic is a response to participants' emotional needs because they needed someone who could patiently listen to their thoughts and worries whenever they wanted to talk. The workshop showed that teenagers had expectations of CAs such as "I want them to just listen to me" or "I want them to empathize with me." What teenagers say didn't actually have to be negative, as even trivial matter was something they would like to tell CAs. Teens

believed that CAs could be good listeners because they are available anytime and anywhere.

Another aspect that makes CAs good listeners is that emotion cannot be transferred from a person to CAs because they do not have real emotions. Participants believed that they could be freed from the exhaustion of intimate relationships if CAs were encountered as listeners to their worries. They believed that they could be more open and candid towards them because they do not have to hide feelings to prevent from hurting their feelings. As this is often a problem with encountering humans, this was mentioned as a positive aspect of machines. For example, P03 reported in the interview, *"I'll, like, whine for no reason at all, and she (CA) can embrace all the negative feelings. Unlike my boyfriend, the CA would never break up with me."* This implies that the machine properties of having no actual emotions could help relieve the fatigue teenagers face from intimate relationships such as family or friends.

Participants also suggested that good listeners are able to respond with answers desired by users, not simply listen to their problems. It was interesting to note that participants did not need CAs to perform advanced conversation skills. They rather wanted to hear encouraging messages from CAs. P06 mentioned that *"I want the CA to tell me that if I keep going like this, I will get into the college that I want. It doesn't matter if it's a cliché. I just want to hear messages of support.* "Participants knew that their concerns regarding studies, family matters, and loneliness could not be immediately solved.

Therefore, they believed that even such clichés can help relieve their emotion and stress, even if it's temporary. This signifies that providing supportive messages, even those that contain hackneyed expressions or are imperfect, can be sufficient to encourage teenagers.

4.3 The trust to honor confidentiality

Participants believed that machines would not reveal their secrets to others, especially their friends. It was important for most participants that the machine ensured confidentiality about their secrets, because they were afraid of unwanted rumors spreading around about them.

"I sometimes want to talk badmouth my friend when she disappoints me. But sometimes my other friends are also close to her, so I can't tell them. Instead, I can talk to CAs about it, who is not related to my friends." (P04)

In their perspective, the real world, where they lived with their friends and family, was separated from the machine world, where CAs existed. This cognitive separation stimulates their expectation that the machine properties allow participants to trust CAs to keep their secrets.

Students also wanted to talk about their personal issues such as family issues or their loneliness to CAs. Students refrained from talking about these topics to those close to them due to the fear of

gossip or unwanted judgment. Because CAs did not judge people, they were comfortable in sharing their feelings to them.

"Sometimes I want to talk about bad things, but when I do that, people usually judge me and start rumors. But the CA doesn't judge me, even when I badmouth my friends or family." (P03)

Supporting previous work by Lucas et al. (2014), this finding shows that participants felt more comfortable revealing secrets to a CA than opening up to their friends and family.

4.4 The anticipation of providing proven information

Participants believed that the machine is able to provide objective advice based on data and this would relieve their stress about their grades or college admissions. P06 said, *"All I am concerned about is admissions. If the CA could analyze my GPA and applications, and compare them to those of other students for some advice on how to be admitted to universities, I would feel better."* In the workshop, participants also wrote, "Give me some advice on how to get good grades" or, "Give me some counseling when I'm in trouble" as their desired functions on the questionnaire. This result reflects participants' perceptions that machines can create data-based, proven advice by analyzing a lot of data. This machine property specifically resonates with the past literature on the human-machine relationship. Participants had a strong belief in the precision of CAs in delivering

the right information. Because CAs are machines, they expected them to be rational and logical beings based on precise algorithm and data. This is an extension of past works on the human-machine relationship or automation bias.

Interestingly, teenagers expected that supporting data would also make supportive messages given to them by the CA more effective. Participants did not need to have personalized supportive messages. Instead, they preferred "proven messages of support" that others had already found helpful. P01 explained, *"After analyzing large data, they (CAs) can give me words of support with messages that are proven to comfort everyone."* This finding is in line with the first finding related to responding with desired answers.

Chapter 6. Study 2 - Participatory Design Study

After Study 1 was completed, it was necessary to discover how teenagers would incorporate the machine properties into the design of CAs. This would provide evidence on how the dialogues of CAs that provide emotional needs should be designed. Therefore, Study 2 was conducted to explore this issue. Moreover, through this research, a solid design strategy could be configured, since a user-centered workshop can reflect how the users would like to receive the type of service they need. The topics and ways in which teenagers would like to engage in CAs that deal with emotions needed to be observed.

To this end, a participatory workshop was held with three main purposes: (1) to collect utterances from teenagers regarding emotions to provide ground for future CA designs, (2) to create a dialogue management flow that invites teenage users to talk about emotions effectively, and (3) how teenagers reflect machine properties in the dialogue between CAs and users. The workshop was held for two consecutive days.

1. Participants

The workshop involved 24 teenagers (19 male, 5 female) who volunteered for the summer technology camp for high school students hosted by an academic institution. Participants were aged between 16

and 17. For the efficiency of the workshop, the 24 participants were divided into two groups, and each group participated on 1 day for 4 hours.

2. Study Procedure

The workshop was designed with reference to a workshop study by Alvarado, 2018, where users and system designers collaborated to build a new interface or a new agent. The workshop was broken down into three steps: Step 1) Exploring CAs, Step 2) Emotion PathFinder Role-Playing, Step 3) Emotion Agent Role-Playing. Each workshop lasted three hours in total. Figure 6 shows the settings and the apparatus of the workshop.
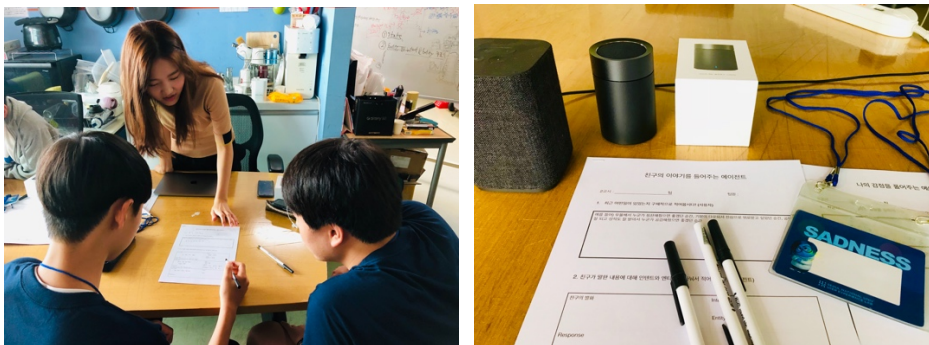

Figure 6. Fellow researcher explaining the procedure of role-playing(left) and the apparatus used in the workshop (right)

2.1 Step 1 - Exploring CAs

Step 1 was designed to allow participants to identify the basic mechanisms and functions of commercial CAs. First, 12 participants were divided into six groups of two members. The groups took turns in exploring a variety of smart speakers such as Amazon Echo[1], Google Home[2], or Naver Clova[3] through asking questions and making requests. This process was necessary for participants to become familiar with CAs by understanding key functions and use-cases of smart speakers. Moreover, in order to facilitate Step 2 and Step 3, a brief and simplified lecture was provided on the key concepts of CAs: Intent and Entity.

In this paper, before proceeding further, the concepts of CAs must be explicated to comprehend the logic behind the individual steps. Let's say that a user says "My favorite color is purple" to a CA. In Google DialogFlow, which is used as a technological apparatus for this design workshop, an "intent" is the purpose of an utterance of a user. In the utterance above, the intent is "giving information about color." Also, an "entity" is a "mechanism for identifying and extracting useful data from natural language inputs." In the utterance, the word purple is an entity, classified under a color category.

Google Dialogflow was used in this workshop to allow teenagers to feel that they were actually designing CAs on their own, ensuring that they would whole-heartedly reflect their needs and expectations of them. Also, Google Dialogflow presents the most current and up-

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to-date methodology that allows users even without any technological background to make CAs easily.

The designs of agents used a type of therapeutic methodology called emotion-focused therapy (EFT) introduced earlier in the paper. There were two reasons in adopting this therapy in the design. First, the therapy provides a constraint for the participants to focus on developing dialogues, not the overall process of dealing with emotions. Considering that they were not experts on mental health, they would have been confused as to how to handle emotions without such constraint. To be specific, EFT uses concepts such as emotion awareness called the "Arriving stage" and emotion transformation called the "Leaving stage." This set of procedures aid teenagers in developing CAs at ease. In addition, this therapy exclusively deals with emotions, which is the main focus of this study. This study is about how to design CAs that alleviate negative emotions and enhance positive ones to relieve the stress level of teenagers. The concentration on the emotion of EFT allows participants to become aware of the objective of the study and their roles.

2.2 Step 2 - Emotion PathFinder Role-Playing

Participants designed an agent named 'Emotion PathFinder' through role-playing via Google Dialogflow. This agent represents the arriving stage in EFT, in which one becomes fully aware of one's emotions by saying out loud relevant events and emotions. In this context, Emotion PathFinder engages in the conversation by guiding

teenagers to realize their emotions about a particular event by asking questions about the event. The participants were required to talk to one another about an emotional event and discuss how they should design the agent. Since two participants were placed in each group, each was given a role of User or Agent. The User then wrote his/her most recent emotional episode in a worksheet distributed earlier. This was done in order to immerse the participant in the episode and the emotion. Then, the User told the Agent about the incident in a role-playing manner. The User analyzed their utterances in terms of Intent and Entity as learned beforehand. The Agent tried to give the most adequate response to each utterance according to the given intents. Because this step was a part of the "Arriving" process of EFT, participants were required to keep in mind that their agent should focus on listening to what the user is saying and try to deduce the emotion of the user. They uploaded their utterances and responses to Google Dialogflow to complete making their agent and test it.

2.3 Step 3 - Emotion Agent Role-Playing

Next, participants designed an 'Emotion Agent' through role-playing via Google Dialogflow. The Emotion Agent represents the leaving stage in EFT, in which the user is able to embrace his/her emotion and convert negative feelings into positive ones. Emotion Agent was described as a CA that allows users to completely understand the emotion and release negative emotions after listening to a friend's deeper emotion. Therefore, each team was assigned a

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type of emotion and asked to design an agent that can help the user gain a deeper understanding of the emotion and release negative emotions through conversation. In this process, in order to make it easy for participants to design an agent, the movie *Inside-Out* was utilized as a metaphor due to its familiarity with teenagers. This movie is a Pixar animation, which portrays a teenage girl, Reily, who is going through problems of relocation to a different town. It includes five emotions from Ekman's six basic emotions to represent Reily's feelings: Joy, Sadness, Anger, Disgust, and Fear. As these are core emotions of humans and are familiar to teenagers, they were also used for the design of Emotion Agents. In this process, because there were six teams, all emotions of Ekman's six basic emotions were used, which also includes the emotion of Surprise, added to the five aforementioned.

3. Findings from the Participatory Design Study

The data gathered were composed of utterances of participants impersonating as Users, the responses of Emotion PathFinder and Emotion Agents (also referred to as Emotion Bots in the present study), and the intents and entities participants marked for the individual remarks. Through the analysis of the data, three findings were deduced: (1) the different types of intents of teenagers behind their dialogues towards each emotion of CAs, (2) the responses teenagers wanted to receive from CAs and the related machine properties of Study 1, and (3) the strategies for developing conversations of CAs.

3.1 Finding 1 - Intents of teenagers during conversations of CAs

Because the intents were written by teenagers and, thus, were highly heterogeneous, an organized codebook that systematically classifies the utterances needed to be constructed. To this end, three researchers open-coded the various intents of 157 utterances and re-grouped them according to their meanings. By observing the expressions used in the clustered intents, rules were developed for each intent based on the work of Lee (2016) which portrayed and classified the empathetic response strategies. Table 3 depicts a part of the finalized codebook. Through the codebook, the intents of the utterances from participants were clustered and analyzed. The inter-rater reliability (Cohen's kappa) was 0.84. The utterances were analyzed according to each emotion to represent what teenagers wanted to say on what type of emotion. The findings below include what kind of intents were directed for each emotion when participants developed the CAs.

Agent	Intent Category	Intent Sub-category
Emotion PathFinder	Understanding Episodes	Explain Episode
		Express Emotion
		Explain Episode & Express Emotion
		Express Thought
Emotion Bots	Continue Conversation	Ask Back
		Give Solution
		Agree
	Empathize	Console
		Encourage
		Listen Intently

Table 3: A part of the codebook derived from the workshop. The
intents differ according to the agent spoken to.

There were six agents developed by participants: Sadness, Joy,
Anger, Disgust, and Surprise. Table 4 depicts how the intents were
dispersed according to each emotion.

	Continue Conversation			Empathize		
	Ask Back	Give Solution	Agree	Console	Encourage	Listen Intently
Joy	68.42%	0.00%	0.00%	0.00%	10.53%	21.05%
Anger	42.86%	0.00%	21.43%	0.00%	0.00%	28.57%
Disgust	35.00%	10.00%	0.00%	45.00%	10.00%	0.00%
Sadness	21.05%	5.26%	0.00%	42.11%	5.26%	26.32%
Worry	31.25%	25.00%	6.25%	31.25%	6.25%	0.00%
Surprise	40.00%	0.00%	10.00%	0.00%	0.00%	40.00%

Table 4. The intents of conversation differ for each emotion

For Sadness, to be consoled was the main intent provided by the
utterances of participants. 42.11% of utterances had the intent of being
consoled. The expression of negative feelings in the utterances
highlighted this intent. For example, as can be seen in the utterances,

"I felt really sad because the shoes did not match my feet size," or "I feel sad because I had to let my dog go," participants wanted to express their negative feelings and be consoled by saying out loud their emotions and the surrounding circumstances. The negative expression of emotion differed from each utterance. For instance, words such as "depressed," "tiring," "upset" were often used. Other than being consoled, the intent to be encouraged was often used by the participants to regain strength. For participants, sadness was a type of emotion that needed to be recovered from. By talking to the CAs, they wanted to be encouraged to lift their spirits.

For Joy, two main intents participants had towards the CAs were "being asked back" and "being listened to intently" with consecutively 68.42% and 21.05% of total utterances on the emotion. Both are significant of intents on active listening, where the listener reacts to the speaker by asking for more detail and empathizing with them. Participants wanted to share their excitement with Joy and talk more about joyful episodes through encouragement and attention from CAs. Their joyful episodes consisted of events such as going to the pool, their favorite band releasing an album or Korea winning Germany in the World Cup. By telling these episodes to Joy, participants wanted them to carefully listen to what they wanted to say and reply back with words of empathizing.

For Worry, two main intents that participants had towards CAs were asking back and consoling. These were shown in 31.25% each among the total responses in the emotion. Participants expressed their

needs through expressions starting with "What if" questions or "I am worried because." These keywords are indicative that they are in need of specific solutions from the CA. For instance, there were utterances such as *"What if I can't make friends there?"* or *"I'm worried because I don't want to hear nagging from my parents."* It is also notable that in the emotion Worry, participants asked for advice and solutions. They expected the agent to provide them with appropriate problem-solving methods in troublesome situations.

For Anger, the two main intents of participants were "being asked back" and "being listened to intently," as with Joy. These intents had a frequency of 42.86% and 28.57%, consecutively. In anger, the participants wanted to express their feelings as much as they could. A participant told the CA about the time when a wallet was lost or when a friend did not participate actively in group work. These did not end in one sentence but went on to provide more detail about the episode. They wanted to vent their emotion by telling these episodes in detail when the CA listens. Even more, they wanted CA to get angry at the episodes as well, indicating the level of empathizing participants wanted from CAs.

Finally, Disgust was required to release the emotions through "being consoled." The main intent of Disgust is skewed towards being consoled with 45% of total responses. This indicates that participants wanted CAs to provide them with emotional support. For instance, participants expressed their feelings of words through saying *"I was annoyed because"* or *"It's really annoying."* These

expressions meant that they wanted to express their annoyance and at the same time, want the CA to console them and support them to release their emotions.

3.2 Finding 2 - Responses of CAs and Machine Properties

The responses of the CAs were analyzed with reference to the machine properties derived in Study 1. The data was analyzed in the following manner. The responses were open-coded with two researchers, the response types were clustered according to similar meanings, and a codebook was developed. The inter-rater reliability (Cohen's Kappa) was 0.80. The perspective of the coding was drawn from Study 1. The findings from the study indicated that there were three expectations towards CAs, and mainly two expectations were analyzed through the data from Study 2: active-listening and data-based counseling. The reason the second finding, the trust to ensure confidentiality, was ruled out was that this trust could not be deduced from the dialogues themselves. This remains as a factor that has to be further investigated in future studies. Instead, this finding focuses on what types of expectations, especially those related to machine properties, are reflected in the dialogues and how. Moreover, through analysis of the dialogues, it was discovered that participants included other qualities inside CAs such as anthropomorphic qualities and small talks. Therefore, the codebook also includes such characteristics. The

responses were analyzed according to the codebook through the frequency of their characteristics. (Table 5)

Category	Sub-category	Frequency	Percentage
Good Listener	Detail	41	24.6%
	Empathizing	38	22.7%
Data-based Information	Advice	25	15.0%
	Encouragement	18	10.8%
	Recommendation	6	3.6%
	Consolation	5	3.0%
	Information	5	3.0%
Anthropomorphism		12	7.2%
Small Talk		8	4.8%
Ending		7	4.2%
Action		4	2.4%
SUM		167	100.0%

Table 5. The frequency of the response characteristics of CAs developed by teenagers

3.2.1 Being a Good Listener

The colored cells in Table 5 portray the machine properties that teenagers included in the responses of CAs. It can be observed that the good listener characteristic of CAs composes approximately 47% of total responses. Being a good listener can be divided into "asking for detail" and "empathizing."

Asking for detail was the CAs' way of inducing further information from the user. Because participants wanted to continue the conversation with agents regarding their emotions, they made the CAs to ask follow-up questions for specific detail. They depicted the CAs as agents that could continuously listen to their worries and problems.

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Therefore, participants organized the dialogue of agents to ask back however much they wanted to in order to fully acknowledge their emotions and help the agents to recognize them. This type of response is also a strategy for developing CAs, and it is further explained in the later section.

Empathizing actively was a type of machine properties mentioned in Study 1. Participants from Study 1 mentioned that this is something they would want from CAs because they could not be yielded easily from other people. 22.7% of responses included this type of dialogues in CAs. For example, participants wrote down responses such as "*I would totally feel the same way if I were you. I hate that kind of stuff, too!*" or "*That is terrible. Wasn't the theoretical class boring?*" in order to make the speaker feel that he was being empathized and able to tell more about the emotion.

Because the important aspect of this study was to examine what type of dialogues participants actually tried to make with the CAs, the strategy of their empathizing was analyzed. It was noted that the participants used the method of actively agreeing with the user and sharing the emotion. In a sense, saying that "*I feel the same way as you do*" was a phrase most frequently used for empathizing. For example, with Sadness, responding to the user's words as "*I feel sad, too*" or "*Hearing you say that makes me feel sad, too.*" This conveys that participants want CAs to understand their feelings by completely agreeing and empathizing with them.

In this aspect, being a good listener is important as machine properties in two ways. First, participants wanted to pour their emotions and personal experience with the CAs. They wanted to continue their conversation about their personal experience and the related feelings as much as possible. Second, participants wanted the CAs to unconditionally empathize with them. Regardless of what the user says to the agents, the CAs that participants designed kept on agreeing with the opinions of users and empathizing with their feelings. This conversation is possible because the agents are capable of saying whatever the user wants to hear. This is something different from humans in that people such as family or friends are likely to give unwanted advice or disagree with them.

3.2.2 Data-based Information

In Study 1, participants mentioned that the CAs were able to provide them with data-based information. In Study 2, this type of data-based information was further divided into five categories: advice, encouragement, recommendation, consolation, and information.

Interestingly, advice was a type of response most sought out by the participants. Approximately 15% of responses consisted of advice given by the CAs. Especially, the emotion of Worry instigated advice from the CAs. The worries participants wrote down were related to family or friend matter, such as worrying about whether they would make friends in a new class or worrying whether their parents would be mad at them for coming home late. In response to these worries,

participants wanted CAs to provide them with advice based on the data they hold. Therefore, they imagined what the machine would best say based on such data in certain kind of situations and tried to give advice to the user accordingly. For example, one participant tried to give advice to a user on "how to deliver the true feelings to mother." After looking up the Internet briefly on this, wrote down the response of the agent as *"Look into your mother's eyes with a smile on your face and say whatever you want to say step-by-step in a clear voice. But be careful not to put the subject as your mom!"* This indicates that participants expected the CAs to gather relevant information from the web and provide the users with appropriate advice.

Similarly, encouragement and consolation were expected by the participants. Participants did not want random answers to be given to the users, but rather wanted the answers to be specific to the circumstances and based on concrete data. For instance, with regards to the emotion of Sadness arising from starting a new semester, participants designed the CAs to reply, *"If you spend your day without any regret, you will be able to finish a successful semester."*

Recommendation and information were two aspects that did not appear from Study 1. Because Study 2 was about designing CAs, participants were free to design any agent they hoped for. Some participants chose to deliver relevant information or recommend entertainment to soothe the emotion of users. For example, when there was an utterance about a user being sick, some participants chose not to simply console through mere words, but provide information on a

hospital nearby. Likewise, an utterance about the emotion of Joy induced participants to design CAs that not only empathize with the emotion through voice, but also to turn on some music that matches their feelings. This entertainment and information aspect seems to have been derived from the current technology of smart speakers on the market.

3.2.3 Anthropomorphism

Through analysis of the responses, it was discovered that participants developed CAs not only according to the machine properties, but also added anthropomorphic qualities inside them. This was done by adding specific personalities or personal histories of CAs.

Participants especially tried to make the emotional personality of agents more explicit through appropriate responses. For example, in order to make the CAs more empathetic towards users in terms of Sadness, participants included responses such as *"I'm not that good at information searching, either,"* or *"what if I make a mistake?"* This was drawn from the actual characters of Inside Out, where the emotion Sadness was always gloomy and discouraged. Adding such personalities made the CAs more human-like, enabling users to engage with the CAs more.

Moreover, participants added personal histories to the CAs. Personal history means that the agent has a story of its own, indicating that they were not mere machines that only replied with answers to the utterances but have memories. The relevant examples of such

responses were "*I've never made any friend except you*" or "*I went to Lotte World, too!*" This type of dialogue also made the CAs empathize more with users and delivered the notion that they could become actual friends with teenagers.

3.3 Finding 3 - Strategies for developing CAs

Aside from the analysis of the utterances of participants and the responses of CAs, three strategies for developing CAs that listen to and console teenagers were developed through the workshop. These key findings are derived from both the utterances and responses.

First, participants wanted an agent who speaks casually like themselves. In order to enact their role as a CA that listens to what teenagers say, they used non-honorific languages. This was interesting because every smart speaker in South Korea currently utilizes honorific language when talking to users. Participants assuming their role as Listening Agents also frequently used slang terms that friends in their own age range know and use such as "*getting pissed off,*" "*got screwed,*" or "*threw the game.*" This implies that participants expected agents to be aware of the expressions and situations teenagers frequently encounter. Also, the CAs must use the terms spoken by teenagers by using the 'Entity' function of Google Dialogflow. This echoing was used by participants as a strategy to know that the CA is actively listening to

what the users say. A brief explanation on 'Entity' will follow in the next section.

Second, it is important for the Emotion PathFinder to prompt a continuous conversation with the user. 30% of total dialogues included this type of conversation. As it is the role of the Emotion PathFinder to keep being attentive to the user's stories, participants labeled their utterances as 'Asking what happened' or 'Listening to my story' as their intents. Moreover, participants formulated an agent that not just passively listens, but also actively engages in the conversation by "echoing" the user's words (e.g. User: I'm mad 'cuz I had an argument with my friend. Agent: You had an argument with the friend. Tell me what happened!). 16% of total dialogues included echoing the counterpart's language. In writing the responses of agents, participants focused on not only agreeing to what the user said, but also on asking questions to completely understand the situation, such as 'What made you feel that way?" or "Tell me more about what happened." As such, participants used a variety of strategies to guide the user to talk more about the story. These strategies were adopted in the dialogue management of the Emotion PathFinder prototype in Phase 2.

Finally, as for the Emotion Agent, participants formed its responses in a 'First-Empathize, Then Solve' manner. To be specific, participants first designed the agents to ask the users why they felt a certain emotion or chime in with the users' words by saying "Oh really?" or "Wow!" This indicates that when discussing

emotions, it is essential to keep empathizing with teenagers' emotions, rather than simply providing them with an abrupt, one-sentence solution. After the empathizing is deemed sufficient, participants designed the agents to try different strategies for resolving the users' feelings according to the emotion they feel. For anger and joy, participants chimed in and encouraged the users to express their emotions. For example, responses of the Anger character induced users to express further anger by replying "What? Isn't he crazy?" to the user's comments. Meanwhile for sadness and worry, participants provided a solution or consolation to alleviate negative feelings. For instance, Worry replied, "Naggings from parents can be annoying but it's because they worry about you," and tried to soothe the negative feelings of the user. These strategies were adopted when designing the dialogue management of the Emotion Bots prototype in Phase 2.

Chapter 7. Discussion

In this section, the lessons learned from the design and user study process are summarized.

1. Machine properties and design implications

From the findings of the two consecutive studies, machine properties have been recognized as factors that drive teenagers to talk about their emotions with CAs. The teenagers that participated in the studies pointed out three factors: being a good listener, keeping secrets, and providing data-based information. They actively included these factors in the design of CAs. The design implications for these machine properties follow.

First of all, teenagers expected that CAs would be good listeners for three reasons. They believed that they would respond actively to their worries by asking questions for detail. This implies that future design of CAs that support their emotional needs should keep asking for more information about the topic and keep the conversation going, rather than ending the conversation in one sentence. In this way, they can help teenagers elaborate on their worries. This type of continuous conversation can induce a therapeutic effect on its own (Ayobi et al., 2008) because there have been researches that demonstrate how merely talking about their emotion can help in relieving negative emotions. Moreover, the CAs should respond empathetically towards the teenagers. Participants pointed out that CAs, being a machine, can

give them the answers they want. Through Study 2, it was discovered that the responses teenagers expected from CAs were largely empathetic ones. In this respect, CAs can respond to teenagers in a way that they also feel the same emotions as them. Teenagers seemed to find this sort of response comforting. This is in relation to the past researches that they do not receive sufficient emotional support from parents or friends. The empathetic responses of CAs can serve to fill this gap.

Teenagers also thought that machines are unable to feel emotions, which is an advantage for them to discuss even negative ones. From Study 2, it was also found that teenagers actively tried to discuss their worries and sadness, believing that CAs can listen to them and provide them with support. This expectation relates to emotional contagion, in that negative feelings of the users are not transferred to the machine. Emotion contagion refers to "the phenomenon of having one person's emotions and related behaviors directly trigger similar emotions and behaviors in other people" (Hatfield et al., 1993). It is particularly common among close relationships (Levenson, 2006), which incites a dilemma among teenagers. The necessity to share their negative feelings with others conflicts with their reluctance to make others feel bad as well. Thus, the emotionlessness of machines is an advantage in this aspect. Though the agents were based on "emotions," it was obvious to participants that they did not have actual feelings. The agents' comments of joy and sadness merely functioned as words of empathy rather than as actual emotions transferred to the agents. Thus,

the future designers of CAs in emotion must keep in mind the fact that the agents need not speak as though they were being emotionally affected by the users. A certain distance from the users is necessary.

Moreover, the belief that the agents will not spread the words of teenage users is important for teenagers in sharing their emotions. The reason participants could ask for advice or discuss sensitive matters with the agents was that they assumed that what they say will stay between them and the agents. It is noted in other studies that adolescents develop social relationships by sharing their secrets and deep emotions with others. Although with humans there is apprehension that such information may spread, this can be alleviated with CAs, leading to trust in the agents and more emotions and thoughts shared. In other domains, there have been methods to safeguard against the breach of security using voice such as Headley (2012). Thus, the future designers of CAs should keep in mind that their CAs must keep the stored data securely and express this security out loud for the teenagers. For instance, saying "What we talk about today is strictly between us" can help increase the trust level of teenagers and allow them to provide more information and emotion. In addition, provision of a security methodology, such as voice-lock, into CAs can also result in higher security of agents perceived by the teenagers.

2. CASA paradigm and machine properties

In this section, the studies conducted are reviewed under the light of CASA paradigm. It also elicits new findings that can be scrutinized in future studies. Three key insights can be derived in this manner.

First, the dialogue content and the tone of voice seem to complement the personality of agents when voice cues are non-existent. There have been past researches surrounding CASA paradigm that indicate how the computer's voice affects how people perceive computers relevant to the gender stereotype or personality. Through this study, it could be noted that even without such voice cues, teenagers tried to input different personalities into the agents through different tone of voice or contents of dialogues.

Moreover, even without the lack of salient human-like characteristics of agents, teenagers were able to interact with CAs in a social way. The agents did not have a face, different voice, gesture, or social identity. However, the purpose of the agent as emotional support, their ability to listen intently to their utterances, their empathetic responses, and the information they provide appropriately served to perceive them as social actors and behave in such a way. This suggests that it may not only be the anthropomorphic qualities of agents that allow users to perceive them as social beings. The information and dialogue they share with users or their perceived role as "emotion-sharing agents" highlighted the users' perception towards them as social beings.

Finally, teenagers expressed their trust in the system, as past human-machine relationship works stated. Participants had a type of automation bias towards the CAs in that they believed the agents to always provide accurate information and appropriate advice. This bias led to an increase of trust towards the system. Because they trusted the agents, they believed that they can share their emotions and experiences more in order to receive more advice on their matter.

3. Applicability in the counseling sector

The design of the CAs in this study presents the possibility of the CA being used in the domain of counseling, especially if the emotion and the conversations are stored as data. Currently, the counseling field tracks the emotional changes a client experiences through methodologies such as emotional diary (Ayobi et al., 2018) or emotion trackers (Lee et al., 2017). The CAs that support teenage emotions can also meet this purpose. Through the daily discussion of emotions, the data can be stored for the therapist in showing the changes in the client's emotions and their intensities. If these agents are applied on smartphones, they will be able to capture in-situ emotions, unlike the usual procedure which resembled a diary. Delivering emotions to the agents is also unobtrusive in that it does not require a pencil and paper. It just requires a smartphone to talk to.

This storage of emotional data can also build further rapport between the user and the agents. Participants noted that if the agents remembered their past emotions or episodes related to emotions, their

feeling of intimacy towards the agents would increase. P02 from Study 1 hoped that agents "*had the ability to read past conversations. It felt like I was meeting someone new every day, but if the conversation felt like it was being continued, there would be a relationship between us.*" This leads to the belief that agents that remembered emotions and episodes will help in building rapport with the user, gaining a firm foothold in tending to their emotions and providing a viable methodology for the psychological sector.

Chapter 8. Conclusion

1. Research summary

    Although many studies have tried to mitigate teen stress through technology, especially CAs, their emphasis on anthropomorphism led them to pay relatively less attention to machine properties. In order to find out the role of machine properties of CAs in tending to teenage emotions, three research questions were raised and answered using three studies. To address the first research question on discovering the needs of teenagers towards CAs and the role of machine properties in their expectations, a workshop and in-depth interviews were conducted. As a result, it was discovered that teenagers expected agents to be "good listeners" due to their lack of real emotion and capability to empathize with them, keep secrets, and provide data-based information.

    To address the second research question on the design strategy in creating CAs to support teenage emotions, a participatory design workshop was conducted. The findings expand on the results from Study 1 and try to discover how machine properties act in the way of making dialogues between CAs and teenagers on emotions.

    For future work, the prototype must be improved to incorporate larger dialogues and enhance the understanding of CAs, and the number of participants tested must be increased to evaluate

psychological factors such as self-esteem and emotional awareness to further quantitatively validate the research.

2. Limitations

There are still some limitations to this study. The limited number of participants in the study may make the findings difficult to generalize. Moreover, the studies are rooted in the South Korean context. The differences in culture and environment may affect the awareness of machine properties needs towards CAs. For example, in countries where technology is not as pervasive as South Korea, teenagers might be more reluctant towards sharing their emotions to CAs due to their lack of trust and knowledge. In order to overcome these limitations, future work may call for a larger population to be tested and comparative research depending on the cultural context. Despite these limitations, the work still gives insight into the interaction between teenagers and CAs on the subject of emotions and the role of machine properties in this subject.

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국문 초록

국내 10 대의 스트레스가 증가하며 이를 해결하기 위한 기술적 노력들이 나타나고 있다. 여러 연구들은 이 중 대화형 에이전트 (CA)를 활용하고 있지만, 이 연구들은 대부분 CA 를 어떻게 인간처럼 만드는 데에 치중하고 있다. 이러한 의인화에 대한 초점은 상대적으로 CA 가 자체적으로 갖고 있는 기계적 특성을 놓치도록 하고 있다. 이에 따라 청소년과 CA 간 정서적 대화에 있어 어떠한 기계적 특성이 중요한지에 대한 연구, 그리고 실제로 감정에 관한 대화를 나누는 CA 에 있어서 청소년들이 원하는 특성은 무엇인지에 대한 연구는 미비한 상황이다. 따라서 본 연구는 청소년의 정서적 지지를 위해 디자인된 CA 의 기계적 특성이 어떠한 측면에서 중요한지, 그리고 이와 같은 CA 는 청소년을 위해 어떻게 디자인 되어야하는지를 워크샵과 사용자 중심 디자인 방법론을 통해 알아보고자 하였다.

이 논문은 이 목적을 위해 진행한 두 가지 연구에 대해 서술하고 있다. 먼저 CA 에 대한 청소년의 니즈를 확인하기 위해 워크샵과 인터뷰를 진행하였다. 인터뷰 결과 청소년들은 CA 가 자신의 말을 잘 들어줄 수 있고, 비밀을 지켜줄 수 있으며, 데이터 기반의 정보를 제공해줄 수 있기 때문에 조언과 위로를 받고 싶다는 것을 확인할 수 있었다.

다음으로, 참여적 디자인 연구가 24 명의 청소년이 참여한 워크샵 형태로 진행되었다. 청소년들은 롤플레잉을 통해 자신들이 CA 에게 어떠한 말을 하고 싶고, CA 가 자신에겐 어떠한 말을 해주면 편안함과 위로를 느낄지 서술하고, Google Dialogflow 를 통해 직접 CA 를 디자인 하도록 하였다. 이를 통해 청소년의 발화 데이터와 CA 의 답변 데이터를

수집하고, 두 명의 연구원이 오픈 코딩하여 테마 별로 분류하는 방식으로 분석을 실시하였다. 그 결과, 청소년들은 특정 감정에 대해 이야기할 때 특별한 목적을 지니고 CA 와 대화하고 싶고, CA 의 답변을 제작할 때 기계적 특성을 반영하는 것을 발견하였다. 또한, CA 의 대화 전략 측면에서 청소년들은 자신들이 사용하는 어휘와 말투를 지니고, 자신들이 감정에 대해 표현하도록 도와주며 적극적으로 공감해주는 CA 를 원하는 것을 알 수 있었다.

이 연구는 정신 건강 도메인에서 CA 의 활용성을 기계적 특성이라는 색다른 시각에서 탐험하고, 청소년들이 직접 CA 를 디자인하는 환경 속에서 그들의 니즈를 확인하였다는 점에서 그 의의가 있다.