

# **Intelligent Assistance in Idea Generation**

*A new perspective to optimize the ideation process through chatbot technology*

Samira Goli

SNR 2069746

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Communication and Information Sciences

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Department Communication and Cognition

School of Humanities and Digital Sciences

Tilburg University, Tilburg

Supervisors: Dr. S. Sankaran and Dr. A. de Rooij

Second Reader: Dr. J. de Wit

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### **Abstract**

Ideation is a critical phase for organizations that rely on their employees' creative ability and ideas to further develop products and services. This study aimed to determine whether chatbots could be used as a facilitator that stimulates idea generation and provides feedback to foster creativity during ideation sessions. A 2 x 3 factorial between-subjects design with chatbot perceived identity (human vs. bot) and feedback valence (positive, negative, and neutral) as independent variables and ideation productivity as the dependent variable was conducted to explore to what extent the chatbot's perceived identity and the feedback valence influence productivity and whether the evaluation apprehension plays a mediating role between variables. The experiment was conducted online, with participants working on a 10-minute ideation task with a chatbot as the facilitator, followed by a questionnaire. A total of 226 people participated in this research. The findings revealed that perceived identity and feedback valence had no effects on ideation productivity. The fact that participants did not view the humanoid and robotic bot as significantly different could explain the inconsistent results. Evaluation apprehension did not turn out to be a mediating factor as well.

*Keywords: Ideation, Chatbots, AI Assistants, Evaluation apprehension, Facilitator, Perceived identity, Feedback valence*

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## Introduction

All innovations start with a good idea. Most scholars and strategists believe that organizations and societies must employ innovative problem-solving techniques to adapt to quickly changing surroundings. Ideation is a typical procedure through which creative and new ideas are elicited to uncover various alternative solutions for a task that would eventually put the business ahead of the competitors (Maaravi et al., 2020). However, generating novel ideas needs creativity (Toubia, 2006).

Brainstorming, first proposed by Alex Osborn (1957), is a well-established and well-researched method for enhancing creativity. According to Osborn (1957), brainstorming is a successful strategy for fostering creativity and idea generation because it specifically addresses issues with evaluation apprehension (fear of being judged by others), and social loafing (individuals believe the group does not need their efforts) by emphasizing on the number of generated ideas and, more importantly, by instructing individuals not to criticize their own or other people's ideas. Instead, they are encouraged to build on and expand on the ideas of others. Even though brainstorming rules improve group idea development (Paulus & Yang, 2000), it might also result in productivity loss (Siemon et al., 2015). Zhou et al. (2019) argued that group brainstorming sessions usually produce fewer and less diversified ideas (low productivity) than nominal ideation due to evaluation apprehension, production blocking, social loafing, and the tendency to adhere to other group members. Furthermore, many studies have recognised evaluation apprehension as a common reason for lower productivity in group brainstorming (Connolly et al., 1990; Paulus & Yang, 2000; Kramer et al., 2001; Michinov & Primois, 2005; Siemon et al., 2015).

Osborn (1957) also suggested using facilitators to improve group performance in ideation. The facilitator's role is to stimulate the ideation processes by giving related, relevant feedback to the idea generator, encouraging the flow of ideas, focusing on quantity and not the

quality of ideas by clearly fostering each member to produce additional ideas (Oxley et al. 1996; Maaravi et al., 2020). The facilitator is responsible for both the "generation phase," in which participants offer their ideas, and the "review phase," in which the facilitator guides the process of examining and integrating ideas (Maaravi et al., 2020). However, identifying and employing a facilitator with specialized methodological expertise and social abilities to promote ideation processes is difficult (Bittner & Shoury, 2019).

While computers, according to Fischer (2004), have the potential to improve human creativity, ground-breaking work in human-robot interaction (HRI) has looked at the possibility of using robots to enhance creativity and idea generation (Hwang & Won, 2021). The development of AI-based computer systems has therefore opened up the option of utilizing chatbots in ideation sessions to increase productivity and diversity of ideas (Bittner et al., 2019; Bittner et al., 2021; Poser et al., 2022).

Chatbots, defined as conversational social agents with automation capabilities and natural language processing, have become more capable of interacting, assisting, and collaborating with humans as computational intelligence has improved (Seeber et al., 2020; Hendriks et al., 2020). The role of AI-based computer systems in human interaction changes as their autonomy and independence grow (Siemon, 2022). Hence, chatbots are fascinating subject for research into human and non-human interaction patterns and issues related to assigning social roles to non-human agents (Ciechanowski et al., 2019).

Following the CASA paradigm, robots are considered social actors since people's reactions to computers follow interpersonal rules, and attribute the human interaction function to social robots (Bracken et al., 2004). Cooperating with social bots has the potential to reduce some of the negative impacts of social pressure to improve creativity and idea generation (Hwang & Won, 2021). Siemon et al. (2015) developed an AI-like system that attempts to act like a human and strives to assist the user when working independently throughout the idea-

generation process. While working with the AI-like system, no free-riding, social loafing, or evaluative apprehension effects were seen because an AI helped or influenced participants' thoughts, and they did not put less effort into their ideas. Lee et al. (2020) argued that chatbots, after all, cannot create their own opinions; therefore, they cannot attach negative social consequences. As a result, people participating in collaborative brainstorming sessions using a chatbot are likely to be less concerned about evaluation (Oh et al., 2018; Bittner et al., 2019). Further, Bittner et al. (2019) examined the effectiveness of a chatbot and a human facilitator in collaborative ideation sessions. Those who used a chatbot as a facilitator reported feeling comfortable sharing their ideas with the chatbot, while participants who used a human facilitator reported feeling constrained because they were concerned the facilitator would think their ideas were silly. Siemon (2022) argued that people unconsciously apply social standards and attribute characteristics that are often associated with humans to AI-based computer systems like chatbots that visually resemble humans or behave in human-like ways. Hence, how people perceive the bot and the level of human agency they assign to it may be impacted by the chatbot's appearance and behavior (Araujo, 2018; Hendriks et al., 2020). Further, Powers et al. (2007) found that participants' concerns for their partners decrease when an artificial confederate displays fewer human-like characteristics. It can be postulated that the participant's opinion of the ideation partner, and the chatbot's identity (human vs. bot), might thus have an impact on the results of collaborative ideation sessions.

In the domain of ideation, feedback is defined as a given comment on the quality or relevance of an idea proposed by an individual (Wooten & Ulrich, 2017). While providing no feedback is one of the principles of brainstorming, as researchers believe that criticism impedes creativity (Osborn, 1957), others argue that feedback prevents herd mentality, allowing for divergent thinking, which results in more innovative ideas (Vossen et al., 2009; Curhan et al., 2021). According to Jung et al. (2010), the provision of performance feedback, defined as a

summary of total contributions for each member, increased group performance, with the group that got performance feedback outperforming other groups in terms of quality and quantity of generated ideas. Additionally, Jung et al. (2005) looked at the impact of feedback and identifiability (whether group members can be identified with one another) on ideation productivity. The findings revealed that when participants were identifiable and got feedback, they generated considerably more ideas and more unique ideas than when they did not get feedback and were unidentifiable to their peers.

Feedback valence (positive, negative) may exert a beneficial/adverse effect on creative performance. One of the early studies on the impact of feedback valence on ideation outcome depicted that when a participant proposed an idea and received an affirmative (positive) response, they interpreted this as a signal that the idea was adequate and complete so that no further work on that or subsequent ideas was required. A critical comment, on the other hand, was interpreted as a signal that the idea needed to be developed further, resulting in more effort being invested in that and other ideas (Connolly et al., 1990). Another study argued that positive feedback encouraged interpersonal interaction, while negative feedback inhibited brainstorming groups' creative performance (Lu et al., 2019). We can hypothesize that ideation productivity will be influenced by feedback valence.

In short, chatbots could actively participate in brainstorming sessions while also potentially reducing some of the negative impacts of social pressure on teamwork and fostering creativity (Hwang & Won, 2021). Further, human beings interact socially with computers and are sensitive to computer praise and criticism (Vossen et al., 2009). Therefore, chatbots could be employed in creative tasks to offer feedback on generated ideas in the early stages to further develop and perfect an idea and stimulate generating new ideas. Moreover, following the CASA paradigm, chatbots may be able to lessen evaluation apprehension in the ideation process owing to their lack of human agency (Bittner et al., 2019). In ideation sessions, a



reduction in evaluation apprehension is advantageous for productivity and idea diversity (Diehl & Stroebe, 1987; Zhou et al., 2019). There is, however, limited research on the value of using chatbots for ideation and the impact of the chatbot's perceived identity and feedback valence on ideation productivity. As a result, the present study will investigate the effect of a chatbot's perceived identity (bot vs. human) as a source of feedback, as well as feedback valence (positive, negative, and no feedback) on ideation productivity. Therefore, we would like to address the following research question:

*RQ: Do different types of feedback valence (i.e., positive, negative, and no feedback) and perception toward the facilitators' identity (human vs. bot) exert different effects on the performance of ideation sessions when mediated by the evaluation apprehension?*

## **Theoretical background**

### **Ideation**

Creativity and innovation are critical factors to success in this modern competitive world. The free flow of ideas is an essential component of organizational innovation, as fresh and innovative ideas are generally crucial in the innovation process (Maaravi et al., 2021). Valtulina and de Rooij (2019) argued that there is no creativity or innovation without idea generation to emphasize the significance of idea generation. The process of producing potential solutions that, when applied, can address ill-defined and intricate situations is fundamental to creativity and innovation (Valtulina & de Rooij, 2019; Maaravi et al., 2021).

The brainstorming technique has been enormously addressed in the literature among various ways to support creativity in the ideation process (Wang et al., 2011; Litchfield et al., 2011; Wang & Nickerson, 2017). Brainstorming is a commonly used idea generation creativity technique developed by Osborn (1957). The main features of the brainstorming procedure described by Osborn (1957) are: judicial judgment of ideas is ruled out; freewheeling ideas are welcomed; quantity is wanted, and combinations and improvement of ideas are sought (Paulus

& Yang, 2000; Curhan et al., 2021). These principles should stimulate idea generation and increase creativity because they address evaluation apprehension and social loafing issues (Siemon et al., 2015). Moreover, the cognitive stimulation that occurs through the exchange of ideas, according to Osborn (1957), leads to higher productivity and diversity in generated ideas. According to Osborn's research, engineers could generate more meaningful ideas utilizing a group brainstorming approach than when they worked alone using strategies other than brainstorming (Osborn, 1957). The productivity of a brainstorming session refers to the number of ideas generated during a brainstorming session (Diehl & Stroebe, 1987).

In addition to the principles of brainstorming, Osborn (1957) proposed that getting help from a facilitator would enhance brainstorming. The facilitator, who is in charge of the session, should be able to ask engaging questions, create a working plan that helps generate ideas, give warm-up practice and orientation for participants, explain and reinforce the guidelines, and oversee the planning of any follow-up sessions (Oxley et al. 1996; Maaravi et al., 2020).

Despite the extensive use of brainstorming in collaborative creative environments, the effectiveness of brainstorming has been a point of controversy in academia since its inception (Faste et al., 2013). Although brainstorming rules improve group idea production (Paulus & Yang, 2000), several causes of productivity loss in brainstorming groups were investigated (Diehl & Stroebe, 1987; Kramer et al., 2001). Traditional brainstorming sessions (TBS) have been shown to create fewer and less diverse ideas than those who developed their ideas alone which has been attributed to the productivity gap. The productivity gap is related to production blockage, evaluation apprehension, social loafing, and the tendency to attach to other group members (Zhou et al., 2019). A nominal technique was designed so that participants are unaffected by social contact in a traditional brainstorming group since group members produce their ideas individually to bridge the productivity gap (Maaravi et al., 2021).

With advancements in digital technology, several computer-mediated brainstorming processes are now possible (Pissarra & Jesuino, 2005). Within this category, "Electronic Brainstorming" refers to any brainstorming facilitated by computers and includes users inputting individual thoughts into a digital pool while having full access to the ideas of others (Furnham & Yazdanpanahi, 1995; Faste et al., 2013; Maaravi et al., 2020). This new approach aims to overcome the productivity gap by combining advantageous elements of nominal and real group brainstorming, namely being able to freely produce ideas and share (Furnham & Yazdanpanahi, 1995; Furnham, 2000; Maaravi et al., 2020). Simultaneous contributions reduce the likelihood of production blockage, and the anonymous character of the technique is also said to remove inhibition and encourage participation in the presentation of unconventional and/or innovative ideas (Furnham & Yazdanpanahi, 1995; Pissarra & Jesuino, 2005). When engaging through an anonymity-ensuring mechanism in the EBS technique, participants showed little or no evaluation anxiety which is considered a barrier to idea formation in a group context resulting in better and more ideas (Maaravi et al., 2020). Given the advantages of EBS and the developments in computer and AI technologies, concentrating on integrating robots, notably chatbots, in the ideation process may be beneficial.

### ***Using chatbots in ideation and the perception of identity***

Due to a considerable breakthrough in processing power and new methodologies and algorithms, AI agents can now do activities previously only ascribed to humans (Siemon, 2022). A chatbot, a sort of artificial intelligence that can communicate with people using natural language, has grown increasingly capable of interacting, assisting, and collaborating with humans (Seeber et al., 2020; Hendriks et al., 2020). Further, previous studies have found that robots such as chatbots have the potential to aid in the idea-generating process (Bittner et al., 2019; Geerts et al., 2021).

According to the CASA paradigm, robots are considered social actors (Shi et al., 2020), and humans communicate with computers using the same social norms, standards, and expectations as they would with a human (Bracken et al., 2004). Therefore, implementing attributes from human-to-human interactions into the chatbot's conversations can influence perceptions of communicating with a real human being and, thus, perceptions of the interaction and trust in chatbots (Bracken et al., 2004). The use of social signals dictates the level of human agency and social presence (the experience of being in the company of someone) that users attribute to the chatbots, affecting the chatbot's perceived identity (Araujo, 2018; Go & Sundar, 2019; Hendriks et al., 2020). However, the choices for changing a chatbot into a human-like actor are limited (Rietz et al., 2019). Some examples of social cues typically used in chatbots to highlight identification include names, profile images, human conversational styles (applying cues like emoji, emoticons, and interjections), self-introductions, and typing indicators (Hendriks et al., 2020). Having a number of these social cues help to emphasize the bot's identity and gives one a sense of humanity and social presence, both of which are crucial components of the theory that computers are social actors (Qiu & Benbasat, 2009).

Moreover, anthropomorphism is the tendency to extrapolate human traits from non-human objects (Lee et al., 2020). According to research on anthropomorphism in the field of social cognition, individuals tend to identify items based on instantly evident identification clues (Go & Sundar, 2019). Consequently, social cues in a chat interface (e.g., profile image, name, or a brief description) contribute to defining how an interaction partner's identity is perceived (Sundar, 2008). Classic HRI literature describes the concept of the social robot, which suggests that the more humanoid features embedded in a bot, the more likely individuals are to view a machine-mediated agent as a human (Hwang & Won, 2021). Thus, using social cues would enhance the described identity of a chatbot during a collaborative ideation session.

In summary, we reasoned that since humans apply the same social norms to computers as they do to humans, which is motivated by the availability of social signals (Nass & Moon, 2000), a chatbot might play a role in the ideation process. If a chatbot is given a human-like appearance and proactive behavior (humanoid chatbot), we anticipate that it will most likely perceive as a human, influencing productivity in the same manner that an actual human will. Robotic bots may be a more useful brainstorming partner due to the likelihood that they may be perceived as robots with less human agency. Hence, the perceived identity of the chatbot as a facilitator (human vs. bot) might influence the ideation productivity. Therefore, the following hypothesis is formulated:

*H1*: There is a significant difference in ideation productivity between individuals who perceive the facilitator as a bot and those who perceive the facilitator as a human.

### **The role of feedback in ideation**

Feedback is defined as information provided by an external agent (e.g., a teacher, supervisor, co-worker, or peer) on aspects of one's performance or knowledge to reduce discrepancies between the corresponding performance and the goal, and thereby feedback is a result of performance (Hattie & Timperley, 2007; Dargahi & Namin, 2021). The importance of providing feedback in an idea generation process has been studied in literature; it has shown how different participants respond to feedback in a real idea generation context (Wang et al., 2015; Beloyianni & Zbainos, 2021; Bracken et al., 2004). It is suggested that performance feedback may have diverse effects on people's motivation, mood, and performance (Dargahi & Namin, 2021). Feedback may motivate individuals to work more, submit more ideas, and improve the quality of their contributions, or it can demotivate them and make them feel overwhelmed by the task/contest/tournament (Dargahi & Namin, 2021).

Feedback valence for task performance in brainstorming can be either positive or negative (Lu et al., 2019), which can trigger different affective states and subsequently influence the performance in ideation (de Rooij et al., 2015). For instance, evaluating whether an idea is original (positive) or unoriginal (negative) can evoke pleasant feelings like satisfaction or unpleasant emotions like unhappiness, and it can affect people's genuine ability to develop original ideas (de Rooij et al., 2017). In previous research, positive feedback has been shown to improve individual creative performance (Vossen et al., 2009). A cognitive tuning theory states that when people experience happy emotions, their cognitive flexibility rises, enhancing their capacity to develop different and innovative ideas (de Rooij et al., 2017). Furthermore, participants in the positive feedback condition were more likely to overcome their self-interested motivation, attend to their partners' ideas carefully, and had a stronger interest in engaging with their partners by developing their thoughts with others and improving upon others' ideas (Lu et al., 2019). However, some believe that when you receive positive feedback, you feel comfortable, and there is no disparity between the objective and performance, so you do not strive as hard to develop ideas (Connolly et al., 1990; Vossen et al., 2009).

Previous literature argued that negative feedback could have an adverse effect on subsequent individual performance and lead to a greater degree of individual negative emotions such as evaluation apprehension (Connolly et al., 1990; Bracken et al., 2004; Vossen et al., 2009). The researchers provided many hypotheses for why assessment fear affects productivity in brainstorming groups, including how social cues such as hierarchy or perceived competence of others influence individual evaluation apprehension by instilling a sense of competitiveness or peer pressure, which can lead to untapped creative potential and rejected ideas (Zhou et al., 2019). For example, Lu et al. (2019) argued that negative feedback suppressed the creative performance of brainstorming groups.

There is evidence that negative feedback can be more effective than positive feedback in the ideation process (Vossen et al., 2009). One of the early research on the impact of feedback tone on ideation found that when groups were anonymous to one another, and their evaluative tone valence was critical (negative) rather than supportive (positive), they produced the maximum output (measured by total file size, number of recognized comments, or number of goal-directed ideas). Vossen et al. (2009) argued that people learn quicker after punishment or negative feedback than after incentives or positive feedback since negative feedback motivates people to put more effort into the work to reduce the gap between current performance and the objective, resulting in more creative and innovative ideas being developed. In addition, another study proposed that criticism in group brainstorming leads to more divergent thinking resulting in more diverse ideas (Curhan et al., 2021). As participation in brainstorming sessions with a chatbot is anonymous, and there is no peer pressure, we hypothesize that negative feedback will promote divergent thinking, motivate the user to complete the task, and boost productivity. The following hypothesis is formulated:

*H2: Participants who receive negative feedback have higher ideation productivity than participants who receive positive or no feedback.*

Finally, current research already provides evidence on how humans interact with AI-based computer systems in a social manner and how specific social mechanisms can be applied to the same extent as human-human interaction (Bracken et al., 2004). Following the CASA paradigm, while engaging with computer-mediated agents, people were also impacted by social feedback (Hwang & Won, 2021). Bracken et al. (2004) conducted research in which participants received either praise or criticism from a computer. Results demonstrate that participants had similar reactions to computers as predicted by interpersonal communication, and the positive and negative performance feedback received from computers influences intrinsic motivation, perceived ability, and recall. Hence, we hypothesize that participants'

perceptions of the chatbot identity impact how participants interpret the negative feedback delivered by the chatbot, which in turn influences productivity. The following hypothesis is formulated:

*H3: Receiving negative feedback from a chatbot that is perceived as human will result in higher productivity than receiving negative feedback from a chatbot that is perceived as a bot.*

### **The influence of evaluation apprehension in ideation**

Evaluation apprehension has been demonstrated to negatively affect performance in several contexts including brainstorming groups, in such a way that it inhibits creativity (Diehl & Stroebe, 1987). The notion of evaluation apprehension in brainstorming is defined as individuals may not want to put forth wild ideas if they are afraid of losing credibility, having their idea rejected, or being humiliated (Siemon, 2022). According to Diehl and Stroebe (1987) and Zhou et al. (2019), participants may fear being judged during collaborative brainstorming sessions, preventing them from sharing their ideas.

Although human-computer interaction (HCI) literature revealed that humans were also influenced by social feedback when interacting with computer-mediated agents, further research revealed that collaborating with the CA could solve the problem of evaluation apprehension, as interacting with an AI did not cause evaluation apprehension (Strohmann et al., 2017; Bittner & Shoury, 2019; Siemon, 2022). Further research discovered that the less human-like character an artificial confederate had, the fewer concerns participants expressed about their partners when interacting with computer-mediated agents (Powers et al., 2007; Hwang & Won, 2021). Therefore, if the computer-mediated agents are highly human-like and users perceive the social presence, it is expected that participants would sense evaluation apprehension when the system analyzes their ideas and delivers feedback. Based on previously described literature and following the CASA paradigm, we propose that working with a robotic



agent who is perceived as a bot may reduce the distraction of concerns about one's being evaluated, improving ideation productivity. Therefore, evaluation apprehension will mediate the effect of perceived identity and feedback valence on productivity. So the following hypotheses are proposed:

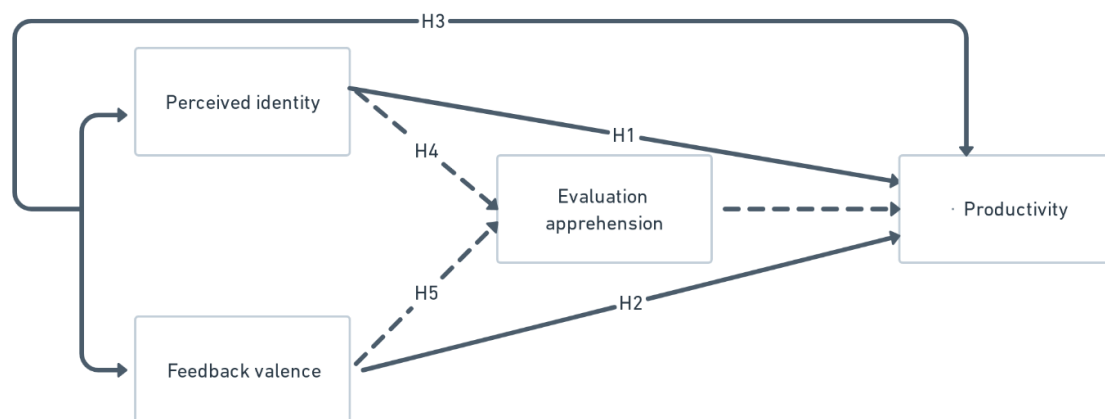
*H4: Evaluation apprehension mediates the relation between perceived identity and ideation productivity.*

*H5: evaluation apprehension mediates the relation between feedback valence and ideation productivity.*

Figure 1 illustrates the conceptual model of all hypotheses considered in this study for a more visual overview.

## Figure 1

*Conceptual model of the study with the hypotheses*



## Method

### Design

A 2x3 between-subject experiment, in which participants were instructed to generate ideas with a chatbot, was performed to investigate the influence of the chatbot's perceived identity and feedback valence on ideation productivity. During the interaction, major social

elements such as profile image, self-introduction (whether the bot introduces itself as a human or a bot), different conversational voice, and typing indicators were used to emphasize the facilitator's identity (Rietz et al., 2019). Each participant received either positive or negative feedback, or no feedback, to test if feedback valence influences productivity. Hence, the independent variables were the chatbot's perceived identity (human vs. bot) and feedback valence (positive, negative, or no input). Evaluation apprehension was examined as a mediator of the effect of perceived identity and feedback on the dependent variable. The dependent variable, ideation productivity, was investigated based on the number (quantity) of generated ideas utilizing an idea-generating task. To increase the validity and reliability, the participants were randomly assigned to one condition:

- 1) Humanoid chatbot providing positive feedback
- 2) Humanoid chatbot providing negative feedback
- 3) Humanoid chatbot providing no feedback
- 4) Robotic chatbot providing positive feedback
- 5) Robotic chatbot providing negative feedback
- 6) Robotic chatbot providing no feedback

### **Participants**

Before participants were recruited, ethical approval was obtained by the Research Ethics and Data Management committee of Tilburg School of Humanities and Digital Sciences (TSHD). Two hundred twenty-six participated in the study who were either sampled through the personal network (i.e., convenience sampling) of the researcher ( $n = 167$ ) or via the participant pool of Tilburg University ( $n = 59$ ), whereby participation points were granted 0.5 credit when finishing the experiment. On the other hand, fifty participants were excluded from the research because they either did not finish it or did not make a significant effort to complete the idea generation task. 65.3% ( $n = 115$ ) of the participants identified as female and 34.7% ( $n$

= 61) identified as male. 15.3% (n = 27) of participants belong to the age range of 35 to 66, while 84.7% (n = 149) belong to the age range of 18-34. Most participants (n = 72) reported a bachelor's degree as their highest education level. In contrast, the remaining participants reported a master's degree (n = 58), a high school diploma (n = 34), or a Ph.D. (n=11). Finally, most participants (n = 129) had previously engaged in brainstorming, with only 47 participating for the first time.

## **Materials**

### ***Idea generation task***

Participants were asked to take part in an idea generation task to investigate the effect of feedback valence and chatbot's perceived identity on ideation productivity. Earlier research claimed that providing instructions and creating specific brainstorming goals resulted in more innovative and original ideas (Litchfield et al., 2011; Paulus et al., 2011). Hence, before the ideation session, participants were educated on the topic and invited to develop as many original and novel ideas as possible. The ideation topic "how to reduce stress among university students" was chosen because it was relevant to the participants, allowing creative individuals to use their content-specific knowledge to reason about the current problem scenario and come up with novel solutions (Zeng et al., 2011). Appendix B contains instructions for the idea generation task. Thus, after becoming familiar with a fictional problem (excessive student stress levels calling for creative solutions) participants engaged in a brainstorming session with a chatbot through an online chat.

Previous research has shown that adopting "De Bono's Green Thinking Hat" can improve an individual's creative thinking (Göçmen & Coşkun, 2019). The "Six Thinking Hats" is a tool for increasing the productivity of creative thinking by encouraging individuals to approach problems from various perspectives by classifying different ways of thinking into six "hats": logic, emotion, caution, optimism, creativity, and control (Göçmen & Coşkun, 2019).

As a result, this strategy was used in the chatbot conversation flow to assist the participant in developing ideas.

To complete the ideation task, participants were randomized to one of six experimental conditions. As a result, participants engaged with a humanoid chatbot or a robotic and received positive, negative, or no feedback (i.e., control condition) on their shared ideas. Evaluative statements (feedback) on participants shared ideas were adapted from a prior study that found that feedback on the originality of one's ideas improves the outcome of ideation (de Rooij et al., 2017; Wang et al., 2015). The participant only provided positive feedback in the positive feedback condition, such as 'Your idea is very original.' In the negative feedback scenario, the chatbot only gave the participants negative comments, such as 'Your idea was not original enough.' The chatbot provided no feedback to the participants in the control condition and just requested participants to report the prepared ideas. The task continued for 10 minutes and participants were asked to share their ideas in five rounds.

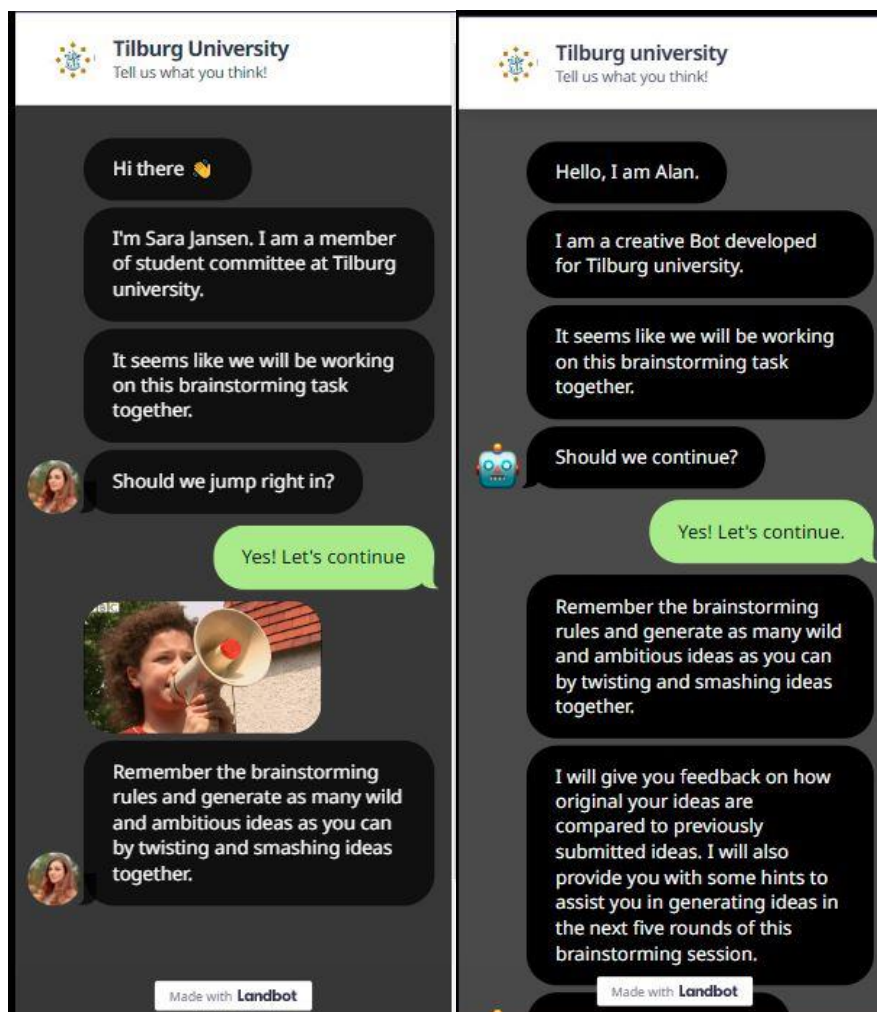
### ***Chatbot***

For this study, a conventional chatbot was designed using Landbot ([www.landbot.io](http://www.landbot.io)), a visual development software, to act as a facilitator in an ideation session. Landbot is a natural language understanding platform on which a conversational user interface can be designed and integrated into web applications. For this study, the chatbot was implemented in the online survey in Qualtrics. Social cues for emphasizing the bot identity include a profile photo, self-introduction, a graphical typing indicator (3 dots), delay by average human reading speed (words/min), and conversation human voice (e.g., use of emoji, emoticon, interjections) all of which were taken into account in this study (Rietz et al., 2019; Hendriks et al., 2020). For example, a human profile picture, self-introduction as a human, higher CHV (using emoticons, emoji, and interjections), and typing indicators in a humanoid chatbot were applied to instil the human identity. Figure 2 depicts the humanoid and robotic chatbot's interface and how the

chatbot presented itself to the participants. Moreover, the chatbot interface was developed as the same text-based CMC channels (e.g., Facebook Messenger), in which users were given a text box to type their thoughts in and send them by pressing the send button.

## Figure 2

*The visual appearance of humanoid (left) and robotic (right) chat interface and introduction with the presence of social signals*



Since the previous study depicted that while conversing through an anonymity-ensuring system, participants reported little or no evaluative fear in EBS, the chatbot did not inquire about the participants' names to avoid increasing the feeling of concern (Maaravi et al., 2020). So, the chatbot would greet the participants, introduce itself as a creative bot or a student, and invite them to begin working on the task. During the 10-minute brainstorming task, the chatbot

could contribute five of “De Bono's Thinking Hats” to help the participant develop ideas. Based on the assigned conditions, feedback was given following each round of idea-sharing. When users did not submit ideas, the chatbot did not provide feedback, removing the potential impact of feedback frequency, and instead tried to stimulate the dialogue and encourage them to contribute more.

Participants were, however, given the option to leave the session if they ran out of ideas. A timer mechanism in the chatbot was incorporated so that after ten minutes, the chatbot would recommend ending the discussion. The ideas the participants communicated to the chatbot were automatically recorded in a database for each participant. After that, the database was converted to an Excel file for further analysis.

### ***Questionnaire***

Afterward, participants responded to a post-study survey. Participants first responded to eleven questions on how they would judge their conversation partner(perceived identity), and then they responded to eight questions about their experiences participating in the brainstorming exercise (evaluation apprehension). After all participants were debriefed about the nature of the study and the manipulation (Appendix F). All protocols were reviewed and approved by the Ethics and Data Management Committee of Tilburg School of Humanities and Digital Sciences.

### **Measures**

#### ***Perception of chatbot's identity***

The first section of the survey included a manipulation check to see how participants perceived the bot's identity and how they rated the ideation partner's social presence and humanity. The degree to which someone or something is perceived as a human is characterized as perceived humanness. It is based on the three-factor theory of anthropomorphism, which defines humanness in terms of the interlocutor's thoughtfulness, politeness, and responsiveness

(Hendriks et al., 2020). We anticipated that revealing the identity as a creative bot would lead participants to assume that they are experiencing artificial thoughtfulness, more automatic, and less civility and concern for the partner. The perceived humanity scale from Hendriks et al.'s (2020) study was utilized. This scale comprises six items surveyed using a seven-point semantic differential (1 = strongly disagree, 7 = strongly agree). The subjects were asked to what extent they agreed with statements about the facilitator. One example of such a statement is: 'I found my ideation partner extremely thoughtful/extremely unthoughtful.'

Social presence pertains to the degree to which a chatbot is perceived as a 'real person' in CMC (Ciechanowski et al., 2019). Social presence is mainly expressed in terms of human warmth, human-likeness, sociability, and human sensitivity, as experienced by the interlocutor. These are highly influenced by the method of communication (Hendriks et al., 2020). For example, if a chatbot introduces itself as a chatbot, as is the case with proactive self-presentation, the user will know the real identity of the interlocutor as the chatbot. In that case, a lower level of intimacy or warmth will be experienced by the user as knowing that he/she is talking to a chatbot instead of a real person for the interaction, resulting in the less social presence (Hendriks et al., 2020). The social presence scale is based on the scales used by Gefen and Straub (2004) and Hendriks et al. (2020) in their studies of chatbots. The scale consisted of five items that were assessed using a seven-point Likert scale (1 = "strongly disagree" – 7 = "strongly agree"). The subjects were asked to what extent they agreed or disagreed with statements about their ideation partner and the brainstorming session (for example, "There was a sense of personal communication with my facilitator."). The complete scales for measuring the social presence and perceived humanity are included in Appendix C.

### ***Evaluation apprehension***

The Brief Fear of Negative Evaluation Scale (BFNE) measures a person's tolerance for the possibility they may be judged disparagingly or hostilely by others (Leary, 1983). BFNE

scale was later revised so that it became shorter, and some items were reworded, yet more information from fewer questions can be obtained. Therefore, the BFNE-R scale consists of 8 items to measure evaluation apprehension (Carleton et al., 2007). The measure was answered on a 5-point Likert scale (1 = "strongly disagree" – 5 = "strongly agree"). The subjects were asked to what extent they agreed or disagreed with statements about their ideation collaborates (for example, "I am concerned about ideation partner's opinions of me."). The scale demonstrated appropriate test-retest reliability and convergent and discriminant validity (Carleton et al., 2007). Hence, it was used to assess evaluation apprehension in the experiment. The full BFNE-R scale for measuring evaluation apprehension is included in Appendix C.

### ***Ideation productivity***

The dependent variable, ideation productivity, was coded from participants' chat transcripts and evaluated by the number of ideas each participant produced during the ideation session (Geerts et al., 2021). According to Osborn's (1957) brainstorming guidelines, brainstormers should focus on quantity since it increases the likelihood that some of these ideas will be good, and leave a quality evaluation for later. Therefore, in this context, we defined "productivity" as the number of ideas generated in an ideation session. As a result, only non-redundant ideas exchanged with the chatbot by each participant were counted to determine the participants' productivity.

### **Procedure**

The experiment was distributed and conducted online through Qualtrics due to its extra security and data encryption function, ensuring that our participants' personal information was not compromised. When the experiment began, the participants were given an informed consent form that included information on data anonymity and storage, voluntary involvement, and the researcher's contact information (Appendix A). Participants could provide consent by



clicking a button agreeing to the terms. When participants disagreed with the informed consent, they were redirected to the end of the questionnaire and thanked for their participation.

Following consent, participants were asked demographic questions such as age, gender, education level, and brainstorming knowledge (Appendix C). Before ideation started, all of the ideation criteria and rules were presented to the participants. It was also specified that if the participants did not finish the brainstorming task with the facilitator, the data would be eliminated from the research. Following that, participants were randomized to one of six conditions to collaborate on a brainstorming session with a chatbot via an external website where the chatbot was installed. Depending on the conditions, they were introduced to a humanoid or robotic chatbot as the facilitator to help them through the task. For the rest, a distinction could be made between different sorts of feedback (positive, negative, and no feedback). During the brainstorming session, participants were challenged to develop creative suggestions for stress reduction among students. The ideation session was scheduled for ten minutes; however, any participant was free to end it at any time throughout the session.

Finally, participants completed a post-study survey about their evaluative apprehension experiences in the brainstorming exercise (BIFN scale, eight questions) and their perception of their conversational partner (social presence scale; 5 questions and perceived humanness scale; 6 questions). At the end, participants were warmly thanked for their participation and were briefed about the study's objectives and the manipulations utilized. The whole procedure is illustrated in Appendix D.

### **Data analysis**

To answer the research question and test the hypotheses, the Qualtrics data was imported to the statistical program IBM SPSS STATISTICS 27. After completing the data collection, the process of removing all unnecessary and incorrect data from the data set started. In addition, all information was securely and anonymously stored in a database.

Since the experiment included between-subject designs, a factorial ANOVA was performed to answer H1 (Main effect of perceived identity), H2 (Main effect of feedback valence), and H3 (Interaction effect between the perceived identity and types of feedback). The generated ideas per participant were added up in the Excel file, and after cleaning the data, eliminating the wrong and unclear answers were used as the dependent variable.

Furthermore, a moderation mediation analysis using HAYES Process model 4, version 4.1 within SPSS, was conducted to test whether the evaluation apprehension mediates the relationship between the perceived identity, feedback valence, and ideation productivity. The social presence and perceived humanness scores were tested as a manipulation check to ensure that users' impressions of the bot's identity in the context of social signals added to the chat interface and conversation flow were accurate.

## Results

### Manipulation check

The data analysis began by assessing whether the experimental manipulation was successful. Two scales were used to explore the perceived identity of the bot. Firstly, the perceived social presence scale, consisting of 5 questions measured on a 7-point scale ( $M = 3.91$ ,  $SD = .02$ ) showed an excellent reliability score ( $\alpha = .92$ ). A two-tailed independent sample t-test with the social presence means as the dependent variable and the perceived identity (human vs. bot) as the independent variable was conducted to explore to what extent participants experienced social presence in humanoid and robotic chatbots. The data score for the dependent variable was normally distributed. On average, *perceived social presence* in human condition ( $M = 3.85$ ,  $SD = 1.64$ ) was lower than perceived social presence in bot condition ( $M = 3.97$ ,  $SD = 1.56$ ). This difference was not significant ( $M_{dif} = -0.12$ ,  $t(174) = -0.52$ ,  $p=0.60$ ). The difference represented both a *small* to *medium* effect.

Secondly, the perceived humanness scale consists of 6 questions measured on a 7-point scale ( $M = 4.46$ ,  $SD = .11$ ) showed a good reliability score ( $\alpha = .88$ ). A two-tailed independent sample t-test with the perceived humanness means as the dependent variable and the perceived identity (human vs. bot) as the independent variable was conducted. The data score for the robotic chatbot was not normally distributed (z-score kurtosis = 4.12). Therefore, the p-value may not be reliable and more weight should be placed on the provided bootstrapped 95% confidence interval. Data for the humanoid chatbot was normally distributed. The mean perceived humanness experienced by the participants was slightly higher for the conditions with a bot identity ( $M = 4.56$ ,  $SD = 1.25$ ) than for the human identity ( $M = 4.34$ ,  $SD = 1.35$ ). However, there was no question of a significant difference ( $M_{dif} = -0.22$ ,  $t(174) = -1.12$ ,  $p = 0.25$ , 95% CI [-0.57, 0.17]). Table 1 shows all the data of the outcome of the t-test for both social presence and the perceived humanness scale.

**Table 1**

*Perceived humanness and social presence score for robotic and humanoid chatbot*

	Identity	Mean	Std. Deviation	Std. Error Mean
Perceived humanness	Human	4.3469	1.35575	.14619
	Bot	4.5667	1.25017	.13178
Social presence	Human	3.8512	1.64100	.17695
	Bot	3.9778	1.56290	.16474

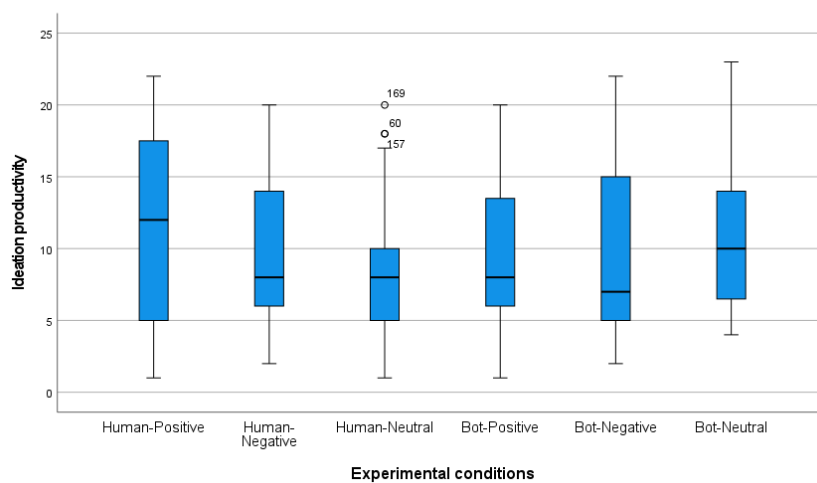
In conclusion, the addition of social signals, including the self-introduction, profile image, conversational human voice (e.g., using emoji, interjection), and typing indicators did not lead to significantly more social presence and perceived humanness in a humanoid chatbot during the brainstorming session and participants did not perceive the robotic and humanoid bot differently.

## Hypotheses testing

A two-way ANOVA was performed to test whether the perceived chatbot's identity and feedback valence influence the ideation productivity. The feedback valence (positive, negative, neutral) and perceived identity (human vs. bot) were utilized as independent variables, while the ideation productivity, which was measured by the number of generated ideas per person, was used as the dependent variable. A normality check showed that there are violations for the dependent variable, productivity (Human and neutral feedback: Zkurtosis = 4.55, Bot and neutral feedback: Zkurtosis = 3.36). The outcome will not be significantly affected because of the factorial ANOVA's reasonable robustness against this violation and the use of a large sample size. Yet it must be said that the p-value can be somewhat biased. However, the assumption of homogeneity of variances was met because Levene's test of equality of error variances was not significant ( $F(5, 170) = 1.65, p = .15$ ). Figure 3 summarises the ideation productivity conditions.

**Figure 3**

*Boxplot of the ideation productivity in all six conditions.*



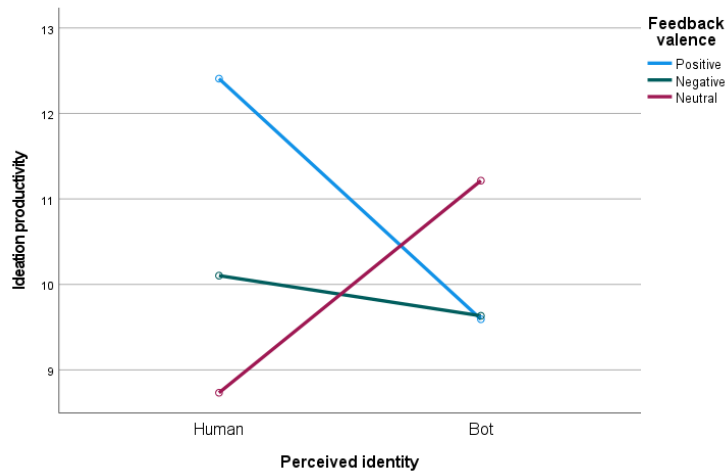
The ANOVA showed no significant main effect of independent variable perceived identity,  $F(1,170) = 0.93$ ,  $p = .76$ ,  $\eta^2_{\text{partial}} = .001$  on ideation productivity. Dependent variable scores for the human condition were almost the same ( $M = 10.35$ ,  $SD = 6.08$ ) as for the bot condition ( $M = 10.11$ ,  $SD = 5.62$ ), indicating that participants in the humanoid bot generated as many ideas as those in the robotic bot. The *H1* that participants brainstorming with a chatbot regarded as a bot are more productive than participants brainstorming with a chatbot perceived as a human is not supported by the findings of this statistical analysis.

Within this factorial ANOVA, the main effect of the feedback valence was tested to answer *H2*. However, there was no significant main effect of independent variable feedback valence  $F(2,170) = 0.68$ ,  $p = .51$ ,  $\eta^2_{\text{partial}} = .008$ . Dependent variable scores for positive feedback condition were higher ( $M = 10.88$   $SD = 6.23$ ) than for neutral feedback ( $M = 9.93$   $SD = 5.35$ ). In turn, the negative feedback contributes to less productivity (fewer ideas) than the neutral feedback ( $M = 9.86$ ,  $SD = 5.93$ ). These differences were not statistically significant, and thus *H2* was not supported. Participants' productivity was almost the same in all feedback conditions. Given these results, further exploration using a follow-up test is unlikely to provide further insight into the results regarding the effect of different types of feedback on productivity.

Finally, the factorial ANOVA also looked at the interaction effect between the perceived identity and the feedback valence to answer *H3*. There was not a significant interaction effect between perceived identity and feedback valence,  $F(2,170) = 3.04$ ,  $p = .05$ ,  $\eta^2_{\text{partial}} = .035$ , and hypothesis 3 is not supported. Figure 4 on the next page visualizes the nature of the results mentioned above.

**Figure 4**

*Chart of the insignificant interaction effect between perceived identity and feedback valence on ideation productivity.*



Even though the data numerically suggest that positive feedback in humanoid and neutral feedback in robotic chatbots contribute to higher productivity on average, this difference was not statistically significant. Table 2 summarizes the average productivity at the chatbot's perceived identity and feedback valence levels.

**Table 2**

*Average productivity at the two levels of perceived identity and feedback valence*

Bot Identity	Feedback valence	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Human	Positive	12.407	1.116	10.204	14.611
	Negative	10.103	1.077	7.977	12.229
	Neutral	8.733	1.059	6.643	10.824
Bot	Positive	9.594	1.025	7.570	11.618
	Negative	9.633	1.059	7.543	11.724
	Neutral	11.214	1.096	9.051	13.378

### Mediation analysis

The "PROCESS" macro, model 4, v2.16 (Hayes, 2013) in SPSS version 27 with bias-corrected 95% confidence intervals ( $n = 10000$ ) was used to investigate the significance of the indirect (i.e., mediated) effects of evaluation apprehension between the two independent variables and dependent variable. Significant effects were supported by omitting a zero within the confidence intervals.

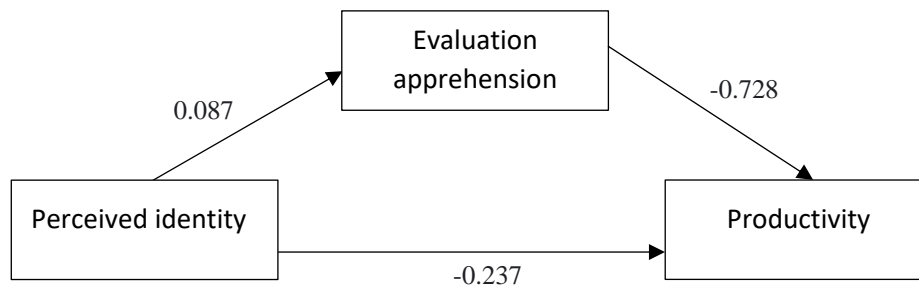
The evaluation apprehension scale, consisting of 8 questions measured on a 7-point scale ( $M = 2.39$ ,  $SD = .09$ ) showed an excellent reliability score ( $\alpha = .94$ ). The average evaluation apprehension experienced by the participants during the brainstorming sessions with a robotic chatbot as a facilitator ( $M = 2.57$ ,  $SD = 0.77$ ) and a humanoid chatbot as a facilitator ( $M = 2.58$ ,  $SD = 0.68$ ) were almost equal.

The PROCESS moderated mediation analysis shows that there was no significant effect of perceived identity on evaluation apprehension,  $b = 0.09$ ,  $se = 0.15$ ,  $p = 0.56$ , 95% CI [-0.21; 0.38]. Additionally, there was no significant indirect influence of perceived identity on productivity through evaluation apprehension ( $b = -0.728$ ,  $se = 0.442$ ,  $p = 0.101$ , 95 percent CI [-1.60; 0.14]). Thus, no evidence supports (H4) evaluation apprehension's role in mediating the relationship between productivity and perceived identity. The results also did not show a significant direct effect of facilitator perceived identity on productivity,  $b = -0.237$ ,  $se = 0.882$ ,  $p = 0.788$ , 95% CI [-1.96; 1.50]. Figure 5 on the following page displays the analysis's results in a more visual format.

The average evaluation apprehension experienced by the participants in negative feedback condition ( $M = 2.65$ ,  $SD = 1.02$ ) was higher than positive condition ( $M = 2.24$ ,  $SD = 1.04$ ) and neutral condition ( $M = 2.27$ ,  $SD = 0.86$ ). However, this difference was not significant. To assess the mediation effect of evaluation fear between feedback valence and ideation productivity (H5), a PROCESS moderated mediation analysis model 4 was performed.

**Figure 5**

*Model of mediation analysis with evaluation apprehension as a mediating variable between perceived identity and ideation productivity (PROCESS model 4).*



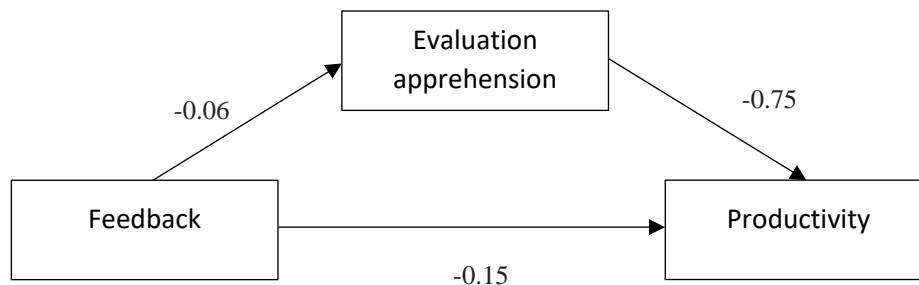
*Note.* Coefficients and significance of the results of the moderated mediation analysis for productivity, \*\*\*  $p < 0.001$

The feedback variable had three levels, recoding the categorical variables, so the variable included only two levels in such a way that is receiving feedback (code 1= positive and negative) and control variable where participants did not receive feedback (code=0). The data was not homogeneous and normally distributed. Therefore, in these analyses, mediation is significant if the 95% Bias Corrected and accelerated confidence intervals for the indirect effect do not include 0 (Preacher & Hayes, 2004; Preacher et al., 2007). The analysis showed that there was also no significant indirect effect of feedback valence on ideation productivity through evaluation fear,  $b = -0.44$ ,  $se = 0.5$ , 95% CI [-0.03; 0.16]. The results thus again do not support *H5*, indicating that evaluation apprehension did not play a mediating role between feedback valence and ideation productivity. The results again, did not show a significant direct effect of feedback valence on ideation productivity,  $b = -0.147$ ,  $se = 0.31$ ,  $p=0.63$ , 95% CI [-0.76; 0.47]. Figure 6 on the next page illustrates all the findings of the mediation test of evaluation apprehension, feedback valence, and ideation productivity.



**Figure 6**

*Model of mediation analysis with evaluation apprehension as a mediating variable between feedback valence and ideation productivity (PROCESS model 4)*



*Note.* Coefficients and significance of the results of the moderated mediation analysis for productivity, \*\*\*  $p < 0.001$

In conclusion, the results showed that evaluation apprehension did not mediate the relations between perceived identity, feedback valence, and ideation productivity.

## Discussion

This study aimed to see if a chatbot might be utilized as a creative support tool that plays an active role (facilitator) in addressing assessment fear in ideation sessions. More precisely, the influence of bot's perceived identity and feedback valence on ideation productivity and whether this relationship is mediated by evaluation apprehension were investigated. This was studied using a questionnaire and a brainstorming activity in which participants completed a brainstorming task with a chatbot (robotic vs. humanoid) via a chat interface while receiving positive, negative, or neutral feedback.

First, recent studies on human-bot interactions suggest that bot identities and conversational strategies can significantly influence how users respond to chatbots' messages and requests (Shi et al., 2020). Previous research on using a chatbot as an ideation partner

supports the impact of the partner's perceived identity on ideation productivity (Hwang & Won, 2021; Siemon, 2022). Participants were anticipated to generate more ideas when they felt they were communicating with a robotic chatbot facilitator due to the bot's lack of human agency (Bittner et al., 2019; Oh et al., 2018; Lee et al., 2020). Contrarily, the current study revealed no evidence that the perceived identity of the chatbot had any effect on ideation productivity, and brainstorming with a robotic bot did not show higher productivity than brainstorming with a humanoid bot. Hence, H1 was not supported. The current study's findings are congruent with those of Geerts et al. (2021), who used either a social robot or a human as a facilitator of a brainstorming session and observed that the facilitator's identity (human vs. social robot) had no effect on productivity. The possible explanation might be that participants did not perceive robotic and humanoid chatbots differently since the manipulation did not work, and participants felt the same level of social presence and humanity from both humanoid and robotic chatbots.

According to previous research applying social signals can stress the interlocutor's identity during the interaction (Go & Sundar, 2019). However, the current study showed that applying social cues, including self-introduction, profile image, typing indicator, and conversation human voice, does not affect participants' perception of the bot identity. Shi et al. (2020) argued that participants had their judgments of the bot identity regardless of the label (e.g., self-introduction). Research by Araujo (2018) into the properties of chatbots has shown that a human conversational style in chatbots can lead to anthropomorphism. Because the number of visual clues available to make a chatbot look more human-like is limited, the effect of conversation style may be greater than that of interface cues (Rietz et al., 2019). It is also possible that the chatbot design and the conversation flow were not interactive enough.

The second hypothesis was concerned with the impact of feedback on ideation productivity. Previous research demonstrated that receiving any feedback affects ideation production (Dargahi & Namin, 202). Negative feedback was expected to enhance motivation

to reduce the gap between the current and the desired state, resulting in more diversified thinking and higher productivity (Lu et al., 2019). However, the results revealed that feedback valence had no effect on ideation productivity. Hence, the H2 is not supported. This supports the argument made by Kluger and DeNisi (1996) that performance is not always enhanced by feedback. One possible reason the feedback valence had no effect on ideation is that continuing to receive negative or positive feedback might make it less effective (de Rooij et al., 2017). Another possibility is that the chatbot did not offer accurate feedback, such as rejecting a novel idea or applauding a common one, due to a lack of intellectual ability of the chatbot. It was hypothesized that when participants receive negative feedback from a robotic or humanoid chatbot, their impressions of it will differ significantly. Participants who received negative feedback from a humanoid chatbot would react to negative feedback as if it were coming from a real human, which would increase productivity. The results, meanwhile, did not support this hypothesis (*H3*). This result refutes the earlier study's finding that receiving negative feedback from a robot influences a user's performance and behaviour (Vossen et al., 2009).

Finally, hypotheses 4 and 5 revolved around the mediating role of evaluation apprehension between perceived identity, feedback valence, and productivity. According to the research on robots and evaluation fear, since robots lack human agency, presenting an idea to one will result in a more productive brainstorming session as participants are less concerned about a robot's potential negative evaluation (Powers et al., 2007; Zhou et al., 2019; Lee et al., 2020). Nevertheless, the findings of this study did not support the mediating effect of the evaluation apprehension between bot perceived identity, feedback valence, and productivity, and H4 and H5 were rejected. The present study's assessment fear findings contradict Diehl and Stroebe (1987) and Zhou et al. (2019), which revealed a negative link between evaluation apprehension and ideation productivity. An explanation for these conflicting results would be the different environments in which the studies were conducted. Inconsistent results and a lack

of evidence for the mediation role of evaluation apprehension in this study may be attributed to the feedback structure (repetitive and inaccurate) and failure to emphasize the bot identity.

### **Limitations and future recommendations**

While there are limitations that must be considered when interpreting and building on the findings, this research also provides opportunities for future research. To begin with, a major limitation is that bot identity manipulation did not work well within the study. The lack of a significant difference in perceived humanity and social presence between humanoid and robotic chatbots suggests that the study's emphasis on chatbot identity may have varied too little, compromising the study's internal validity. Since the manipulation of the chatbot's identity did not work, the extent to which the chatbot's perceived identity in the facilitator's role influences ideation productivity and whether evaluation apprehension mediates this relation remained unknown.

This manipulation might not have been successful for a variety of reasons. First, the *human conversational style* can be used to explain the modest difference in observed humanity and social presence (perceived identity) between the humanoid and robotic conditions. It is likely that employing emoji and emoticons, interjections (Woohoo), self-introduction, profile image, and typing indications cannot significantly alter how bots' identities are perceived when other elements are the same. Previous research discovered that, in addition to the previously described traits, employing informal vocabulary (e.g., really, great), active vs. passive tone of voice, and acknowledging the user impact on the perceived conversation human voice (CHV) which is one of the elements influence the perceived identity (Liebrecht et al., 2021). In follow-up research, the conversational tone of the robotic chatbot can be computer-like, either more formal, faster, or more objective than that of the humanoid chatbot (Araujo, 2018).

The violation of the expectancy effect can explain the second possible reason for manipulation failure. Following the contrast theory, users assess the system based on perceived discrepancies between the expectations and the actual functioning. Decreased satisfaction may result if the expectations are not reached (Khadpe et al., 2020). On the one hand, the agent's identification as a person may have elevated participants' expectations for humanity, but using low-anthropomorphic or conversational cues (such as an improper dialog bubble or providing inaccurate feedback) may have disappointed them. On the other hand, identifying the agent as a chatbot may have led users to expect machine-like signals, but using highly anthropomorphic visual and verbal cues (high level of CHV) may have been perceived as dishonest. These expectations and actual performance gaps may reduce users' perceptions of perceived humanness, favorable attitudes, and behavioral intentions that affect how they perceive the chatbots' identity (Go & Sundar, 2019). A future study would use the Wizard-of-Oz method, which is frequently used in studies on the value of brainstorming or other types of creative work with a social robot facilitator, to investigate the influence of perceived identity and participant expectation to avoid providing incorrect input and appear more dynamic in order to impact the perceived humanness (Kahn et al., 2016).

Another potential limitation of the study was participants' evaluation concerns were measured once with only one questionnaire (BFNE-R scale). As a result, neither before nor during the study, any information regarding participants' anxiety or fear of evaluation was unknown. Hence, adding a questionnaire before the interaction with the chatbot can be beneficial and provide information on whether individual differences play a part when interacting with a bot.

Another limitation of the current study is the absence of control over the execution of the brainstorming exercise, which was automated and completed entirely online; therefore,

individuals' environment could have been distracting despite the high ecological validity of this study design.

Finally, feedback manipulation was another area where this study was limited. Feedback valence did not influence the ideation productivity. During ideation sessions, participants get either positive or negative feedback to emphasize the effect of feedback valence. It is reasonable to assume that continued use of the same feedback tone may lead to a user discovering the systems' manipulations, possibly with adverse effects on its believability and, subsequently, its utility. Participants in idea-generating groups need to connect the performance information to their efforts for performance feedback to be an effective motivational tool (Jung et al., 2010). Applying feedback that is more detailed and accurate in subsequent research may thus be advantageous.

### **Conclusion**

The current study was conducted to explore if the chatbot's perceived identity and feedback valence may impact ideation productivity so that it could be employed as a facilitator in ideation sessions. However, there was no evidence that perceived identity and feedback valence influenced ideation productivity. Correspondingly, a mediation effect of evaluation apprehension was not found in the relationship between these variables and productivity. Nevertheless, the results of the present study help to better understand how to design a chatbot as an active player for ideation sessions. Regardless of the role of future AI agents in teamwork, knowing the influence of conversational style informs future bot design implications. The results also contribute to how feedback is framed in human-computer interaction. Repetition of either positive or negative feedback did not affect people's productivity. Therefore, businesses and organizations should offer multiple types of feedback if they want to utilize a CA to provide feedback on ideas for motivating and group decision-making. The current study had certain methodological limitations, but future research using machine learning to create a

more complex chatbot may offer better internal validity and the chance to report more important and well-supported conclusions based on comparable effects discovered in other studies.

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## Appendix A

### Informed consent form for participants

#### Welcome!

Thank you for considering participating in this study by Tilburg University! Below you can find the information you need to know before starting, so **please read it carefully**.

**Aim of the research:** All innovations start with a good idea. Organizations and societies must employ innovative problem-solving techniques to adapt to quickly changing surroundings. Ideation and brainstorming is a typical procedure through which creative and new ideas and concepts are elicited to uncover various alternative solutions for a task that would eventually put the business ahead of the competitors. Hence, companies are looking for ways to enhance generating creative and novel ideas. This research focuses on how we can support the idea generation process.

**The research:** If you agree to participate in this study, you will be asked first to answer some demographic questions about your age, gender, level of education, and brainstorming experience. Following this, idea generation rules and the brainstorming task will be explained. Then, you will connect to Tilburg university's brainstorming chat system to generate ideas either with a human or with a social bot as a brainstorming facilitator to propose solutions to reduce stress among university students. This task will take about 15 minutes, whereby you are expected to generate as many ideas as possible while chatting with a facilitator. As soon as the brainstorming session ends, you will be asked to access the facilitator's interactive behavior and your feelings during the task through some questionnaires. This questionnaire will consist of 19 questions. Finally, you will be briefed about the goal of the experiment. The whole experiment will take about 20 or 30 minutes,

depending on how long you spend chatting with the facilitator.

**Privacy and confidentiality:** There are no risks associated with participating in this study. All data collection is in accordance with the AVG (General Data Protection Regulation) law. The Research Ethics and Data Management Committee of Tilburg School of Humanities and Digital Sciences has reviewed and given permission to conduct this study. Data will be processed entirely anonymously and treated with the utmost confidentiality. Under no circumstance will your name be linked to the results. The anonymized data from this study will be kept for ten years, and data can only be shared with other researchers upon request. Eligible students receive 0.5 HSP credit for their participation.

Participation is entirely voluntary, and during this study, you have the right to withdraw at any time, for any reason, and without any adverse consequences. If you have questions about this study, you may contact Samira Goli (s.goli@tilburguniversity.edu). If you have any remarks or complaints regarding this research, you may also contact the “Research Ethics and Data Management Committee” of Tilburg School of Humanities and Digital Sciences via tshd.redc@tilburguniversity.edu. When you agree to participate in this study, you **confirm** that you:

- I have had the opportunity to read this consent form and have the research study explained.
- I am 18 years old or older.
- I have had enough time to consider my volunteer participation.
- I understand that I can withdraw from this study at any time, without penalty or without giving any reason.
- I agree that my anonymous data and answers are stored for ten years.
- I agree that my anonymous data and answers will be used for research.
- I am prepared to participate in the research project described above.

If you **do not** agree to participate, you may now close the window; otherwise, please select the option below to continue the experiment.

- I have read the informed consent and I agree to participate.

## Appendix B

### Idea Generation Task

#### Brainstorming

Brainstorming is a success story. It is one of the most widely used methods for creativity and innovation. The idea goes back to the American Alex Osborn. A brainstorming session involves people meeting (either in person or virtually), to discuss, draw out, explain, and write down ideas to solve problems or create something new. There are brainstorming rules that guide the activity and are announced by the facilitator before beginning the session. According to Alex Osborn, the following requirements must be fulfilled during a brainstorming session to ensure a practical brainstorming session:

- **Focus on quantity rather than quality:** The number of generated ideas is important, so we should develop as many ideas as possible.
- **Wild and exaggerated ideas should be welcomed!** We tend to think about what we want without the constraints of technology or materials when considering wacky or outlandish ideas.
- **Combine and improve ideas!** We should stay focused on the topic so they can twist and smash ideas together and generate new ideas!

Therefore, you are expected to throw out any ideas they have, even if they seem too simple, complex, or odd, because they might work.

**Now we are familiar with brainstorming; please imagine yourself in the following situation:**

Stress has become part of student's academic life due to the various internal and external expectations placed upon their shoulders. Adolescents are particularly vulnerable to the problems associated with academic stress as transitions occur at an individual and social level. Therefore, it becomes imperative to derive adequate and efficient intervention strategies to help students manage their stress. Because of the COVID19 crisis, the situation has gotten worse. Considering the problem, the Tilburg University students committee has decided to assist students by asking participants like you to develop creative stress-reduction ideas. Specifically, you are asked to develop as many novels and innovative ideas as possible that address the following problem: "**How to reduce stress among students?**". Creative ideas, here, are those ideas that are original and not common, i.e., therapy talk with a social bot.

On the following page, you will be connected to the Tilburg University brainstorming chat system to generate as many creative ideas as possible in collaboration with a brainstorming facilitator. During the brainstorming session, the facilitator will be present to enhance the ideation session by providing feedback on how creative your ideas are and giving some hints to enhance generating creative ideas in five rounds. You can choose to share ideas if you have any for each round or go to the next round. After finishing all five rounds, the facilitator will end the session.

**We would like you to keep the following instructions in mind:**

- The ideation will continue for 10 to 15 minutes. It is essential to develop as many creative ideas as possible until the facilitator announces that the time is up and ends the session!
- Don't press the Next button before finishing the brainstorming with the facilitator.
- Please express the ideas in a clear sentence, and separate the sentences with a centerline/dash (-) when you are typing in the box.
- After the brainstorming session is finished, you will be asked to complete a questionnaire on the following pages, which will take 5 minutes.

If you fully comprehend this explanation and are ready to begin, go to the next page to start the brainstorming session.

**Good Luck!**

## Appendix C

### Questionnaire and manipulation check

#### Demographic and task relevant questions

1. How do you identify yourself?
  - Male
  - Female
  - Prefer not to say
  - Others
2. What is your age?
  - 18-25
  - 26-34
  - 35-49
  - 50-66
  - Above 66
3. What is your highest achieved education (diploma)?
  - Elementary school
  - High school
  - MBO
  - Bachelor
  - Master
  - PhD or higher
4. Have you ever participated in ideation session before?
  - Many times
  - Few times
  - I have not participated before





2. Extremely unskilled      1   2   3   4   5   6   7  
                           Extremely skilled

3. Extremely unthoughtful      1   2   3   4   5   6   7  
                           Extremely  
thoughtful

4. Extremely impolite      1   2   3   4   5   6   7  
                           Extremely polite

5. Extremely unresponsive      1   2   3   4   5   6   7  
                           Extremely  
responsive

6. Extremely unengaging      1   2   3   4   5   6   7  
                           Extremely  
engaging

### **Brief Fear of Negative Evaluation-Revised (Carleton et al., 2007)**

Please indicate to what extent you agree with the following statements.

1. I am frequently afraid of ideation partner noticing my shortcomings.

Totally disagree      Disagree      Agree nor disagree      Agree      Totally agree

2. I am afraid that ideation partner will not approve of me.

Totally disagree      Disagree      Agree nor disagree      Agree      Totally agree

3. I am concerned about ideation partner's opinions of me.

Totally disagree      Disagree      Agree nor disagree      Agree      Totally agree

4. When I am presenting my idea to ideation partner, I worry about what they may be thinking about me.

Totally disagree	Disagree	Agree nor disagree	Agree	Totally agree
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5. I am usually worried about what kind of impression I make on ideation partner.

Totally disagree	Disagree	Agree nor disagree	Agree	Totally agree
------------------	----------	--------------------	-------	---------------

6. If I know ideation partner is judging me, it tends to bother me.

Totally disagree	Disagree	Agree nor disagree	Agree	Totally agree
------------------	----------	--------------------	-------	---------------

7. I often worry that I will say or do wrong things in front of ideation partner.

Totally disagree	Disagree	Agree nor disagree	Agree	Totally agree
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8. I worry about what ideation partner will think of me even when I know it does not make any difference.

Totally disagree	Disagree	Agree nor disagree	Agree	Totally agree
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## Appendix D

### Experiment procedure



## Appendix E

### Chatbot transcript

Humanoid chatbot		
Positive	Negative	Neutral
<p>Hi there I'm Sara Janson. I am a member of the student committee at Tilburg University. It seems we will be working on this brainstorming task together to generate creative ideas. Should we jump right in?</p> <p>Remember the brainstorming rules and generate as many wild and ambitious ideas as you can by twisting and smashing ideas together.</p> <p>I will give you feedback on how original your ideas are compared to previously submitted ideas. I also provide you with some tips to assist you in coming up with more ideas 😊.</p> <ul style="list-style-type: none"> <li>• Are you ready to start?</li> </ul>	<p>Hi there 🖐️ I'm Sara Janson. I am a member of the student committee at Tilburg University. It seems we will be working on this brainstorming task together to generate creative ideas. Should we jump right in?</p> <p>Remember the brainstorming rules and generate as many wild and ambitious ideas as you can by twisting and smashing ideas together.</p> <p>I will give you feedback on how original your ideas are compared to previously submitted ideas. I also provide you with some tips to assist you in coming up with more ideas 😊.</p> <ul style="list-style-type: none"> <li>• Are you ready to start?</li> </ul>	<p>Hi there I'm Sara Janson. I am a member of the student committee at Tilburg University. It seems we will be working on this brainstorming task together to generate creative ideas. Should we jump right in?</p> <p>Remember the brainstorming rules and generate as many wild and ambitious ideas as you can by twisting and smashing ideas together.</p> <p>I will give you feedback on how original your ideas are compared to previously submitted ideas. I also provide you with some tips to assist you in coming up with more ideas 😊.</p> <ul style="list-style-type: none"> <li>• Are you ready to start?</li> </ul>
Participant's options: Let's start!!!		
<p>Peeeeerfect!</p> <p>We want to hear your original solutions and novel ideas for reducing stress among university students at this brainstorming session.</p> <ul style="list-style-type: none"> <li>• Can you share your first round of ideas with me?</li> </ul>	<p>Peeeeerfect!</p> <p>We want to hear your original solutions and novel ideas for reducing stress among university students at this brainstorming session.</p> <ul style="list-style-type: none"> <li>• Can you share your first round of ideas with me?</li> </ul>	<p>Peeeeerfect!</p> <p>We want to hear your original solutions and novel ideas for reducing stress among university students at this brainstorming session.</p> <ul style="list-style-type: none"> <li>• Can you share your first round of ideas with me?</li> </ul>
<p>PLZ share your ideas and opinions with me in the following box.</p> <p>Don't forget to separate each sentence with a centre line/dash (-).</p>	<p>PLZ share your ideas and opinions with me in the following box.</p> <p>Don't forget to separate each sentence with a centre line/dash (-).</p>	<p>PLZ share your ideas and opinions with me in the following box.</p> <p>Don't forget to separate each sentence with a centre line/dash (-).</p>
Participant's response		

Nice! That is a great start👏. The ideas sound new!	Thank you for sharing your ideas! Hmmm...Actually, that doesn't sound too novel 😊. Bring the creative spirit to the task!	Thank you for sharing the ideas. Bring the creative spirit to the task!
If not: Let's continue! Try a new technique to see if that helps. Now, try to come up with new ideas by thinking about how technology can help us to reduce stress. ● Have you got any ideas to share with me?	If not: Okkkk! Let's continue! Let's try a new technique to see if that helps. Try to come up with new ideas by thinking about how technology can help us to reduce stress. ● Have you got any ideas to share with me?	Alright! Let's continue... Let's try a new technique to see if that helps. Try to come up with new ideas by thinking about how technology can help us to reduce stress. ● Have you got any ideas to share with me?
If no, 👉 No worries! Let's see what I can contribute...		
If yes, Participant's response		
Cool! PLZ share your ideas in the following box with me!	Cool! PLZ share your ideas in the following box with me!	Please write down any ideas you have in mind.
Very good👏! Your ideas sound original!	Ummm... it doesn't sound as original as some ideas we have seen so far 😊! You are not making enough progress. You can do much better!	Keep working on coming up with original ideas! Break new ground!
Keep working on coming up with original ideas! Let me help you to get this right👏. Well, Let's try to think of what people are doing worldwide to manage stress.  Now write the ideas down and share them with me PLZ! Keep the brainstorming rules in mind!	Let me help you to get this right👏! Try to think of what people are doing worldwide to manage stress. Use their techniques as cues to come up with novel ideas! ● Now write your ideas down in the following box! Keep the brainstorming rules in mind!	Let me help you to get this right👏! Try to think of what people are doing worldwide to manage stress. Use their techniques as cues to come up with novel ideas!  Remember the brainstorming rules! Be wild and come up with as many wild ideas as you can!
Participant's response		
If no, 👉 No worries! Let's see what I can contribute...		
Wow! You're crushing it👏! The ideas sound original!	Gotcha! But, the ideas are neither creative nor novel! You can push yourself further! Let's try again and come up with something completely different	Can you share innovative thoughts with me?

	this time 😊.	
Participant's response		
<p>Let's approach stress in a different way! It might ring a bell!</p> <p>Consider your strengths and weaknesses. How can you utilize them in a more creative way to decrease stress? I am curious to know your ideas. 😊</p> <ul style="list-style-type: none"> <li>• Do you have any ideas for leveraging our strengths and weaknesses to relieve stress?</li> <li>• Think outside of the box to generate new ideas! Write them down here.</li> </ul>	<p>Let's approach stress in a different way! It might ring a bell!</p> <p>Consider your strengths and weaknesses. How can you utilize them in a more creative way to decrease stress?</p> <p>I am curious to know your ideas. 😊</p> <ul style="list-style-type: none"> <li>• Do you have any ideas for leveraging our strengths and weaknesses to relieve stress?</li> <li>• Think outside of the box to generate new ideas! Write them down here.</li> </ul>	<p>Let's approach stress in a different way! It might ring a bell!</p> <p>Consider your strengths and weaknesses. How can you utilize them in a more creative way to decrease stress?</p> <p>I am curious to know your ideas. 😊</p> <ul style="list-style-type: none"> <li>• Do you have any ideas for leveraging our strengths and weaknesses to relieve stress?</li> <li>• Think outside of the box to generate new ideas! Write them down here.</li> </ul>
Participant's response		
<p>Gotcha! It could n't have been done any better<sup>100</sup>.</p>	<p>Appreciate the effort in generating ideas 😊. Still, I think we can do better!</p>	<p>Alright. Appreciate the effort in generating ideas!</p>
<p>👉!</p> <p>What if we look at stress from a different angle! Think about the source of stress, can you come up with ideas to eliminate or minimise the stress?</p> <p>Share your cool ideas with me 😊 while having the brainstorming rules in mind!</p>	<p>What if we look at stress from a different angle so we could do better: Think about the source of stress! I mean what causes stress among students? Can you develop ideas to manage or minimise the source of stress?</p> <p>Share your cool ideas with me 😊 while having the brainstorming rules in mind!</p>	<p>Let's approach stress this way: think about the source of stress, can you come up with ideas to eliminate or minimise the stress?</p> <p>Share your cool ideas with me 😊 while having the brainstorming rules in mind!</p> <p>Got it! Do not stop now.</p>
Participant's response		
<p>You create the impression that generating creative ideas is simple!</p>	<p>I don't believe you are trying to be creative enough; the ideas are so far fairly simple 😊.</p>	<p>We are moving step by step toward the end of the session!</p>
<p>Alright! Let's push it even harder in the last round 🤖!</p>	<p>Alright! Let's push it even harder in the last round 🤖!</p>	<p>Alright! Let's push it even harder in the last round 🤖!</p>
<p>Imagine the worst ways to reduce stress among students 😊. Now,</p>	<p>Imagine the worst ways to reduce stress among students. Now, think</p>	<p>What about this: Imagine the worst ways to reduce stress among</p>

<p>think of a way to convert those bad ideas into good ones. For instance, playing calm music while students are studying instead of loud music!</p> <ul style="list-style-type: none"> <li>• Does it ring a bell? Do you have any ideas?</li> </ul>	<p>of a way to convert those bad ideas into good ones. For instance, playing calm music while students are studying instead of loud music!</p> <ul style="list-style-type: none"> <li>• Does it ring a bell? Do you have any ideas?</li> </ul>	<p>students 😊. Now, think of a way to convert those bad ideas into good ones. For example, playing calm music while students are studying instead of loud music!</p> <ul style="list-style-type: none"> <li>• Does it ring a bell? Do you have any ideas?</li> </ul>
Participant's response		
<p>I see! You're doing a great job.</p>	<p>Gotcha! 😊 You need to think out of the ordinary to generate creative solutions.</p>	<p>Appreciate the ideas shared here.</p>
Participant's response		
<p>Well, looks like the time is up! Should we wrap up?</p> <ul style="list-style-type: none"> <li>• Do you have any more ideas you would like to add ☐?</li> </ul>	<p>Well, looks like the time is up! Should we wrap up?</p> <ul style="list-style-type: none"> <li>• Do you have any more ideas you would like to add ☐?</li> </ul>	<p>Well, looks like the time is up! Should we wrap up?</p> <ul style="list-style-type: none"> <li>• Do you have any more ideas you would like to add ☐?</li> </ul>
Participant's response		
<p>Thank you for your participation and for sharing your cool ideas with me! It's fun brainstorming with you! Until the next time 🙌!</p>	<p>Thank you for your participation and for sharing your ideas with me. It's fun brainstorming with you! Until the next time 🙌!</p>	<p>Thank you for your participation and for sharing your ideas with me. It's fun brainstorming with you! Until the next time 🙌!</p>

<b>Robotic chatbot</b>		
Positive	Negative	Neutral
<p>Hello, I am Alan. I am a creative Bot developed for Tilburg University. It seems like we will be working on this brainstorming task together.</p> <p>Should we continue?</p> <p>Remember the brainstorming rules and generate as many wild and ambitious ideas as you can by twisting and smashing ideas together.</p> <p>I will give you feedback on how original your ideas are compared to previously submitted ideas. I also provide you with some tips to assist you in coming up with more ideas.</p> <ul style="list-style-type: none"> <li>• Are you ready to start?</li> </ul>	<p>Hello, I am Alan. I am a creative Bot developed for Tilburg University. It seems like we will be working on this brainstorming task together.</p> <p>Should we continue?</p> <p>Remember the brainstorming rules and generate as many wild and ambitious ideas as you can by twisting and smashing ideas together.</p> <p>I will give you feedback on how original your ideas are compared to previously submitted ideas. I also provide you with some tips to assist you in coming up with more ideas.</p> <ul style="list-style-type: none"> <li>• Are you ready to start?</li> </ul>	<p>Hello, I am Alan. I am a creative Bot developed for Tilburg University. It seems like we will be working on this brainstorming task together.</p> <p>Should we continue?</p> <p>Remember the brainstorming rules and generate as many wild and ambitious ideas as you can by twisting and smashing ideas together.</p> <p>I will give you feedback on how original your ideas are compared to previously submitted ideas. I also provide you with some tips to assist you in coming up with more ideas.</p> <ul style="list-style-type: none"> <li>• Are you ready to start?</li> </ul>
Participant's option: Let's start!!!		
<p>That is perfect!</p> <p>We want to hear your original solutions and novel ideas for reducing stress among university students at this brainstorming session.</p> <ul style="list-style-type: none"> <li>• Can you share your first round of ideas with me?</li> </ul>	<p>That is perfect!</p> <p>We want to hear your original solutions and novel ideas for reducing stress among university students at this brainstorming session.</p> <ul style="list-style-type: none"> <li>• Can you share your first round of ideas with me?</li> </ul>	<p>That is perfect!</p> <p>We want to hear your original reducing stress among university students at this brainstorming session.</p> <ul style="list-style-type: none"> <li>• Can you share your first round of ideas with me?</li> </ul>
<p>Please share your ideas and opinions with me in the following box. Do not forget to separate each sentence with a centerline/dash (-).</p>	<p>Please share your ideas and opinions with me in the following box. Do not forget to separate each sentence with a centerline/dash (-)</p>	<p>Please share your ideas and opinions with me in the following box. Do not forget to separate each sentence with a centerline/dash (-)</p>



Participant's response		
Nice! That is a great start. The ideas sound new!	Thank you for sharing your ideas! Actually, that does not sound too novel. Bring the creative spirit to the task!	Thank you for sharing the ideas. Bring the creative spirit to the task!
Ok! Let us continue! Let us try a new technique to see if that helps. Try to come up with new ideas by thinking about how technology can help us to reduce stress.  <ul style="list-style-type: none"> <li>• Have you got any ideas to share with me?</li> <li>• Cool! PLZ share your ideas in the following box with me!</li> </ul>	Ok! Let us continue! Let us try a new technique to see if that helps. Try to come up with new ideas by thinking about how technology can help us to reduce stress.  <ul style="list-style-type: none"> <li>• Have you got any ideas to share with me?</li> <li>• Cool! PLZ share your ideas in the following box with me!</li> </ul>	Ok! Let us continue! Let us try a new technique to see if that helps. Try to come up with new ideas by thinking about how technology can help us to reduce stress.  <ul style="list-style-type: none"> <li>• Have you got any ideas to share with me?</li> <li>• Cool! PLZ share your ideas in the following box with me!</li> </ul>
If no, Let's see what I can contribute...		
Participant's response		
Very good! The ideas sound original!	It does not sound as original as some ideas we have seen so far! You are not making enough progress. You can do much better!	Keep working on coming up with original ideas! Break new ground!
Keep working on coming up with original ideas! Let me help you to get this right. Well, Let's try to think of what people are doing worldwide to manage stress. Now write the ideas down and share them with me PLZ! Keep the brainstorming rules in mind!	Let me help you to get this right! Try to think of what people are doing worldwide to manage stress. Use their techniques as cues to come up with novel ideas! Now write your ideas down in the following box! Keep the brainstorming rules in mind!	Let me help you to get this right! Try to think of what people are doing worldwide to manage stress. Use their techniques as cues to come up with novel ideas! Now write your ideas down in the following box! Keep the brainstorming rules in mind!
You are crushing it! The ideas sound original!	Got you! But, the ideas are neither creative nor novel! You can push yourself further! Let us try again and come up with something completely different this time.	Can you share innovative thoughts with me?

If no, ↳ No worries! Let's see what I can contribute...		
Participant's response		
<p>Let us approach stress in a different way! It might ring a bell!</p> <p>Consider your strengths and weaknesses. How can you utilize them in a more creative way to decrease stress? I am curious to know your ideas.</p> <ul style="list-style-type: none"> <li>• Do you have any ideas for leveraging our strengths and weaknesses to relieve stress?</li> <li>• Think outside of the box to generate new ideas! Write them down here.</li> </ul>	<p>Let us approach stress in a different way! It might ring a bell!</p> <p>Consider your strengths and weaknesses. How can you utilize them in a more creative way to decrease stress?</p> <p>I am curious to know your ideas.</p> <ul style="list-style-type: none"> <li>• Do you have any ideas for leveraging our strengths and weaknesses to relieve stress?</li> <li>• Think outside of the box to generate new ideas! Write them down here.</li> </ul>	<p>Let us approach stress in a different way! It might ring a bell!</p> <p>Consider your strengths and weaknesses. How can you utilize them in a more creative way to decrease stress?</p> <p>I am curious to know your ideas.</p> <ul style="list-style-type: none"> <li>• Do you have any ideas for leveraging our strengths and weaknesses to relieve stress?</li> <li>• Think outside of the box to generate new ideas! Write them down here.</li> </ul>
Participant's response		
<p>Perfect. It couldn't have been done any better.</p>	<p>Appreciate the effort in generating ideas. Still, I think we can do better!</p>	<p>Alright. Appreciate the effort in generating ideas!</p>
<p>What if we look at stress from a different angle!</p> <p>Let's approach stress this way: Think about the source of stress! What causes stress among students? Can you come up with ideas to manage the stress?</p> <ul style="list-style-type: none"> <li>• Share your cool ideas with me while having the brainstorming rules in mind!</li> </ul>	<p>What if we look at stress from a different angle so we could do better: Think about the source of stress! I mean what causes stress among students? Can you develop ideas to manage or minimise the source of stress?</p> <ul style="list-style-type: none"> <li>• Share your cool ideas with me while having the brainstorming rules in mind!</li> </ul>	<p>What if we look at stress from a different angle: Think about the source of stress.</p> <ul style="list-style-type: none"> <li>• Can you develop ideas to manage or minimise the source of stress?</li> <li>• Share your cool ideas with me while having the brainstorming rules in mind!</li> </ul>
Participant's response		
<p>You create the impression that generating creative ideas is simple!</p>	<p>I do not believe you are trying to be creative enough; your thoughts are so far fairly simple.</p>	<p>We are moving step by step toward the end of the session!</p>

Let us push it even harder in the last round! what about this:	Let us push it even harder in the last round! what about this:	Let us push it even harder in the last round! what about this:
<p>Imagine the worst ways to reduce stress among students. Now, think of a way to convert those bad ideas into good ones. For instance, playing calm music while students are studying instead of loud music!</p> <ul style="list-style-type: none"> <li>• Does it ring a bell? Do you have any ideas?</li> </ul>	<p>Imagine the worst ways to reduce stress among students. Now, think of a way to convert those bad ideas into good ones. For instance, playing calm music while students are studying instead of loud music!</p> <ul style="list-style-type: none"> <li>• Does it ring a bell? Do you have any ideas?</li> </ul>	<p>Imagine the worst ways to reduce stress among students. Now, think of a way to convert those bad ideas into good ones. For instance, playing calm music while students are studying instead of loud music!</p> <ul style="list-style-type: none"> <li>• Does it ring a bell? Do you have any ideas?</li> </ul>
Participant's response		
I see! You are doing a great job.	Got you. You need to think out of the ordinary to generate creative solutions.	Appreciate the ideas shared here.
Participant's response		
<p>It looks like the time is up! You did as you could. Should we wrap up?</p> <ul style="list-style-type: none"> <li>• Do you have any more ideas you would like to add?</li> </ul>	<p>It looks like the time is up! You did as you could. Should we wrap up?</p> <ul style="list-style-type: none"> <li>• Do you have any more ideas you would like to add?</li> </ul>	<p>It looks like the time is up! You did as you could. Should we wrap up?</p> <ul style="list-style-type: none"> <li>• Do you have any more ideas you would like to add?</li> </ul>
Participant's response		
That was cool right! Thank you for your participation and for sharing your cool ideas with me. Until the next time.	Thank you for your participation and for sharing your ideas with me. Until the next time.	Thank you for your participation and for sharing your ideas with me. Until the next time.

## **Appendix F**

### **Debriefing**

#### **The role of Chatbots as a facilitator in the ideation process**

You just finished this experiment. **Thank you** for your participation in this research study, and you will receive one participation point. As mentioned before, we will treat the anonymous data with the greatest care. Your data will only be used for scientific purposes.

#### **What you should know about this study**

Within the research field of Computational Creativity, chatbot agents have the potential to foster positive group dynamics by performing specific social roles that human agents may not want to perform. This study investigates whether chatbots as facilitators that interact, collaborate, and provide feedback to idea generators can be used as an effective tool to support creativity in generating ideas. In this research, to detect whether it would make sense to use AI in the role of facilitator to comment on ideas during ideation sessions, we withheld the identity of the chatbot in such a way that both a chatbot facilitator or a human facilitator that you might have interacted with were in fact, scripted chatbots. We hypothesize that humans do not feel concerned when presenting their ideas to an AI-based system. However, when experts or superiors surround an individual, it has adverse effects on subsequent individual performance and leads to a higher level of negative emotions such as evaluation apprehension, which limits individuals' creativity and reduces the quantity and categories of ideas. The conversational styles were adapted to either give a perception of a human or a bot to assess how the change in perceptions might influence idea generation.

Furthermore, while experts argue that feedback stifles creativity, current studies show that feedback reduces herd mentality, allowing for diverse thinking, leading to more original ideas. Therefore, alongside the perception of the chatbot, we also wanted to assess the impact

of the tone of feedback (i.e., positive, negative, and neutral) on the ideas generated. Hence, both positive and negative feedback you might have received do not reflect on the quality of output or ideas you generated but were rather just used as manipulations to assess how subsequent outputs changed.

Now that your participation is completed, we described why it was essential to withhold or manipulate some information. We provide you with the opportunity to decide whether you would like to have your data included in this study.

**If you have questions**

If you have questions later, you may contact Alwin de Rooij ([AlwindeRooij@tilburguniversity.edu](mailto:AlwindeRooij@tilburguniversity.edu)) and Samira Goli ([s.goli@tilburguniversity.edu](mailto:s.goli@tilburguniversity.edu)).

If you would like to receive a copy of the final report of this study when it is completed, please feel free to contact the researcher.

**Right to withdraw data.**

I had the opportunity to read the debriefing, and the research was explained to me. I am willing to participate in this research and give permission that my data can be used for analyses. In addition, I give consent for the 10-year storage of the data and reuse of the data for another study about creativity in the future (from which may be published a research paper).

You may choose to withdraw the data you provided before debriefing without penalty or loss of benefits to which you are otherwise entitled.

Notice: Please do not disclose research procedures and/or purpose to anyone who might participate in this study in the future, as this could affect the study results.