Fast Friends: Generating Interpersonal Closeness between Humans and Socially Interactive Agents

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ABSTRACT

Humans can develop closeness through the exchange of personal information. A structured method of self-disclosure has been developed in the Fast Friends paradigm, in which two people alternately ask 36 questions with increasing levels of interpersonal intimacy. We transferred this paradigm to interactions with Socially Interactive Agents (SIA). In our study, 72 participants alternately asked and answered 36 questions with a SIA – indicating their level of interpersonal closeness with the SIA at three points. Participants rated specific trust in the SIA after the interaction, and their general trust and attachment styles were measured. Over time, participants' levels of closeness increased, which was moderated by specific trust but not by general trust and attachment style. Participants with high specific trust developed higher levels of closeness to the SIA than participants with low specific trust. These findings indicate that people can develop a close relationship with SIAs and that trust in the SIA is a prerequisite for developing closeness. Furthermore, this paper introduced the Inclusion of Other in the Self Scale for assessing the relationship between two interaction partners during an ongoing interaction.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Socially Interactive Agents, Fast Friends Paradigm, Interpersonal Closeness, Self-disclosure, Inclusion of Other in the Self Scale

1 INTRODUCTION

Relationships are key to humans throughout their lives [5] because social life provides security and emotional support [8]. This is manifested in daily human-human interactions between familiar and unfamiliar people. It happens that people who did not know each other before develop new relationships of different qualities. Humans interact not only with other humans, but also with objects such as computers [34]. Especially when the computer has an interface that resembles another human being – a Socially Interactive Agent (SIA) – the question arises how relationships would develop within mixed dyads of humans and SIAs. Also, could interpersonal closeness be generated by means similar to those used in humans?

In 1997, [6] developed a structured method for generating interpersonal closeness between humans: the Fast Friends paradigm. It is based on the assumption that mutual self-disclosure leads to interpersonal closeness. Therefore, the authors created a set of 36 questions requiring an increasing level of self-disclosure that two strangers answer in turn.

The presented research focuses on corroborating and broadening previous research with SIAs [20, 27] by investigating whether interpersonal closeness can be induced in the mixed dyad with the Fast Friends paradigm. Further, we examined whether individual differences in trust and attachment style affect the development of interpersonal closeness. Finally, we aimed at validating the use of Inclusion of Other in the Self Scale — an efficient single-item — in the context of human-SIA interaction.

2 BACKGROUND

2.1 Interpersonal Closeness and Self-disclosure in Humans

Interpersonal closeness can be conceptualized as a holistic process of incorporating another individual into one's self-concept [5]. It can be reflected in behavior and subjective feelings [4]. While behavioral closeness is more likely to arise in long-term, ongoing relationships, subjective feelings of closeness may arise in short-term interactions – at least temporarily [6]. Here, we define interpersonal closeness as a temporary feeling of connection between the self and another person [6], a prerequisite for the development of a relationship [5].

The feeling of interpersonal closeness can be created by sharing personal information, because self-disclosure is fundamental for relationship building in social interactions [3, 13]. Self-disclosure describes the voluntary and conscious verbal communication of personal thoughts, feelings, and experiences to others. It occurs

naturally in interpersonal interactions and is gradual, as individuals reveal more and more personal information over time [13].

2.1.1 Generating and Measuring Interpersonal Closeness.
Self-disclosure and therefore interpersonal closeness can also be generated applying a structured method. The Fast Friends paradigm was developed based on the Social Penetration Theory [3]. The paradigm consists of 36 questions two strangers answer in turns. Divided into three sets of 12 questions each, the required self-disclosure associated with answering the questions increases both within and across these three sets. In their study, the authors showed that the escalating level of self-disclosure leads to a significantly higher interpersonal closeness compared to small-talk questions. This highlights the importance of self-disclosure for interpersonal closeness as well as the validity of this paradigm.

In their study, [43] adapted the in person Fast Friends paradigm to a virtual relationship-building program on an online learning platform. They found a positive effect of the generated closeness on interpersonal liking and perceived social integration.

In the original human-human Fast Friends study, the authors measured subjective feelings of closeness with the Inclusion of Other in the Self Scale (IOS) – a single-item measure. The scale has demonstrated high reliability as well as convergent, discriminant, and predictive validity in human-human interactions [4].

2.1.2 Interpersonal Closeness, Self-Disclosure and Trust.
Trust is a complex, multidimensional construct [42]. For the purposes of this paper, we distinguish between specific and general trust. Specific trust describes a psychological state on an interpersonal level that one person shows to another, specific person [42]. On the other hand, general trust describes a person's generalized attitude toward the trustworthiness of the world and people in general [37]. Both self-disclosure and specific trust are related to interpersonal closeness [35]. Trust is highly relevant to interpersonal closeness in different types of relationships. People with higher trust report higher interpersonal closure [35]. Furthermore, self-disclosure facilitates the development of mutual trust [3]. It correlates with specific trust in a person, but not with general trust. High levels of trust are associated with greater amounts of disclosure [48]. Overall, the three concepts of interpersonal closeness, self-disclosure, and trust appear to be interrelated in human relationships.

2.2 Attachment Style

Attachment styles can be defined as sets of internal working models of relationships and mental self-representation [29]. There are different ways to measure and categorize attachment style: generally, research differentiates between secure and insecure attachment. The latter can be subdivided into insecure-avoidant and insecure-ambivalent [1]. People with a secure attachment style tend to have favorable perceptions of themselves and others and engage easily in intimacy [2]. Insecure-avoidantly attached individuals show discomfort when engaging with intimacy and negative emotions, whereas insecure-ambivalent ones show dependent and anxious behavior while reacting defensively towards attachment figures [1, 2].

The concept of adult attachment [22] is a mapping of the attachment style categories originally studies in children [1]. The different attachment styles were accompanied by different relational beliefs, feelings and relational experiences [29].

Attachment style affects the development of interpersonal closeness between people. Higher closeness leads to a higher relationship commitment, which is moderated by secure attachment [31].

3 RELATED WORK

Not only in human-human interaction but also in human-computer interaction, the development of relationships is the focus of research. Based on the Media Equation assumption, which describes the phenomenon that people tend to interact with technology in the same way they interact with other people [34], a large number of studies have examined how technology should be designed to enable users to form, develop, and maintain relationships. Reactions to technology become even more pronounced when the computer interface is enriched with a human-like virtual agent, because they elicit social cues. In particular, Socially Interactive Agents (SIA) can create natural and intuitive human-computer interactions by enabling multimodal human-computer interaction through the use of verbal, paraverbal, and nonverbal behaviors [28].

3.1 Interpersonal Closeness within Mixed Dyads

How and what kind of relationship people form with SIAs is explored for both short-term and long-term interactions [25]. One concept related to interpersonal closeness studied in short-term relationships is rapport. Rapport occurs at the behavioral, emotional, and cognitive levels. Behaviorally, it is reflected in the alignment of the interaction partners' body movements. At the emotional level, rapport makes both interaction partners feel comfortable and rewarding. Finally, on the cognitive level, it refers to a shared understanding [45]. SIAs are able to create rapport, including the positive influences on the interaction [19, 27, 32].

One SIA that integrates multimodal rapport behaviors with natural language dialog is Ellie – developed in SimSensei Kiosk. Using both verbal (e.g., empathic response, reciprocal self-disclosure) and nonverbal behaviors (e.g., smiling, encouraging head nods), Ellie creates an engaging face-to-face interaction where the user feels comfortable talking and sharing information [15].

Pauw et al. [2022] used Ellie to investigate the ability of SIAs to provide support when people are in emotional distress. In their study, participants shared two personal emotional experiences to which Ellie provided emotional or cognitive support. Both types of support were found to be equally effective, leading to similar levels of experienced closeness and desire to interact with the virtual human again [32].

In the context of physical health, SIAs also engage in relationship-building behaviors. Bickmore et al. [2005] created two versions of the virtual fitness agent Laura: one that exhibited verbal and nonverbal relational behaviors and one that did not. The relational behaviors included empathy, mutual self-disclosure, meta-relational communication, humor, conversations about the shared past and future, verbal behaviors (e.g., inclusive pronouns), and nonverbal relationship-building behaviors (e.g., direct gaze, smiling). When

Laura exhibited verbal and nonverbal relational behaviors, participants liked her more and had a greater desire to continue working with her [11].

In this paper, we focus on short-term interactions because interpersonal closeness is a temporary feeling of connection between the self and another person. The SIA we use shows rapport and relational behavior both verbally and nonverbally [38].

3.2 Self-disclosure within Mixed Dyads

That self-disclosure is a fundamental behavior for relationship building in social interaction [3, 13] can also be seen in human-computer interaction [10, 24, 26, 30].

For Internet of Things conversational agents, verbal self-disclosure can lead to a feeling of closeness to them [26]. Furthermore, people are more likely to disclose personal information when a text-based computer discloses first and becomes more intimate with their questions [30].

Self-disclosure also has positive effects in the perception of SIAs. Kang et al [2011] studied SIAs in the role of human advisors, with either high, low, or no disclosure. Their results showed that participants reported more co-presence and social attraction to SIAs engaging in high disclosure compared to the other two. Participants self-disclosed more often when interacting with the SIA that disclosed highly intimate information [24]. The SIA used in [24] exhibited rapport behavior, which has previously been found to increase participants' willingness to disclose personal information [19, 27].

Bickmore et al. [2009] investigated whether the self-disclosure of the SIA Laura in the role of a fitness coach affects the user. In their experiment, they tested users' attitudes towards Laura when she presented autobiographical stories in the first-person perspective compared to the third-person perspective. The results showed that participants in the first-person condition reported greater enjoyment of their interactions with the SIA and engaged in more conversations with the SIA compared to those in the third-person condition.

3.3 Attachment Style within Mixed Dyads

Given that humans exhibit relational behavior towards machines [34], the effect of attachment style on human-machine interaction is also discussed in SIA research [25].

In their study, [44] observed the influence of attachment style on a relationship with a virtual child. People with higher avoidant attachment had less positive attitudes toward their virtual child. They believed it would feel less safe around them and were less willing to act as an attachment figure. This effect was found before and after interacting with the virtual child.

Another study found that internal working models of attachment are also applied to a virtual spouse in a virtual environment. Consistent with human-human interaction, avoidant participants used distancing strategies during conflict, such as physical distance and fewer interaction initiations [40].

4 THE PRESENT STUDY AND HYPOTHESES

The present study's main goal is to examine the development of the temporary feeling of interpersonal closeness between a human

and a SIA. To this end, we apply the Fast Friends paradigm, in which human and SIA alternately ask and answer 36 questions with increasing levels of interpersonal intimacy resulting in mutual self-disclosure. In addition, we investigate whether specific trust in the SIA after the interaction, participants' general trust, and attachment style are moderating factors in the interpersonal closeness development. The interaction with the SIA is realized through the Wizard-of-Oz paradigm [14], which gives participants the impression that they are communicating with an autonomous SIA, when in fact it is being operated by the human experimenter ("wizard"). Based on the literature, we formulate the following hypotheses:

Hypothesis 1: In both the original face-to-face human-human Fast Friends study [6] and its application in an online setting [43], interpersonal closeness increased. Therefore, we also hypothesize that over the course of the interaction between the human and the SIA, interpersonal closeness, as measured by the Inclusion of Other in Self Scale, will increase. There is an effect of time over the three measurements T1 (after 12 questions), T2 (after 24 questions) and T3 (after 36 questions).

Trust influences the development of interpersonal closeness in different types of relationships, whereby higher trust is related to higher interpersonal closeness [35]. Therefore, we formulate two hypotheses on trust.

Hypothesis 2: High levels of specific trust in the SIA will lead to a stronger increase of interpersonal closeness during the interaction than low levels of specific trust (moderation hypothesis).

Hypothesis 3: High levels of general trust of the participant will lead to a stronger increase of interpersonal closeness during the interaction than low levels of general trust (moderation hypothesis).

Hypothesis 4: People with a secure attachment style tend to have favorable perceptions of themselves and others and engage easily in intimacy [2]. Therefore, we assume that participants with a secure attachment style will show a stronger increase of interpersonal closeness during the interaction than participants with an insecure attachment style (moderation hypothesis).

Hypothesis 5: Interpersonal closeness measured with the Inclusion of Other in the Self Scale correlates positive with rapport measured with Virtual Rapport.

Figure 1: The Socially Interactive Agent Gloria.

5 METHODS

This laboratory study followed a within-participant design. All participants had the same interaction with a SIA during which they completed the Inclusion of Other in the Self Scale three times (repeated measures factor). Counterbalancing took place with respect to who read the first question, resulting in two versions of the experiment to which subjects were assigned according to their participant number: If the participant number was even, they asked the first question; if the participant number was odd, the SIA did.

Following the recommendations for open research practices [12, 47], all materials (coding plan, scripts, data and analysis) can be found on OSF[1].

5.1 Participants

Participants were recruited mainly via student groups in social networks and had to be fluent in German. From the final sample consisting of $N = 72$ students (70 psychology students, 1 student of business administration, 1 student in the criminal investigation field), none had to be excluded for the analysis. We had $n = 13$ male and $n = 59$ female participants between 18 and 47 years ($M = 22.71$ years, $SD = 5.8$ years). From the psychology students, 65 were rewarded with course credit for participation. All others forwent compensation. They all provided written consent for data collection and publication.

5.2 Procedure

First, the experimenter welcomed the participants and explained the procedure in a standardized way in the experimenter's room. Participants were informed that they would interact with the SIA *Gloria* to get to know each other. Participants then read and agreed to the informed consent form. They were given a sheet of paper with 36 questions and a sheet with the three measures of interpersonal closeness (IOS). Afterwards, the experimenter brought the participants to the room where the interaction with Gloria would take place, which they entered alone. After sitting down in front of the screen showing the SIA Gloria, the question-answer procedure began. After questions 12, 24, and 36, participants rated their current closeness to Gloria (IOS). This was introduced by an overlay of Gloria with the text "Now, please rate how you perceive the relationship between you and Gloria. Mark one of the pairs of circles on the sheet in front of you". After the last question, participants completed questionnaires on a tablet PC before being picked up and debriefed by the experimenter. The entire procedure took 40-50 minutes.

5.3 Material

The interaction between participant and SIA consisted of the questioning and answering of 36 questions divided into three parts, each of 12 questions. The questions are taken from [6]. Within and across the parts, the required self-disclosure associated with answering the questions increases. For the study, the questions of the original human-human study were translated from English into German. The complete set of questions can be found on OSF[1]. Examples of the questions are:

3. Before making a telephone call, do you ever rehearse what you are going to say? Why?
16. What do you value most in a friendship?
35. Of all the people in your family, whose death would you find most disturbing? Why?

The question-answer procedure was as follows: The person who asked the question answered it first. Then the other person followed with their answer, asked the next question and answered it, and so on. The answers of the SIA ware pre-scripted – internally consistent, such that the SIA gradually obtained a human backstory. Care was taken to ensure that the content of the answers was based on the target group (20- to 30-year-old students) and is gender neutral. In a small pilot study with five participants, the script was assessed and adapted regarding credibility, consistency and realism.

5.4 Technical Set up

Participants interacted with a female SIA called Gloria (Fig. 1). Gloria is a high-quality SIA with a natural human appearance and verbal as well as nonverbal dialogue skills [38]. Verbal and nonverbal behavior was scripted in a natural way. Gloria supported her verbal expression with gestures and facial movements. Moreover, she showed back-channeling behavior while the participant was talking. Gloria's behavior was scripted with the Visual Scene-Maker (VSM) [17], a real-time execution and authoring tool for modeling verbal and non-verbal behavior of virtual agents. Gloria was presented on a PC running MS Windows 10[TM] (Intel Core i7 CPU@3.5GHZ, 16GB Memory, NVIDIA GTX 990 graphics cards) connected to a TV screen (43 inches), showing her at a realistic size. Each participant was seated at a table in front of the display at a distance of 119 cm.

5.4.1 Wizard-of-Oz Approach. To guarantee a smooth interaction between Gloria and the participant, we used a Wizard of Oz approach [14]. Therefore, we used two rooms: 1) the experimenter room to observe and control Gloria and 2) the laboratory where the participants interacted with Gloria. The experimenter acted as the Wizard secretly overlooking the participant, controlling when the SIA says her next utterance. The video was streamed using a Logitech Webcam C920 in the laboratory that was connected via USB to a MacBook Pro 13 in the experimenter room. As we told participants they would interact with an autonomous SIA recognizing their behavior, we explained the presence of the camera.

With the *StudyMaster* – a remote control for the VSM – we sent (User Datagram Protocol) network messages during the interaction. These messages contain information on how to change variables in the scene flow and thereby influencing it. The VSM itself sends messages back containing status information.

5.5 Measures

Demographics included gender, age, and field of study.
Interpersonal Closeness was measured three times with the Inclusion of Other in the Self Scale (IOS, Fig. 2, [4]). It consists of a single item with seven pairs of circles overlapping to different degrees labeled "You" and "Gloria". The overlap symbolizes the amount of closeness between both interaction partners.

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[1]https://osf.io/q2gs6/?view_only=ac8f876e15354692aebc185c03d8a23e

(1) In the following illustration, please mark the pair of circles that best describes your relationship with Gloria:
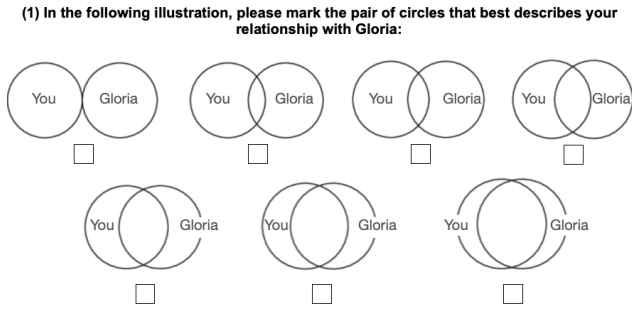

Figure 2: Inclusion of Other in the Self Scale.

General Trust was measured with a short scale for measuring interpersonal trust (KUSIV3, [9]). It aims to capture a trait – a medium-to long-term characteristic. The items were: "I am convinced that most people have good intentions"; "You can't rely on anyone these days"; and "In general, people can be trusted". The three items were rated on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. Cronbach's alpha was excellent at 89.

Specific Trust was measured with three items from [36]. It refers to the short-term acquired trust in the SIA as a state. The items were: "I would rely on Gloria"; "I think Gloria has good intentions"; and "I would trust Gloria" The three items were rated on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. Cronbach's alpha was excellent at .91.

Virtual Rapport was measured using the questionnaire from [18, 36] adapted to our situation. It consists of six items that were rated on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. One example items was: "I felt a connection with Gloria.". Cronbach's alpha was excellent at .87.

We measured two types of *Self Disclosure* adapted from [21, 41]: 1) *Self-Disclosure$_{SIA}$* measured the specific self-disclosure towards the SIA Gloria with the following two items: "How much of your emotions did you disclose to Gloria?"; "How much private information about yourself have you revealed to Gloria?". The Spearman Brown correlation between the two items was .81. 2) *Self-Disclosure$_{Others}$* measured the specific self-disclosure towards people in general with the following two items: "How much private information would you reveal to a stranger on an airplane?"; "How much of your emotions would you reveal at a party with friends?". The Spearman Brown correlation between the two items was .49. All four items were rated on a 7-point scale from (1) *very little* to (7) *very much*.

Perceived Partners Disclosure was measured with four items adapted from [41] measuring how participants perceived the self-disclosure of Gloria. One example item was: "How much did Gloria open up to you?". The items were rated on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. Cronbach's alpha was .82.

Attachment Style was measured with three subscales of the Attachment Style Questionnaire (ASQ, [23]). The used scales were *Trust* (8 items), *Discomfort with closeness* (10 items), and *Fixation on Relationship* (8 items). These scales allow to measure secure versus insecure attachment and to differentiate for the insecurely attached participants between the insecure-avoiding and anxious-ambivalent attachment style. The 26 items were rated on a 6-point

scale from (1) *strongly disagree* to (6) *strongly agree*. For the scale *Fixation on Relationship*, we removed one item due to the increase of Cronbach's alpha from .73 to .77. Cronbach's alphas for the three scales ranged between .77 and .82.

6 RESULTS

Data analyses were conducted with R version 4.1.3. Before data analysis, we examined if there were any outlying values (+/- 3 *SD*) within each experimental condition. No participant had to be excluded. The data had a nested structure, with three measurements across time (Level 1) within each participant (Level 2). Also, a high intraclass-correlation (ICC) indicated that 82.4% of variance in the IOS scale was due to between-participant variance. Thus, hypotheses were tested with linear mixed models with the lme4-package [7]. We grand-mean centered the predictor values (deviation of each individuals' mean from the grand mean; [16]). As the random-slope model showed a better fit than the random-intercept model, $\chi^2(2) = 8.75$, p = .013, we used random slope models for all analyses.

The descriptive data for the measured variables and their correlations are presented in Table 1.

Results for Hypothesis 1 and 2 are displayed in Table 2. We proposed that throughout the interaction, the interpersonal closeness will increase, which was confirmed (Hypothesis 1). Interpersonal closeness was increasing throughout the interaction.

In Hypothesis 2, we proposed that high levels of specific trust in the SIA will lead to a stronger increase of interpersonal closeness during the interaction than low levels of specific trust. The analysis revealed a significant moderator effect of specific trust for the increase of IOS over time, as indicated by a significant IOS by time interaction (see Table 2). Participants high in specific trust increase their reported interpersonal closeness more over time than participants low in specific trust (see Figure 3). Therefore, Hypothesis 2 was confirmed by our data.
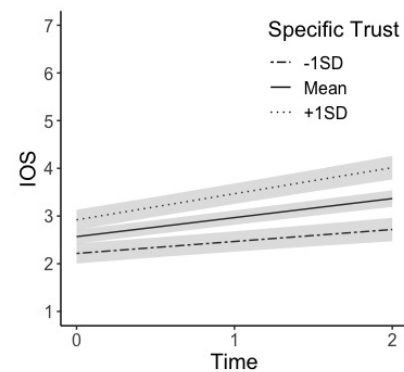
Figure 3: Predicted effect of specific trust on the increase of the interpersonal closeness. Shaded areas represent +/- 1SE.

Hypothesis 3 proposed that high levels of general trust of the participant will lead to a stronger increase of interpersonal closeness during the interaction than low levels of general trust. We did not find a moderating effect of general trust on the increase of interpersonal closeness, as the interaction with time was not significant, $b = 0.04$, $p = .393$. Thus, Hypothesis 3 was not confirmed.

Table 1: Descriptives and Correlations.

		M(SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Attachment Style: Trust	4.09 (0.70)	(.78)											
2.	Attachment Style: Discomfort with closeness	3.58 (0.74)	-.69***	(.82)										
3.	Attachment Style: Fixation on Relationship	3.53 (0.76)	-.62***	.54***	(.77)									
4.	General Trust	4.85 (1.23)	.53***	-.56***	-.21	(.89)								
5.	Interpersonal Closeness T1	2.56 (1.28)	.06	-.00	.14	.05	-							
6.	Interpersonal Closeness T2	2.93 (1.46)	.14	-.15	-.00	.13	.79***	-						
7.	Interpersonal Closeness T3	3.39 (1.60)	.05	-.07	.06	.10	.76***	.83***	-					
8.	Specific Trust	4.93 (1.39)	.08	-.17	.21	.19	.27*	.34**	.42***	(.91)				
9.	Self-Disclosure$_{SIA}$	4.82 (1.21)	.14	-.04	.05	.16	.28*	.20	.33**	.39***	(.81)			
10.	Self-Disclosure$_{Others}$	3.74 (1.13)	.19	-.08	-.05	.19	-.28*	-.12	-.19	.01	.02	(.48)		
11.	Perceived Partners Disclosure	5.38 (0.82)	.10	.02	-.13	.01	.15	.15	.17	.18	.17	-.04	(.82)	
12.	Virtual Rapport	4.62 (1.20)	.14	-.20	-.06	.22	.47***	.54***	.69***	.70***	.38***	-.08	.31**	(.87)

Note. N = 72. 1.–3. 6-point scale from 1 (*strongly disagree*) to 6 (*strongly agree*); 4. 7-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*); 5.–7. Visual 7-point scale from no closeness to high closeness; 8. 7-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*); 9.–11. 7-point scale from (1) *very little* to (7) *very much*; 12. 7-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Cronbach's alpha in the diagonal, except for Interpersonal closeness as it is a single item measurement. Spearman Brown correlations for Self-Disclosure$_{SIA}$ and Self-Disclosure$_{Others}$. *p < .05, **p < .01, ***p < .001 (two-sided)

Table 2: Results of the Mixed model Testing the Interaction between time and IOS (Hypothesis 1 and 2)

	IOS		
Predictors	Estimates	CI	p
(Intercept)	2.57	2.28 - 2.87	<0.001
time	0.40	0.29 - 0.52	<0.001
Specific Trust	0.25	0.04 - 0.46	0.019
time:specific trust	0.11	0.02 - 0.19	0.012
Random Effects			
σ^2	0.37		
τ_{00}	1.23		
τ_{11}	0.05		
ϱ_{01}	0.35		
ICC	0.80		
N	69		
Observations	207		
Marginal R^2 / Conditional R^2	0.167 / 0.834		

Note. τ_{00} = between-group variance for the intercept; τ_{11} = between-group variance for the slopes; ϱ_{01} = random slope-intercept correlation.

We stated that participants with a secure attachment style will show a stronger increase of interpersonal closeness during the interaction than participants with an insecure attachment style (Hypothesis 4). We did not find a moderating effect of secure attachment on the increase of interpersonal closeness, *b* = 0.04, *p* = .755. Therefore, hypothesis 4 was not confirmed by our data.

Finally, we hypothesized that interpersonal closeness measured with the IOS correlates positive with rapport measured with Virtual Rapport. The data shows that both measures correlate highly (see Table 1) confirming Hypothesis 5.

7 DISCUSSION

This paper investigated whether the temporary feeling of interpersonal closeness can be elicited in human-SIA interactions. It replicated a study that examined the Fast Friends paradigm, a structured method for inducing mutual self-disclosure in humans, in a mixed dyad with a SIA. At three points during the interaction, participants rated their interpersonal closeness on the IOS, an efficient and time-saving single-item measure.

Indeed, participants reported higher levels of interpersonal closeness throughout the interaction (confirming H1). This is consistent with the findings of the original study, which examined interpersonal closeness generated by the Fast Friends paradigm in face-to-face human-human interactions [6] and its application in an online setting [43]. The result shows once again that users apply

social rules to their interactions with computers, as humans are inherently social and SIAs display social cues [33].

Also, the more participants trusted the SIA, the more their interpersonal closeness increased during the interaction (confirming H2). These results support other evidence for the positive influence of trust on the development of interpersonal closeness in different types of relationships [35] and its link with self-disclosure [3, 48].

However, neither participant's general trust nor their attachment style — that is, their general relationship patterns with other humans — influenced how strongly their felt closeness increased during the interaction (not supporting H3 and H4). Still, these rather stable relationship patterns correlated with each other as well as the specific situational measures. It might have been that the stable, more general personality factors lacked a clear referencing to the situation and were thus asymmetrical towards the criterion of interpersonal closeness in their situational specificity [39]. This can lead to smaller effects than for a more symmetrical combination of criterion and predictor, like it was the case for specific trust and situational closeness. Thus, the power of the current study might not have been sufficient to find a presumably lower effect of general personality factors on the situation.

The findings show that the specific trust towards the agent is different from general trust in relationships with humans and has a unique influence on building a relationship with virtual agents. Thus, it is important for future research to disentangle participant's general trust and relationship patterns from the one they exhibit towards the SIA during the unique interaction.

Finally, in analyzing the correlation between the Inclusion of Others in Self Scale and the Virtual Rapport Scale, we wanted to show that they correlate positively with each other (H5). As expected, both measures are highly correlated. This shows that the Inclusion of Other in the Self Scale can be a valuable measure for assessing the relationship between two interaction partners during an ongoing interaction. Since it is a single-item measure, it is very economical and can be administered during the interaction without distracting the interaction partners for long.

7.1 Limitations and Future Work

The main limitation of this study was that, as in most other studies [11, 15], we used a female SIA for our interaction. However, we did not control for the gender of the participants. Therefore, we had only 18% male participants. One study found gender differences

in self-disclosure to humans vs. robots: women preferred to self-disclose to robots, while men preferred to self-disclose to humans [46]. Also, in [4], scores on the IOS correlated highly (though not significantly) with the amount of self-disclosure for men, but not for women. Indeed, also in our study, when only including the female participants, we find the same effects. Future studies should balance the gender of both the SIA and the participants to uncover possible gender effects in the application of the Fast Friends paradigm in human-SIA interaction.

A second limitation of the current study is the sample size. In the time available to conduct the in-person laboratory study, we were only able to recruit 72 participants. A larger sample size is needed to determine the effect of attachment style on the development of interpersonal closeness as the three attachment styles are not evenly distributed in the population (secure 56%, insecure-avoidant 25%, insecure-ambivalent 19%) [22].

8 CONCLUSION

This study replicated the Fast Friends paradigm within a mixed dyad of a human and a Socially Interactive Agent. It corroborates and broadens previous work by showing that human feelings of interpersonal closeness with a SIA increase over the course of an interaction that promotes self-disclosure, and that this increase is moderated by trust in the SIA. Furthermore, this paper introduced the single-item Inclusion of Other in the Self Scale as an economical measure for assessing the relationship between two interaction partners during an ongoing interaction.

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