Warming the Ice: The Role of Social Touch and Physical Warmth on First Impressions in Virtual Reality

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Abstract

First impressions are critical in shaping social interactions, with perceptions of interpersonal warmth playing a central role in fostering positive judgments. Social touch, such as handshake, conveys both interpersonal and physical warmth, potentially influencing impressions and social proximity. Using VR and haptic technologies, we explore how handshake temperature (warm or cold) affects first impressions, and interpersonal distance, during interactions with a virtual agent. We aim to discuss the implications for designing more engaging and realistic human-agent interactions, with a focus on the role of haptic feedback in fostering positive impressions.

Index Terms: First Impressions, Social Touch, Thermal Feedback, Interpersonal distance

1 Introduction

First impressions are often formed quickly and effortlessly during social interactions. Pioneering work [2, 8] has shown that warmth and competence are central to first impressions, with warmth often prioritized in rapid judgments during first encounters. The perception of interpersonal warmth is associated with impressions of sociability and sympathy. Social touch, such as handshake, is a direct way to convey warmth and foster connection. Advances in virtual reality (VR) and haptic technologies now make it possible to simulate authentic social interactions, including physical contact. This opens new perspectives for studying how touch influences impression formation and interpersonal dynamics.

Metaphors for warmth, such as "a warm person", reflect an unconscious tendency to associate physical warmth with positive impressions. These metaphors link abstract traits, such as personality, to concrete experience like physical warmth (e.g., [13]). Previous work has shown that physical warmth can shape first impressions. A seminal study by William and Bargh [22] showed that holding a warm drink promotes benevolent judgments towards others (see also, [10]). However, replication failures (for review, see [15, 12]) have questioned these findings, particularly in contexts involving inanimate objects, leaving open the question of how warmth influences social perceptions in interpersonal contexts.

Social touch plays a critical role in social interactions. Even a light touch of the hand can elicit prosocial responses such as trust and benevolence towards others —known as the Midas effect [6]. This subtle social touch has been linked to behaviors such as increased tipping [6], better store evaluation [9], and improved impression of instructors or library employees in an academic contexts [7, 14]. Together, these findings suggest that social touch plays a key role in the fostering prosocial relationships (see [19] for a review). To our knowledge, none of these studies have assessed how touch accompanied by warmth affects first impressions, particularly in immersive environments. The hand, as a socially acceptable body zone, enables initial contact, even between strangers [20]. The handshake, a key gesture in first encounters, shapes trust, cooperation, and social judgments [7, 11]. The handshake has also gained attention in human-robot interactions, influencing perception of the robot's credibility and friendliness (see for review, [18]). However, little is known about how the temperature of a handshake — such as a slightly warm or cold hand — shapes impressions in social interactions. *This study aims to explore how the physical warmth of a handshake during an initial interaction influences first impressions of a virtual agent.*

Figure 1: Handshaking with a character from the ATHOS database. The TouchDIVER glove provides thermal feedback (warm or cold).

2 Methodology

This study, currently in the design phase, explores how thermal feedback during a human-agent handshake in VR influences first impressions.

2.1 Material

Four human-like virtual characters (two men, two women) from the ATHOS database [5] ar used. These characters, with neutral facial expressions, have walking and gesture animation using Mixamo and are placed in a 3D virtual environment in Unity.

The haptic force feedback and thermal cues are provided by using the TouchDIVER glove (WEART) on the right hand of participants (the hand used for handshaking, see Figure 1). Thermal cues are delivered through a little metal plate inside the finger cap that touches the finger's skin. The glove is integrated in Unity through its software development kit (SDK) and simulates realistic interactions in the virtual environment.

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2.2 Procedure

The study lasts approximately 30 minutes, including instructions and interactions with each of the four agents (in a counterbalanced order). Only right-handed participants will be included in the study, as the haptic glove will be specifically worn on the right hand (the hand typically used for handshaking). The cover story describes the study as testing a new haptic glove. Participants will first complete an adapted version of NARS [16] (used in [3]) to assess their a-priori about virtual characters.

In VR, participants will meet a virtual agent in a neutral waiting room and either touch a screen to unlock the test room (*No-Social-Touch* condition) or shake the agent's hand (*Social-Touch* condition). In the *Warm* (*Cold*) condition, when touching the screen or shaking the agent's hand, warm (cold) haptic feedback will be delivered through the glove. The temperatures for *Warm* and *Cold* conditions were pretested in a pilot study to ensure they were perceived as intended (warm or cold). After the initial interaction, the agent will leave for the test room, while participants complete a questionnaire (first impressions of *warmth* and *competence* traits on a 5-point Likert scale [1]). Participants will then be teleported to the test room, where a stop-distance task will objectively measure their preferred *interpersonal distance* with the agent— a metric previously linked to first impressions [4]. Then, the agent will ask the participant to pick up objects and provide feedback on their haptic sensations, ensuring that they remain unaware of the study's aim to examine physical warmth and impression formation. At the end of the interaction, participants will be teleported to the waiting room where they will meet the next agent and repeat all the steps (a different functionality of the glove will be tested).

After the interactions, participants will complete the Social Touch Questionnaire [21], the Body illusion questionnaire and a short version of the Igroup Presence Questionnaire used in [17]. They will also indicate whether they noticed any temperature variations during the interactions (Yes/No).

2.3 Hypotheses

The study is based on a mixed 2 (Touch: *No-Social-Touch* vs *Social-Touch*) x 2 (Temperature: *Warm* vs *Cold*) experimental design, with Touch as between-subject factor and Temperature as within-subject factor. We hypothesize that [H1] physical warmth impacts first impressions: [H1a] participants in the *Warm* condition will attribute higher scores of *warmth* to the agent, and [H1b] accept shorter *interpersonal distance*, compared to the *Cold* condition. [H2] predicts that temperature effects are amplified by social touch: [H2a] participants will attribute higher scores of *warmth* to the agent and [H2b] accept shorter *interpersonal distance*, in the *Social-Touch* with *Warm* condition versus the *No-Social-Touch* with *Warm* condition. We do not have specific hypotheses on the relationship between *warmth* and *competence* impressions, thus we will conduct an exploratory analysis to investigate the relationship between the two dimensions in this context.

3 Conclusion

This study investigates how the physical warmth of a handshake influences first impressions and interpersonal distance in virtual interactions. Using VR and haptic technologies, the protocol aims to advance our understanding of cognitive processes in social perception and inform the design of immersive and socially meaningful virtual environments. Practical applications include telepresence, professional training or remote social support, by recreating authentic tactile interactions to strengthen interpersonal bonds.

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