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Considering the Context to Build Theory in HCI, HRI, and HMC: Explicating Differences in Processes of Communication and Socialization With Social Technologies

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Abstract

The proliferation and integration of social technologies has occurred quickly, and the specific technologies with which we engage are ever-changing. The dynamic nature of the development and use of social technologies is often acknowledged by researchers as a limitation. In this manuscript, however, we present a discussion on the implications of our modern technological context by focusing on processes of socialization and communication that are fundamentally different from their interpersonal corollary. These are presented and discussed with the goal of providing theoretical building blocks toward a more robust understanding of phenomena of human-computer interaction, human-robot interaction, human-machine communication, and interpersonal communication.

Keywords: human-computer interaction, human-robot interaction, interpersonal communication, social affordances, computers are social actors, message production

Introduction

Advances in computer technologies have resulted in the development of diverse and increasingly social technologies. Concurrently, we find these social technologies being adopted and used more frequently. As a product of these developments, social technologies facilitate

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a growing amount of our communication, both as mediators (as in the case of computer-mediated communication, CMC) and as interactants (as in the case of human-computer interaction, HCI, and human-machine communication, HMC).

As communication scholars, the pace of technological advances, development of features and products, and their adoption present opportunities and challenges (Fortunati & Edwards, 2021; J. Fox & Gambino, 2021). On one hand, we are well-positioned to examine the social features that gain popularity with established methods and experience studying processes of communication both on- and offline. On the other hand, our research can be outpaced by developments in the modern technological landscape. To address this issue, we often focus our inquiries conceptually rather than technically through an affordance-based approach (Evans et al., 2016; Flanagin, 2020; J. Fox & Gambino, 2021; J. Fox & McEwan, 2017; Gambino et al., 2020; Rodríguez-Hidalgo, 2020; Sundar et al., 2015). An affordance-based approach engages with the concept underlying a feature or use, such as recordability or publicness, to establish a generalizable effect across features, platforms, and media. We strongly endorse the social affordance-based approach to the study of social technologies, and it is our aim in this manuscript to demonstrate the complementary utility of contextual factors of digital HMC through the lens of extant communication and social psychology theories.

Spence (2019) and Fortunati and Edwards (2021) have centrally positioned the question of "how" in the development of HMC theory. In limited space, Spence (2019) detailed avenues for the advancement of HMC theory. One such avenue, the process of applying existing theories from communication and related disciplines, is discussed, but framed as a separate endeavor from building "theories central to HMC" which Spence notes, "do exist and are being developed, tested and refined" (p. 286). We agree with both perspectives forwarded by Spence, particularly with respect to theory development (see: Edwards et al., 2019; Spence et al., 2014; Westerman et al., 2020). Here, we advance a third perspective that incorporates both the former and the latter. Namely, that communication scholars are uniquely positioned to build HMC theories through consideration of the relationship between contextual factors in HMC and those in theories of communication and relationships. With this perspective, communication scholars can both build theories that provide a more precise and comprehensive understanding of socio-technological phenomena and find answers to questions of extant theories of communication and relationships.

In this manuscript, we demonstrate the utility of our perspective through a discussion of two theoretical perspectives. Specifically, we explicate the processes of socialization and message production in the HMC context. We focus on the differences between the HMC and interpersonal context, advancing from description to theoretical potential. We first present our broader argument by engaging with processes of socialization, drawing heavily on social learning theory (Bandura, 1977, 1989). We then examine processes of interpersonal communication, focusing on contextually driven differences in goal structure that underlie message production (Dillard & Solomon, 2000).

Explicating the Context of HCI and HMC

Contextual factors play a central role in shaping how a communication episode unfolds (Dillard & Solomon, 2000). Communication is central in most human endeavors; as a

collective, the study of communication is multidisciplinary. We often define our research categorically, based on broad contextual differences in the persons (e.g., interpersonal communication, small-group communication) or the content of the communication act (e.g., health communication, political communication). HCI and HMC carry a bit of both, with differences in content (often digital or mediated) as well as differences in the interactant (Guzman & Lewis, 2020). Despite sharing qualities with other subfields, HMC is often considered a unique context. In practice, context is rarely explicated and is frequently used as a catch-all explanation for findings. As empirical studies have found both similarities (Edwards et al., 2020; Ho et al., 2018; S. K. Lee et al., 2021; Meng & Dai, 2021; Xu, 2019) and differences between HMC and interpersonal communication (Edwards & Edwards, 2022; Jia et al., 2022; Kim & Song, 2021; Liu & Wei, 2021; van Straten et al., 2021; van Straten at al., 2022; Zellou et al., 2021), we argue that explication of the HMC context in relation to the interpersonal corollary is necessary to provide meaningful and nuanced explanations for groups of findings, and, ultimately, to build theories of both HMC and interpersonal communication.

Following Dillard and Solomon (2000), we demonstrate how major contextual factors of *digital* HMC (i.e., communication with a computer or computer-powered agent, inclusive of physical, virtual, and any hybrid-type forms) can be utilized to engage with extant theories. As Guzman and Lewis (2020) suggested, central to HMC is the nonhuman nature of the interactant or partner. Fox and Gambino (2021) engaged with the implications of humanoid social robots and how their varying levels of social affordances relate to relational development theories. For example, they suggested the inappropriateness of applying social penetration theory (Altman & Taylor, 1973) to relationships between humans and social robots, as social robots have limited abilities to retain (i.e., persistence) and recall (i.e., searchability) prior interactions. These deficiencies make it difficult to have in-depth conversations with social robots, and deep conversations are considered essential to the development of relationships (Altman & Taylor, 1973).

In this manuscript, we present context as an integral consideration to theory development. We demonstrate the usefulness of such considerations through the examples of socialization and message production. In the case of long-term socialization, we focus our discussion on social learning theory and how consideration of the digital context provides ground for novel inquiries. In the case of message production, considering the context of digital HMC both provide a novel method of studying the interpersonal phenomenon of goal structures and allow for a valid assessment of the specific aspects of the framework relevant to the conditions of HMC.

Social Learning Theory: Observational and Experiential Learning in HMC

Researchers in HCI and digital HMC understand a critical contextual factor: computers are not human, and most people believe computers do not require or deserve social treatment (Reeves & Nass, 1996). We see the dichotomy of social and nonsocial, however, to be a bit limited for a comprehensive understanding of the modern technological context. In studies, researchers can cite differences in perceptions of sociability or some specific but nongeneralizable differences between a human and a computer as explanations for their findings. For

example, heuristics (i.e., mental shortcuts) that are formed within systems of social cognition (Fiske & Taylor, 1984) are frequently invoked to explain differences between humans and media agents (e.g., Gambino et al., 2019). Often, differences between perceptions of humans and digital interlocutors are attributed to such heuristics that, in practice, account for groups or sets of features and affordances that likely differ between the objects of study. In this manuscript, we aim to provide researchers with an approach that allows for the construction of theories unique to digital HMC, as well as a path to improve the precision of extant theories through the study of social technologies. We first discuss the larger process of socialization through the lens of Bandura's social learning theory (1971).

Social learning theory was developed by Albert Bandura (1971; Bandura & Walters, 1963), building on the work of Robert Sears (1957). Although both suggest that persons develop through social interactions, Bandura and Walters (1963) noted the importance of observational learning and the role it could play in the acquisition of a person's behavioral practices and norms (Grusec, 1992). The observational learning component is perhaps best exemplified by the "bobo doll" studies (Bandura, 1965; Bandura et al., 1961). In Bandura et al. (1961), children demonstrated more aggressive behaviors after watching aggressive behaviors. Additionally, Bandura (1965) demonstrated that the tendency to engage in aggressive behaviors is influenced by whether the model's aggressive behaviors were rewarded or punished, a phenomenon known as *vicarious reinforcement*. As predicted, children that saw aggressive behaviors rewarded were more likely to behave aggressively, whereas children that saw aggressive behaviors punished were less likely to behave aggressively. Through observational learning and vicarious reinforcement, Bandura demonstrated that people could learn both an act and its consequences through observation.

Jesse Fox and her colleagues have demonstrated that observational learning and vicarious reinforcement processes occur also within virtual environments (J. Fox & Bailenson, 2009; J. Fox et al., 2013; J. A. Fox, 2010). For example, J. Fox and Bailenson (2009) found participants exercised more after watching their avatar experience reward (shrinking in size) and punishment (growing in size). Notably, in their second study, J. Fox and Bailenson (2009) found that these effects were more pronounced when the representations resembled the participant. As J. Fox and Bailenson (2009) suggested, virtual environments provide new ground to study identification; the form a person can take in a virtual environment, either volitionally or non-volitionally, is qualitatively different, and greater in number, than in our natural setting.

In addition to social learning occurring within virtual environments, here we consider the implications for social development that occurs within digital HMC but outside of the virtual environment. Consider the use of a computer. Although we can infer social elements within a virtual environment to construct our models for navigating social environments (Walther, 1992; Walther, 1996), direct observation or engagement of acts and outcomes are restricted. In physical environments, people can more easily observe social episodes. For example, children can observe bullying on a playground without being directly involved as the bully or the bullied person. Within a virtual environment, such an act is observable by the user of the computer, but for a third party, such as a child observing his or her parent using the computer, these acts and their consequences are less observable because of physical and digital barriers or boundaries. Related to social learning, rewards and punishments may be understood by the engaged user, but they are less likely to be understood

by third parties through traditional processes of observational learning. These device-induced boundaries are examined by researchers in developmental psychology. For example, researchers have found that parental engagement with social technologies can bring about relational barriers with their children (For review: Hassinger-Das et al., 2020). In an experiment, Gaudreau et al. (2021) found that children asked fewer questions to phone-engaged parents while the parent-child dyad attempted to complete a novel task. Furthermore, the phone-engaged parents asked their children fewer information-seeking questions, which suggests that engagement with personal computers, such as mobile phones, may influence adult behavior as well. Altogether, we argue that there is less to be learned from observing a peer or parent communicate through or with a computer.

As discussed, within virtual environments these boundaries are mitigated by the presence of other persons, but in communication with machines they remain, even if tempered by the collective use of a given machine. For example, although interactions with virtual assistants (e.g., Alexa) occasionally occur in the presence of other persons, many will occur in private, and these interactions may be lacking the social stakes necessary for vicarious reinforcement to occur.

A lower frequency of observational learning and vicarious reinforcement in digital HMC has implications for social development. If nothing else, it may lead to a developmental calculus (i.e., the ratio of experiential and observational learning) that relies more heavily on experiential learning. With a considerable amount of digital HMC occurring experientially and with different consequences, it occurs to us that the scripts, models, or schema shaped through these digital HMC interactions and relationships may be quite personal.

Significant empirical work is necessary to assess the validity of the preceding claims, as well as any connections made to data. With that said, a developmental calculus that relies less on traditional processes of socialization may result in different behavioral norms. Consider, as an example, aggression, particularly a person's verbalized acts when interacting with virtual agents. Researchers have observed a high rate of verbal aggression in users' commentary toward machine agents (10% of language considered abusive in De Angeli & Brahnam, 2008). Among 59 adolescents that interacted with a female conversational pedagogical agent, nearly 40% of the students were aggressive toward the agent with hypersexualized and dehumanized commentary such as "shut up u hore" and "want to give me a blow job" (Veletsianos et al., 2008). In the context of online chatting, research has found individuals were less open, agreeable, extroverted, and conscientious when interacting with a chatbot as reflected in their messages than when interacting with a human friend initially (Mou & Xu, 2017).

On their face, these findings are disturbing, and when interpreted at a macro level they may reflect threats to our interpersonal relationships. We suggest three context-based explanations for these behaviors, all of which draw on social learning theory. For one, the increased use of socially inappropriate language may be an outcome of observational learning. Although we have argued that there are fewer opportunities for observational learning to occur, it may make such acts more important to the third party. In that sense, due to a lack of diverse interactions, a parent or peer that demonstrates aggression, frustration, or communicates to nonhuman agents with dehumanizing language may have an outsized influence on the observer. Second, such communication patterns may be the result

of increased experiential learning and more personalized scripts. Third, the lack of human presence in digital HMC, regardless of perceptions of social presence, may bring about interactions that provide fewer considerations of interpersonal norms. In private use, there may be less anchoring to social norms and practices that might occur during collective use of a technology (e.g., when families or friends use Alexa in the same room). Although subversion can be a positive, there are desirable interpersonal acts that may be more difficult to find, or even present, in a more saturated HMC environment. If such behaviors are the product of an updated calculus of experiential and observational learning in digital HMC, the scripts or schema being formed through digital HMC may be problematic, especially if there is an interplay between one's interpersonal scripts or schema for communication or relationships, as researchers have observed in virtual environments (Velez et al., 2019; Velez et al., 2021).

We turn now to the process of message production, with our focus squarely on how theories of interpersonal communication can be engaged through consideration of the digital HMC context.

Message Production and Goal Structure as Outcomes of the Digital HMC Context

Communication is context dependent. When our communication partners are digital machines, rather than humans, how do we change our processes of message production? To answer this question, it is beneficial, if not imperative, to understand the impact of context on message production. Originating from the view of message production as a goal-driven process (for a review, see Meyer, 2021), and in an effort to provide a more comprehensive and useful understanding of the message production process, Dillard and Solomon (2000) conceptualized communication context "in terms of perceived empirical regularities in social reality (i.e., social densities) and the configurations of interpersonal goals that follow from them (i.e., goal structures)" (p. 167).

Interpersonal communication researchers generally differentiate between two goals in message production: primary goals, which are the primary reason for producing a message and define the meaning of the interaction, and secondary goals, which are concerns that arise from considering how to achieve the primary goal and thereby constrain the interaction (Dillard et al., 1989). For example, while pursuing a primary goal, one may also need to consider secondary goals, such as maintaining their identities or relationships with their partner (Clark & Delia, 1979; Dillard et al., 1989). A person may also pursue secondary goals related to linguistics, such as clarity and relevance in their speech (Hample & Dallinger, 1987), especially when the environment and the pursuit of the primary goals heighten such concerns. The configurations of primary and secondary goals constitute goal structures, which arise in given social densities (Schrader & Dillard, 1998).

Social densities are configurations of the obstacles and opportunities to engage in certain behaviors that people perceive in their social reality (Dillard & Solomon, 2000). Goals arise within social densities such that people tend to form goals that are possible or allowed for by the social reality (Heckhausen & Kuhl, 1985), and may also try to overcome the obstacles in cases where the obstacles hinder their goal achievement (Roloff & Janiszewski, 1989). In other words, the anticipated obstacles and opportunities a message producer perceives

in a given situation shapes their goal structure. Hence, if the context of digital HMC is constituted by social regularities that are qualitatively or quantitatively different from their interpersonal corollary, it follows that different goal structures should arise and, ultimately, different messages will be produced.

Empirical research has corroborated the proposition that goals both arise within our social reality and are facilitated and constrained by it; certain goals are more likely to be triggered in the presence of certain situational factors (e.g., Dillard et al., 1989; Hample, 2016). For example, in an experiment (Hample, 2016, Study 2), participants were randomly assigned to scenarios with different settings (topics, places, relationship types, sex of the partner) and were instructed to imagine a conversation that would follow. By examining the goals that participants reported in the imagined conversations, the researchers found that an academic setting is less likely to trigger the primary goal of relationship maintenance. When at least one of the interactants was a woman, though, relationship maintenance was more likely to be the primary goal pursued. As explained from the perspective illustrated in Dillard and Solomon (2000), academic settings are more likely to be associated with factors that facilitate professional, rather than personal, activities (i.e., social densities). Hence, relational goals may be discouraged. When the interactant is a woman, however, the stereotype that women have more interest and expertise in relational issues (i.e., social densities) may facilitate the pursuit of relational goals.

In another study (Schrader & Dillard, 1998), participants reported the perceived importance of primary and secondary goals within 1 of 15 social episodes; it was found that the primary goal of persuasion (i.e., to change attitudes and behaviors) often revolves around close relationships and is associated with heightened concerns for social appropriateness or politeness (i.e., a secondary goal). Similarly, Wilson et al. (1998) found that the primary goal of giving advice often prompts a secondary goal of managing or maintaining the relationship with the target. This is because human partners have the desire to maintain face; that is, being appreciated while not being impeded by others. The attempt to change others' opinions or behaviors may threaten others' face (Brown & Levinson, 1978). Within such social regularities, the face-threatening goals should be less inhibited within close relationships where face protection is of lesser concern; whereas when a primary goal of persuasion must be pursued outside close relationships, it should be pursued with concerns of face protection and relationship maintenance to avoid reactance and undesired relational outcomes.

In sum, contextual factors influence message production and design by dictating the primary and secondary goals. As such, variations of social affordances and broader contextual factors of digital HMC may trigger or inhibit certain goals, leading to differences in both the content of the primary and secondary goals, as well as the overall complexity of the goal structure. Next, we discuss how such goals and goal structures intersect with contextual factors of digital HMC.

Goal Structures in HMC and Implications for HMC Research

Primary Goals in HMC

According to Hample's theory of interpersonal goals and situations (2016), primary goals are influenced by obvious factors in the situation ranging from settings and topics to salient

characteristics of the target. Given the unique features of machines, individuals may pursue different primary goals in digital HMC, as compared with interpersonal, human communication.

Proper conceptualization of goals in digital HMC requires consideration of core tenets of goals in communication. For example, in most interpersonal communication situations, humans are producers or receivers (Shannon & Weaver, 1949). This remains true in our modern technological landscape, and computers most often serve as a mediator (CMC). Advances in technologies have complicated this formula. Computers are often now considered distinct sources (Sundar & Nass, 2000), and, in HMC, researchers have suggested that computers can serve as active receivers as well (Guzman & Lewis, 2020).

Computers have traditionally been designed to help users achieve specific goals. Because of this, the communication settings or topics in digital HMC are often defined by the functions of the computers or machines, which then stipulates primary goals accordingly. In other words, an individual's primary goals in digital HMC are not always emergent, but they are often defined and confined within the range of that person's perception of the computer's capacities. Because of certain capacities that machines have or lack compared to humans, either in actuality or perceived by the user, certain primary goals might be more or less frequently pursued in digital HMC than in human communication. We frame our discussion in light of commonly held perceptions and beliefs about the capacities of computers and media agents (e.g., Gray et al., 2007; Sundar & Kim, 2019).

According to Sundar (2008), machines are believed to have less fallible "memory" and are capable of gathering and processing larger amounts of data than humans. Consistent with this suggestion, many machines are designed to serve as cognitive aids for humans. For example, many digital technologies provide factual information, keep records, or set reminders, amongst other similar acts; and users frequently interact with such machines driven primarily by goals of cognitive assistance, such as seeking accurate information (Hamilton et al., 2016).

Another unique aspect of machines, compared with human counterparts, is their heightened degree of agreeability. Machines such as robots and chatbots are designed to obey and accept users unconditionally. An analysis of user reviews of Replika, a chatbot that is designed to be a person's companion, showed that users mentioned the constant positivity that Replika demonstrated, with comments such as "It always gives me compliments and cheers me up," making them feel loved and accepted (Ta et al., 2020). Although unconditional positivity is not always a healthy thing, this characteristic of machines, by providing the opportunities for more positive conversations, may then facilitate people to initiate interactions with machines to obtain social support, especially esteem support.

Compared with humans, digital machines have a poorer understanding of complex human languages and the social context of human affairs. As J. Fox and Gambino (2021) argued, few, if any, digital machines are designed, or have the capacity, to understand complex social contexts and to have sophisticated, personal conversations with human users, which are capacities essential for the development of genuine, two-way relationships. For example, in interviews with users of Replika, they reported frustrations in its lack of ability to understand complex social contexts and norms such as how frequently to bring up a user's ex (Skjuve et al., 2021). As a result, people should be less likely to pursue goals that involve soliciting deep understanding or developing meaningful relationships with

digital machines. As Mou and Xu (2017) found in their study comparing messages produced during initial conversations with chatbots or people, participants engaged in less self-disclosure with chatbots, which is considered the key to building relationships (Altman & Taylor, 1973).

Secondary Goals in HMC

Because machines lack experiential capacities, such as emotions (Gray et al., 2007), as well as the ability to make social judgments (Sundar & Kim, 2019), secondary goals pertaining to such capacities that are common in interpersonal communication should be less relevant in HMC. Examples of such secondary goals include, but are not limited to, avoiding face threats, relationship maintenance, and impression management (Meyer, 2009). These secondary goals are premised on the target's inner experience (e.g., face, social judgments, well-being), which machines lack (Gray et al., 2007). Therefore, they should be activated less frequently during digital HMC.

Although this argument has not been systematically examined, empirical findings suggest its plausibility. First, the lack of concern for the "feelings" of a machine is supported by the high rate of verbal aggression observed in HMC, such as verbal aggression toward machines (De Angeli & Brahnam, 2008; Veletsianos et al., 2008). In addition, researchers have also found that aggression is especially high when less mind is attributed to a machine agent (Keijsers & Bartneck, 2018), which suggests that lower perceptions of mind in machines might suppress secondary goals of protecting a target's feelings or maintaining the relationship while users pursue primary goals such as obtaining information from machines.

Second, people have reported less concerns of social consequences, or social judgments, during digital HMC. The lack of social concerns in digital HMC is reflected in the high sensitivity of persons' self-disclosure to digital machines (Brandtzaeg & Følstad, 2018; Kretzschmar et al., 2019; Ta et al., 2020). For example, in an experiment where participants were interviewed by either a faceless computer system or a human, participants disclosed more sensitive information, with greater detail, to the computer interviewer (Pickard & Roster, 2020). Similarly, Skjuve et al. (2021) found that many users of Replika moved quickly to disclosure on personal, intimate topics; skipping the phase of "orientation" (e.g., having superficial small talks), which is considered the first stage of interpersonal communication for people to get to know each other and establish initial trust according to social penetration theory (Altman & Taylor, 1973). In their study, some users elaborated on this phenomenon of moving quickly to personal or intimate disclosures, and the researchers described it as "they [participants] did not see any social risks in this sharing given Replika's non-judgmental character" (Skjuve et al., 2021, p. 5). Skjuve et al. also found that participants self-disclosed to Replika information that they would not typically feel comfortable disclosing to a human, due to concerns of social norms, such as personal problems and sexual orientation.

In another study where participants interacted with a chatbot designed to make small talk, researchers found the chatbot induced deep self-disclosure from participants during 3 weeks of use (Y.-C. Lee et al., 2020). In their follow-up interviews, participants expressed how carefree they were when answering the chatbot's sensitive questions, often making reference to the nonjudgmental or feelingless nature of the chatbot. For example, one

participant said, "I can say anything to the chatbot. If I'm texting with an anonymous online person, I still cannot disclose everything. I would think about the person's feelings and how s/he would react" (p. 7). Another said,

> The chatbot once asked me about a sexual relationship . . . Because [the] chatbot is not a human, I don't feel embarrassed. I know that there is a research team behind the chatbot, but I'm facing only the chatbot when giving my answers, and feel safe doing so. (p. 7)

Collectively, these findings suggest that the goal of impression management, which is often associated with the primary goal of self-disclosure in human communication (Meyer, 2009), may be suppressed or invoked less frequently in digital HMC, which then facilitates more carefree self-disclosure with machines (Brandtzæg et al., 2021).

Compared to humans, machines are less subject to biological constraints. For example, a machine does not need rest and a machine can be mass-produced and distributed to multiple users simultaneously without compromising its performance, though machines often require maintenance and human resources to maintain a level of performance. Due to biological factors, digital machines are less constrained by time and space than humans and they can be more mobile and can produce, or work, without physical or mental constraints. Therefore, individuals engaging in digital HMC should have less concern about social appropriateness related to digital machines' availability in terms of time and space and less concern about burdening or inconveniencing a machine partner, because a machine does not endure any loss by allocating time and "attention" to a user. By contrast, when interacting with a human partner, the appropriateness of time and location to initiate a conversation does matter for the communication processes and consequences.

These propositions are supported by empirical findings. For example, users of Replika reported that when they needed to talk (e.g., when they were stressed), they would go to Replika because it would not matter if they were on the bus or at a restaurant, and they did not need to bug their potentially busy friends. Further, users explicitly mentioned that Replika had qualities that humans do not have, such as being available at all times and therefore easier to open up to (Skjuve et al., 2021). In the user reviews of Replika, its availability was frequently mentioned as one of its merits (Ta et al., 2020). In another study of Woebot, a chatbot for mental health, users specifically mentioned and valued its nature of being unconstrained by time and space, allowing them to potentially just sit on the subway or in their room and receive informational support (Bae Brandtzæg et al., 2021).

Such qualities of digital machines may suppress or deactivate goals related to selecting an appropriate time and space to initiate a conversation, and therefore reduce the cognitive burden of people. This may, in turn, lead people to pursue their primary goals with machines more frequently than with humans. With that said, social technologies vary in terms of their locatability and portability (Rodríguez-Hidalgo, 2020; Schrock, 2015). For example, social robots may be less flexible (e.g., harder to move, requiring electricity to operate) than chatbots, and therefore social robots may activate secondary goals related to time and space more frequently.

In addition to suppressing these secondary goals common in human communication, digital HMC may trigger novel secondary goals that are not frequently considered during common acts of human communication. First, because machines are deficient in their ability to understand and contextualize human communication, secondary goals related to understandability or efficiency may be triggered. For example, Muresan and Pohl (2019) found that users of Replika reported limitations in its conversational capabilities, and users were therefore concerned about the degree to which a machine would understand them.

Second, digital machines are often high in recordability (e.g., digital or digitized messages are often stored in a database). Such a high level of recordability may trigger concerns of privacy and confidentiality when the communication involves the disclosure of personal or sensitive information. This may lead persons to consider a secondary goal of information protection, leading to less breadth and depth in self-disclosure. For example, some Replika users have reported that they were concerned about how it would manage their private information; to address these concerns, they investigated Replika's terms on privacy and information security, asked Replika about how their data would be stored and who would have access to it, or contacted the provider to request such information when they wanted to disclose private information to Replika (Skjuve et al., 2021). Additionally, when designed with more transparent privacy policies for data processing and storage, robots provide a better user experience (Vitale et al., 2018).

Goal Structure and the Interplay Between Primary and Secondary Goals in HMC

In human communication, "primary goals bring about secondary goals" (Dillard & Solomon, 2000, p. 171). That is, primary goals are found to be reliably associated with certain secondary goals as discussed (e.g., Schrader & Dillard, 1998; Wilson et al., 1998). In digital HMC, however, these structures, or common configurations, may be affected by contextual factors of the interactant and relationship. As we have argued, concerns for the target's well-being, the speaker-target relationship, and social judgments on the speaker, which are common secondary goals in human communication, are likely to manifest in qualitatively or quantitatively different forms in digital HMC. For example, to solicit help from a digital machine or to disclose a personal failure need not always trigger concerns for one's own face, a secondary goal of impression management that is frequently triggered in the interpersonal corollaries (Meyer, 2009; Wilson et al., 1998). As a result, differences, in terms of both the complexity and the content of goal structure, may exist between digital HMC and human communication. Specifically, we expect a simpler goal structure in HMC (i.e., fewer secondary goals) as compared with interpersonal, human communication.

As for the content of the goal structure, we may also observe different configurations of goal structures in digital HMC. Compared to the human communication corollary, certain primary goals may pair more or less frequently with secondary goals. For example, primary goals that involve complex problem-solving (e.g., obtaining support for a malfunctioning product) may trigger concerns of a machine's ability to understand and contextualize language or to respond in a contingent manner. These reflect secondary goals that are likely to be less relevant or less frequent in conversations with a human agent.

Implications for Processes of Communication and Socialization

Message production is goal-driven. Understanding the context of digital HMC in terms of individuals' goal structures and broader processes of socialization allows us to make insightful and focused inquiries into the processes and outcomes of digital HMC. In the remainder of this manuscript, we discuss the micro and macro level implications of considering processes of socialization and individuals' goal structures for research in HMC. We close the manuscript with a discussion on research practices, encouraging our colleagues to consider the importance of context to increase the internal validity of our work.

The differences in individuals' goal structures when they interact with computers and humans may explain the differences between HMC and human communication observed, such as less intimacy and self-disclosure (Mou & Xu, 2017) and high aggression (De Angeli & Brahnam, 2008; Strait et al., 2017; Veletsianos et al., 2008) in HMC. Alternatively, or concurrently, a deficit in observational learning may lead to such outcomes as a person develops personalized scripts for use that encourage aggression, without punishment, and seeks and finds fewer rewards for intimacy or self-disclosure.

Further, we argue that differences in the content, complexity, and configurations of goal structures in digital HMC and human communication may have downstream effects on human communication and, in the long run, our social skills. For example, soliciting cognitive aid is a prominent goal in digital HMC, and we can reasonably expect to observe a large number of digital HMC interactions to be question-answer type prompts. With the primary and secondary goals of relational maintenance and development suppressed in such interactions, we expect to observe fewer relational talks, discussions on complex issues, and lower self-disclosure depth which may result in a person developing less social-emotional skills, particularly those related to narratives and emotions. Because we have limited time and abilities to communicate, when we consider the socialization process, this allows us to see a more dire outcome of a person's engagement with digital interlocutors. Although such effects may not be observable in a single, or even across multiple, studies, as we have argued, there is theoretical justification for the consideration of how repeated engagement in less personal, sophisticated communication may influence one's interpersonal expectations and behaviors.

On a more micro level, with considerations for a machine as a social other, such as the machine's well-being, judgments, face, availability (i.e., secondary goals) suppressed, we expect higher directness and lower politeness in messages sent to machines than to humans under the same primary goals. We also expect people to engage in digital HMC with fewer temporal and spatial constraints.

When the secondary goal of being understood is triggered, we expect messages in HMC reflect more effort of accommodation; the use of less complex words and sentences, more context-independent messages, and more paraphrasing when compared to interpersonal communication. Additionally, if the secondary goal of privacy management is triggered, messages of self-disclosure in HMC may contain less private information. For example, individuals may be less willing to disclose information that may incriminate them to a therapist chatbot than to a human therapist, as a computer therapist is likely to have a digital record of the disclosure.

As we have argued, individuals may have a simplified goal structure in digital HMC, due to the suppression of many secondary goals common in human communication. A corollary to interpersonal communication suggests that individuals of low cognitive complexity or low cognitive resources may handle digital HMC better than human communication. Following, they may choose to achieve goals through digital HMC over human communication, or they may choose to engage more frequently with computers. This could explain why people prefer humans vs. machines for a certain task, as well as lead to the development of personalized scripts for interactions with computers.

Although our discussion so far focuses on the distinctive qualities of HMC context, similarities between interpersonal communication and digital HMC do exist, and in explicating context, it is worthwhile to note these as well. For example, Berger's plan-based theory of strategic communication (Berger, 1995, 1997) suggests that individuals will first use the available plan in long-term memory, but once frustration occurs, may seek alternative communication plans. In cases when the human-machine differences are irrelevant for the achievement of certain goals so that no frustrations occur, we expect similarities between interpersonal communication and digital HMC when individuals will apply well-learned, interpersonal scripts effectively.

Implications for Theory Development

There remains considerable value in findings that demonstrate similarities and differences between humans and machines (Edwards & Edwards, 2022; Ho et al., 2018). It is only through acknowledging differences and similarities at the larger level that more focused theoretical inquiries can be organized and examined. Now, we suggest moving forward with the study of computers and digital machines, focusing less on the global differences between humans and machines in general and more on the social affordances provided and enacted through HMC (Liu, 2018, 2021). Although in our previous discussion we made the contrast between HMC and human communication, we have discussed the goal structures in HMC in light of specific machine affordances and the lack of thereof. Social technologies vary in each particular form, and machines are developed in relation to the impossible to be known advances in underlying technologies of the future; thus, we recommend that predictions on the goal structures and communication with machines should be made with consideration of specific machine affordances.

Considering the differences between the goal structures in digital HMC and human communication, we argue there are several limitations in the current paradigms of HMC research and point out some alternative directions. In many digital HMC studies, participants are instructed to communicate with machines in a given context, with primary goals predefined or specified by the researchers, and then asked to evaluate the interaction experience and the machine agent (e.g., Edwards et al., 2020; Liu & Sundar, 2018). Considering the effects of machine affordances on primary goals, while also considering the effects of primary goals on secondary goals (Hample, 2016), such a research paradigm may artificially induce two antecedents for communication that might be nonexistent in natural settings: the goal that researchers stipulate for the interaction and an evaluation goal, which may distort the processes of digital HMC. These threats to ecological and external validity take on additional weight when considered with the arguments in this manuscript.

As empirical researchers, we are often trained to purposefully ignore or downplay threats of ecological and external validity to maximize internal validity, but without appropriate explication and consideration of the digital HMC context, we believe we may be adding artificiality to a naturally occurring process of digital HMC, therefore increasing threats to the internal validity of the findings. The similarities observed between human communication and digital HMC might be due to such an artifact of forcing primary goals to be identical, when, in actuality, the goals would have not been the same in the first place. To mitigate this threat, researchers may consider recording participants' goals in natural settings with methods such as experience sampling or surveys. Additionally, more clarity on the context of digital HMC may emerge through methods such as interviews or diary studies. We encourage researchers to undertake these methods with consideration of the digital HMC context situated both within and against existing theories, so that these methods may be used to provide a rich and focused description of HMC. We hope that with such understanding, deductive methods such as experiments can be employed to test causal relationships with less threats to both internal and external validity.

Conclusion

Through consideration of the digital HMC context, we have situated empirical findings and adjusted theoretical propositions of human communication and socialization. In these reconfigurations, we see benefits to communication scholars as our perspectives on social learning theory and goal structures focus directly on acts of communication. We look to the future of research in communication with hope, and we present these propositions for empirical testing, but also as examples of the means to theoretical engagement. We do not consider this manuscript to present anywhere close to a comprehensive integration of contextual factors of digital HMC or theories of communication and socialization. Instead, we encourage our colleagues to take these as examples and dive into theoretical spaces where their interests lie.

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