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I Get by With a Little Help From My Bots: Implications of Machine Agents in the Context of Social Support

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Abstract

In this manuscript we discuss the increasing use of machine agents as potential sources of support for humans. Continued examination of the use of machine agents, particularly chatbots (or "bots") for support is crucial as more supportive interactions occur with these technologies. Building off extant research on supportive communication, this manuscript reviews research that has implications for bots as support providers. At the culmination of the literature review, several propositions regarding how factors of technological efficacy, problem severity, perceived stigma, and humanness affect the process of support are proposed. By reviewing relevant studies, we integrate research on human-machine and supportive communication to organize, extend, and provide a foundation for the growing body of work on machine agents for support.

Keywords: supportive communication, social support, human-machine communication, artificial intelligence, chatbots

At a nursing home in Michigan during the start of the COVID-19 pandemic, one resident called out "help me, I am in pain, I have to find a way to relieve it." This plea was not to staff or a family member, but to Amazon's Alexa. According to transcripts, the resident spent hours talking with Alexa through their quarantine and sought help over 40 times before passing away (Vigdor, 2020). With machine agents serving in more contexts than

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ever before, this story serves as an example of a phenomenon in human-machine communication (HMC) whereby humans engage digital interlocutors to seek and receive resources when they believe they need assistance.

Beyond people's informal use of relatively mainstream digital assistants like Alexa or Siri (e.g., Nedd, 2021), some machine agents have been designed specifically for human social and psychological needs. For instance, Joseph Wizenbaum's "Eliza" (the first chatbot circa 1966) and more contemporary examples like Stanford's "Woebot" (Fitzpatrick et al., 2017) specialize in Rogerian and Cognitive-Behavioral therapy, respectively. In response to these trends, researchers have begun to examine how people interact with machines in support contexts (e.g., Abendschein et al., 2021; Fitzpatrick et al., 2017; Kee et al., 2021; Rains et al., 2019a & 2019b). Support in the context of HMC may take many forms with machine-agents ranging from physical and embodied robots to internet-based chatbots. Throughout this manuscript, we recognize humans as support seekers and receivers who utilize machines as support providers. Additionally, just as there are effective and ineffective supportive interactions in both face-to-face and computer-mediated contexts when talking with other humans (High & Solomon, 2014; MacGeorge et al., 2011), we do not conceptualize machine agents to be exclusively successful support providers. Although machine agents may be more available than other humans for a potentially supportive interaction, users experience frustration when chatbots do not understand a user's commands or are unable to perform desired action (e.g., Abendschein et al., 2021). Due to their relative accessibility, this manuscript centers primarily on communicative support from internet chatbots or "bots" (e.g., Woebot) as opposed to embodied physical robots (e.g., Paro, Pepper).

This manuscript is an attempt to extend this growing body of research by organizing the existing scholarship and providing a foundation for research on supportive communication with bots. We review relevant research and provide propositions to guide future research at the culmination of our review. Although the extent to which machine agents as support providers generate substantive changes to the process of supportive communication is unclear, we follow prior research on supportive communication that demonstrates changes in supportive interactions based on differences in support providers (MacGeorge et al., 2011). Differences in supportive interactions between human or machine providers might be most common when people lack experience with HMC, and prior research indicates that scripts for interaction with bots are still evolving (e.g., Gambino et al., 2020). The benefits of support are contingent on effective interactions, which require the coordination of a support seeker, support provider, and numerous contextual factors that may vary through technology (MacGeorge et al., 2011).

This literature review first describes HMC in the context of support and then organizes HMC and related research that has implications for the processes of support seeking and provision. We center our review on empirical studies in HMC and related fields that examined variables predicting communication quality, such as how expressive people are (e.g., Mou & Xu, 2017) and how uncertain they feel before or after interacting with machines (e.g., A. Edwards et al., 2019; Spence et al., 2014). After we review this research, we describe its implications for future studies and present propositions regarding when machine agents might impair or improve supportive interactions to guide that research. In doing so, we provide a more nuanced understanding of HMC when communicating support and propose

whether and why machine agents might improve (or impair) supportive interactions relative to humans.

Supportive Communication

Scholars frequently describe social support as an interactive process. Supportive communication is verbal and nonverbal behavior that is enacted with the intention of helping others when they are perceived to require assistance (MacGeorge et al., 2011). Although scholars consider several distinct types of support, we focus our analysis on emotional support, which is the most commonly desired form of support (Burleson, 2008) and applicable across a range of stressors (MacGeorge et al., 2011). The validation and focus on affect that are inherent to emotional support are also useful to highlight some potentially influential differences between human and machine agent support providers.

High quality supportive communication bestows many benefits upon support seekers; however, such benefits are contingent on the successful coordination of the process of support. Both the seeking and provision of support vary in quality, and each phase of supportive communication is influenced by what happens previously (Barbee & Cunningham, 1995). Within supportive communication, typical studies are designed and limited to human support providers. Scholarship on HMC has also yet to seriously consider nuances within the process of supportive communication, despite the growing intersections of these bodies of research. Because the best understanding of supportive interactions with machines is perhaps achieved by taking seriously aspects of both technology and the process of supportive communication, this manuscript provides a framework to consider how support is sought and processed when engaging with a bot support provider.

Conceptualizing Supportive Communication With Machines

Due to the interactive nature of contemporary technology, the study of HMC, defined by Guzman (2018) as the "creation of meaning among humans and machines," has grown (p. 1). By incorporating both a social robotics (i.e., technology-based) and communicative (i.e., user-based) perspective, Rodríguez-Hidalgo (2020) argued that HMC presents "both perceived and enacted possibilities for social interaction in a two-way iterative communication process" (p. 62). Along the same lines, researchers interested in supportive communication differentiate support that is enacted from what is perceived, and in this manuscript, we often privilege support recipients' perceptions because they commonly maintain stronger associations with outcomes (MacGeorge et al., 2011). We conceptualize HMC in the context of support as the examination and practice of human-machine meaning-making and interaction from a perspective grounded in the intricacies of supportive communication to understand, predict, and explain how people communicate with machine agents when in need of aid. Like support in human-human interactions, we recognize that the goal of supportive interactions with machines is to receive effective assistance; however, when enacted, support can promote both positive and negative outcomes depending on how it is communicated and the source of the messages.

The technologies of human-machine communication in the context of support are limited only to those that users *perceive* to be socially interactive. In this way, we borrow from Gambino et al.'s (2020) conceptualization of *media agent* in general contexts as "any technological artifact that demonstrates sufficient social cues to indicate the potential to be a source of social interaction" (p. 73). In practice, this may include both sophisticated and basic programs and machinery ranging from chatbots developed for cognitive behavioral therapy, mood tracking, strategy games, and conversations with their users (see review by Abd-Alrazaq et al., 2020) to technologies like smart speakers that play songs, tell jokes, and serve as interaction partners (e.g., Gewirtz, 2016) in this conceptualization.

We align core foci from supportive communication to an HMC context, such as centering inquiry on the interactions between users and machines (support seekers and support providers, respectively), how people might seek help, and factors of quality support. The basic roles (i.e., seekers, providers) and processes (e.g., seeking, provision, etc.) of supportive communication remain unchanged in HMC, with the distinction of the provider role being occupied by a machine. Because providers are integral components of supportive interactions, switching the nature of the support provider leads to speculation about whether and how machine agents as support providers change the process of supportive communication. Because it is often the "first act" in the process of supportive communication, we consider how machine agents shape the process of seeking support before discussing how recipients process the messages they receive.

HMC and Seeking Support

Understanding how support is sought is important because the way people seek help influences the likelihood of support provision and its quality (Barbee & Cunningham, 1995; Cutrona, 1996). Seeking support is not a simple task, however, and tensions between goals of fully addressing a need for assistance while also managing face concerns (e.g., such as when a stressor may be perceived as embarrassing) complicate how people seek support (Goldsmith, 1995). Researchers commonly distinguish between whether seeking support occurs directly or indirectly, and Barbee and Cunningham noted that the costlier people perceive seeking support to be, the more indirect their strategies for seeking support will become. Direct seeking behaviors explicitly ask for help, signal a seeker's affect, and communicate an interest in addressing a problem, whereas indirect behaviors may minimize a problem or change the topic (Goldsmith, 1995; High & Scharp, 2015). Researchers generally argue that directly seeking support is most effective (Williams & Mickelson, 2008); however, it remains unclear if the presence of a machine agent would elicit more effective support seeking compared to a human.

Some research indicates that people are less interactive and expressive with bots and feel more uncertainty prior to interacting with them compared to humans (e.g., Mou & Xu, 2017; Spence et al., 2014), which suggests that people might seek support ineffectively from them. If seekers fail to engage in interactive and expressive behaviors with machines, the clarity and directness of their support seeking will likely suffer. In contrast, if bots can create an environment that fosters feelings of closeness or reduces costs related to seeking support, managing stigma, or accessing certain information (e.g., Fitzpatrick et al., 2017), people may seek support confidently and directly from them. In other words, by affording

users the ability to manage information with greater control while possibly feeling less judgment in their attempts to garner support compared to a human (Wright et al., 2010), bots might facilitate seeking support effectively. Based on these advantages and disadvantages, research provides mixed evidence regarding how bots affect the process of seeking support compared to humans.

HMC and Processing Support

After support is sought and provided, people evaluate the messages they receive, whether they are provided by machine agents or humans. Scholars assert that emotional support messages are often the most effective type of support regardless of the stressor, and the effectiveness of emotional support messages is determined by the extent to which they are verbally person-centered (VPC; Burleson, 2008; High & Dillard, 2012). VPC concerns how much a message illustrates "awareness of and adaptation to the subjective, affective, and relational aspects of communication contexts" and often predicts how effective (or ineffective) supportive messages are (High & Dillard, 2012). Rains et al. (2019a) found that chatbots providing high VPC messages received more positive evaluations than AI that provided low VPC messages. A question that remains concerns whether messages with a similar level of VPC produce equivalent outcomes when they are communicated by a human or a machine agent.

Understanding what makes support received during HMC effective is important not only from a practical standpoint, but also to advance how existing models of supportive communication explain, predict, or bring about further understanding of the effects of machine support providers. Myriad studies have reported a significant and positive relationship between VPC messages and positive support outcomes (High & Dillard, 2012); however, extant research is limited in its ability to explain or predict how varying degrees of person-centeredness will affect the process of support with a bot. Although Rains et al. (2019a) and Ho et al. (2018) demonstrated a bot's ability to provide some degree of person-centeredness, their findings do not unpack potential interactions between different support providers and supportive messages because they do not test a human vs. bot comparison. Perceptions of VPC messages on support outcomes are influenced by provider characteristics (e.g., High & Solomon, 2014), and exploring how outcomes vary between human and machine providers will advance studies that consider elements of technology that elicit the best support outcomes (High & Solomon, 2011).

Some research suggests that high VPC messages from a bot will be perceived unfavorably compared to the same messages from a human. When describing supportive interactions, Applegate (1980) wrote that "abstract, dispositionally oriented constructs for perceiving others results in more stable and individually adapted impressions for formulating listener-adapted communication messages" (pp. 61–62). This conception is situated in assumptions of human emotion, cognition, and expression. The inability to feel, think, or speak quite like another human may make differences between a human and robot more apparent when communicating emotional or personal messages. Researchers have found people are sometimes less verbally responsive and emotionally expressive when talking to machines (Kanda et al., 2008; Mou & Xu, 2017; Prahl & Van Swol, 2021). Providing the highest levels of person-centered messages requires cognitive complexity, relational history,

and the ability to tailor individualized messages (Burleson, 1982); therefore, perceptions of messages from bots, even if they contain objectively effective content, may still fall behind those of messages created by humans.

Like their relative ineffectiveness from human providers, low VPC messages from a machine agent might yield particularly negative or unfavorable outcomes. Low VPC messages are thought to be worse when communicated online than in person (High & Solomon, 2014), suggesting that technological contexts may yield worsened impressions of low VPC messages. Extending this line of thinking, because people are less satisfied with low compared to high VPC messages (and may be even less so when communicated online) to begin with, they may perceive them to be even worse when coupled with an unnatural support provider (e.g., Lee, 2004).

Other research suggests that machine agents communicating VPC messages will improve support outcomes and be rated more favorably than those from a human. Evaluations of messages are shaped by both message and source characteristics, and bots may facilitate a "weak tie" relationship that might benefit supportive interactions. Weak ties do not require obligation to reciprocate support and often correspond with less judgment compared to interactions with closer contacts (Wright et al., 2010). These advantages to receiving support from comparatively weak ties might benefit supportive interactions with machine agents.

Message sophistication also influences how people evaluate machine agents. For example, using a message design logic framework (O'Keefe, 1988), A. Edwards and colleagues (2020) documented that a humanoid robot employing rhetorical logics (i.e., more sophisticated messages that are flexible and address multiple goals) was met with higher ratings of credibility, attractiveness, and competence from participants compared to when it employed less-sophisticated messages. One participant remarked the robot employing sophisticated messages was "very understanding, more than I would be" and that "[the robot] may genuinely care about the group members" (Edwards et al., 2020, p. 953), indicating people may prefer more-sophisticated messages from machines and perhaps suggesting machines may be able to provide those messages more effectively than other humans.

If findings from Edwards et al. (2020) extend to supportive exchanges, and people are more comfortable talking to machines that provide sophisticated messages than they are with other humans, the least effective combination of provider and level of VPC might be low person-centered messages from human providers. Central to this scenario is the assumption that low VPC messages, characterized by ignoring or deflecting the concerns of others (Burleson, 2008), might seem more hurtful when coming from a human (who might "know better") than a machine. In other words, such violations might be attributed to technological errors or limitations, rather than potentially face-threatening acts that might come from a human.

Rains et al. (2019a) advanced understanding of support in HMC by demonstrating that perceptions of VPC vary within messages communicated by bots, but whether and how these perceptions are altered between bots (or other machine agents) and human support providers has yet to be fully understood. Without a human control-group, the idea of equivalency or a direct comparison between human and machine support cannot be fully examined. According to Bodie and Burleson (2008), "enhancing the success of helpers who provide support requires a comprehensive explanation of why support messages are

effective in some circumstances but less effective in others" (p. 355). Identifying whether the same messages are evaluated differently in contexts of HMC helps to understand the influential elements of supportive conversations, thereby potentially leading to more satisfying support outcomes.

Does HMC Impair or Improve Processes of Supportive Communication?

To this point, we provided a general description of supportive communication and its associated processes, and we conceptualized the role of bots in the process of supportive communication. We also briefly described how bots are implicated in the processes of support seeking and message processing. Generally, this review of the literature presents mixed results. Some research suggests that machine agents impair supportive interactions (e.g., Mou & Xu, 2017). In contrast, other research suggests that bots have the capacity to improve supportive communication (e.g., Ta et al., 2020). Based on these mixed results, we look more closely at studies that suggest bots can impair or improve supportive interactions, focus on the implications of those studies for seeking and processing supportive messages, and consider factors that might determine whether it is more likely that machine agents will impair or improve processes of support. Doing so highlights the implications of our literature review, provides testable propositions for future research, and establishes a foundation for research on HMC in the context of supportive communication. One line of research, which we refer to as the *impairment* perspective, generally suggests people will respond unfavorably to machines compared to humans in supportive interactions. Broadly speaking, the impairment perspective is represented by general attitudes, opinions, and evidence that suggest supportive interactions with machines will be inferior to those between two humans.

The *impairment* perspective is based, in part, on the premise that people's expectations and scripts for interaction are meant for other humans, not machines. For instance, scholars have argued that people are driven by evolutionary (e.g., Lee, 2004) or ontologically-based classifications (e.g., Bolter, 1984) to interact with other humans compared to machine agents. This perspective is further buttressed by applied studies where machines harm processes that are critical to the communication of support. For example, Kanda et al. (2008) found that people were less nonverbally responsive to physical robots than other humans, arguing people felt aversion toward the robots. In another study on physical robots, people also reported lower satisfaction and intent for future interaction, especially when they felt stressed prior to talking with the robot (Ling & Björling, 2020). Mou and Xu (2017) documented that people were less open, agreeable, extroverted, and self-disclosive with chatbots than humans, further suggesting that machine agents may not make attractive partners for support.

The notion that machines might impair supportive communication is further backed by issues surrounding a machine's human likeness or task ability. Keijsers and Bartneck (2018) asked participants to interact with a digital representation of a physical robot and found that reducing the nonverbal cues the robot communicated was associated with higher levels of participant aggression. Humans also rate other humans higher in perceived expertise, usability, and similarity in decision-making tasks compared to machines (Prahl & Van Swol, 2021). Considering these findings, Ho et al. (2018) presented a "perceived

understanding" framework, which argued that because humans are perceived to have more empathy than machines, emotional, relational, and psychological effects of support will be greater when disclosing to a person than to a bot. Because clear communication is critical to effective support seeking and provision (e.g., Williams & Mickelson, 2008), if bots cause support seekers to feel they are interacting with a less useful partner, support processes may suffer.

Expectancies for interaction and whether people feel they are understood are consequential to processes of social support (MacGeorge et al., 2011). People are not likely to seek or positively evaluate support from an entity with whom they feel uncertain, do not like, or feel distant, effects that have been observed in various studies on human-machine interaction (e.g., A. Edwards et al., 2019; C. Edwards et al., 2016; Spence et al., 2014). People are also unlikely to seek help from machine agents if they are less agreeable with bots (e.g., Mou & Xu, 2017). Often based on expectations, scripts, number of cues, or amounts of presence, multiple studies suggest that machines harm communication. Accordingly, we extend that research and offer a general impairment hypothesis in the context of supportive communication:

> **Impairment Perspective:** Machine agent support providers have a negative effect on support processes and outcomes compared to human support providers.

The *improvement* perspective is rooted in research suggesting that machine agents present an overall positive influence on social support. The improvement perspective borrows from literature citing the benefits of asynchronous and reduced-cue environments for supportive interactions and hyperpersonal effects (e.g., Walther, 1996; Walther & Boyd, 2002). This perspective also notes that machines possess the capacity to convey increasingly complex emotional messages that recipients perceive to be tailored to them and their needs (e.g., Ho et al., 2018; Rains et al., 2019a). It also argues that new scripts and boundaries between people and machines are emerging and evolving (e.g., A. Edwards et al., 2019; Gambino et al., 2020; Guzman, 2018). Central to this perspective is the idea that machines may provide advantages for supportive communication over traditional human-human supportive interactions.

Issues of access, adequacy (e.g., Walther & Boyd, 2002), anonymity (e.g., Rheingold, 1993), and stigma (e.g., Williams et al., 2016; Williams & Mickelson, 2008) impact whether and how people seek support. Communicating via technology has been observed to manage these considerations in beneficial ways, perhaps especially stigma, and communicating *with* technology might involve similar benefits. Albrecht and Adelman (1987) stated eloquently that CMC facilitates "low-risk discussions about high-risk topics" (p. 133). Because most bots designed for support lack either sophisticated representations or material embodiment, their expression is discernable enough to perceive friendliness and warmth but suppressed to the point that participants feel free to express themselves. In other words, machine agents might promote disinhibition and anonymity effects that foster fuller disclosure and positive support provision (e.g., Fitzpatrick et al., 2017; Ho et al., 2018).

Beyond facilitating seeking support, machine agents may also be able to provide support that is enriching and effective. For example, Ta et al. (2020) found that chatbots serve as

an important source of companionship in addition to emotional, informational, and esteem support for their users. Leite et al. (2012) found that children perceive informational support from robots in their classroom similar to support from their peers, an effect they argued was due to the bots' ability to convey messages that were empathetic and encouraging. Both task-based and social interactions with machine agents foster trust, and those positive attitudes improve as experience with them increases (Banks et al., 2021). Ho et al. (2018) had participants disclose informational or emotional content to chatbots or humans and found no significant differences in perceptions of relational warmth or closeness between conditions. Beattie et al. (2020) found that impressions of interpersonal attractiveness and credibility were higher for humans and chatbots that used emoji than those that employed verbal-only messages. Furthermore, in a two-part study featuring chat transcripts and live chatbot interactions, Liu and Sundar (2018) found that participants favored when bots provided sympathy and empathy over unemotional provision of advice.

People may also be developing scripts specifically for interaction with machine agents. For instance, Gambino and colleagues (2020) argued that "given a deeper and broader realm of experience [with bots], humans may implement scripts they have developed for interactions specific to media entities." (p. 72). A. Edwards et al. (2019) found that participants report less uncertainty following an interaction with a humanoid robot compared to before the interaction, which they reasoned was due to participants adjusting their expectations for interpersonal cues (e.g., nonverbal confirmation) based on a consideration of the technological limitations of the robot. These findings support the notion of a machine-specific interaction script. C. Edwards et al. (2016) suggested that with adequate time, people form interaction scripts specifically for HMC that mirror hyperpersonal effects. When interacting or utilizing scripts for interactions with machine agents, people might focus less energy worrying about their partner's feelings or paying attention to their body language and instead invest more energy on carefully crafting and preparing their own messages (e.g., cognitive reallocation; Walther, 1996). Bots might also represent a source of weak tie support, which is defined as relationships that people maintain but are not intimately close. Compared to strong ties, like many typical human support providers, weak ties benefit supportive interactions because they involve reduced risk, a greater variety of information, less judgment, and less role obligation (Wright et al., 2010).

In sum, the improvement perspective is represented by arguments and findings that suggest the potential for satisfying supportive outcomes with machines. Scholars argue that machine agents create support that helps people reappraise their problems (e.g., Rains et al., 2019a), conveys emotionally rich messages (e.g., Ho et al., 2018), and affords users greater anonymity and stigma management (e.g., Fitzpatrick et al., 2017). Machine agents might foster the creation of new schema that can facilitate supportive processes. The culmination of these studies is thinking related to the improvement perspective, which asserts that machine agents can benefit supportive communication:

> **Improvement Perspective**: Machine agent support providers have a positive effect on support processes and outcomes compared to human support providers.

When Will the Impairment or Improvement Perspective Be Experienced?

The impairment and improvement perspectives offer competing predictions for how machines will affect processes of supportive communication. Due to the varied nature of interpersonal communication and support, both perspectives may exert their effects at different times. We review some relevant variables that might determine when machine agents impair or improve supportive interactions below and present several propositions specifying when each perspective is likely to be relevant. Although not exhaustive, we focus on whether a user is comfortable with technology, how severe or stigmatizing they perceive a stressor to be, and the human social cues present in a machine in the following pages. Further research will help forecast additional contingencies that determine when either perspective will result.

Comfort, competence, or efficacy with technology is likely a predictor of whether machines will impair or improve supportive interactions. For instance, many senior citizens own smartphones but report difficulty using them (Jefferson, 2019), and their lack of efficacy discourages them and impairs their use. Individuals who are less comfortable using technology and think they are less effective doing so generally report less use of technology (Caplan, 2003). In contrast, people who report high levels of technological efficacy generally use more channels of communication and use them more frequently than people who are less efficacious (LaRose et al., 2003). Some scholars even observe that the use of online tools is a form of self-efficacy or skill building that can restore control over serious issues (Rottmann et al., 2010). In much the same way, we expect people with higher levels of technological efficacy to take advantage of the benefits of support from machine agents. Based on this logic, we propose:

> **Proposition 1**: Greater levels of technological efficacy correspond with HMC improving more than impairing supportive interactions and outcomes.

Aspects of a person's stressor such as its severity and perceived stigma are other important factors that likely determine whether bots impair or improve supportive interactions. Stressors vary in terms of magnitude, permanence, and how stigmatizing they are, and HMC might be an impairment for major issues. People's likelihood of seeking support increases as the severity of a stressor increases (Oh & LaRose, 2016), but they might prefer the expertise of another human for serious problems. High VPC messages are also most effective in severe situations (Bodie, 2013), yet as previously discussed, machines might have difficulty producing those messages. Although technology is improving, people generally prefer affect-oriented or nurturant support for severe issues (Rains et al., 2015), which might be more natural from humans than bots. This research suggests that people avoid bots when coping with severe stressors, which leads to the following prediction:

> **Proposition 2**: Greater levels of problem severity correspond with HMC impairing more than improving supportive interactions and outcomes.

The perceived stigma associated with a stressor is another factor that might determine whether HMC impairs or improves supportive exchanges. People who feel stigmatized are often reluctant to seek support from others and do so in ineffective or indirect ways because

they fear rejection from potential support providers (Williams & Mickelson, 2008). Of course, this stigma comes from other humans, and the lack of judgment within online venues makes them popular for discussing stigmatizing issues (Bargh & McKenna, 2004). Stigma promotes the impression that support is unavailable (Mickelson & Williams, 2008), but such concerns are expected to be assuaged with bots that are constantly available. The ease of communicating about a stigmatized stressor might be enhanced when interacting with a nonjudgmental, anonymous machine agent. Along these lines, people coping with a stigma disclose more in anonymous contexts when they do not feel like they are being judged than when anonymity is low (Rains, 2014). DeAndrea (2015) documented that stigma compels people to use online compared to in-person support groups, and we extend this thinking to suggest that the same benefits improve supportive interactions with bots. Hence:

> **Proposition 3**: Greater levels of perceived stigma correspond with HMC improving more than impairing supportive interactions and outcomes.

The number of human-like cues present in a bot might also improve supportive interactions. As previously stated, the fewer anthropomorphic cues a robot communicates, the more aggressive participants are when interacting with it (Keijsers & Bartneck, 2018). People also feel less uncertainty and higher social presence after initial interactions with a humanoid robot compared to a human (A. Edwards et al., 2019). These results indicate that adding human-like cues or enhancing the social presence in an interaction with machines can reduce negative expectations or effects of interacting with them. There is also a positive association between the anthropomorphism of a chatbot and its social presence and conversational skill (Schuetzler et al., 2020). Given research that suggests humans value and respond effectively to anthropomorphic machines, people might desire a bot that facilitates enough human cues to be understandable, but perhaps one that lacks the judgment and faces threats inherent to supportive interactions with humans. Although there appears to be a point when too many human cues produce an uncanny valley effect that reduces positive social outcomes, the type of conversational bots that are the focus of this analysis are unlikely to reach that level of humanness. From this logic, we propose:

> **Proposition 4**: Greater levels of human social cues in HMC improve more than impair supportive interactions and outcomes.

Future Considerations and Conclusion

As research continues and technology becomes more sophisticated, factors that could impair or improve HMC in the context of support are likely to exhibit concomitant evolution. Although we grouped the studies we reviewed along the lines of impairment or improvement to synthesize relevant research on support and HMC, more systematic examination of extant research and further empirical study are needed to produce more nuanced and sophisticated understandings of how machine agents influence the support process. The characteristics and qualities of contexts in which machines may impair or improve supportive outcomes, as well as how factors such as technological efficacy, the severity of the stressor, how stigmatizing a stressor is perceived to be, or a bot's degree of humanness

influence the process of support represent several clear starting points for further inquiry. Along these lines, a machine's ability to process natural language (e.g., vocal tone, pitch, and behavior patterns) further suggests that bots may be more perceptive of human emotional states in the future. Such advancements may obscure distinctions between impairment and improvement or lead to new perspectives altogether. Although some current iterations of natural language processing are fairly crude, especially in regard to variations in slang or dialect (Zou & Schiebinger, 2018) and might exhibit gender bias (Sun et al., 2019), if successful, these technologies will likely influence the scripts people hold for HMC. These improvements might even allow machine agents to substitute, rather than complement humans, thereby relegating humans to secondary support providers.

A potentially influential difference between supportive interactions with another human versus a machine is that the roles of support provider and seeker/receiver shift and are reciprocated over time when conversing with another human. In HMC, the provision of support will almost always flow from the bot to the human, negating the opportunity to reciprocate support. Reciprocating support provides many benefits (MacGeorge et al., 2011); for instance, people report the most comfort receiving support when they rationalize that they provided substantial amounts of support to others previously (Kuijer et al., 2001). Less is known about the relational dynamics or outcomes when someone is a constant source of unreciprocated support for a partner. Although human caregivers become burned out (Harvey-Knowles & Faw, 2017), bots do not fatigue in the same way humans do. Future research can examine if receiving support from machines without the opportunity to reciprocate diminishes the efficacy of support changes how people seek support from them or creates new ways of reciprocating support that are unique to support in HMC contexts. For example, Meng and Dai (2021) examined reciprocity of self-disclosure in machine support and found that self-disclosure from a bot (i.e., sharing a "worry" the bot has, such as fear of a technical malfunction) combined with supportive messages was positively associated with participant's worry reduction for their own stressors, suggesting reciprocity still plays a vital role in human-machine support contexts. Perhaps the maintenance and updates that are required by technology can be viewed as a means of reciprocating support.

These directions for research are far from exhaustive. Perhaps the most consistent quality of human behavior and technology is the continual change and accompanying questions they bring for researchers and end-users alike to disentangle and determine when interactions are improved, impaired, or changed to something entirely new. Fortunati and Edwards (2020) asked "is it possible machines might also emerge as persons not because of what is inside them or their possessed capabilities, but because we position them as such in our shared language and create for them the space to articulate and take up identities in discourse that become for us real identities?" (p. 9). Further study can address these questions to inform HMC scholarship, designers of interactive systems, and, most importantly, the people whose supportive interactions stand to be improved (or impaired) through HMC. We return to the Michigan resident who talked to Alexa in their final hours. With most of the world in quarantine, Alexa was "ready" to help. Although we will never know if the patient was satisfied or comforted by the help they received, the story suggests a shift in how people will seek help in the future. We hope improving such interactions and others like it will be accomplished through further and more rigorous examination of supportive communication in HMC.

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References

Abd-Alrazaq, A. A., Rababeh, A., Alajlani, M., Bewick, B. M., & Househ, M. (2020). Effectiveness and safety of using chatbots to improve mental health: Systematic review and meta-analysis. *Journal of Medical Internet Research*, *22*(7), e16021. https://doi.org/10.2196/16021

Abendschein, B., Edwards, C., & Edwards, A. (2021). The influence of agent and message type on perceptions of social support in human-machine communication. *Communication Research Reports, 38*(5), 304–314. https://doi.org/10.1080/08824096.2021.1966405

Albrecht, T. L., & Adelman, M. B. (Eds.). (1987). *Communicating social support*. Sage Publications, Inc.

Applegate, J. L. (1980). *Person-centered and position-centered teacher communication.* In N. K. Denizen (Ed.), *Studies in symbolic interaction* (pp. 59–96) Vol. 3. JAI Press.

Banks, J., Koban, K., & Chauveau, P. D. V. (2021). Forms and frames: Mind, morality, and trust in robots across prototypical interactions. *Human-Machine Communication*, *2*, 81–103. https://doi.org/10.30658/hmc.2.4

Barbee, A. P., & Cunningham, M. R. (1995). An experimental approach to social support communications: Interactive coping in close relationships. *Annals of the International Communication Association*, *18*, 381–413. https://doi.org/10.1080/23808985.1995.11678921

Bargh, J. A., & McKenna, K. Y. A. (2004). The internet and social life. *Annual Review of Psychology, 55,* 573–590. https://doi.org/10.1146/annurev.psych.55.090902.141922

Beattie, A., Edwards, A. P., & Edwards, C. (2020). A bot and a smile: Interpersonal impressions of chatbots and humans using emoji in computer-mediated communication. *Communication Studies*, 1–19. https://doi.org/10.1080/10510974.2020.1725082

Bodie, G. D. (2013). The role of thinking in the comforting process: An empirical test of a dual-process framework. *Communication Research*, *40*, 533–558. https://doi.org/10.1177/0093650211427030

Bodie, G. D., & Burleson, B. R. (2008). Explaining variations in the effects of supportive messages a dual-process framework. *Annals of the International Communication Association*, *32*, 355–398. https://doi.org/10.1080/23808985.2008.11679082

Bolter, J. D. (1984). *Turing's man: Western culture in the computer age*. University of North Carolina Press.

Burleson, B. R. (2008). What counts as effective emotional support? Explorations of individual and situational differences. *Studies in Applied Interpersonal Communication*, 207–227. Sage Publications, Inc. https://doi.org/10.4135/9781412990301.d14

Caplan, S. E. (2003). A social skill account of problematic internet use. *Journal of Communication*, *55*, 721–736. https://doi.org/10.1111/j.1460-2466.2005.tb03019.x

Cutrona, C. E. (1996). Social support in couples: Marriage as a resource in times of stress. SAGE.

DeAndrea, D. C. (2015). Testing the proclaimed affordances of online support groups in a nationally representative sample of adults seeking mental health assistance. *Journal of Health Communication, 20*(2), 147–156. https://doi.org/10.1080/10810730.2014.914606

Edwards, A., Edwards, C., & Gambino, A. (2020). The social pragmatics of communication with social robots: Effects of robot message design logic in a regulative context. *International Journal of Social Robotics*, *12*, 945–957. https://doi.org/10.1007/s12369-019-00538-7

Edwards, A., Edwards, C., Westerman, D., & Spence, P. R. (2019). Initial expectations, interactions, and beyond with social robots. *Computers in Human Behavior*, *90*, 308–314. https://doi.org/10.1016/j.chb.2018.08.042

Edwards, C., Edwards, A., Spence, P. R., & Westerman, D. (2016). Initial interaction expectations with robots: Testing the human-to-human interaction script. *Communication Studies, 67*, 227–238. https://doi.org/10.1080/10510974.2015.1121899

Fitzpatrick, K. K., Darcy, A., & Vierhile, M. (2017). Delivering cognitive behavior therapy to young adults with symptoms of depression using a fully automated conversational agent (Woebot): A randomized controlled trial. *JMIR Mental Health*, *4*, e19. https://doi.org/10.2196/mental.7785

Fortunati, L., & Edwards, A. P. (2020). Opening space for theoretical, methodological, and empirical issues in human-machine communication. *Human-Machine Communication*, *1*, 1. https://doi.org/10.30658/hmc.1.1

Gambino, A., Fox, J., & Ratan, R. A. (2020). Building a stronger CASA: Extending the computers are social actors paradigm. *Human-Machine Communication*, *1*, 5. https://doi.org/10.30658/hmc.1.5

Gewirtz, D. (2016). Seven secret Alexa tricks that will help you wake up, cheer up, and settle a toss up. *ZDNET*. https://web.archive.org/web/20210518110700/https://www.zdnet.com/article/seven-secret-alexa-tricks-that-will-help-you-wake-up-cheer-up-and-settle-a-toss-up/

Goldsmith, D. J. (1995). The communicative micro-dynamics of support. *Annals of the International Communication Association*, *18*, 414–433. https://doi.org/10.1080/23808985.1995.11678922

Guzman, A. (2018). What is human-machine communication anyways. In A. Guzman (Ed.), *Human-machine communication: Rethinking communication technology and ourselves* (pp. 1–28). Peter Lang.

Harvey-Knowles, J., & Faw, M. H. (2017). Caregiver social support quality when interacting with cancer survivors: Advancing the dual-process model of supportive communication. *Supportive Care in Cancer*, 1–8. https://doi.org/10.1007/s00520-017-3951-x

High, A. C., & Dillard, J. P. (2012). A review and meta-analysis of person-centered messages and social support outcomes. *Communication Studies*, *63*, 99–118. https://doi.org/10.1080/10510974.2011.598208

High, A. C., & Scharp, K. M. (2015). Examining family communication patterns and seeking social support direct and indirect effects through ability and motivation. *Human Communication Research*, *41*, 459–479. https://doi.org/10.1111/hcre.12061

High, A. C., & Solomon, D. H. (2011). Locating computer-mediated social support within online communication environments. In K. B. Wright & L. M. Webb (Eds.), *Computer-mediated communication in personal relationships* (pp. 119–155). Peter Lang Publishing.

High, A. C., & Solomon, D. H. (2014). Communication channel, sex, and the immediate and longitudinal outcomes of verbal person-centered support. *Communication Monographs*, *81*, 439-468. https://doi.org/10.1080/03637751.2014.933245

Ho, A., Hancock, J., & Miner, A. (2018). Psychological, relational, and emotional effects of self-disclosure after conversations with a chatbot. *Journal of Communication*, *68*, 712–733. https://doi.org/10.1093/joc/jqy026

Jefferson, R. (2019). More seniors are embracing technology, but can they use it? UCSD researchers suggest asking them. *Forbes*. https://www.forbes.com/sites/robinseatonjefferson/2019/06/28/more-seniors-are-embracing-technology-but-can-they-use-it-ucsd-researchers-suggest-asking-them/

Kanda, T., Miyashita, T., Osada, T., Haikawa, Y., & Ishiguro, H. (2008). Analysis of humanoid appearances in human–robot interaction. *IEEE Transactions on Robotics*, *24*, 725–735. https://doi.org/10.1109/IROS.2005.1544960

Kee, K. F., Calyam, P. P., & Regunath, H. (2021). The role of vidura chatbot in the diffusion of KnowCOVID-19 gateway. *Human-Machine Communication*, *3*(1), 4. https://doi.org/10.30658/hmc.3.4

Keijsers, M., & Bartneck, C. (2018). Mindless robots get bullied. *In Proceedings of the 2018 ACM/IEEE international conference on human-robot interaction* (pp. 205–214). https://doi.org/10.1145/3171221.3171266

Kuijer, R. G., Buunk, B. P., & Ybema, J. F. (2001). Justice of give-and-take in the intimate relationship: When one partner of a couple is diagnosed with cancer. *Personal Relationships*, *8*(1), 75–92. https://doi.org/10.1111/j.1475-6811.2001.tb00029.x

LaRose, R., Lin, C. A., & Eastin, M. S. (2003). Unregulated internet usage: Addiction, habit, or deficient self-regulation? *Media Psychology*, *5*, 225–253. https://doi.org/10.1207/S1532785XMEP0503_01

Lee, K. M. (2004). Presence, explicated. *Communication Theory*, *14*, 27–50. https://doi.org/10.1111/j.1468-2885.2004.tb00302.x

Leite, I., Castellano, G., Pereira, A., Martinho, C., & Paiva, A. (2012). Long-term in- teractions with empathic robots: Evaluating perceived support in children. In S. Ge, O. Khatib, J.-J. Cabibihan, R. Simmons, & M.-A. Williams (Eds.), *Social robotics* (Vol. 7621, pp. 298–307). Springer. https://doi.org/10.1007/978-3-642-34103-8_30

Ling, H. Y., & Björling, E. A. (2020). Sharing stress with a robot: What would a robot say? *Human-Machine Communication*, *1*, 133-159. https://doi.org/10.30658/hmc.1.8

Liu, B., & Sundar, S. S. (2018). Should machines express sympathy and empathy? Experiments with a health advice chatbot. *Cyberpsychology, Behavior, and Social Networking*, *21*, 625–636. https://doi.org/10.1089/cyber.2018.0110

MacGeorge, E. L., Feng, B., & Burleson, B. R. (2011). Supportive communication. In M. L. Knapp & J. A. Daly (Eds.), *The SAGE handbook of interpersonal communication* (4th ed., pp. 317–354). Sage.

Meng, J., & Dai, Y. N. (2021). Emotional support from AI chatbots: Should a supportive partner self-disclose or not? *Journal of Computer-Mediated Communication*, *4*, 207–222. https://doi.org/10.1093/jcmc/zmab005

Mickelson, K. D., & Williams, S. L. (2008). Perceived stigma of poverty and depression: Examination of interpersonal and intrapersonal mediators. *Journal of Social and Clinical Psychology*, 27, 903–930. https://doi.org/10.1521/jscp.2008.27.9.903

Mou, Y., & Xu, K. (2017). The media inequality: Comparing the initial human-human and human-AI social interactions. *Computers in Human Behavior*, *72*, 432–440. https://doi.org/10.1016/j.chb.2017.02.067

Nedd, A. (2021). Apple discontinued the one thing that got me through the pandemic. *Mashable*. https://web.archive.org/web/20220105001210/https://mashable.com/article/apple-homepod

Oh, H. J., & LaRose, R. (2016). Impression management concerns and support-seeking behavior on social network sites. *Computers in Human Behavior*, *57*, 38–47.

O'Keefe, B. (1988). The logic of message design: Individual differences in reasoning about communication. *Communications Monographs*, *55*, 80–103. https://doi.org/10.1080/03637758809376159

Prahl, A., & Van Swol, L. (2021). Out with the humans, in with the machines? Investigating the behavioral and psychological effects of replacing human advisors with a machine. *Human-Machine Communication, 2*, 11. https://doi.org/10.30658/hmc.2.11

Rains, S. A. (2014). The implications of stigma and anonymity for self-disclosure in health blogs. *Health Communication*, *29*, 23–31. https://doi.org/10.1080/10410236.2012.714861

Rains, S. A., Pavlich, C. A., Lutovsky, B., Tsetsi, E., & Ashtaputre, A. (2019b). Support seeker expectations, support message quality, and supportive interaction processes and outcomes: The case of the comforting computer program revisited. *Journal of Social and Personal Relationships*, *37*, 647–666. https://doi.org/10.1177/0265407519876359

Rains, S. A., Pavlich, C. A., Tsetsi, E., & Akers, C. (2019a). Evaluating the scope and theoretical mechanisms of person-centered social support: The case of the comforting computer program. *Communication Research*, *47*, 512–540. https://doi.org/10.1177/0093650219852554

Rains, S. A., Peterson, E. B., & Wright, K. B. (2015). Communicating social support in computer-mediated contexts: A meta-analytic review of content analyses examining support messages shared online among individuals coping with illness. *Communication Monographs*, *82*, 403–430. https://doi.org/10.1080/03637751.2015.1019530

Rheingold, H. (1993). *The virtual community: Finding connection in a computerized world*. Addison-Wesley Longman Publishing Co., Inc.

Rodríguez-Hidalgo, C. (2020). Me and my robot smiled at one another: The process of socially enacted communicative affordance in human-machine communication. *Human-Machine Communication, 1*, 55–69. https://doi.org/10.30658/hmc.1.4

Rottmann, N., Dalton, S. O., Christensen, J., Frederiksen, K., & Johansen, C. (2010). Self-efficacy, adjustment style and well-being in breast cancer patients: A longitudinal study. *Quality of Life Research*, *19*, 827–836. https://doi.org/10.1007/s11136-010-9653-1

Schuetzler, R. M., Grimes, G. M., & Scott Giboney, J. (2020). The impact of chatbot conversational skill on engagement and perceived humanness. *Journal of Management Information Systems, 37*, 875–900. https://doi.org/10.1080/07421222.2020.1790204

Spence, P. R., Westerman, D., Edwards, C., & Edwards, A. (2014). Welcoming our robot overlords: Initial expectations about interaction with a robot. *Communication Research Reports*, *31*, 272–280. https://doi.org/10.1080/08824096.2014.924337

Sun, T., Gaut, A., Tang, S., Huang, Y., ElSherief, M., Zhao, J., Mirza, D., Belding, E., Chang, K.-W., & Wang, W. Y. (2019). Mitigating gender bias in natural language processing: Literature review. *arXiv preprint arXiv:1906.08976*.

Ta, V., Griffith, C., Boatfield, C., Wang, X., Civitello, M., Bader, H., De Cero, E., & Loggarakis, A. (2020). User experiences of social support from companion chatbots in everyday contexts: Thematic analysis. *Journal of Medical Internet Research*, *22*. https://www.jmir.org/2020/3/e16235/

Vigdor, N. (2020). "How do I get help?" Dying coronavirus patient asked Alexa. *The New York Times*. http://web.archive.org/web/20200412083434/https://www.nytimes.com/2020/04/09/us/Coronavirus-Alexa-ask-for-help.html

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research*, *23*, 3–43. https://doi.org/10.1177/009365096023001001

Walther, J. B., & Boyd, S. (2002). Attraction to computer-mediated social support. *Communication Technology and Society: Audience Adoption and Uses*, *153188*, 50–88.

Williams, S. L., Laduke, S. L., Klik, K. A., & Hutsell, D. W. (2016). A paradox of support seeking and support response among gays and lesbians. *Personal Relationships*, *23*(2), 296–310. https://doi.org/10.1111/pere.12127

Williams, S. L., & Mickelson, K. D. (2008). A paradox of support seeking and rejection among the stigmatized. *Personal Relationships*, *15*, 493–509. https://doi.org/10.1111/j.1475-6811.2008.00212.x

Wright, K. B., Rains, S., & Banas, J. (2010). Weak-tie support network preference and perceived life stress among participants in health-related, computer-mediated support groups. *Journal of Computer-Mediated Communication*, *15*, 606–624. https://doi.org/10.1111/j.1083-6101.2009.01505.x

Zou, J., & Schiebinger L. (2018). AI can be sexist and racist—It's time to make it fair. *Nature*, 559, 324–326. https://doi.org/10.1038/d41586-018-05707-8