A Conceptual Framework for Machine Self-Presentation and Trust

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Abstract. Increasingly, researchers are creating machines with human-like social behaviors to elicit desired human responses such as trust and engagement, but a systematic characterization and categorization of such behaviors and their demonstrated effects is missing. This paper proposes a taxonomy of machine behavior based on what has been experimented with and documented in the literature to date. We argue that self-presentation theory, a psychosocial model of human interaction, provides a principled framework to structure existing knowledge in this domain and guide future research and development. We leverage a foundational human self-presentation taxonomy (Jones and Pittman, 1982), which associates human verbal behaviors with strategies, to guide the literature review of human-machine interaction studies we present in this paper. In our review, we identified 36 studies that have examined human-machine interactions with behaviors corresponding to strategies from the taxonomy. We analyzed frequently and infrequently used strategies to identify patterns and gaps, which led to the adaptation of Jones and Pittman's human self-presentation taxonomy to a machine self-presentation taxonomy. The adapted taxonomy identifies strategies and behaviors machines can employ when presenting themselves to humans in order to elicit desired human responses and attitudes. Drawing from models of human trust we discuss how to apply the taxonomy to affect perceived machine trustworthiness.

Keywords: self-presentation; impression management; embodied agents; social machines; emotional intelligence.

1 Introduction

Machines embedded with social behaviors elicit predictable social responses from humans. Nass et al. (1994) introduced the “Computers are Social Actors” hypothesis that humans respond to machines with humanlike behaviors the same way they would respond to humans [78]. Since then, drawing from experimentation with human-to-human interaction, additional studies have demonstrated the ability of socially intelligent machines to calibrate human trust and compliance, increase liking and engagement, reduce stress, and improve task performance (e.g. [62][22][16][19][14][84][63]). However, it is difficult to systematically compare and integrate lessons learned across parallel research efforts due to the lack of an underlying framework for classifying social machine behavior. In this paper, we argue that the influential self-presentation theory [36] provides a principled foundation to structure existing knowledge and guide future research and development in the human-machine interaction domain. By categorizing these studies according to a self-presentation taxonomy, we can integrate and draw conclusions across different studies.

Building on that position, our overarching research goals are to (1) categorize studies on how socially intelligent machines interact with humans according to a self-presentation taxonomy, (2) integrate the empirical findings of those studies based on the categories, and (3) identify strategies that have received limited attention but may be relevant for future research directions.

In this paper, we approach our first goal by briefly introducing self-presentation theory and discussing its relevance to human-machine interaction.

Inspired by Erving Goffman’s “Presentation of the Self in Everyday Life” [24], Jones and Pittman identified five strategies humans use in order to enhance the image they present to others (Table 1). The human employing the strategy is known as the actor, and the intended audience of the presentation is called the target. Each strategy is intended to promote a different perceived trait. For example, to look more competent during a job interview, the actor may employ a strategy of Self-promotion, emphasizing her credentials and achievements and taking credit for past successful efforts. On the other hand, an employee seeking advancement might dress formally and work late hours not because it demonstrates competence but because it demonstrates integrity and commitment to the principles of the work environment, which aligns with the Exemplification strategy. Employing the Ingratiation strategy makes the actor appear to like the target by flattering, agreeing, doing favors, and otherwise showing esteem; thereby securing reciprocal liking from the target. An actor employing the Intimidation strategy seeks compliance by appearing dangerous, while an actor employing the Supplication strategy appears helpless in order to invoke the target’s nurturing instinct and sense of social obligation.

Table 1. Self-presentation strategies after [36], and some of their measured effects with sources. Some sources address more than one strategy.

Strategy	Promoted trait	Strategy definition	Prototypical behaviors	Measured effects on target	Example sources
Exemplification	integrity	Emphasizing actor's adherence to principles.	Conspicuously showing self-discipline, making demonstrations and justifications for a cause	Increased perceived integrity and leadership potential of actor, team cohesion, commitment to task	[20] [66] [9] [83][17]
Ingratiation	friendliness	Expressing appreciation or commitment to the target.	Disclosing sensitive personal information, agreeing with opinions, showing a personal interest	Increased liking of, favors for, and trust in actor	[88] [10] [104] [91]
Intimidation	danger	Suggesting the actor could cause difficulties for the target.	Making threats, acting volatile, creating discomfort	Increased compliance toward actor	[38]
Self-promotion	competence	Emphasizing actor's strengths.	Claiming responsibility for a good outcome, highlighting strengths and achievements, showing off	Increased perceived competence and leadership potential of actor, compliance toward actor	[66] [43] [82]
Supplication	dependence	Emphasizing actor's vulnerability to elicit sympathy or obligation.	Appearing weak or needy, asking for help	Increased support to and engagement with actor	[106] [85]

Many human-machine interaction studies implicitly make use of these strategies.³ For instance, in one of the studies reviewed as part of this research, humans were more willing to respond to computer prompts if that computer had helped them with a web search previously [41]; doing favors is an Ingratiation behavior. In another case, a robot that advertised its medical functions was more accepted by potential human patients than one that did not [44]; highlighting one's strengths is a Self-promotion behavior. Therefore, the self-presentation taxonomy allows us to integrate and draw conclusions across different studies. For example, studies exploring machine self-disclosure, empathy, flattery, and humor fall under the self-presentation strategy of Ingratiation, which targets human attitudes including liking, trust, willingness to do reciprocal favors for, and perceived friendliness.

2 Materials and Methods

We performed a literature review to identify machine behaviors corresponding with self-presentation strategies. The literature search was carried out by per-

³ [14] is the only human-machine interaction study we found that explicitly references self-presentation strategies.

forming online keyword searches in Google Scholar and by following citations and references from one publication to another, assisted by Google Scholar, ACM Digital Library, IEEE Xplore, APA PsycNET, ScienceDirect, and arXiv.org. Search terms included variations of "computer", "agent", "robot", and "machine", combined with "self-presentation" and "impression management". Other search terms included particular self-presentation strategies and associated behaviors, such as "flattery", "empathy", "self-disclosure", "self-promotion", and "intimidation". For thoroughness we also considered relevant studies already known or recommended to us. We selected papers using the following inclusion criteria:

1. The publication had been peer-reviewed.
2. The study had adequate controls that would allow for effects to be measured with confidence. This criterion excluded non-experimental sources such as case studies.
3. The dependent variables of the study are the responses of humans interacting with a machine such as a computer, virtual agent, or robot.
4. The independent variables of the study include the verbal behavior of the machine. The self-presentation literature has neglected nonverbal behaviors like gestures and facial expressions, mainly because they are hard for humans to consciously control [13]. However, we address the implications of this taxonomy for nonverbal machine behavior in our discussion.

We reviewed 105 studies, of which 71 provided evidence on the effects of machine behavior on human attitudes and 42 manipulated the verbal behavior of the machine. We identified machine behaviors from the reviewed studies that correspond with the self-presentation taxonomy. These machine behaviors were classified according to the self-presentation strategies and analyzed for patterns.

3 Results

The survey found 36 studies that describe verbal machine behaviors corresponding to strategies in the Jones and Pittman taxonomy (see appendix).⁴ Of the 36 studies, over three quarters (28/36 or 76%) examined Ingratiation behaviors showing esteem for the human such as flattery, disclosure, playfulness, and empathy. Seven of the studies used Supplication behaviors to elicit human sympathy such as appearing weak, asking for help, and making errors and apologies. Four of the machines in the studies used Exemplification behaviors, showing serious dedication to a task, giving motivational messages, and referencing charitable activities. Two machines used Self-promotion to make themselves appear more competent. No machines were implemented with behaviors to intimidate their partners. The numbers total more than 36 because some studies included behaviors corresponding with more than one strategy.

⁴ Examples of verbal behaviors not accounted for by the self-presentation taxonomy are: appearing introverted or extroverted [55], clarifying roles and procedures [62], polite language [107], and unexpected or inappropriate utterances [50].

4 Discussion

4.1 A Self-Presentation Taxonomy for Machines

The distribution of studies across the self-presentation taxonomy reveals patterns in human-machine research that highlight current research focus and suggest future directions. We examine each strategy below (subsections 4.2-4.6). Our analysis demonstrates that humans respond to machine behavior as they would to human behavior as predicted by self-presentation (see Tables 1 and 2). Our analysis also leads us to identify Self-effacement as a relevant machine self-presentation strategy (subsection 4.7). After a discussion of nonverbal behaviors (subsection 4.8), we propose a new self-presentation strategy unique to machines, Personification (subsection 4.9). The result is an extension of the human self-presentation taxonomy to a self-presentation taxonomy for machines (Table 2). To illustrate the potential of this new taxonomy we discuss its application to one common problem in human-machine interaction studies: human trust in machines (subsection 4.10). We end with a note about cross-cultural implications (subsection 4.11).

4.2 Exemplification

Machine Exemplification – demonstrating commitment to a task, cause, or principle – is underrepresented in the literature (four out of 36 studies of machine behavior corresponding with self-presentation strategies). Given the ongoing concern with “machine morality” as machines are given more autonomy over their tasks and the impact this has on human trust [68], this lacuna is surprising. Four studies explored Exemplification behaviors and are described below: offering motivational messages, encouraging the human to be involved in a task, and associating with good deeds. Machine Exemplification elicits reciprocal commitment and dedication from human partners, as anticipated by human Exemplification studies.

In one study, students in a computer literacy course were assigned one of twelve different digital tutors and asked to develop instructional plans. The students whose pedagogical agents offered motivational messages worked more carefully and thoughtfully than the others [3].

In two cases [2][23] a robot that acted with formal politeness and focused on the task at hand (Exemplifying) was contrasted to a robot employing playful (Ingratiating) behaviors. The Exemplifying robot increased commitment to a goal, while the Ingratiating robot increased enjoyment and liking.

Exemplification may also impact trust. An agent that presented itself as helping people in need was perceived as more trustworthy than agents presenting themselves as serving a medical team or the government [108]. This is in line with research connecting perceived integrity to trust [70] and demonstrates the potential of Exemplification behaviors for improving trust in machines.

Mobile health apps implement behaviors that might be considered Exemplification behaviors such as setting and reviewing goals, rating the user, and comparing the user to others [11], in the sense that they show commitment to

desirable norms and values. Malle [68] described how a machine could demonstrate integrity by maintaining and communicating desirable norms and values.

Based on human Exemplification research, we expect that machine Exemplification would raise moral and leadership expectation [20][66][9]. The studies we surveyed did not measure these outcomes.

Table 2. A self-presentation taxonomy for machines. This table only lists a few representative sources. A full listing is found in the appendix.

Strategy	Promoted trait	Strategy definition	Behaviors in the literature	Measured effects on target	Example sources
Exemplification	integrity	Emphasizing actor’s adherence to principles.	Showing commitment to a task, good works, inspiring messages	Increased trust in machine and commitment to task	[11] [3] [2] [23] [108]
Ingratiation	friendliness	Expressing appreciation or commitment to the target.	Self-disclosure, empathy, flattery, doing favors	Increased liking of, perceived friendliness of, and trust in machine, and reciprocal favors	[30] [35] [47] [52] [59]
Intimidation	danger	Suggesting the actor could cause difficulties for the target.	No machine examples found		
Self-promotion	competence	Emphasizing actor’s strengths.	Explaining qualifications, looking and sounding like an expert	Increased perceived competence and trust in machine	[14] [44]
Supplication	dependence	Emphasizing actor’s vulnerability to elicit sympathy or obligation.	Looking "cute", needing care, playing dumb, asking for help	Increased support to and engagement with machine	[1] [21] [95]
Self-effacement (added)	humility	Downplaying actor’s strengths to be relative.	Making and recovering from minor errors, apologies	Increased liking and acceptance but lower perceived competence of machine	[50] [27] [73]
Personification (proposed)	alive-ness	Appearing to be a “real” person.	Mimicking human attributes, appearance, and behavior.	Increased trust in machine	[32] [103] [99]

4.3 Ingratiation

Recent human-machine studies clearly favor a strategy of Ingratiation (28 out of 36 studies) – that is, acting friendly. Common Ingratiation behaviors in the human-machine literature are flattery, showing empathy, and self-disclosure. The effects of Ingratiation include improved liking, trust, and perceived friendliness, as anticipated by human Ingratiation studies.

In one typical example, a digital blackjack opponent was programmed to display text that was either self-centered (“The dealer beat me; I’m disappointed”)

or empathic (“You won; that’s wonderful!”). The empathic agent was rated as more caring, supportive, likeable and trustworthy [8]. Similar results have been noted for machines that are agreeable and that use flattery, humor, and self-disclosure.

Another common reaction to machine Ingratiation is reciprocal benevolent behavior, particularly in the case of favors, agreement, and self-disclosure [41][94][39].

4.4 Intimidation

No examples of machine Intimidation were found. Evidently, scholars have been more interested in crafting friendly machines (through Ingratiation) than scary machines (through Intimidation). People who are “intimidated” by their nonhuman teammates sometimes fail to speak up to correct errors and prevent loss [33, p. 334], which can lead to tragic loss of life in the case of aircraft, ground vehicles, and weapons systems. However, there are reasons to explore machine Intimidation. It may be desirable for a machine to appear intimidating to an adversary for defense applications (e.g., national security, home safety, and personal protection). Intimidation may prevent costly engagements; pirates in the 18th century had such a dangerous reputation that the sight of the Jolly Roger could elicit quick surrender from merchant ships [58]. Intimidation may also help to discourage misbehavior, such as in the case of robots monitoring students for cheating [77].

4.5 Self-Promotion

Examples of machine Self-promotion are rare (two out of 36 studies) and are limited to digital assistants and robots that advertise their own strengths. Reviewed studies indicate that Self-promotion can improve perceived competence, trust, and compliance toward machines [14], [44], [100].

In one study, a digital agent welcomed the user to a survey with text and voice that conveyed messages either of Ingratiation (praising the user: “You are in the top 97.2% of study participants”) or Self-promotion (highlighting the agent’s abilities: “I have an embedded expert system that increases my ability to interact naturally with humans...”). The Self-promoting agent was rated as more powerful, having more expertise, and more trustworthy than the Ingratiating agent [14].

4.6 Supplication

Seven of the 36 studies exhibited robots with Supplication behaviors such as acting weak, ignorant, helpless, or scared; intentionally making errors, and explicitly asking for help. As anticipated by human Supplication research, these behaviors were found to increase human involvement.

In one illustrative application [95], a Nao robot was introduced to help children learn verbs. In the first stage of learning, the robot would perform a wrong movement, and a human instructor would correct the robot and demonstrate the verb to the child by moving the robot’s arm. In a second stage, the child was free to explore with the robot. If the child noted the robot mis-performing the action,

the robot would say “please teach me”. The children engaged in three types of “teaching”: by moving the robot’s arm, by performing the action themselves, or by vocal instruction. Ultimately, in sessions using the robot, children performed significantly better on post-tests about the verbs than in sessions without any robot.

4.7 Self-Effacement

In addition to eliciting involvement, robots that made mistakes were found to be more likeable than robots that performed perfectly. Self-effacement, a self-presentation strategy conceived as an extension to Jones and Pittman’s taxonomy, can help explain why robots that make mistakes and apologies are sometimes rated as more likeable than robots that perform their tasks perfectly [73][81]. Perceived competence can be accompanied by perceived arrogance and a decrease in likeability, a phenomenon known as the self-promoter’s paradox [43][60][90]. Self-effacement is a strategy for lowering this perceived arrogance and increasing likeability by downplaying and hedging strengths [43][102][6]. As an example, an actor perceived as highly competent can make a minor blunder to increase likability, a phenomenon known as the pratfall effect [60]. Making mistakes and apologies, as well as downplaying one’s own abilities, can be used by actors employing a strategy of Self-effacement (if they are intended to counteract the actor’s perceived competence) or Supplication (if they are intended to create a perceived neediness).

Based on human Self-effacement research, we expect that modesty would be another effective Self-effacement behavior for machines [102]. We did not find any examples of machine modesty.

4.8 Nonverbal Behaviors and Appearance

Although we primarily focused on verbal machine behavior in our literature review, we observed that some nonverbal behaviors correspond with self-presentation strategies. The self-presentation literature has neglected nonverbal behaviors because they are hard for humans to consciously control [13]. Machines, however, can control their nonverbal behavior; and their outward appearance (physical or digital) can be purposely designed, just as people dress or arrange their environments in order to impact human expectations [24]. In the course of our survey we found machines that employed verbal and nonverbal behaviors in combination. Ingratiation behaviors, for example, were accompanied by smiling and an open stance [28][18]. Self-promotion can be supported by an older-sounding voice [15]. A “cute” appearance conveying vulnerability and helplessness elicits nurturance from humans and can be seen as a Supplication behavior [98][101][42]. The AIBO robot dog can convey helplessness and elicit human engagement without any verbal capability [54]. Robot size contributes to Intimidation [29]. Regarding Exemplification, we can imagine a machine with a visual design inspired by human uniforms to show commitment to a team and task. Future work can explore how to incorporate nonverbal machine behavior and appearance into a self-presentation taxonomy.

4.9 Personification: A New Strategy?

One self-presentation challenge machines have that humans typically do not is appearing to be a distinct person [37][67]. Although the ability to exhibit verbal behaviors may be a part of establishing such an appearance, this strategy is primarily nonverbal in nature. This trait has been implied in discussions of machines and social presence [54][79][40], mind [16], [103], and techno-animism [34]. Personhood can be concisely defined as the quality that makes a “someone” rather than a “something”, a “who” rather than a “what”. Anthropological discussions of personhood ascribed to nonhumans such as animals, natural forces, spirits, and statues note that persons can be held accountable for their actions and as such can be the recipients of gifts, appeals, promises, and praise (e.g. [26][105]). This applies to machines as well; a recent study of human attitudes toward Amazon Alexa found evidence of personhood in the use of the gendered pronoun “she”, professions of love, and rebukes [65]. When asked for verbal descriptions and drawings of three different voice assistants, participants provided human physical and personality characteristics [48]. An associated self-presentation strategy does not yet exist because self-presentation has been limited to human actors, who are already assumed to be persons. We propose a new self-presentation strategy for machines, which for now we call Personification, that focuses on presenting this quality of personhood.

Our survey of verbal machine behaviors included possible examples of Personification. A digital agent that introduces itself by humanlike name, gender, preferences, background, and/or profession [45][108][57] is presenting itself as a person. Several of the machines in our survey made statements implying the ability to feel emotions such as happiness and fear [50][1][8][18]. However, these studies employed Personification in support of one of the other self-presentation strategies.

In an informal follow-up survey we performed focusing on machine gesture, posture, and appearance, we found that 16 out of 25 studies were concerned with making the machine to appear more like a person, more specifically like a human, and even more specifically like the human user. Waytz et al., for example, found that autonomous vehicles with a name, gender, and human voice were trusted more and blamed less than those without [103]. Another study of autonomous vehicles reported greater trust when the vehicle had a face and head movements that matched that of the human user than when the face and head movements did not match the user’s [99].

By placing Personification in the taxonomy with other self-presentation strategies, we make the statement that appearing to be a person is just one possible strategy in a framework of social strategies for machines. Additional research will continue to shed light on relevant behaviors, their effects and when they are most helpful.

4.10 Machine Self-Presentation and Trust

A prevalent topic of investigation in human-machine studies is how to increase human trust in automated systems, as well as how to calibrate trust so that the

human trusts the machine an appropriate amount [80][53][69][71]. The proposed machine self-presentation framework offers a novel approach to these questions.

The Integrative Trust Model [70][72] is one of the most commonly referenced trust frameworks and has been applied to predict human trust in information systems such as e-commerce [92]. This model identifies three factors of perceived trustworthiness that the trustor (the person trusting) must perceive in the trustee (the person being trusted): ability, benevolence, and integrity. Ability is the likelihood that the trustee can achieve success in some domain. Benevolence is the likelihood that the trustee will act for the good of the trustor. Integrity is the likelihood that the trustee will act in line with acceptable goals and rules.

Because of its emphasis on perceived traits, the Integrative Model is particularly compatible with self-presentation. In fact, three of the self-presentation strategies described by Jones and Pittman correspond with the three factors described by the Integrative Model. The Self-promotion strategy is used to increase perceived ability. The Ingratiation strategy is used to increase perceived good intention toward the target. The Exemplification strategy is used to increase perceived integrity. A proposed self-presentation model of trust augmenting the framework from [70] with the self-presentation strategies is shown in figure 1. The trustee can employ the three strategies to promote the three factors of trustworthiness. Together with the trustor’s own tendencies, these three factors determine how much the trustor trusts the trustee. The trustee’s actual performance then feeds back into the trustor’s perceptions. As the trustor’s perceptions of the trustee’s ability, benevolence, and integrity vary over time, the trustee may have to rely on one strategy or another over time to maintain trust [97].

Fig. 1. Expected effects of self-presentation strategies on factors of perceived trustworthiness, adapted from [70].

As predicted by this conceptual self-presentation model of trust, strategies of Self-promotion, Ingratiation, and Exemplification have all been found to increase human trust in machines [14][8][108].

To improve human trust for a given application, the first step according to this model is to determine which of the three factors of trustworthiness is lacking, then apply the corresponding strategy to enhance it. For instance, if human rid-

ers doubt the ability of an autonomous vehicle to reach a destination in a timely manner, a strategy of Self-promotion (advertising strengths and achievements, demonstrating domain knowledge) could increase trust. On the other hand, if the riders question whether the vehicle would prioritize their needs in an emergency, a strategy of Ingratiation (showing personal interest, empathy, flattery, agreeableness, etc.) would be appropriate; and if the riders are concerned for the safety of pedestrians crossing the road, Exemplification behaviors (expressing moral values) could raise confidence in the vehicle's respect for all human life.

Different trusted roles seem to call for different distributions of ability, benevolence, and integrity. For instance, when seeking emotional support humans pay more attention to benevolence and integrity than to ability. When seeking domain expertise, on the other hand, humans prioritize ability [72]. Therefore, the self-presentation strategy employed to promote trust should correspond to the human's needs.

The literature also suggests that trust should be calibrated; that is, the amount of trust placed in a system should match its actual trustworthiness under given conditions [71]. Therefore, the self-presentation strategies should be applied only as needed to properly calibrate trust. Bozeman and Kacmar [7] suggest that for any self-presentation goal there are both "enhancement" behaviors for raising the target's impression as well as "adjustment" behaviors for lowering the target's impression; the actor balances these behaviors to achieve and maintain an impression that matches the goal. In the case of machine behaviors, if the human overestimates the machine's ability, Self-Effacement behaviors such as hedging claims, making minor errors, and expressing anxiety can lower perceived ability to an appropriate level [81][4][60][89]. While there are no formal self-presentation strategies for lowering perceived benevolence and integrity, machines can make clear their purposes, affiliations, and privacy policies [108][61]; this kind of transparency can help humans understand when machines are not necessarily prioritizing the user's interests. Ingratiating behavior in the human-machine interaction literature has been contrasted to self-centered machine behavior, which is shown to lower perceived benevolence and trustworthiness [8]. Future research can elucidate whether self-centered machine behavior constitutes a useful self-presentation strategy for calibrating trust.

This model has its limitations. It does not attempt to represent the impact on trust of the other self-presentation strategies such as Personification, though this could be addressed in future research. Furthermore, although the referenced self-presentation strategies can affect trust, the real-world performance of the machine can be a critical factor in how much trust a human will have in the machine. For instance, if the autonomous vehicle referenced in the example fails to reach its destination in a timely manner, humans' trust in its ability may suffer. Self-presentation researchers have identified human behaviors associated with recovering from poor performance [86][74]. Future research could determine how these behaviors fit into the self-presentation taxonomy for machines.

4.11 Cross-cultural Implications

The machine self-presentation framework potentially allows us to apply existing research on self-presentation differences across cultures and social groups (e.g. [56][43][46][12]) to machines. Consider for example Self-promotion and Self-effacement strategies. As mentioned in subsection 4.7, Self-promotion can lead to a perceived arrogance that can be counteracted by Self-effacement behaviors. This complementary relationship between the two strategies can be explained using the cultural concept of *face*, defined as "the positive social value a person effectively claims for himself" [25]. Self-promotion is a face-claiming strategy since it attempts to raise the actor's perceived usefulness; Self-effacement behaviors on the other hand attempt to lower expectations. Claiming too much face is viewed as arrogant, while persons claiming too little face may be viewed as unworthy social partners ("disgraceful"). Thresholds for "too much" and "too little" depend on culture, roles, and the target's individual preferences. For instance, so-called individualistic cultures tend to expect persons to claim more face than collectivistic cultures [51][96], which means that machines deployed in individualistic cultures may be able to rely on Self-promotion more than machines deployed in collectivistic cultures. The actor must select a combination of Self-promotion and Self-effacement behaviors that, while achieving interaction goals, also maintains face bounds appropriate to the culture and context.

Fig. 2. Expected effects of self-presentation strategies on face, adapted from [51, p. 129].

Supplication behaviors such as asking for help are similar to Self-effacement behaviors in that they can lower expectations of performance [49]. This model of self-presentation and face might be expanded through further review and analysis of the literature to explain how each of the self-presentation strategies affects face and what this means for machine implementations.

5 Conclusion

In our literature review, we identified strategies that are relevant for social machines to improve quality of interaction and performance with humans. Our primary contribution is the extension of Jones and Pittman's human self-presentation taxonomy to a machine self-presentation taxonomy, which can inform future research and serve as design guidance for more effective human-machine interaction.

Considering the prevalence of self-presentation strategies in the surveyed sources, largely unacknowledged until now, our machine self-presentation taxonomy can inform future theory building by helping researchers make decisions

on what variables to manipulate and what outcomes to expect, situating their contributions in an organized landscape of human and machine behavior studies. For example, the framework can connect studies of machine disclosure, empathy, flattery, and humor under the label of machine Ingratiation, with the expectation that all of these would have similar impacts on human attitudes including increased liking, trust, willingness to do reciprocal favors for, and perceived friendliness of the machine. The machine self-presentation strategies can be connected to psychosocial models of desirable interaction outcomes such as trust and cultural appropriateness to achieve human-machine interaction goals.

We also expect that these and other self-presentation strategies for human-machine interaction will be defined and refined as the literature grows. For instance, while Ingratiation is well represented in the literature, we found relatively few studies of Exemplification and Self-promotion, both strategies that have been shown to impact trust in human-machine relationships. By mapping self-presentation theory to human-machine interaction, we enable researchers to form hypotheses about machine behaviors and outcomes not yet represented in the human-machine literature and continue to identify ways in which machine self-presentation is like or unlike human self-presentation. Finally, we propose that the taxonomy continue to be augmented with new strategies to accommodate behaviors beyond our current analysis as well as those elucidated by future research.

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Appendix

This table shows the 36 surveyed experiments of verbal machine behavior that correspond with self-presentation strategies: the machine behavior manipulated, the self-presentation strategy corresponding with that behavior, and results, as interpreted by the authors. Further information can be obtained by contacting the authors directly.

Source	Behavior	Strategy	System/Domain	Results
[1]	appearing weak	Supplication	Furby	reduced response time
[2]	serious vs. playful	Exemplification vs. Ingratiation	elder assistant	Ingratiation: increased liking and perceived intelligence
[3]	motivating messages	Exemplification	pedagogical agent	increased commitment and self-efficacy
[5]	empathy	Ingratiation	FitTrack/exercise	increased liking, engagement, commitment
[8]	empathy	Ingratiation	blackjack	increased perceived caring, liking, trust
[14]	flattery, enhancement	Ingratiation vs. Self-promotion	conversational agent	Self-promotion: increased perceived power, trust, perceived expertise; Ingratiation: increased attraction, no increased liking or trust
[16]	disclosure, taking interest	Ingratiation	Nao	increased mind, no increased liking or engagement for personal vs. factual disclosure
[18]	empathy	Ingratiation	PR2	increased trust
[19]	flattery, praise	Ingratiation	questions	increased enjoyment, engagement, perceived ability
[21]	asking for help	Supplication	face recognition	increased engagement
[22]	flattery, praise	Ingratiation	SociBot	increased liking and trust, reduced negative emotion
[23]	serious vs. playful	Exemplification vs. Ingratiation	physical therapy	Exemplification: increased commitment; Ingratiation: increased enjoyment
[27]	error, apology, asking for feedback	Supplication/Self-effacement	BERT2/cooking	increased engagement and satisfaction
[30]	empathy	Ingratiation	game assistant	reduced frustration
[31]	disclosure, imitation	Ingratiation	Virtual Rapport 2.0	increased social presence (rapport) and naturalness
[35]	flattery, praise	Ingratiation	desktop/game	increased perceived friendliness, engagement, positive mood, and perceived ability; reduced confusion

[40]	disclosure	Ingratiation	counselor	increased attraction and co-presence
[39]	disclosure	Ingratiation	counselor	increased engagement (reciprocal disclosure) and rapport
[41]	favors	Ingratiation	desktop	increased engagement (reciprocal favors)
[44]	asking for help	Self-promotion vs. Supplication	Nao/eyecare	Self-promotion: increased perceived intelligence, increased trust, perceived benefit, attachment, satisfaction, social presence
[47]	empathy, sympathy	Ingratiation	game assistant	increased engagement
[52]	flattery	Ingratiation	desktop/trivia	increased attraction and perceived credibility, reduced conformity
[57]	flattery, taking interest, disclosure	Ingratiation	movie recommender	increased trust and enjoyment, leading to satisfaction and intention to use
[59]	empathy	Ingratiation	iCat/chess	increased perceived friendliness
[64]	empathy	Ingratiation	iCat/health	increase perceived friendliness, liking, trust, social engagement
[69]	disclosure	Ingratiation	circuit building	increased trust and perceived friendliness
[73]	errors	Supplication/Self-effacement	Nao/LEGO	increased liking
[75]	disclosure	Ingratiation	desktop	increased attraction, reciprocal disclosure, and general positive emotion
[76]	humor	Ingratiation	desktop	increased liking, reciprocal humor, perceived similarity and cooperation
[81]	errors	Supplication/Self-effacement	Daryl	increased liking, ease, enjoyment, general positive emotion; reduced intelligence, reliability, security, competence, and superiority.
[84]	empathy	Ingratiation	iCat/language learning	increased performance and motivation, reduced physical proximity
[87]	disclosure	Ingratiation	Nao (Echo)	increased perceived warmth and engagement
[93]	mutual disclosure, taking interest	Ingratiation	questions	increased perceived friendliness
[94]	agreement	Ingratiation	opinions	increased reciprocal agreement
[95]	playing dumb, errors	Supplication	Nao/vocabulary	increased engagement
[108]	taking interest, favors, charitable acts	Exemplification + Ingratiation	patient assistant	Exemplification + Ingratiation: Increased trust, liking, satisfaction, engagement, compliance