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HUMAN-MACHINE COMMUNICATION

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Opening Space for Theoretical, Methodological, and Empirical Issues in Human-Machine Communication

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This journal offers a space dedicated to theorizing, researching empirically, and discussing human-machine communication (HMC), a new form of communication with digital interlocutors that has recently developed and has imposed the urgency to be analyzed and understood. There is the need to properly address the model of this specific communication as well as the roles, objectives, functions, experiences, practices, and identities of the interlocutors involved, both human and digital. There is also the need to be aware that in a first moment scholars are obliged to use the same words such as communication, interlocutors, interaction, and relationship that are typically used in other communicative contexts such as Human-Computer Interaction (HCI), Human-Robot Interaction (HRI), Human-Agent Interaction (HAI) and that this may bring in a first phase confusion and ambiguity in the conversation on HMC. Using current language to face new ground may, in fact, introduce obscurity in our analyses, as different meanings may be attributed to these words. Take, for example, the word communication. When we say that humans communicate with a machine, do we mean the same thing as when we say a human communicates with another human directly or through a medium? If not, to what specific form of communication do we refer? Certainly not of human-human communication, which involves common, circular processing of the message and meaning. When we say that machines talk back to us, we do not mean that this talk is identical to that of a human interlocutor, but the point is: what is the difference? In everyday life, much human-human communication also seems functional, automatic, and "scripted" (Kellerman, 1992). Today, machines offer humans an answer to the question: what is the automatable part of communication?

Scholars who focus their attention and engagement on this field of study know well the difficulty they face in exploring the new terrain of human-machine communication (Fortunati et al., 2019; Guzman, 2018). In reality, communication with digital interlocutors ontologically is not the same thing as communication with another human, both directly and in a mediate way. Here the meaning is built by two entities—humans—that both have the biological and psychological ability to formulate, issue, receive a message, and, based on

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this message, elaborate another message. Together, during their dialogue, they contribute to building that meaning that is the fruit of their common effort by cooperating on various plans. The plasticity of the human brain and the empathy humans feel toward other humans enable them to produce the circularity of messages and their flows. Humans within the communication process can in fact perceive the environment, the context, the time, the various nonverbal languages of the other, share or be aware of the differences regarding the cultural and the social dimensions, and, in some cases, hold in common memories and the past. Both of the interlocutors involved in the communication process may perceive and experience the action of the other in the same way. In doing so, humans transform the judgment of perception in judgment of experience, while digital interlocutors can do that limitedly because they are not conscious of themselves and the world (Faggin, 2019).

When the other is not a human but a digital interlocutor, everything changes. The ability to formulate, issue, receive a message, and elaborate another message is much lower, and it is the reason for which we call the other a "quasi-second interlocutor." We know that our interlocutor is a machine, quite special insofar as the machine presents itself as a *human surrogate* that, as Zhao (2006, p. 402) states, *simulates* possessing the biological and psychological abilities to formulate, issue, and receive a message, and, on the basis of this message, to elaborate another message. That is, they simulate having a mind and a communicative intelligence as well as communicative and social skills. In particular, media agents and robots are unable to produce "reciprocal meaningful behavior," which, according to Max Weber (1976), is what characterizes social action, leading Höflich (2013) to propose the term "quasi-social action" for the social action produced by digital interlocutors. Similarly, Höflich (2013) proposes defining relationships to robots as "quasi-interpersonal" because, although robots are machines without empathy, their reactions are interpreted as if they were social. Alternatively, Krotz proposes "pseudosocial" to name the social component of the interaction with a robot (2007, p. 161).

There are, however, other conceptual approaches to communication that may integrate digital agents more readily. It depends in fact on how communication is defined whether machines may be considered true or only simulated partners and whether and when a distinction between "true" and "simulated" is worth drawing. For instance, according to Peters (2006), although *dialogue* (understood as a meeting of minds or an integration of egos) is often regarded as the best or central kind of communication, it is perhaps an unrealistic ideal for most human social interaction. As an alternative to communication as reciprocal/symmetrical dialogue, Peters proposes *dissemination*, a mode of communication for "creatures that emit weak, pathetic signals—infants, pets, the dead, most of us, most of the time" as well as extraterrestrials, the divine, and computers (2006, pp. 218–219). Dissemination centers the heart of everyday exchange on the gaps between senders and receivers, on the other instead of the self, on the indefiniteness of meanings and consequences, and on the irreducibility of embodiment (or aspects of touch and time). Rather than a meeting of minds, communication becomes in this sense "the name for those practices that compensate for the fact that we can never be each other" (Peters, 2006, p. 268).

Similarly, much depends on how the "person" or "self" or "other" in communication is defined. The underlying assumption of much communication scholarship, and especially of interpersonal communication research, is that communication must occur between two or more people (Edwards et al., 2019). Robots and other communication technologies are

hardly considered people in any robust social, ethical, or legal sense. For this reason, Westerman proposes the term "interactoral" to refer to the communication between/among social actors (Westerman et al., 2019). Or we might consider the communication between human and machine "interpersona" to refer to those aspects of perceived character or social role played by any actor. But, is it possible for HMC to actually be *interpersonal*, albeit not human-human? Perhaps infants also are not (yet) "people" (although they are Homo sapiens) and therefore communication with them is not interpersonal in the sense of "occurring between full-fledged persons" but rather in the sense that the symbolic interaction between caregiver and developing child becomes the context in which persons and selves—along with minds, societies, and cultures—are constituted and become real (Cooley, 1902; Mead, 1934). 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?

Humans are aware that media agents and social robots are quasi-interlocutor, quasi-communicator, quasi-social, but they play the game and pretend to really communicate and to have social relationships with them. As Reeves and Nass (1996) have noticed regarding computers, it can happen that, within the practices of their use, humans forget that their interlocutors are simulating, and they treat them as if they were real humans. The strength of this illusion depends on the simulating ability of the media agents. Although it is an illusion, and is even consciously recognized as such by the people involved, it can generate all the same feelings of communicative and social satisfaction as interactions with other humans. As Ho, Hancock, and Miner (2018) recently demonstrated, people disclosing personal information garnered the same emotional, relational, and psychological benefits whether they thought their partner was a chatbot or a person.

The profoundly social responses to today's digital interlocutors represent a contemporary manifestation of a more historical human impulse to call forth, even from the void, an addressee. Buber (1970) used the term "pan-relation" to refer to "the drive to turn everything into a You" (p. 78). And where the imagination "does not find a living, active being that confronts it, but only an image or symbol of that, it supplies the living activity from its own fullness" (p. 78). One might remember how in the film *Cast Away*, the character Chuck Noland, stranded on an island and utterly alone, personified the volleyball "Wilson" to be his companion, conversing and arguing with this dear friend for the next 4 years. All it required for this heartfelt association to emerge was a genuine longing for relation and perhaps also the tiniest material semblance of life: a round shape for a head and marks for a face. How much easier is it to treat as You a machine that can speak back, fill social roles, and perhaps also resemble a person in physical form?

In this framework, the powerful effects of familiarity also need to be considered. The more humans are familiar with media agents and social robots, the more their communicative and social behavior toward them becomes specific and appropriate as Gambino, Fox, and Ratan argue in this volume. Most research in this domain is still conducted on first impressions, or at the point of "zero acquaintance" as it is called in psychology. Imagine what more we will learn as future research attends to the relationships developed over time, both between people and particular media agents and between societies and whole classes of machine actors.

It is in this difference of abilities, skills, and awareness that the power relationship between humans and media agents opens up. Whereas the dialogue between humans is a form of peer communication, a dialogue with a digital interlocutor is not so, since the latter struggles to make itself sufficiently credible as a quasi-second interlocutor. The greater power that humans have, however, does not protect them from ambiguity and contradictions. A robot usually has less advanced communication abilities than a human being, both inbound and outbound. It has less comprehension ability as well as less language competence and a lack of nonverbal expressiveness. From a communication point of view, the power relationship between humans and robots hangs heavily toward humans, to the point that some children have been shown to consider the robot DORO as a child younger than themselves or as disabled (Fortunati et al., 2018). However, we would be wrong if we assumed this difference in power to automatically benefit humans. As in any relationship characterized by a power imbalance, those with less power (e.g., social robots) nevertheless exercise power over those with more, as the former oblige the latter to shape their expectations and behavior in the interaction in an "as if" mode.

To make the relationship work, humans must adjust their communication practices to the less advanced communication skills of the robot and act accordingly (Höflich, 2013; Krotz, 2007, p. 160). To adjust probably means frustration for humans because they must stay within the tight limits of what can be automated in communication. In conversations, human beings use multiple registers—from the pragmatic to the affective, the cultural to the spiritual—and they pass from one to another with ease. What happens when we have to stop in front of certain fences and thereby accept limitations on our communicative fluidity? What is sure is that these power dynamics contribute to originate a twofold process: the robotization of humans and the humanization of robots.

The problem that remains open is to understand why humans tend to apply this "as if" behavior. We try to advance a tentative interpretation here. Human beings cannot attribute full value to themselves because their being has been given to them by other humans and is thus taken as given, whereas machines are their creatures, having been generated by humans. In our opinion, the impossibility for humans to attribute full value to themselves explains the value transfer onto machines and the rise of this behavior in "as if" mode. Of course, this tentative interpretation is not intended to exhaust the understanding of this problem. Rather, it is further reason to continue to investigate this power relationship in the future.

The structured asymmetry between humans and machines at the social and communicative levels also has implications regarding the methodologies we can apply to investigate this new field of research. This volume includes empirical research that concerns people's perceptions, conceptualizations, attitudes, and behavior toward media agents and social robots (Guzman; Rodríguez-Hidalgo; Lutz & Tamò-Larrieux; McEwen et al.; Ling & Björling). The results illuminate important aspects of users' opinions and attitudes in this concern. But what happens when we would like to or need to investigate the second semi-interlocutor; that is, the media agent or social robot? Does it make sense to interview digital interlocutors? Or to administer a questionnaire to them? With which methodological tools should we approach them? Maybe nonparticipant observation and content analysis of what they say in order to study the type of conversation that takes place between humans and them?

These few lines allow us to sketch the right approach that we should take toward this new genealogy of machines. It is the approach suggested by Aristotle, who in the *Metaphysics* (1:2:983a:14) declared that he appreciated the thaumata (τῶν θαυμάτων ταὐτόματα), the "automatic puppets," for their ability to intellectually surprise and stimulate theoretical questions. Like the automatic puppets of Aristotle, social robots stimulate important, ontological questions about who we are as human beings and how our brains and emotions work. Some scholars have already accepted this challenge (e.g., Edwards, 2018). Others have decided to take up this challenge of further developing the study of human-machine communication with stimulating theoretical arguments as well as stimulating empirical investigations. The insight that these seven articles collectively enable us to develop further is that current digital artifacts are no longer the mediators between us and the world because they have incorporated the world and are the other with whom we interact (Rivoltella & Rossi, 2019, pp. 81–82).

The first article, "Toward an Agent-Agnostic Transmission Model: Synthesizing Anthropocentric and Technocentric Paradigms in Communication," is written by Jaime Banks and Maartje de Graaf. It is a theoretical paper that contends the need to revise the analysis of some important elements of communication following the phenomenological, ontological, and operational shifts in communication processes emerging in the last decades. In reality, this need for revision lies in the transformations that both humans and machines have undertaken. Now humans are hybridized with machines since they include a certain number of technologies in their bodies (such as prostheses, pacemakers, and microchips like those for Parkinson's care). Likewise, their domestic sphere and even their everyday lives have been colonized by machinization processes. On the other hand, machines have become much more similar to human beings by incorporating AI, neural networks, machine learning, sensors, and biological components. The traditional ontological boundaries between humans, animals, plants, and objects have blurred, and since the conceptualization of these entities forms the basis of the social representation of reality, it is worth making an effort to clarify their scientific definitions. These transformations have made necessary the creation of new conceptual tools to analyze not only the main elements of communication processes but also to innovate even the model of analysis. The authors take one of the most popular models, the Shannon and Weaver (1949) model, and shows its present inadequacy for the reasons we mentioned so far. In particular, they propose integrating the anthropocentric and the technocentric approaches via a new agent-agnostic framework for human-machine communication. This framework is based on three criteria that both humans and machines can satisfy: agency, interactivity, and influence.

The second paper, "Ontological Boundaries between Humans and Computers and the Implications for Human-Machine Communication" by Andrea L. Guzman, addresses the important issue of the social representations of humans and machines. When machines are able to acquire various degrees of similarity to humans in terms of intelligence and emotion, it is crucial to explore whether and how people's notions of human and machine converge and diverge. To develop her discourse, Guzman presents two qualitative research projects offering 73 semi-structured interviews with U.S. American adults. The specific machines she investigates are voice-based AI assistants, like Siri, and automated-writing software. She reviews the main ontological differences between humans and machines that the conceptual universe of her informants reveal. The differences detected are the origin

of being, degree of autonomy, status as tool or tool-user, level of intelligence, emotional capabilities, and flaws. Guzman discusses these differences in terms of their implications for human-machine communication.

People have always talked to technologies while using them because, as Reeves and Nass (1996) showed, we tend to treat machines as if they were humans. But our words were a kind of aloud or "between us and us" monologue and consisted of a large variety of comments: from rude comments such as "you are stupid" addressed, for example, to our computer to nice comments such as "how much I love you" addressed, for example, to our mobile phone. These monologues were also the expression of a huge difference of power between us, the humans, and the sophisticated family of digital interlocutors and media agents. Voice-based AI assistants, like Siri, have changed these communicative rituals because these machines are capable somehow of talking back to us. Suddenly, users have been forced to pass from a monologue to a dialogue. Of course, the dialogue is still far from being a human-like dialogue since it is characterized by a lot of constraints and automatisms, but it is, however, a dialogue. That is, we have passed to another mode and dimension of communication. Within a few decades, people have passed from acceptance of *talking to* machines to *talking with* machines. In the early 1990s, when the use of the fixed telephone and the answering machine was studied in Italy, it was found that the first reaction of people, especially older adults, was a refusal to talk to a machine. First, the answering machine represented a violation of the expectation to find another human being at the other end of the line. Second, people felt diminished in their humanity because they had to lower themselves to the same level as a machine. This meant giving up their power, their overt superiority of being human compared to machine, by agreeing to follow its instructions for leaving a message for a human. Within a few years, this refusal and the motivations that justified it disappeared. The acceptance of talking to a machine became widespread among the population (Fortunati, 1995).

Now, Siri, Cortana, Alexa, and so on, invite humans to talk with them (Guzman, 2018) and to generate a dialogue. Behind them, there is not a human, but an AI that simulates a human. In principle, dialogue is the most democratic and equal form of communication because it puts human interlocutors basically on the same plane. Of course, the differences of power between the two interlocutors count a lot in shaping the dialogue in particular ways and giving it some characteristics. Nevertheless, the dialogue makes the interlocutors equal in the sense that it is based on the expectation that both the interlocutors share the same, basic ability to speak and understand the same language, to have the same cultural references, and the same knowledge of social roles, good manners, and contexts. When an interlocutor is a machine, we address it cautiously but also with curiosity and interest, ignoring for a while the question of our power.

The third article, "Me and my Robot Smiled at One Another: The Process of Socially Enacted Communicative Affordance in Human Machine Communication" is authored by Carmina Rodríguez-Hidalgo. This conceptual article attempts to integrate the issue of affordances within the process of human-machine communication. It demonstrates that this integration makes it possible to describe the process of communication with a machine more realistically. As she notes, although affordances are discussed often in both robotics and communication science fields, the uses and meanings of the terms is inconsistent, reflecting object-based versus user-based perspectives, respectively. Based on

earlier conceptualizations of affordances, Rodríguez-Hidalgo defines "communicational affordances" as "both perceived and enacted possibilities for social interaction in a two-way iterative communication process, which emerges in the enactment of an integrated, sequential relational system which brings attitudinal, cognitive, and behavioral effects in both communication partners" (p. 62). The proposed new model of enacted affordances within this communicative process is exemplified through the specific case of human-social robot communication. This application makes clear how the material body of social robots presents affordances that, of course, contribute to shaping the style and the type of communication we might have with them. Thus, there is a need to incorporate the notion of affordances within the study of human-robot communication. The work undertaken by Rodríguez-Hidalgo is relevant because it integrates two lines of research and debate that had not yet been able to communicate effectively. The author has shown in her article how fundamental it is to produce this integration for being equipped with the right tools to effectively analyze human-robot communication.

The fourth article in this volume is written by Andrew Gambino, Jesse Fox, and Rabindra (Robby) A. Ratan and is entitled "Building a Stronger CASA: Extending the Computers Are Social Actors Paradigm." This is another theoretical paper that addresses human-machine communication by revisiting the CASA framework (Nass & Moon, 2000; Nass et al., 1994) drawn from the media equation (Reeves & Nass, 1996). The computers are social actors paradigm is one of the most popular theoretical approaches, conceived to describe and understand how users communicate with a particular typology of machines: electronic media used for the purpose of information and communication. In reality, this framework deals with the first generation of these ICTs that arrived in society: the computer. No wonder that the media equation framework arrives more or less after a shine from the advent of the first computers: all this time was needed to reflect on, explore, and understand the communicative and social potential of this type of machine. Media equation theory has been particularly important because the exploration of the interaction with computers has constituted a useful model for understanding the relationship between humans and the digital media that have followed. As Paul Ceruzzi notes (rep. in Haigh, 2019, p. 1), the computer would become the "universal solvent," able to dissolve the other machines. This expression that "comes from alchemy, referring to an imaginary fluid able to dissolve any solid material" is very well suited to describing the potential ability of computers to colonize the machines around them. Computers leave for television, mobile phones, and radio, a recognizable casing, but they substitute everything inside. Gambino, Fox, and Ratan analyze and discuss CASA to explain how people communicate with digital media demonstrating social potential. They observe that the relevant changes that over time have influenced humans, machines, and how people interact with them impose the need to revise this theoretical framework. They propose to expand the CASA framework in light of these changes. They situate this theory temporally by introducing within the framework the variable of time (the history of interaction and familiarity with particular media agents and general agent classes), affordances, and mindfulness. Among the important implications of these extensions to CASA are the notions that people may respond mindlessly or mindfully to media agents, with either human- or media-centric scripts, and that learned ways of treating media agents may influence responses to other people, rendering the script application of CASA bidirectional rather than unidirectional as originally conceived. Their original

and fresh vision brings an extension of CASA able to accommodate and explain previous dissonant findings in research projects applying that theoretical framework.

The fifth article is written by Christoph Lutz and Aurelia Tamò-Larrieux and is entitled "The Robot Privacy Paradox: Understanding How Privacy Concerns Shape Intentions to Use Social Robots." This paper deals with an issue that is quite important and troubling to many, which is privacy concerns. The authors examine very well the privacy paradox that consists in a kind of misalignment between privacy attitudes as well as opinions and related behaviors. As Lutz and Tamò-Larrieux explain, despite people's substantial privacy concerns regarding social media and online services, they nonetheless often disclose a lot of sensitive information and only minimally safeguard their own privacy. This is applicable to each information and communication technology and even more so to social robots. As the authors rightly underline, social robots bring enhanced mobility and autonomy. They enter everywhere at homes, hospitals, schools and universities, and other public spaces (malls, supermarkets, theatres, cinemas, and so on), and they can take a picture or a video of all that they see, record conversations, and capture many kinds of user data. Potentially, they can spy on our intimacy: not only communicative and emotional intimacy, but also physical intimacy. An older person walking at home may be supported by a robot that accompanies them throughout various rooms of the house or apartment, including the bathroom. In the debate about social robots, for example, it is not rare to read that elderly people declare they prefer to have their private parts washed by robots instead of humans, because there is the widespread belief that the robot causes them less embarrassment than a human being. Likewise, for informational tasks, people may prefer to ask awkward questions of or disclose sensitive information to robots instead of human listeners in hopes of avoiding social judgment or disconfirming feedback cues. This trust that people place in robots, sure of the fact that these robots defend their privacy, does not seem to be well placed, and this creates a serious problem for the communities that are keen to use social robots. Lutz and Tamò-Larrieux investigate the nature and level of respondents' privacy concerns (informational, social, and physical) about social robots through an online survey of 480 U.S. American adults. This research highlights the importance of considering privacy concerns as part of a larger "calculus" people perform to determine whether and how to use social robots. As the authors show, concerns about privacy and intentions to use robots are contingent with factors such as social pressure from others and the tendency to weigh potential risks against other valued benefits.

The sixth article, "Interlocutors and Interactions: Examining the interactions between students with complex communication needs, teachers and eye-gaze technology," is written by Rhonda McEwen, Asiya Atcha, Michelle Lui, Roula Shimaly, Amrita Maharaj, Syed Ali, and Stacie Carroll. The authors present a relevant study on the role of eye-tracking technology in the communication process of children with complex communication needs in a special education classroom. The main research question posed by the authors was: To what extent does eye-tracking technology represent an effective communication system for these children with complex communication needs? Twelve children with profound communication and physical disabilities such as Rett syndrome (4), Cerebral palsy (2), Brain injury (2), Chromosome deletion q13, Seizure disorder and Complex, not otherwise specified, were observed and studied over three months. The study took into account three communication units of analysis: the children with complex communication needs; the human

communicative partners represented by teachers, educational assistants, and therapists; and the eye-tracking technology.

Indeed, there is a long history of using machines in education—from the calculator, to the computer, to today's virtual assistants, wearables, AR applications, and embodied social robots—and trends suggest that the classroom of the future will be "an intricate blend of human and machine intelligences and agents working together to enhance learning" (Edwards & Edwards, 2018, pp. 184–185). This integration of educational technologies and communication media may be particularly useful for learners with complex needs. However, there is little research examining the entangled and co-constitutive human-machine communication environments from which meanings and educational experiences are wrought. In his theory of technological mediation, which builds upon on Idhe's postphenomenological approach (see Idhe, 2009), Peter-Paul Verbeek (2006) proposes that the use of technology in context mediates human-world relations in myriad ways, including *embodiment relations* (technology does not call attention to itself, but rather to aspects of the world given through it), *hermeneutic relations* (technology represents an aspect of the world), *background relations* (technology shapes experiential context), *cyborg relations* (technology merges with the human), *immersion relations* (technology forms an interactive context), and *augmentation relations* (technology mediates and alters our experience of the world). Importantly, McEwen et al. show that when students use a digital technology for communication, in addition to entering into some of the more obvious relations suggested above, they are also engaged in communication with the device itself. This is the "alterity relation" in which technology presents itself as a quasi-other to the subject (Idhe, 2009; Verbeek, 2006). In this sense, eye tracking technology "is not considered as simply a mediating device, but an active participant in the communication taking place" (McEwen et al., p. 116). By focusing on a communication environment that for the children involved both human (teachers, therapists, selves) and technological aspects (eye gaze machines), McEwan et al. effectively disrupt the technical versus social-psychological dichotomy prevalent in much educational research and demonstrate the value of research approaches that avoid privileging either humans or technologies. The research carried out by McEwen et al. represents a precious contribution to the theme of technology and disability for communicative purposes.

The final paper, "Sharing Stress With a Robot: What Would a Robot Say?" is written by Honson Ling and Elin A. Björling. This paper addresses the topic of sharing stressful experiences, which potentially interests a huge audience, from doctors to psychologists, from engineers to robotics designers, from sociologists to communication scholars. Any progress on stress self-disclosure studied in HRI could alleviate dramatic situations. For decades, research in communication and psychology has shown that self-disclosure is central to both intimacy and well-being. Opening up about distressing experiences can bring a sense of relief, catharsis, and togetherness, and can contribute to sensemaking through the act of expression. However, an engaged and willing human listener is not always available (they may be absent or facing burnout or caretaker exhaustion) or even desirable (they may introduce social judgment or responses that are unskillful or unhelpful). As less capable communication partners, social robots may even facilitate the process, which brings to mind a literary observation of how people may unfold in the presence of hearer with communication limitations:

> "One of the positives to being visibly damaged is that people can sometimes forget you're there, even when they're interfacing with you. You almost get to eavesdrop. It's almost like they're like: If nobody's really in there, there's nothing to be shy about. That's why bullshit often tends to drop away around damaged listeners, deep beliefs revealed, diary-type private reveries indulged out loud; and, listening, the beaming and brady-kinetic boy gets to forge an interpersonal connection he knows only he can truly feel, here." (David Foster Wallace, 2011, *Infinite Jest*)

Furthermore, the presence of a human listener may not always be necessary. Even ancient communication technologies have been used to compensate for displaced human communicators or to substitute for a human partner. With writing, our approach already evidenced the basic twofold treatment of technology as tool and partner; people self-disclosed to others *through* written letters, but they also turned toward the paper itself as a legitimate hearer and addressee (as in "Dear Diary,"). Pennebaker's (1997) groundbreaking research shows that even self-disclosure to no one in particular can be beneficial to its source.

Robots, as sophisticated communication technologies, introduce real interactivity and sociality. They may prompt processes of self-disclosure by leveraging norms of reciprocity in which people tend to match others' utterances in terms of breadth and depth and by building an interaction history of intimacy that cultivates trust and free expression. Ling and Björling undertake the important work of beginning to identify the robot message features that will most successfully foster positive perceptions and encourage human disclosures. They situate the study in relation to Kahn et al.'s (2011) New Ontological Category (NOC) Hypothesis, which suggests that social robots and other personified systems may constitute an emergent category of being (seen, for instance, as both animate and inanimate) that introduces new patterns of perception and social practice. This article presents an exploratory study with a small group of participants (N = 36), but it is still able to generate useful indications for future research on this topic. By examining the differential effects of three types of robot disclosure (emotional, technical, and a novel "by-proxy" disclosure) on human-robot interactions, Ling and Björling offer practical implications for interaction design and demonstrate the sometimes surprising ways in which human-robot self-disclosure may differ from human-human self-disclosure.

Reading these seven articles is an advantageous intellectual exercise for entering this new field of research on Human-Machine Communication. The present volume contributes substantially both at theoretical and empirical levels by outlining this new field of research, giving new perspectives and models, and inspiring new paths of research. None of this would be possible without the extensive expertise, constructive spirit, and intellectual generosity of the editorial board. We extend our gratitude to the members and manuscript reviewers for their thoughtful feedback and dedication to excellence in inquiry.

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References

Aristotle, *Metaphysics*.

Buber, M. (1970). *I and Thou*. (W. Kaufmann, Trans.). Charles Scribner's Sons.

Cooley, C. H. (1902). Looking-glass self. *The production of reality: Essays and readings on social interaction*, 6.

Edwards, A. (2018). Animals, humans, and machines: Interactive implications of ontological classification. In A. Guzman (Ed.), *Human-machine communication: Rethinking communication, technology, and ourselves* (pp. 29–50). Peter Lang.

Edwards, A., & Edwards, C. (2018). Human-machine communication in the classroom. In M. L. Houser & A. M. Hosek (Eds.), *Handbook of Instructional Communication Instructional: Rhetorical and Relational Perspectives* (2nd ed., pp. 184–194). Taylor & Francis.

Edwards, A., Westerman, D., Edwards, C., & Spence, P. R. (2019). Communication is . . . Transhuman. In A. Tyma and A. Edwards (Eds.) *Communication Is . . . Perspectives on Theory* (pp. 47–66). Cognella.

Faggin, F. (2019). Silicio. [Silicon] Milano: Mondadori.

Fortunati, L. (1995) (ed.) *Gli italiani al telefono*. Milano: Angeli.

Fortunati L., Cavallo, F., & Sarrica M. (2018). Multiple communication roles in human-robot interactions in the public space. *International Journal of Social Robotics*, publish.ed.online, 7 December 2018.

Fortunati, L., Manganelli, A. M., Cavallo, F., Honsell, F. (2019). You need to show that you are not a robot. *New Media & Society*, *21*(8): 1859–1876.

Guzman, A. (2018). *Human-machine communication: Rethinking communication, technology, and ourselves*. Peter Lang.

Haigh, T. (2019). (Ed.) *Exploring the early digital*. Springer.

Ho, A., Hancock, J., Miner, A. S. (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

Höflich, J. R. (2013). Relationships to Social Robots. Intervalla: Platform for intellectual exchange 1, 35–48.

Ihde, D. (2009). *Postphenomenology and technoscience*. Sunny Press.

Kahn, P. H., Reichert, A. L., Gary, H. E., Kanda, T., Ishiguro, H., Shen, S., Ruckert, J., & Gill, B. (2011). The new ontological category hypothesis in human-robot interaction. In *Human-Robot Interaction (HRI), 2011 6th ACM/IEEE International Conference* (pp. 159–160). https://doi.org/10.1145/1957656.1957710

Kellerman, K. L. (1992). Communication: Inherently strategic and primarily automatic. *Communication Monographs*, *59*, 288–300. https://doi.org/10.1080/03637759209376270

Krotz, F. (2007). Mediatisierung: Fallstudien zum Wandel von Kommunikation. [Mediatization: Case studies on the transformation of communication]. VS-Verlag.

Mead, G. H. (1934). *Mind, self, and society* (Vol. 111). University of Chicago Press.

Nass, C., & Moon, Y. (2000). Machines and mindlessness: Social responses to computers. *Journal of Social Issues*, *56*, 81–103. https://doi.org/10.1111/0022-4537.00153

Nass, C., Steuer, J., & Tauber, E. R. (1994). Computers are social actors. In *Proceedings of SIGCHI '94 Human Factors in Computing Systems* (pp. 72–78). ACM. https://doi.org/10.1145/259963.260288

Pennebaker, J. W. (1997). *Opening up: The healing power of expressing emotions*. Guilford Press.

Peters, J. D. (2006). *Speaking into the air: A history of the idea of communication*. The University of Chicago Press.

Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. Cambridge.

Rivoltella, P. C., & Rossi, P. G. (2019). Il corpo e la macchina. Tecnologia, cultura, educazione. [The body and the machine: Technology, Culture and Education] Brescia: Scholè.

Shannon, C. E., & Weaver, W. (1949). *The mathematical theory of communication*. University of Illinois Press.

Verbeek, P.-P. (2006). Materializing morality: Design ethics and technological mediation *Science, Technology & Human Values*, *31,* 361–380.

Wallace, D. F. (2011). *Infinite jest*. Hachette, UK.

Weber, M. (1976). *Wirtschaft und Gesellschaft. Grundriss einer verstehenden Soziologie* (5th ed.). Tübingen: I.C.B. Mohr.

Westerman, D., Edwards, A., Spence, P. R., & Edwards, C. (2019, November). Beyond people: Communication is transhuman. Paper presentation at the National Communication Association Annual Conference, Baltimore, MD.

Zhao, S. (2006). Humanoid social robots as a medium of communication. *New Media & Society*, *8*, 401–419. https://doi.org/10.1177/1461444806061951