Responding to Humanoid Robots:
A call to examine the role of instincts
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Abstract: Using concepts from media ecology and cognitive science, the paper examines some mechanisms which underlie our responses to humanoid robots. It suggests that 'tertiary orality' (talking to robots and computers) requires caution: humans are prompted by their instincts to personalize the voices, faces and body language of robots and computers, and they seem to be designed to attribute intention and emotion where none is present. We argue that the combination of new technology and ancient human instincts creates the uncanny: the familiar in the strange and the strange in the familiar, which is simultaneously seductive and alienating; we argue that people should be educated to understand these phenomena. This is an area where media ecology can make an important contribution.

Introduction

The cultural use of new technologies is never neutral: new technologies are inserted into current practices. While new technologies often reshape the practices, current cultural practices shape the uses and the understanding of the technologies as well. Often we are unaware of the philosophies undergirding the practices, but in modern Western culture the interaction between philosophies and machines has accelerated our tendencies towards utilitarian values: we evaluate ourselves on our ability to get things done; successes must be measurable, and quantities provide much more convincing evidence than qualities (Postman, 1993).

The romantic tradition has always opposed utilitarianism. Since the days of Wordsworth, there has been a strand of romanticism that has been specifically ecological, and today that tradition is reflected in a number of media ecology works. For instance, some argue for the need for silence, solitude and media fasts to allow a perspective on the clamorous world (Bruneau, 2012; Turkle, 2011; Cooper, 2011; Cooper Berdayes, 2012), and the implication of their arguments is that human beings are ends in themselves, and that their natures are not transparent and resist quantification. Lanier's *You Are Not a Gadget* (2010) makes the implication explicit.

On the other hand, quantification leaves a material residue, and according to the current scientific ethos if we wish to understand ourselves, it is this residue we must examine. It has become the object of scientific inquiry, and a number of media ecologists have begun inquiring. For instance, Carr (2010) summarizes neuroscience discoveries about the brain's interaction with the internet; Grabowski (2012) introduced the 2012 MEA conference attendees to the neurophysiologic peculiarities of symbol perception; according to Cali's study (2012), at least one media ecology teacher includes neurophysiology in the syllabus; Hallowell (2009) considers the implications of biology of cognition and argues that 'a biological perspective can help inform the study of media ecology by providing a complex naturalistic approach that takes into account the realities of the biological world and the role of the brain in co-creating our perceptions of reality' (p.154); MacDougall (2012) is attempting to quantify the neurological effects of reading in different media. Such attention to the body is part of media ecology tradition. For example, in *The Presence of the Word* Ong (1967) drew approximate parallels between Freud's stages of psychosexual development and the development of communication technologies, where oral-

aural in communication corresponds to Freud's oral stage, writing and print correspond to the anal stage, and 'if we keep our frame of reference large and general, it is possible to discern something in common between today's overpoweringly socialized world of vocal communication enlarged through the electronic media and the Freudian genital stage of psychosomatic development' (p.101). Ong points out that 'both the psychosexual stages and the media stages are concerned with maturity' (p.104).

Following this media ecological tradition, our paper turns to cognitive and evolutionary sciences in order to begin examining what happens when human beings interact with electronic appliances that talk back. Electronic appliances equipped with human-like voices and faces exemplify the uncanny: the familiar in the strange and the strange in the familiar. The uncanny is simultaneously seductive and alienating. Something happens to humans when they become involved with these inanimate objects; humans talk to them as if they were persons, but the machines remain inanimate. Grosswiler (2012) argues that this interaction has created a new type of orality. Turkle (2011) demonstrates that this creates a new type of relationships—we care for and 'are cared for' by robots. It is this care that is uncanny; it taps into the ancient instincts of our species, perhaps instincts predating homo sapiens. Unlike writing and print, which require extensive training of skills that are not innate, 'tertiary orality' (talking to robots and computers) comes naturally to masses of people; we experience the machines pulling us to themselves. We are driven by our instincts to react to the robots and computers as if they were people, and we must train ourselves to resist this personification. The paper offers a brief overview of useful scientific discoveries (based both on publications in specialized journals and on books written by scientists for non-specialists), demonstrates that they offer some possible answers to the uncanny aspects of tertiary orality, and challenges us to explore in what ways our interaction with humanoid computers changes who we are and how our instincts become exploited.

Programmed Reactions

In *Alone Together* Turkle (2011, pp.127-129) tells a story of a young man who could not tear himself away from the conversation with a robot when the robot sighed, lowered its gaze, glanced away and otherwise 'behaved' coyly. The robot, called Kismet, 'nodded and smiled in recognition', 'babble[d] with interest and encouragement,' 'sound[ed] warm in its interest.' 'sound[ed] happy, one might say giggly, flattered,' and when the young man was saying good bye, the robot 'purr[ed] in a warm tone' and 'made low 'intimate' sounds.' The young man decided not to leave.

The coyness displayed in flirtation is a human universal (Brown, 1991); all over the world people flirt, and a successful flirtation triggers predictable responses. Fisher (1992, p.25) argues that 'like the smile, the sequential flirt, the coy look, the head toss, the chest thrust, and the gaze are probably all part of a standard human repertoire of gestures that, used in certain contexts, evolved to attract a mate'. When similar body language is programmed into a robot, the robot does not intend to attract a mate, but humans react as their genetics prompt them.

This is the uncanny, which we must understand to protect ourselves. To be protected, the humans interacting with such a robot need to understand that a) their instinctive reactions are

being tapped; b) what is tapping them is an unfeeling machine programmed by other humans who do not necessarily have their best interests at heart; c) therefore, they should monitor their own reactions carefully. The young man described by Turkle clearly fell under the spell of the typical flirtation routine programmed into Kismet by its creators. Kismet had no interest in him.

As robots become more and more sophisticated, people will need to be educated about the dangers of their seductions, just as people are presently educated about the dangers of alcohol, tobacco, or texting while driving.

Faces

Turkle (2011) describes disturbing experiments in which children were introduced to robots with humanoid facial features and encouraged to interact them. The robots had a limited ability to follow human movements, and 'respond' to the children's advances, although imperfectly. The children yearned to be liked by the robots; they became sad and hurt when the robots were unresponsive; they became happy when the robots did respond; they grew attached to robots and attributed feelings to them. Turkle (p.84) describes her own reaction upon 'meeting' such a robot: 'Cog 'noticed' me soon after I entered the room. Its head turned to follow me, and I was embarrassed to note that it made me happy – unreasonably happy.[…] Cog had a face, it made eye contact, and it followed my movements. With these simple elements in play, although I knew Cog to be a machine, I had to fight my instinct to react to 'him' as a person'.

The reaction of Turkle and the children is understandable. Humans innately ascribe mental states, intentions and feelings to others, and this ability manifests itself in infancy, becoming fully developed by age four or five (e.g. see Dennett, 1987; Gopnik, 2009). As a healthy human child or adult looks at another being's face, the human instinctively interprets the other being's facial expressions as showing such qualities as sadness, joy, interest, boredom, or fear. Because we evolved as social beings, we rely on this ability to navigate our social worlds. This instinct is vulnerable and makes us vulnerable as well. For instance, it can be damaged as it is in autistic and psychopathic people, who lack the ability to interpret other people's expressions and react to them (Baron-Cohen, 1995; Blair et al, 2005). On the other hand, the instinct can betray us into ascribing feelings to inanimate objects, like a machine that 'hums' a tune while it works, a toy that smiles, or a robot that averts its gaze or bats its eyelashes. Jason Mitchell (2009, pp.85-86), the head of Harvard's Social Cognition and Affective Neuroscience Laboratory, writes:

> … the most dramatic innovation introduced with the rollout of our species is not the prowess of *individual* minds but the ability to harness that power across many individuals. […] In order to integrate the behavior of many individuals, the human mind must be capable of at least two kinds of special processing. First, to have any hope of coordinating the minds of others, we must have a way to understand what's happening inside them – that is, a set of processes for inferring what those around us are thinking and feeling; what their goals, desires and preferences might be; and what personality traits and temperament differentiate them from other people. In other words, we must be 'mind readers', capable of perceiving the mental states of the people around us. [...] The brain regions identified during mind-reading tasks continue to churn away [even when the person is at rest]. This chronic engagement of 'social brain' regions suggests that the human brain has a predilection for contemplating the minds of others. *Our tendency to anthropomorphize – to see mind where none truly exists, as in inanimate objects or the forces of nature – may well result from the chronic overactivity of those brain regions implicated in social thought*. (emphasis added)

Mitchell (p.86) explains that these brain regions shut down when we are interacting with inanimate objects:

> 'Perhaps our mental algorithms cannot simultaneously remain vigilant for the presence of other minds and also interact with entities that are inherently mindless…, but must instead suspend the tendency to approach the world in a social manner when faced with nonminds. If we were unable to suppress the predisposition to see all things as having a mind, think how hard-hearted we'd have to be just to pour scalding water into a mug, pound a nail, or slam-dunk a basketball'.

The uncanny emerges when something that is inherently mindless (a computer, a robot, a phone) is given surface features that falsely signal that it has a mind, thus confusing regions of the brain that would ordinarily shut off. The robot is simultaneously perceived as having and not having feelings. As Turkle (2011, p.100) says, 'we are drawn by our humanity to give these machines something of the consideration we give to each other. Because we reach for mutuality, we want them to care about us as we care for them. They can hurt us'. In other words, our instincts can deceive us and make us vulnerable. Our tendency to apply to machines the instincts developed to deal with humans makes us subject to manipulation by the unscrupulous.

This is not to say that we are doomed to be duped. Part of what makes us human is our ability to curb instinctive reactions in favor of reactions that are culturally imposed or logical; for example, we may be afraid of snakes, spiders**,** or public speaking, but unlike other animals, after initial recoiling, we can force ourselves not to flee. However, the frontal lobes, which are generally credited with the function of overruling instinctive reactions, are not thought to be fully developed in humans until the early twenties (Churchland, 2011). As an adult and a trained researcher, Turkle was aware that her instinct to react to Cog as if Cog were a person was attributing human features to an inappropriate object, and was able to resist her impulse. The children in the experiments, on the other hand, were too young to resist, even after they were shown the machinery inside the robot. This ability to glean intentions and emotions from the facial expressions and body language pre-dates our species (Call and Tomasello, 1998; Premark, 1988), and is apparently rooted deeply enough to require conscious resistance, as can be seen not only in children's reaction to humanoid robots, but also in adult reactions to con men and various politicians.

Robots become especially uncanny when they acquire not only humanoid features and voices, but also facial expressions. Since Darwin, evolutionists have assumed that basic emotions are expressed in universal facial gestures; Ekman (1970) presented the quantitative data demonstrating the 'pan-cultural element in facial expressions of emotion' (p.156) for the emotions of happiness, sadness, fear, disgust, surprise and anger, and he suggests that 'there may well be such a pan-cultural element for more than' these (p.156). Darwin's argument is that such universal emotions are innate and evolved in the human species, however culturally specific their signaling may appear (e.g. Jack et al, 2012). Drawing on years of research, Gopnik (2009) demonstrates that newborns imitate facial expressions, map them to emotions, and establish a correlation between their own feelings and the expressions they observe and imitate. She concludes that 'babies are born knowing that particular facial expressions reflect particular kinesthetic feelings' (p.205).

It is not only students of psychology and anthropology who have studied our ability to react to emotional expression; the creators of robots have as well. For instance, Nexi, a robot developed at MIT, speaks in a pleasant female voice and can rearrange its face 'to show that I am sad, mad, excited or even bored,' and 'happy to have met you' (Grosswiler, 2012). Again, we react to Nexi's allure. Notice that MIT engineers have programmed Nexi to proclaim emotions; that and our instinctive reaction to the expressions on a humanoid face deceives us into thinking that it has feelings. To resist this uncanny simulation requires a conscious effort. In the meantime, the relationship simulates mutuality: robots are being programmed to identify our facial expressions and to respond accordingly (Scassellati, 2002). Our relation to these artifacts has crossed a boundary.

As we interact more and more with ever subtler humanoid robots, we will need to learn to suppress the impulse to respond to simulated facial expressions. This suppression will only be partially successful, and some of us will find ourselves loving objects which will only be able to simulate, not return love. Lanier (2010) cautions that in adapting to computers we tend to simplify ourselves to match the computer's limited abilities; Lanier (p.32) puts this strongly: 'You can't tell if the machine has gotten smarter or if you've just lowered your own standards of intelligence to such a degree that the machine seems smart. […] People degrade themselves to make the machines seem smart all the time'. Turkle (2011) in *Alone Together* worries that in the environment of talking machines with expressive voices and faces, we will lower our standards of love and caring.

Children must be educated from a very early age to distinguish a living organism from a machine, and even then many children, like the ones in Turkle's experiments, will probably find themselves attaching to the humanoid or animal-like machines, especially if their parents are distant or busy. The American Academy of Pediatrics warns that in the critical age before eight years old**,** children form not only all their fundamental skills but also their understanding of human relationships (Rothschild, 2012). Parents and educators must act during this crucial period. Unfortunately, the loudest voice in the market of digital products for children currently belongs not to the American Academy of Pediatrics, but to the corporations manufacturing mediated toys (Rothschild, 2012), and these corporations will be marketing them aggressively and drowning out the voices of pediatricians and scholars. The voices of media ecologists should be heard in the discussion.

Voices

Ong (1967, p.112) writes:

> Sound is more real or existential than other sense objects, despite the fact that it is also more evanescent. Sound itself is related to present actuality rather than to past or future. It must emanate from a source here and now discernibly active, with the result that involvement with sound is involvement with the present, with here-and-now existence and activity. Sound signals the present use of power, since sound must be in active production in order to exist at all.

In the presence of speech humans are mobilized, because speech is a potentially dangerous power. Humans seem to naturally treat speech differently from other sounds. Our brain is designed to discern speech through a thicket of interference, and often we will 'hear' things that were not said if we are looking for them – we will interpret bleeps and tones as words (Remez et al. 1981). As Pinker (2000, p.156) says, 'Speech perception is another one of the biological

miracles making up the language instinct'. Citing several studies, he describes the difference between our perception of mechanical noises and of speech phonemes:

> Real speech, somehow, is perceived an order of magnitude faster: ten to fifteen phonemes per second for casual speech, twenty to thirty per second for the man in the late-night Veg-O-Matic ads, and as many as forty to fifty per second for artificially sped-up speech. Given how the human auditory system works, this is almost unbelievable. When a sound like a click is repeated at a rate of twenty times per second or faster, we no longer hear it as a sequence of separate sounds but as a low buzz. (p.157).

We complement the imperfect sound flow with our knowledge of context and the expectation of what it might or should demand, but correct understanding depends vastly more on our paying attention to the actual sounds produced by the speaker and on patterning those sounds onto our linguistic system. 'To perceive an utterance, then, is to perceive a specific pattern of intended gestures' (Lieberman and Mattingly, 1985). (By gestures Lieberman and Mattingly mean specific movements of our vocal apparatus, like labialization, voicing, placing the tongue on the alveoli, etc.). Again, as with facial expressions, humans seem to be built to pay extraordinary attention to the sound of human voice and to project the speaker's action onto the listener's own biological properties and abilities; we are designed to correlate the speech we hear with our own internal mechanisms.

What happens when the voice we hear is synthesized and produced by a robot, a GPS, or a phone? Can we immediately discard the millennia of evolving with only other humans as speech producers? More likely, our instincts will prompt us to project some of our own biology onto the machine. No wonder many drivers call their GPS 'this annoying woman' or other human names and yell at it, or coax it; no wonder people find it natural to react to their talking phone as if it were a sapient conversation partner. When Nexi talks, the fact that its voice sounds human betrays us into projecting our own linguistic abilities on it.

Long before formal theories of communication, humans had coined sayings and proverbs reflecting tried and true ways to communicate effectively and not to be hoodwinked in daily communication contests with peers, spouses, children, and supervisors (Polski, 2008). One of the most important tenets of this first communication theory concerns the balance between listening and speaking, and folk maxims worldwide prescribe listening over speaking (Rozhdestvensky, 1996), as reflected in such sayings as 'You have two ears and one mouth, so listen twice and speak once,' 'The learned one does not speak, the ignorant one does not let others speak,' or 'Even a fool is thought wise if he keeps silent, and discerning if he holds his tongue.' People are taught from infancy that listening should take precedence over speaking. Listening is a vitally important skill, because it allows the actor to discern the intentions of the opponent and to prepare a worthy response. When the conversation partner is an inanimate object with a series of programmed cues, the human is challenged to abandon years of conversation training and remember to shut out the 'partner'; some people forget that they should not treat an object as if it were a person; others lack human contact and content themselves with interacting machines. Such situations are parodied in the IPhone commercial series, where John Malkovich and Samuel L. Jackson emotionally converse with their phones. The fault, however, is not in our phones but in ourselves and our instincts, ensnared in the uncanny.

Among other listening skills, we develop a skill to distinguish spontaneous responses in conversation from responses that have been rehearsed or are willed – talking appliances falling universally into the latter group. We call response A 'real' and response B 'fake' on the basis of signals, such as intonation, some probably universal, some culturally-specific, and feel more comfortable in conversations where responses are more 'real' and less rehearsed or clichéd (one of the issues of going into another culture is the difficulty in 'reading' a new group of signals). One of the challenges of the creators of humanoid voices will be to defeat this ability, to make the voices 'real,' and possibly the creators will rise to the challenge. One assumes that humanoid voices will seem less and less programmed, although at the same time as our culture becomes more and more utilitarian, human voices are likely to become progressively more so. A challenge for us then will be to become ever better at detecting 'insincerity.' As this happens, we will be delving into the uncanny.

Discussion

The uncanny in a variety of guises has been a major theme of postmodernism. Postmodernist theorists have issued manifestoes for cyborgs (Haraway, 1991) and proclaimed the ascendency of the simulacra (Baudrillard, 1994). They have celebrated the crossing of borders**,** impurity and a variety of transgressions. Humanoid robots are certainly a transgression of borders. Their perfection would promise an almost apocalyptic transformation.

The uncanny is tinged with nightmare. The image of the humanoid robot as terminator is etched into our culture. Perhaps that image is too hyperbolic, but it is certainly troubling. For instance, throughout Turkle's book (2011) the reader is confronted with her own misgivings about the phenomena she is describing. She finds the robots and the human interaction they encourage creepy, creepiness being an attribute of the uncanny.

The uncanny is a place of fascination and horror, and it demands neither celebration nor rejection, but study. We must study how digital communication taps into our deepest, sometimes pre-linguistic instincts, and how, in turn, our biological nature becomes affected by digital communication. For example, why does the ability to make anonymous comments online encourage some to nastiness and cruelty (Lanier, 2010), but leaves others unaffected? In the same way, we can ask why some are drawn to respond to humanoid robots, while others are not.

The uncanny is inevitably seductive. Seduction is a kind of play. We enjoy it. We want to play along, and play is part of what makes us human. But the uncanny is always dangerous; when seduction stops being play and becomes a way of turning another into an instrument, it threatens the other's autonomy. Martin Buber (1971) made a famous distinction between the I-Thou and I-It relationships; his point was that we can accept the other as other and value it for what it is, or we can accept the other as something to use and value it for what it can contribute to our well-being and self-esteem. We can treat humanoid robots as 'Thou's,' but they can only treat us as 'Its.' They cannot be programmed otherwise.

Dozens of studies (Reeves and Nass 1996) demonstrate that humans respond to media in the same way they respond to living social actors, even when the media images are not humanoid. Reeves and Nass recommend various software designs which would exploit these automatic

human responses to social actors so that humans respond even more personally to media; those changes would make the uncanny even more seductive. The arms race escalates: the more psychologically sophisticated the robots are the more awareness humans need in these relationships.

Obviously our education, the structuring of our desires, our ability to re-assess values and remodel behavior affect the way we respond to communication technologies. Because computers that speak and simulate emotion are almost inevitable, we must learn to respond to this new form of the uncanny. Ong (1967) observed that the electronic media stage suggests the ideal of the mature human being; maturity includes self awareness and the awareness of the forces which drive us. A mature handling of the uncanny requires the study of the biological basis of our reactions.

Conclusion

Individuals who face talking computers and emoting robots need to be educated in the biological basis of their reactions and trained to react appropriately.

Media ecology's interest in the sensorium has long required it to pay attention to the body, and we are now beginning to look closer at the data of the cognitive sciences. While the founders of media ecology did not address the neurophysiologic aspects of communication (Morrison, 2012), their knowledge of a variety of disciplines helped them assess the large-scale social implications of a variety of media: for example, McLuhan, a literary scholar, could discuss quantum mechanics with physicists (Logan, 2010), and built some of his most famous metaphors on images of electric light. Now media ecologists must study what our biological nature implies about the nature of human communication. In Hallowell's (2009, pp.154-155) words, 'Media ecology's unique interdisciplinary and largely humanistic perspective' is posed to connect 'our biological being and our subjectivity. […] Media ecology is a lens that can enhance how we understand the link between our biological history and our cultural history'.

As humanity enters into the age of mass anonymous posts, talking computers and humanoid robots, media ecologists can contribute what they have always been contributing: a rational and balanced view of the large-scale processes which helps the culture understand its new stage, and avoid somnambulism (McLuhan, 2003). This means that we must see who we are and why we act the way we do.

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