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A Semblance of Aliveness: How the Peculiar Embodiment of Sex Robots Will Matter

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Abstract: While the design of sex robots is still in the early stages, the social implications of the potential proliferation of sex robots into our lives has been heavily debated by activists and scholars from various disciplines. What is missing in the current debate on sex robots and their potential impact on human social relations is a targeted look at *the boundedness* and *bodily expressivity* typically characteristic of humans, the role that these dimensions of human embodiment play in enabling reciprocal human interactions, and the manner in which this contrasts with sex robot–human interactions. Through a fine-grained discussion of these themes, rooted in fruitful but largely untapped resources from the field of enactive embodied cognition, we explore the unique embodiment of sex robots. We argue that the embodiment of the sex robot is constituted by what we term *restricted expressivity* and a lack of *bodily boundedness* and that this is the locus of negative but also potentially positive implications. We discuss the possible benefits that these two dimensions of embodiment may have for people within a specific demographic, namely *some* persons on the autism spectrum. Our preliminary conclusion—that the benefits and the downsides of sex robots reside in the same capability of the robot, its restricted expressivity and lack of bodily boundedness as we call it—demands we take stock of future developments in the design of sex robot embodiment. Given the importance of evidence-based research pertaining to sex robots in particular, as reinforced by Nature (2017) for drawing correlations and making claims, the analysis is intended to set the stage for future research.

Key words: sex robots, social robots, enactive embodied cognition, social cognition, autism

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1.0 Introduction

There is no escaping newspaper and magazine headlines telling us that the robot revolution is upon us—the robots are here. Academics and industry leaders alike are working hard to develop technologies that will assist humans in their daily lives and even replace humans for the more mundane or dangerous tasks. Though the majority of today's robots are meant as assistive tools, a new category of robots is being developed that will engage human users in more long-term companionship relationships. These robots are called social robots (Breazeal 2003). One of the distinctive features of a social robot, highlighted by Sherry Turkle, is that we get the most out of our interactions with it by treating it not as a mere tool, built strictly for our purposes, but as a minded being.[2] In Turkle's words: social robots are "programmed to have mental states that shift as they interact with people"; "interacting with" a social robot thus "involves figuring out how a robot is 'feeling' in order to get along with it" (2010, 3). Put differently, social robots are designed in such a way that they possess "the appearance of aliveness" and offer users the "phantasy of reciprocation" (Turkle 2010, 3). Reciprocation can be understood as the act of recognizing and being recognized by another as a minded sentient intentional being and is typically seen as a central feature of dyadic human-to-human social interaction (cf. Buber 1958; Honneth 1995; Reddy 2008). That we are dealing with the mere *fantasy* of reciprocity in the context of social human-robot interactions has motivated concerns about the social and ethical consequences of the expected proliferation of social robots, with humans beings drawn into asymmetric and potentially deceptive interactions (Frennert and Östlund 2014), the risk of social deprivation or loneliness (de Graaf and Allouch 2016) and/or "the potential *for humans' emotional dependence on social robots"* (Scheutz 2011, 205).

More recently the area of social robots has seen a new kind of robot enter the scene that seems to take these concerns to new heights: the sex robot. This new addition to the world of social robots and of sex tech invites certain philosophical questions related to the sex robot as a companion: what significance will it have when we begin to embrace the semblance of aliveness and reciprocation in one of the most intimate and vulnerable areas of dyadic social interaction? Might it lead to an impoverishment in the skills and sensibilities we rely on to sustain our sexual relationships and perhaps our social ties with others more generally? Or could it open up promising new ways of relating to others and ourselves, perhaps facilitating novel possibilities for establishing or regaining one's own sexual integrity and entering or re-entering the sexual arena?

The answers to these pressing questions are ultimately an empirical matter and challenging to answer in a robust manner prior to the actual widespread introduction of sex robots into our lives. Although the field of HRI (Human Robot Interaction) has generated important empirical insights regarding human-social robot interaction there has been, to the best of our knowledge, no research carried out on HRI involving humans and sex robots. As such, sex robots can be seen as an instance of what Ibo van de Poel terms "experimental technology," where "technologies [are] experimental if there is only limited operational experience with them, so that social benefits and risks cannot, or at least not straightforwardly, be assessed on basis of experience" (2016, 669). The lack of experiential data paired with the potentially transformative nature of sex robots underscores the importance of finding fruitful resources that can open up paths for relevant forms of anticipation and reflection. As Jack Stilgoe, Richard Owen and Phil Macnaghten (2013) have pointed out, such anticipatory reflection often takes on a multidisciplinary shape, involving for instance "social scientists or philosophers" (1571). In the spirit of this multidisciplinary approach to experimental technologies, we believe that turning to insights from the field of enactive embodied (social) cognition can help us anticipate some of the social implications of the proliferation of sex robots in a targeted manner.

In the following paper we will focus specifically on two features of embodiment central to human-to-human dyadic interaction –sexual or otherwise—namely 1) *the expressivity of the living body* and 2) *the boundedness of the living body*. The first feature of embodiment, we argue, is importantly *restricted* both in its scope and fineness of grain in sex robots when compared to the expressivity of the human body. We call this the 'restricted expressivity' of the sex robot. The second feature, which reveals the body as a site of "existential exposure" is, we argue, only derivatively present in the case of sex robots. Focusing on these dimensions of human embodiment and how they differ with respect to the sex robot's embodiment can help us anticipate what is at stake—for better *or* for worse—if and when sex robots are to become commonplace household companions.

Our aim is not in the first instance to be prescriptive but to point in the direction of areas in need of further empirical, conceptual, and ethical research. At the same time, however, we do believe that an analysis of human bodily boundedness and expressivity and the role it plays in human to human interaction contrasted with sex robot embodiment can open up a middle ground position between two diametrically opposed prescriptive positions commonly found in academic debates. On the one hand we have Kathleen Richardson's "Campaign Against Sex Robots"[3] arguing for a ban on sex robots and on the other hand we have scholars such as

David Levy (2009) suggesting that it is okay and even encouraged for humans to have sex with, or fall in love with, robots. We want to caution against these two all-or-nothing stances that either stifle innovation and presume a prescriptive stance on sexuality or leave consumers open to exploitation by industry to play on their weaknesses. Instead, we suspect that the peculiar embodiment of a sex robot can have both disconcerting and important emancipatory therapeutic possibilities. To defend the latter point we conclude our paper by turning to a concrete case, where we explore the extent to which some persons on the autism spectrum might benefit from the restricted bodily expressivity of sex robots.

2.0 Sex Robots: What Are They and How Are They Reflected Upon?

2.1 Sex Robots and Robo-Philosophy

Our paper aims to be largely descriptive. In that respect it follows the posture of robo-philosophy rather than that of robot ethics. Robot ethics is very much applied ethics; the application of existing ethical theory and principles to the emerging technology of robotics.[4] Robo-philosophy aims to be broader in scope, to be more exploratory without necessarily being normative or prescriptive. It raises questions such as "can robots have rights?" or "can robots experience emotions?" and explores what the development of robotics teaches us about the human condition, human sociality, the attribution of meaning and so on.[5] This exploratory posture comes from the reality that robotics is constantly pushing the boundaries of what is technically feasible, where robo-philosophy aims to push the boundaries of reflection in tandem with technological development. In line with the goals of robo-philosophy we aim for this paper to open a new space for dialogue and reflections on sociality and sexuality when it comes to social robots.

2.2 Features of Sex Robots

We draw on the definitions of sex robots provided by John Danaher (2017) and Lily Frank and Sven Nyholm (2017a, 2017b) and define a sex robot here as: a robot with a humanoid form (looks like a human person), intended for the purpose of sexual intercourse but with the ability to fulfil other acts, designed with a sophisticated interface (appearance and bodily expressivity) to encourage successful interaction with the human user and with a range of capabilities for sensing, perceiving and acting without the control of real-time operators, most likely attributed to artificial intelligence (AI). The goal of a sex robot is to interact dynamically with a human user, as opposed to a sex doll which is passive.

There are now an estimated five companies in the US embarking on the development of sex robots.[6] Differences between appearance and programming can be seen from one company to another; at some companies, for example, customers can order a tailor-made robot to meet their specific interests (e.g., elf ears, pubic hair shape, breast size, and so on). The sex robot industry continues to search for the ideal substitute for skin. Most dolls and robots are made from silicone or thermoplastic elostomer (TPE) which is a blend of silicone and polyvinyl chloride.[7] The company called Hanson Robotics, which specializes in lifelike (android) social robots (*not sex robots*), has patented "frubber" which can "wrinkle, crease, and amass much more like skin than other animatronics materials" (Oh et al. 2006, 1). Although not yet used in the sex robot industry it is nevertheless considered for its potential there. Considerations for consumers range from how the 'skin' material retains stains, how easy it is to clean, how durable it is, and how it can withstand elevated temperatures. In short, the 'skin' of a sex robot is an innovation in and of itself receiving much attention from developers and consumers alike. We will revisit the notion of skin and contrast its meaning in the human–sex robot context with its significance in human-to-human sexual interaction in section 3.1.

As part of their functionality, sex robots are already, in a minimal sense, meant to express emotions. Users can, for instance, opt for various settings (from Wild Wendy to Frigid Farrah in the Roxxxy sex robot made by True Companion[8]) and they can hear their robots utter a restricted set of verbal expressions. In other words, sex robots are already being built with the intention to offer something that more traditional sex tools don't, namely, the semblance of sexual intercourse with a full-blooded person—with a body that responds to being touched, that can utter desires, that can be brought to orgasm (or the appearance thereof).

We anticipate that future sex robots will follow the work done in social robotics and will be designed to show a variety of bodily expressions beyond moving its arms or imitating an orgasm, for instance bodily movements generally associated with, say, shyness or coyness (lowering eyelashes, turning away the face, perhaps artificially induced blushing).[9] As such, the aim of a sex robot is to draw its human user into a more engaged interaction through its interface, one that elicits an emotional response. As Matt McCullin, the design director behind Realbotix, puts it: "The hope is to create something that will actually arouse someone at an emotional intellectual level beyond the physical. . . . You want to have that illusion that she . . . has sentience" (Canepari, Cooper, and Cott 2015). Over time, the robot may come to learn more details of the human user through the data it is collecting, which can then be used for future interactions between human and robot.[10]

2.3 Current Reflections on Sex Robots

Recent reflections on human–sex robot interaction have explored the positive and the negative impacts for human users on an individual and societal level. Levy, who sparked much of this debate with his book *Love and Sex with Robots* (2009), argues for the plausibility and acceptability of falling in love with a (sex) robot. Kate Devlin presents the possibility that sex robots would allow for a rethinking of traditional binary sex and gender dualisms (2015). Frank and Nyholm discuss the possibility for real love with a robot partner (2017a) and explore the concepts of autonomy and consent as it applies to robot sex partners (2017b).

In contrast, Charles Ess (2015), building on the work of Sara Ruddick and the notion of mutual desire (1975) in 'complete sex,' describes the asymmetry in the human–sex robot interaction and how these interactions will ultimately deprive users of complete sex; we desire to be desired and we desire to have our desire desired, and it is this reciprocity that will not be possible with the sex robot. John Sullins also focuses on the one-sided aspect of the human–sex robot interaction and insists that it minimizes the nuances and depth of true friendship and love, elements he takes to be essential to an ethical society (2012).

One aspect of the debate on sex robots has been to question whether sex robots would help alleviate societal challenges such as rape, sex trafficking or pedophilia (Sharkey et al. 2017). These are difficult topics to address given that undertaking the empirical studies necessary to gain insight would be morally problematic. Moreover, many experts in the field raise valuable questions about the characteristics of rape or human trafficking. For human rights lawyer Kay Firth Butterfield, "sex robots are unlikely, at least in the near term, to address the need for domination which can be a characteristic of the use of human trafficking victims" (Sharkey et al. 2017, 17).

Kathleen Richardson (2015), who runs the campaign against sex robots, is concerned with (among other things) the representation of the female body in the gendered form that is currently commonplace in the sex robot industry, most notably that it promotes a commodification of both the female body and the act of sex. Embodiment of the female form in this way recycles and exacerbates existing gender stereotypes, sexism, and sexual objectification. In contrast, John Danaher, Brian Earp, and Anders Sandberg (2017) have questioned the campaign against sex robots for a variety of reasons one of which has to do with the motives and/or repercussions of endorsing such a broad campaign, that it requires a restricted and conservative view of sex and sex ethics.

In sum, current debates already home in on 1) the robot's embodiment, albeit largely in terms of the highly gendered way in which sex robots are built, and 2) the meaning of genuine reciprocal interaction and the extent to which this might be compromised in sex robot–human interaction. However, what is missing in the current debate on sex robots is a targeted look at the way in which these two focal points come together. In order to take a closer look at the boundedness and expressivity typically characteristic of human embodiment and the role that these dimensions of embodiment play in enabling reciprocal human interaction we now turn to insights from the field of embodied (social) cognition.

3.0 Human Embodiment and Its Role in Social Interaction

3.1 The Living Body as Existential Boundary

It is standard practice in the fields of AI and Robotics to characterize robots as embodied agents; however, the exact meaning of the term embodiment as it is used in these fields is highly ambiguous (cf. Ziemke 2016). In order to say something meaningful about what the embodiment of sex robots might mean for sex robot–human interaction we thus need to be precise in our theoretical commitments. Tom Ziemke (2016) has helpfully suggested that there is one quite particular way of understanding embodiment that has received relatively little attention in embodied AI research despite its potential to reveal deeply relevant differences between how, for instance, human beings are embodied agents and how robots are 'embodied.' This understanding of embodiment is found in the so-called autopoietic enactive literature on embodied cognition. It is this enactive approach to embodied cognition that we will take as the theoretical framework for our discussion.

Enactive embodied cognition brings together insights from phenomenology, biology, (social) neuroscience, developmental psychology, robotics and the science of dynamic systems to argue that *living bodily beings* are natural entities of a particular kind. Specifically, they are autonomous beings who aren't simply governed from outside but who confront their environment on their own terms—they occupy a self-regulating perspective onto an environment that is meaningfully organized in correlation with the organism's self-constituting activities. In the words of philosopher Evan Thompson, living bodily beings actively produce their "own self-maintaining processes, including an active . . . *boundary* that demarcates inside from outside and actively regulates interaction with the environment" (Thompson 2007, 64, our italics). The paradigmatic example of this boundary, demarcating inside from outside; self from other, is the semipermeable membrane

of a cell, which allows a cell to draw on external environmental resources that in turn enable it to maintain itself precisely as a bounded self-organizing being (Cf. Thompson 2007).

From this perspective, to be a bounded living body is at once to be shielded from the world as a separate individuated, differentiated, agent—a world confronted on one's own terms, framed by one's bounded embodied perspective, and it is also to be the site of ineluctable exposure and vulnerability; living beings are by definition selves who are always at the same time outside of themselves; exposed to the elements, dependent on exchanges with the material world, and visible as a self to others.

We can find various iterations of a living body's constitutive separation from and exposure to its world in the sphere of the human, but at the most basic level human skin counts roughly as the equivalent of the cell's semi-permeable membrane. There are compelling reasons to believe that human skin is not merely a biological marker of separateness and exposure, but that it has a profoundly *social* and *existential* significance that gets at the heart of our ties to and vulnerabilities in the face of the other. This idea is, for instance, underscored in "The Skin as a Social Organ," by India Morrison, Line S. Löken, and Håkan Olausson (2010) that builds off evidence from the field of social neuro-science to stress the affective social dimension of the skin as a boundary.[11] Morrison, Löken, and Olausson maintain that "the skin is the site of events and processes crucial to the way we think about, feel about, and interact with one another," (2010, 305) and that when it comes to touching and being touched: "Positive affect and hedonic feelings may be the glue which holds individuals, as necessarily physically separate beings, together in social bonds" (2010, 307). Indeed, they point to a possibly constitutive role of the perception of (touched) skin in the experience of empathy.

In addition to the skin's function as a "social connector," Morrison, Löken, and Olausson also point to its role as a shield or barrier, suggesting that "the erotic dimension of human touch affects everyday interactions even among people who are not sexually involved, by introducing a culturally influenced 'erotic barrier' which precludes certain types of casual touch" (2010, 306).

This idea of the skinned bounded body as a socially essential barrier is also central to holocaust survivor Jean Amery's attempt to make sense of how torture and other sustained physical attacks on his body were able to undo him in a social existential sense, decrying that: "The boundaries of my body are also the boundaries of myself. My skin surface shields me against the external world. If I am to have trust, I must feel on it only what I *want* to feel" (Améry 1980, 28).

Building in part off Amery's personal testimony but also off the enactive notion of the living body as constituting a precarious boundary between inner and outer, Jay M. Bernstein has recently argued that the skinned bounded body is emphatically at stake in human-to-human sexual encounters:

> Our sense of our boundedness is inseparable from the skin as limit. But in this role as 'line of demarcation, a periphery, the fence,' the skin is simultaneously fully exposed: "The skin is electric . . . sensitive to every whisper of wind, chill, heat.' Skin can be scratched, torn, pierced, ripped, burned, scalded, wet, creamed, soaped, rubbed, stroked, tickled, slapped. . . . Skin is limit and vulnerability, fence and porous membrane. . . . [N]early every sexual act contains the collapse of skins boundaries as a moment, potential or actual—a moment in which we are no longer safe, no longer separate, no longer secure behind the fence, film, or membrane. (Bernstein 2015, 150)

If the notion of skin as a boundary that can connect and expose us to others is as essential to sex and intimacy as Bernstein suggests, then it will come as no surprise that, as we have seen, real attempts are being made by the developers of sex robots to simulate human skin as closely as possible. This has, for instance, already lead to the development of different levels of thickness (with lips being soft to the touch, and female sexual organs possessing tougher skin, able to withstand penetration). But this similarity between the meaning of synthetic skin and human skin is clearly limited. It is only in a derivative sense, from the user's perspective, that the robot's skin can be "scratched, torn, pieced, ripped, burned, . . . soaped, rubbed, stroked." For the robot itself, its skin signifies neither separateness nor exposure. We have been suggesting that our skin, by contrast, is one of the ways in which our body manifests itself as the marker of our separateness from the world and our vulnerability and exposure to it. As such, our skin is always more than a purely physical surface. It is at once a physical and an existential boundary: the self is at stake in being touched by another (cf. Améry 1980; Van Grunsven 2014; Bernstein 2015). Thus, even if the robot has the semblance of skin, what is missing in the human–sex robot context is the element of reciprocal connectedness and, also, that of reciprocal exposure and with that of vulnerability and risk.

We will explore a potentially promising upshot of this elimination of risk and exposure in section 4. At the same time we want to present as an important question for empirical research, how the perception of sex robot's fake skin with its derivative meaning will affect users' interactions with it. Morrison, Löken, and Olausson (2010) have indicated that there is a link between feelings of empathy

and "the perception of features surrounding third-person tactile events" (311). Will the mere visual and tactile semblance of skin 'trick' us into empathizing with the robot, attributing sensations of pleasure and pain more readily to it? Or will the robot's lack of genuine existential exposure affect our perception of its skin in such a way that empathic interactions are also limited? Answers to these questions will open up additional queries concerning the sex robot's impact on sociality. For instance, if the semblance of skin contributes more readily to empathic relations between humans and sex robots, does this support concerns mentioned earlier with respect to social robots drawing humans into deceptive asymmetrical interactions? Or, should we be worried precisely about the opposite; how a lack of empathic relatedness to the robot could promote and inculcate callous if not violent sexual behaviour? These are questions without easy answers, meant to stimulate further discussion in the search for answers on the meaning of human–sex robot interactions.

3.2 The Scope and Strata of Human Bodily Expressivity

In the previous section we encountered the idea of the skin as a boundary that both exposes us to and separates us from the world, thus serving as a condition for our vulnerability to others and for our integrity as individuated separate agents. The idea of the body as a marker of exposure on the one hand and separateness and individuality on the other can also be cashed out in terms of the body as simultaneously the locus of *involuntary* and *intentional agential* expressivity; the body that blushes, burps, shivers, weeps, and moans exposes us, reminding the world (and ourselves) of our vulnerability (to varying degrees we tend to feel exposed and humiliated when our involuntary body announces itself in public), and the body that acts, moves, intends, gestures, announces our agency and autonomy (cf.Bernstein 2015; Plessner 1975; Van Grunsven 2014).

It is both the body in its intentional and involuntary expressive strata that tends to manifest itself to others as affording responsiveness in social interaction. Empirical research on intentional bodily movements indicates that this responsiveness often involves the tracking of subtle differences in "kinetic information" (Becchio et al. 2012). Cristina Becchio et al. have shown, for instance, that, even before it has been completed, we are "able to *discriminate* between cooperative [and] competitive" gestures within the same type of movement (e.g., reaching to grasp) and that it is in virtue of our perceiving these variances in expressed intentions in the midst of interaction that we align our own responses in accordance with them: agents, often "automatically adjust their actions to those of another

person to achieve a common goal" (Becchio et al. 2012). In other words, these subtle kinetic differences and a person's ability to pick up on them can be crucial in setting the tone and direction for a given human interaction.[12] This seems paradigmatically the case in sexual interactions, which are, at least typically, largely non-linguistic in character.

But, as we just mentioned, the gamut of human expressivity reaches far beyond intentional goal-oriented gestures such as grasping, turning, waving, reaching, to also include a rich variety of involuntary bodily expressions. Think of the various ways in which a person can involuntarily express sadness, excitement, joy—through smiles, laughter, cries, shrieks, blushing, shivering, etc. Indeed, as Bernstein points out, it is often precisely the body in its involuntary expressive dimension that is at stake in sexual interactions:

> It is the moment in which bodily passivity and involuntariness is celebrated and enjoyed. . . . [W]e are stripped bare, exposed . . . the moment of involuntariness—of touch, arousal, yearning, scintillation, penetration, orgasm—the moment of exposure tokens an existential stratum of the self in relation to others. (2015, 151)

When we add to the intentional and involuntary registers of human bodily expressive behavior the fact that it is imbued with further significance depending on shared practical contexts (how a person moving in closely and reaching out to touch can be inviting or threatening depending not only on who initiates it but on how, where, to what end, and when this takes place) and we are starting to get a sense of the rich variety of ways in which the human body can be expressive.

Social robots are built to be expressive in ways that mimic the expressivity of living beings. By tracking human movement, lowering their eyes, tilting their heads, and other such movements, they promote emotional attachments and a desire to interact in their users. Yet, what we want to emphasize here is that both in *scope* and in *fineness of grain* the expressivity of the human body is unparalleled. The bodies of sex robots are characterized by what we may call *restricted expressivity*. This also means, as we will go on to suggest, that the skills involved in responding appropriately to the expressive bodies of robots are significantly less demanding. In order to support that point we will first discuss some of the insights from the field of enactive embodied social cognition that support the idea that our understanding of and responsiveness to others as minded beings turns crucially on skill-based and skill-promoting reciprocal interactions.

3.3 Skill-acquisition and Spontaneity in Intercorporeal Dialogue

There is wide agreement among developmental psychologists that our responsiveness to the bodily manifestation of others as intentional emotional expressive agents is, at least to a certain degree, bedrock in human infants. Andrew Meltzoff and Keith Moore (1977), for instance, have famously shown that newborns are often already able to mimic their caretaker's facial expressions, such as tongue protrusions, which suggests that newborns have a perceptual sense of the connection as well as the difference between self and other (cf. Gallagher and Hutto 2008). Thomas Fuchs and Hanne De Jaegher argue that we need to understand neonate imitation as profoundly shaped and motivated by infants' emotional investment in non-linguistic *intercorporeal dialogues* with primary care-takers (Fuchs and De Jaegher 2009, 478–79).[13] These intercorporeal dialogues enable a scaffolding process: already invested in the other and the "mutual affective resonance" that interactions make available, infants gradually acquire an increasingly rich experiential grasp of others, as well as of themselves, as beings who afford address and engagement.

Although things like timing, turn-taking, flow and momentum are important for the establishment of intercorporeal dialogues, they are equally, and crucially, marked by mismatches and moments of breakdown (cf. De Jaegher and Di Paolo 2007, 496, 479). Moments of breakdown provide opportunities for realignment and often lead to the emergence of new forms of interaction and are integral to the development of the infant's sense of herself and the other as an agent who can initiate, participate in, modulate, and disrupt dialogical exchange (cf. Reddy 2008; Van Grunsven 2015).

Developmental psychologist Ed Tronick has termed the gradual development and mastery of interaction skills through engagement "dyadic expansion." Vasudevy Reddy captures Tronick's proposal as follows: "the infant's experiences can expand in complexity within a dyadic base: dyadic engagement stretches the infant a step beyond her capacities, drawing her into skills and embedding her in *patterns of feeling and doing* that she would not otherwise have had access to" (Reddy 2008, 81, our italics).[14] What we build up through intercorporeal dialogue is "a pre-reflective knowledge of how to deal with others—how to share pleasure, elicit attention, avoid rejection, re-establish contact. The infant acquires specific interactive schemes . . . that are needed for keeping up the respective interaction" (Fuchs and De Jaegher 2009, 481). We thus seem to have a gradually enriched

skill-based access to others—and to ourselves—as beings whose expressive behavior affords engagement and response (cf. Van Grunsven 2015).

When we acquire a skill we stabilize and familiarize ourselves with a certain region of the world. And while skill is in this sense constitutive of our ability to effortlessly identify things and persons in the world in terms of the responses they afford, it also makes the world potentially predictable. This can be enormously comforting. When infants (or adults) aren't secure in the expectation of repair needed to recover with resilience (or playfulness) from instances of dialogical breakdown, Reddy notes that they are "armed with" reliable "patterns of feeling and doing . . . that at least have the advantage of being familiar and coherent" (Reddy 2008, 81).

But the familiar, though safe, can also be boring. Indeed moments of breakdown and the unexpected are not just integral to the development of further styles and skills for interaction; they also explain our *interest* in dialogue, intercorporeal or other. Speaking of the intercorporeal dialogues characteristic of infant-caretaker interactions, Reddy writes: "Dialogue cannot be scripted and predetermined. It must possess within it the possibility of going down a road which none of those engaged in it could have known about. . . . We take the unscripted quality of our conversations for granted, but it is precisely this that keeps us alive in our engagement" (2008, 82–83). Without the possibility of breakdown within dialogue, caused by the unforeseen way in which the spontaneity of the other announces itself, our interactions with one another would be as predictable, as amenable to domestication and mastery, and with that as risk-free as our unidirectional engagement with and incorporation of tools (cf. Di Paolo and De Jaegher 2007). That is, they wouldn't be genuine interactions at all.

This highlights why interactions with social robots, including sex robots, can only create what Turkle has termed a "*fantasy of reciprocation*" (2010, 4). For though their expressivity creates a semblance of aliveness, social robots are at bottom still our tools; their functionalities designed for us, their skills task-domain specific; their behavior ultimately non-spontaneous (See also Frank and Nyholm 2017a). Of course, this also helps explain our interest in social robots. After all, the other's spontaneity, her ability to surprise me, to face me with a demand of ongoing responsiveness to her fine-grained expressions, is also what makes genuine interaction so demanding and risky. Turkle discusses the increasing trend among people to withdraw from the challenges of genuine reciprocal interaction, especially in the context of love and sex: "I find people willing to seriously consider robots not only as pets but as potential friends, confidants, and

even romantic partners. We don't seem to care what these artificial intelligences 'know' or 'understand' of the human moments we might 'share' with them. . . . [T]he performance of connection seems connection enough" (Turkle 2012, 9).

Admittedly, we should be careful not to romanticize human-to-human interaction, especially when sexually contoured. Intercorporeal dialogues, especially sexual ones, fail all the time—both in minor and disastrous life-destroying ways. There is bad sex, alienating sex, objectifying sex, oppressive sex. Yet, the infinitely demanding character of human-to-human interaction also underscores its depth and significance. Not only is there always more of the other that we can come to see in the process of engagement, but we ourselves can be profoundly affected by the interaction process: we are "constantly being re-shaped as an entity in relation and . . . gradually building up awareness of . . . [ourselves] in these relations" (Reddy 2008, 148–49). Starting with an ongoing responsiveness to the demands that the expressive bodies of others place on us, it is through reciprocal interaction that we exercise and refine the skills we rely on to perceive others as persons in the fullest sense of the word. And conversely, it is also in this setting that we can unfold and manifest ourselves in new and sometimes unforeseen ways.

4.0 Can the Restricted Expressivity of Sex Robots Be Beneficial?

Our analysis of genuine human-human reciprocal interaction and the fine-tuned responsiveness to bodily expressivity that this involves seems to underscore a normative ethical worry about sex robots that is currently already being raised in the field. The worry, broadly put, is that sustained interactions with sex robots and their pervasive presence in society will have an impoverishing effect on human sociality. However, we don't want to exclude the possibility, off hand, that in certain contexts the restricted bodily expressivity of sex robots can actually be beneficial. This is in in part because, as Terrence Fong, Illa Nourbakhsh and Kerstin Dautenhahn point out, "it is possible that [social] robots may become highly sophisticated in restricted areas of socialization" (2003, 7). More importantly, as Danaher raises, we should not rush to ban sex robots as this may require an assumption about 'normal' human-human interaction in general, and sexual in particular, while there are many versions of intercorporeal dialogues. We suggest that the absence of genuine exposure, risk, or genuine spontaneity, with at the same time the presence of bodily expressivity in a restricted sense, may allow different people, for different reasons, to enter (or re-enter) the sexual arena in a safe and manageable manner. To cash out this thought in some more detail we will offer a brief reflection on the

possibly beneficial role that sex robots might play in the lives of some persons on the autism spectrum.

Let us start by emphasizing that we are not attempting to make robust and generalizing claims about the possibly beneficial role that sex robots could play in the lives of autistic people tout court. Doing so would be problematic for multiple reasons. Firstly, though the literature repeatedly stresses the need for it, research on sexuality in autistic adolescents and adults as well as suitable forms of sex-education in the autism context are limited (cf. Koller 2000; Mehzabin and Stoke 2011). Secondly, autism is a widely understood to be a spectrum 'disorder' and as such it is problematic to make any sweeping generalizing statements about the sexual needs, desires, and hurdles experienced by autistic people and what they may or may not benefit from.[15]

Nevertheless, though we should bear in mind that autism is a spectrum condition, both personal testimonies and scientific research have shown that autistic people, in general, have difficulties perceiving some of the subtly specific social meanings of the expressive behavior of other people. Temple Grandin, for instance, speaks of having to "decode" the emotional expressions of others. Growing up as a child she felt that

> [s]omething was going on between the other kids, something swift, subtle, constantly changing—an exchange of meanings, a negotiation, a swiftness of understanding so remarkable that sometimes she wondered if they were all telepathic. She is now aware of the existence of these social signals. She can infer them, she says, but she cannot perceive them, cannot participate in this magical communication directly. . . . This is why she often feels excluded, an alien. (Sacks 1995, 273)

Various explanations of the social challenges faced by people on the autism spectrum have been offered, but in the field of embodied social cognition the emphasis has been placed on the link between sensorimotor abnormalities and the effect that these have on the establishment of intercorporeal dialogues and on the development of interaction skills through such dialogues (cf. De Jaegher 2013; Gallagher 2004). In the words of De Jaegher: "Social interaction difficulties are not to be considered exclusively as individually based." Rather, "the patterns in the interaction processes," or the styles and rhythms characteristic of intercorporeal dialogues, "that autistic people engage in play an important role in them. I propose that people with autism are less flexible in dealing with the wide range of interactional styles that characterize social life, but that how they can deal with this

depends not just on individual capacities, but also on the interactions they engage in" (De Jaegher 2013, 2).

4.1 Autism, Mutual Responsiveness, and Sexual Activity

If good sex (or at least good-enough sex) as an intercorporeal dialogue depends precisely on a mutual responsiveness to the constantly shifting, negotiated meanings and emotions expressed through our bodies (see section 3.2), then it seems that to varying degrees sex may pose its own unique set of challenges for persons on the autism spectrum. Indeed, as Opal Ousley and Gary Mesibov point out, this is not only because people on the autism spectrum tend to "have difficulties interpreting the emotions of others" but also because "they are not understood easily because of the idiosyncratic ways in which they express their emotions" (1991, 447). As such, autistic people are reportedly not only at greater risk of being accused of socially unacceptable behaviour in precarious sexual contexts but they are also at a heightened risk of being the target of sexual abuse (cf. Mehzabin and Stokes 2011).

The challenges and risks of the misinterpretation of social cues have motivated Temple Grandin, who believes that autistic people "rarely succeeded in dating or having sexual relationships," to opt for a life of celibacy (Sacks 1995, 285). A more diverse picture of intimate relationships among autistic adults emerges when we turn to other personal testimonies, such as Wendy Lawson's who stresses that although it was once believed that "individuals with autism were not interested in couple relating or that they were not capable of sustaining long-term couple relationships," that "perhaps as the idea of an autism continuum developed and autism was no longer seen as a narrow category of disability, but included more able individuals, the concept of non-relating changed" (Lawson 2001, 72). Nevertheless, she simultaneously adds that her social relationships tend to be based less on mutuality and more on "what I need" and that she has "tended to form over-attachments or no attachment at all," as "Getting the balance 'right' is rather a difficult task when one's sense of self and of other is confusing, scattered, fragmented and incomplete!" (Lawson 2001, 71).

Throughout the personal testimonies and research that we have encountered, one point of agreement that seems to emerge is that although intimacy and sex with others seems to pose heightened challenges for a considerable number of autistic persons, sexual desires themselves, including the desire to have those desires fulfilled through forms of sexual interactions as opposed to through masturbation, are not absent (See Grandin in Sacks 1995; Mehzabin and Stokes 2011; Pearl-

man-Avnion, Cohen, and Eldan 2017). It is widely acknowledged that, generally speaking, pursuing the desires that stem from one's sexual identity are integral to one's flourishing as a person (cf. The Declaration of Sexual Rights of the World Association for Sexual Health). A widespread exclusion from this area of social life amongst autistic people is thus both psychologically and ethically disconcerting. In fact, if Shiri Pearlman-Avnion, Noa Cohen, and Anat Eldan are right, then the troubling consequences of this could be socially pervasive. They suggest a link between developing and exercising the social skills involved in achieving intimacy and responsiveness in sexual settings, and social skills more generally: "Intimacy and a healthy sexual life may improve an individual's quality of life, facilitate participation in society, *and provide opportunities to learn social skills in multiple domains, including but not limited to that of sexual functioning*" (2017, 280, our italics). It seems all the more important, then, to find ways to make this dimension of sociality more accessible to those persons on the autism spectrum to whom the characterization above applies. Could sex robots play an emancipatory role in this? Though a well-rounded answer to this question requires further research and robust stakeholder analyses, we build off our analysis of the sex robot's peculiar embodiment to offer two suggestions here as to why we think this could indeed be a possibility.

4.2 Sex Robots as an Emancipatory Aid for Some Persons on the Autism Spectrum?

First, it is helpful to point out that technology already plays an important role in facilitating many autistic people with connections to the social world from which they might otherwise feel cut off (cf. Mussies and Maliepaard 2016) We can, again, turn to Temple Grandin for a concrete example. When Grandin seeks refuge from the sensory overload and disorientation that she, like many other autistic people, experiences, she crawls in her self-designed "industrial compressor," which she also terms her "squeeze machine." This machine can "squeeze her powerfully but gently, in a hug like way, and in a way entirely controlled by her" (Sacks 1995, 263). It is here, in her squeeze machine, that Temple feels a connectedness to others. As Sacks puts it: "She feels that the machine opens a door into an otherwise closed emotional world and allows her, almost teaches her, to feel empathy for others" (1995, 264).

Grandin's squeeze machine contributes to a feeling of order and calm in a world that is otherwise often felt as chaotic and causing sensory overload. It seems fair to propose that a crucial source of this sense of chaos is the presence of other

people, whose bodily gestures and expressions lack the kind of immediate perceptually available social meanings that they tend to have for "neuro-typicals." To feel overwhelmed and disoriented by, and alienated from these expressive meanings because the interpretation of them may require painstaking inferential activity, could make sexual interactions with human persons an overwhelming ordeal fraught with heightened levels of riskiness. The expressive bodies of sex robots, by contrast, are much more restricted in scope and fineness of grain. And with that, they are more palpable, less ambiguous, easier to interpret.

One possibility that this might open up is that sex robots could be used as a means for the development of intercorporeal-dialogue skills. If Pearlman-Avnion, Cohen, and Eldan are right in suggesting that the social skills characteristic of sexual intimacy and interaction are not domain-specific but can translate into further dimensions of sociality, then perhaps sex robots designed to gradually expose their users to increasingly sophisticated levels of bodily expressivity would, in some cases, not undermine but precisely promote human-to-human sociality. Whether sex robots could play this 'educational' role in a process of embodied social-skill acquisition that ultimately promotes more successfull human-human reciprocal interaction seems important to explore given what we noted earlier, namely that a desire for connection to others and a desire to have one's sexual desires met through intimacy with others seem decisively present in people on the autism spectrum who currently have trouble participating in this stratum of social life.

At the same time, we want to caution against the idea that sex robots could achieve their social-ethical legitimacy only insofar as they could play this "educational," or "scaffolding," role. Endorsing such an outlook could reflect a strong normative stance on sex that both prioritizes and romanticizes the image of dyadic human-to-human love-making and that inadvertently views other modes of sexual interaction that deviate from this norm as 'less than.' As Rebecca Koller emphasizes in a reflection on autism and sex education: "Those wishing to provide sexuality education for this population must first examine their own attitudes, values, and motives" (2000, 133. See also Mesibov 1985, 7).[16] Following this line of thought, we think it is important to take seriously proposals like the one offered by Martine Mussies and Emiel Maliepaard who, in a manner that aims to widen our understanding of the variations of human sexual desires and interactions, present "robotics as an opportunity to fulfill dreams (including sexual lusts) in situations where it would be biologically difficult or, sometimes, impossible" (2016, 93).[17]

Unlike real living beings, sex robots, like Grandin's squeeze machine, are entirely within the user's control (in discussing her squeeze machine, Grandin men-

tions this quite explicitly as an important feature of the machine's functionality). This points to a second feature of the sex robot's peculiar embodiment that could be beneficial in the context of autism. We tied an element of unavoidable risk in human reciprocal interaction to the fact that a) human-to-human intercorporeal dialogues are by definition unscripted and contain the possibility of encountering the other in her spontaneity and autonomy and b) we tied the riskiness of reciprocal human interaction to the existential vulnerability and exposure that goes along with being a bounded skinned being.

When all goes well, this vulnerability and exposure is, as Bernstein suggested, celebrated in sex. But, as we also just saw, the risks of pursuing such celebration can be elevated to disconcerting levels in the context of autism because of the mis-matches more likely to occur in inter-corporeal dialogues. Because the sex robot is neither an existentially bounded being (its own self is not at stake in its 'skin' being touched by another) nor capable of drawing her user into a truly unscripted dialogue (the sex robot is at bottom still a tool under its user's control), we wager that this could open up important possibilities for sexual exploration not just for some autistic persons but also, say, for persons attempting to recover from certain forms of sexual trauma.

4.3 The Emancipatory Role of Sex Robots beyond Persons on the Autism Spectrum?

With respect to autism specifically, it is far too premature to tell whether sex robots can play a fruitful role in scaffolding the skills of bodily responsiveness that are typically deemed so important in sexual as well as more general social settings, whether sex robots can simply be valuable *in themselves* (without having to play a 'scaffolding role'), and whether the use of sex robots can indeed play an emancipatory role in the pursuit of human flourishing. Since autism is so emphatically a spectrum 'disorder,' these questions do not allow for homogenous answers, nor could they begin to be answered responsibly without hearing from persons on the spectrum themselves. Any future research conducted in the pursuit of these questions must, thus, ensure proper involvement of direct stakeholders and be deeply mindful of the dangers of depicting autistic individuals as one uniform cohort and of contributing to any further stigmatization of autistic individuals. Nevertheless, as Prianka Mehzabin and Mark Stokes stress, "there is a great need to understand the sexuality of these individuals and how better to serve them in areas related to this domain as this area is largely overlooked in research and practice" (2010, 619).

This lacuna, paired with the lack of safe and responsible sexual service providers dedicated to the disabled community in the world, suggests that the academic community should engage in further empirical work to assess whether there is in fact an interest in this technology for members this community, and to explore its potential for good and bad. We suggest our notion of the restricted bodily expressivity of the robot and the removed element of existential risk that is so unavoidably present in sexual interactions between two (or more) bounded living beings as useful parameters for the future ethical and empirical research needed to be carried out in this area.

Further to the discussion of the benefits of sex robots for certain demographics at certain moments in their life, a consultation document published by the Foundation for Responsible Robotics in 2017 suggested the potential for this technology to be used by elderly persons and persons with various disabilities. Accordingly, in view of the philosophical analysis presented in this paper we may speculate that the restricted bodily expressivity of a sex robot may be beneficial for other demographics who are vulnerable for reasons other than living on the spectrum, perhaps they are "disabled, elderly, disfigured, ugly, or socially or sexually inadequate."[18] Exploration of these applications are in the very early stages. Recent work of Ezio di Nucci (2016) explores, among other things, sexual rights for elderly and disabled persons through a discussion of sex robots. In listing the Declaration of Sexual Rights of the World Association for Sexual Health[19] he addresses sex rights and the idea that sex robots for elderly and disabled persons may help satisfy these rights. In contrast, early thoughts from the disabled community question whether the suggestion to use sex robots for the disabled is a move to legitimize this innovation steered from the porn industry: "People pitching these robots are trying to validate their creation,"[20] or as a disability ephemera (a little person sex doll as a collectable, as discussed on the BBC podcost "Ouch"). As seen by the divergence in opinions, more research is needed to understand whether or not this is acceptable and would be accepted.

5.0 Conclusion

Sex robots, as a class of social robots, are intended to be interwoven in one of the most intimate and complex areas of embodied social interaction. While the design of sex robots is still in the early stages we suggest that analyses of sex robot embodiment will increase in significance for this industry. We may go so far as to say that bodily expressivity for sex robots will be the defining feature of a successful sexual social human-robot interaction. This places great weight on the meaning

of bodily expressivity as understood from human-human interactions. Thus, we answer the question posed in the title of our paper ("How the Peculiar Embodiment of Sex Robots Will Matter") by pointing to the philosophical discussion presented in this paper and conclude that: (1) designers will be using this for future prototypes, and (2) it serves as a tool to open the discussion for positives to sex robots along with the projected negatives. More importantly, it presents a starting point to justify how and why sex robots might pose as a benefit to marginalized and vulnerable demographics.

Our preliminary conclusion—that the benefits and the downsides of sex robots reside in the same capability of the robot, its restricted expressivity and lack of existential bodily boundedness—demands we take stock of future developments in the design of sex robot embodiment. Given the importance of evidence-based research pertaining to sex robots in particular, as reinforced by *Nature* (2017) for drawing correlations and making claims, the analysis is intended to set the stage for future research. Coupled with the incredible speed at which the technology is developing we believe now is a crucial moment to engage in philosophical reflections on the meaning of sex robot embodiment as a source for human–sex robot studies in the future.

Notes

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1. No seniority of authorship is implied by the order of names; this paper is the product of a true and entirely equal collaboration.

2. There are various definitions of social robots on offer from both the technical and the social domains. Kerstin Dautenhahn and Aude Billard (1999) proposed one of the earlier definitions: "Social robots are embodied agents that are part of a heterogeneous group: a society of robots or humans. They are able to recognize each other and engage in social interactions, they possess histories (perceive and interpret the world in terms of their own experience), and they explicitly communicate with and learn from each other." Adding more detail to what the 'social' is referring to, roboticist Cynthia Breazeal outlines four classes of sociality with robots, where robots can be "Socially evocative," possess a "Social interface," be "Socially receptive," and/or be "Sociable" (Breazeal 2003). (For a comprehensive look at various definitions and design paradigms related to social robots, please see Breazeal 2002 and Fong, Nourbakhsh, and Dautenhahn 2003.)

3. https://campaignagainstsexrobots.org/.

4. Robot ethics deals with issues of robots for environmental protection (Van Wynsberghe and Donhauser 2017; Sullins 2012), the dual-use nature of robotics (Van Wynsberghe and Nagenborg 2016; Lin and Abney, 2011; 2017), and/or how to build robots for various sectors in a responsible manner, one that incorporates ethical reflection in the very design process of the robot (Van Wynsberghe, 2013; 2016) among other things (Lin, Abney, and Bekey 2011; Lin, Abney, and Jenkins 2017; Sharkey and Sharkey 2011; Calo 2011; Sullins 2012).

5. Robophilosophy was first defined by Johanna Seibt in 2014 as "philosophy of, for, and by social robotics" (Seibt 2017, 390), constituting "a new area of interdisciplinary and experimental philosophy"; as Marco Nørskov elaborates, the contributions of robophilosophy "bring into play a wide range of philosophically related strains of thought with the ambition of opening up future discussions that feed back into theory as well as praxis and go beyond applying existing philosophical theory to robotics phenomena" (Nørskov 2017, xvi). As such, robo-philosophy builds on and uses multiple fields of study in its own initiatives including but not limited to psychology, human-robot interaction (HRI) studies, robo-ethics, mechatronics, and Artificial Intelligence (AI).

6. For more information on sex robot companies, please see the consultation document of the Foundation for Responsible Robotics: https://responsible-robotics-myxf6pn3xr.netdna-ssl.com/wp-content/uploads/2017/11/FRR-Consultation-Report-Our-Sexual-Future-with-robots-.pdf

7. For more on this discussion see https://www.inverse.com/article/36055-best-sex-doll-robot-tpe-silicone.

8. For more on this, see the Foundation for Responsible Robotics consultation document "Our Sexual Future with Robots," https://responsible-robotics-myxf6pn3xr.netdna-ssl.com/wp-content/uploads/2017/11/FRR-Consultation-Report-Our-Sexual-Future-with-robots-.pdf.

9. Shyness and coyness can be considered social "self-conscious affects," that is, they are "those feelings and reactions in the engagement between people which arise from being seen or known by another person (or being thought to be seen or known); they arise from the visibility of one's self to another" (Reddy 2008, 126). The display of such emotions in sex robots could further contribute to a user's sense (likely in spite of him/herself) that their sex robot is indeed a social, self-conscious being with an inner life of her own.

10. Realbotix is looking at integrating artificial intelligence into their applications through a "cloud based application that can run on a tablet or smartphone that will allow a user to create a unique AI personality" (Sharkey et al. 2017, 32)

11. We thank an anonymous reviewer for encouraging us to include Morrison, Löken, and Olausson's (2010) insights.

12. Morrison, Löken, and Olausson (2010) point to similar conclusions with respect to the experience of touch, citing research that shows "that individuals from two countries, the US and Spain, were able to discriminate different categories of emotion on the basis of *how* someone touched them" (307).

13. To build support for the idea that these intercorporeal dialogues reflect a mutual recognition of and investment in the other's emotional expressivity and intentionality, Lynne Murray has constructed an experiment in which a mother and her infant are interacting with each other through a double TV monitor (discussed in Reddy 2008, 75). At some point during the interactive process the infant is cut off from live interaction with its mother and is instead presented with footage of the same interaction that occurred just moments prior. While the infant continues to perceive its mother in her expressive engaged state (there is no sudden visible change in her behavior), the mother's expressions and intentions have lost their engage-ability. What is left are two separate expressive agents mutually visible to one another but without the possibility of responding to one another through turn-taking. The infant reacts with distress, thus indicating that it is not just the mother's bodily expressivity but the breakdown in the dialogical engagement that matters to it.

14. There are numerous other developmental psychologists who argue that by the time that they are two months old, human infants engage in proto-dialogues with their caretakers—dialogues whose currency is emotion (cf. Mary Catherine Bateson, Lynne Murray, Daniel Stern, and Colwyn Trevarthen, as discussed in Reddy 2008, 68–89).

15. *Disorder* has been placed in quotation marks here to signal that the characterization of autism as a disorder is not without controversy and has come under pressure from some representatives of the neurodiversity movement (Cf. Van Grunsven, forthcoming).

16. As cited by Koller, Mesibov warns that "because most autistic people will not form our society's traditional sexual unions consisting of marriage and a family, we must evaluate our feelings about possible alternatives, weighing the needs of autistic people for appropriate sexual outlets against the values and morals of society" (1985, 7).

17. We understand the notion of 'biological' here in a widely construed sense. It is not meant as an endorsement of a biological conception of disability.

18. This phrase was uttered in a letter written by an unnamed disabled man, published in The Observer (6 April 2003, as cited in Di Nucci 2016) and offers a touching account of the kind of suffering connected to unfulfilled sexual needs.

19. In 1999, the *World Association for Sexual Health* (WAS) adopted a *Declaration of Sexual Rights*. For more on this, see http://www.worldsexology.org/resources/declaration-of-sexual-rights/. In short, it identifies eleven different sexual rights and says that sexual rights are fundamental and universal human rights.

20. From the online BBC podcast "Ouch"; http://www.bbc.com/news/av/disability-41523849/can-sex-robots-help-disabled-people.

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