



The Making of Gendered Bodies in Human-Robot Interactions

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Abstract

With a growing curiosity in anthropomorphic robots, academics and interested parties have started to examine the ethical implications and social impacts of their (mis)use. Gender in anthropomorphic robots is a field that is slowly beginning to receive attention. Yet, its ambiguity has led to treating gender in anthropomorphic robots in a reductionist fashion, pointing to how stereotypical characteristics make certain gender identities and practices legible. I illustrate that the making of gendered bodies goes beyond the oversimplification of stereotypical readable gender cues. Thus, relational and corporeal ways of connecting people and technological artifacts can help to (de)construct the practices of gendering the human body and the body of anthropomorphic robots. This entails ‘alive genders’. By ‘alive genders’ I am referring to an approach which keeps understandings of gender destabilized and evolving. This not only brings awareness to the interdependence of the human body and the body of anthropomorphic robots but helps designers and roboticists to study the gendering of robots as a part of social practices.

Keywords Anthropomorphic robot · Body · Gender · Human-robot interaction · Relationality · Alive genders · Roboticists

‘Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect.’

-Chief Seattle, Duwamish

With a growing curiosity in anthropomorphic robots, industry, academics, and interested parties have started to examine the ethical implications and social impacts of their (mis)use. The UNESCO report on voice assistants and gender equality [1] offered a step toward highlighting the interactions and intersections of gender and technological artifacts. While gender in anthropomorphic robots is slowly beginning to receive attention [2], few researchers have explicitly engaged the concept e.g., [3–5], or reflected on how different disciplinary perspectives and understandings of gender affect research and scholarship e.g., [6–8]. It might be assumed that the meaning of gender is obvious. Yet, its

ambiguity has led many to treat the concept as though it were just physical traits that humans or algorithms can correctly read or send as signs of belonging to a particular gender category [9].

This approach to gender in anthropomorphic robots engages a reductionist stance that assumes stereotypical characteristics make certain gender identities and practices legible. According to the logic underlying this approach, robots designed with gendered anthropomorphic attributes elicit more enjoyable interactions as this contributes to stabilizing and meeting social expectations e.g., [10–12]. Alongside this formation, it has been suggested that the clearer the gender of the robot, the more accepted it will be e.g., [13–15]. Taking up these insights, I will illustrate that the making of gendered bodies goes beyond the oversimplification of legible, often embodied, gender cues.

Butler suggests that gender is not a biological quality nor a fact, but a social construction that is continuously (re)created. That is, gender is discursive and (on the way to being) performed [16]. From this theoretical insight, one can posit that it is insufficient to work only with fixed or static representations of human and robotic gendered bodies. However, in this paper I will also engage insights from some indigenous ontologies, specifically the Anishnaabe and Maori, that

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recognize interconnected relationships between a person and an object. Thus, I borrow from these Indigenous traditions of thought the notion of relationality in which human and nonhuman bodies are intimately entangled with one another e.g., [17–19] to explore how bodies are gendered and co-produced in human-robot interactions. I chose this theoretical framework as one of the purposes of this paper is to counteract the practice of isolating different ontologies from one another. Thus, I put in conversation Western and Indigenous literature to provide a space where they can coexist, inform one another, and provide new ways of knowing and understanding gender and bodies in and outside academia and the robotics lab. This is part of the spirit of inter and transdisciplinarity: to be able to share and learn from one another.

In this paper, I aim to make visible relational and corporeal ways of connecting people and technological artifacts as a means to (de)construct the practices of gendering the human body and the body of anthropomorphic robots. They are important sources of knowledge that have been trivialized, reduced, or silenced [20–22] when exploring the role and effects of gender in human-robot interaction. I start by discussing the origins of the word *gender* and its eventual evolution into a binary category. I next highlight how gender is experienced through the interdependence of the human body and the body of anthropomorphic robots. This entails ‘alive genders’. By ‘alive genders’ I am referring to an approach that maintains understandings of gender as destabilized and evolving. This not only brings awareness to relational bodies but helps roboticists and designers to study the gendering of robots as part of social practice. I employ the concept ‘alive’ to provoke my readers, and to prompt interrogation of the normative underpinnings attached to this concept. After examining how human and mechanical bodies mutually shape each other, I conclude with some reflections of my analysis on gendering robots. My aim in this piece is to raise questions rather than to provide answers.

The main contributions and arguments of this paper are threefold. First, in Chap. 1. *On the Origins of Gender and 1.1 The (Re)presentation of Anthropomorphic Robots: Reflecting on Gender as a Social Construct*, I engage with the notion of the body to think about the making of gender in anthropomorphic robots. I argue that human and robotic bodies are always physically present whether we want to see them or not. To think and feel with the body [20–23] allows us to reflect on our own gendered experiences but also on how our understandings of gender are shaped and negotiated while interacting with technological artifacts. Second, in Chap. 2. *Inside the Binary Body of Anthropomorphic Robots*, I center on relational knowledge of the human and the robot as a framework of co-production and a

way of being accountable for the gendering practices of (re)presenting bodies. Acknowledging that the human body and the body of the anthropomorphic robot exist in relationship to each other helps us to perceive non-cognitive information where multiple symbolic forces, like gender, are (re)constructed and (re)inscribed. For example, being open to relational and corporal knowledge opens the possibility of reducing the design of robots gendered stereotypically and in binary forms. This could orient the design and tasks of robots towards what is called gender neutrality in robots [24, 25]. Third, in Chap. 3. *Human and Robotic Bodies as Sources and Objects of Gender Knowledge*, my work suggests a different way to approach gender in human-robot interactions. Instead of treating it as a simple or isolated variable, I propose to examine the true social in robotics by observing how gender becomes alive in one-on-one encounters where the human body meets the body of the anthropomorphic robot. This provides relevant insights into how gender is understood and (re)presented in bodies. Finally, I conclude by suggesting some implications of designing with alive genders for the field of human-robot interaction research.

1 On The Origins of Gender

Even as it discretely shapes human experiences by influencing body image, skills, and identities without us being fully aware of it, gender is not ontologically pre-existing. Understandings and conceptualizations of gender shift historically and are context specific. The word *gender*, as it is used in the Western academy, derives from the Greek *genos* that refers to family, class, sort, kind, or breed [26, p. 8]. In the eighteenth century, the botanist Linnaeus suggested a system to classify plants according to the number and position of the stamens or ‘husbands’, and pistils or ‘wives’, as he called them [27]. This sexual system gave birth to the classification *genus*, or *genera* in plural, that clusters closely related species. Later, during the 1950s, the term *gender* was ‘coined’ by the sexologist John Money whose intersexuality theories served to justify sexual reassignment surgeries on children to make their bodies conform to social ideas of male/female categories [28, 29]. As such the term *gender* ‘originated’ in the biomedical field as part of Money’s and Stoller’s clinical practices, separate to how it was adapted by feminism.

Thus, before the feminist movement adopted the term, *gender* was described in relation to psychological and biological phenomena such as the way the brain system shapes the behavior and the gender identity of a person [30]. With De Beauvoir’s formulation ‘one is not born, but rather becomes, a woman’ [31, p.267], *gender* was linked with social constructions of how one should behave (*gender*

roles) and power structures. Gender became not a direct result of one's sex, but rather a concept within which being a woman was defined by the experiences of men. That is, women were presented as the Other while men were the subject and 'the absolute' [31, p. XIX]. Oakley [32] notes, as well, the ways in which sex and gender are sometimes thought of as distinct: physiology (sex) is to female, male and intersex while social and cultural forces (gender) is to masculine and feminine. This contributes to the idea that gender aligns with one's sex, but as Delphy [33] later suggested, sex does not explain gender, rather gender creates sex, a conversation which erases the distinction between the biological and the social. More recently, Scott [34] has pointed out that language is a tool for analyzing gendered power asymmetries. She further explains that language is much more than words but is rather networks of meaning that create reality and materialize gender in paper.

1.1 The (re)Presentation of Anthropomorphic Robots: Reflecting on Gender as a Social Construct

With the social constructivist stance, gender together with sex became a social and cultural construction. According to Butler [35], gender is a relational social construct that is enacted through the continuous 'stylized repetition of acts' (p.179). Through this repetition of acts, bodies take shape and become a matter of gendering. Butler's work discusses how bodies are enabled through a constant set of gestures and actions that reiterate heterosexual norms. This construction of the body is not only applicable to humans but can also be employed in robotic bodies. This is the case of the robots Mitri and Mitra by Invento Robotics. Mitra, the first humanoid assistant of the startup, was initially designed to be gender-neutral [36]. This meant a body composed of a head that would turn to look at people, a touch screen on the torso, and wheels instead of legs, but no 'gender cues'. However, as in the case of Robota that was gendered as female due to the lack of a robot that could meet the required male features (30 cm height minimum and rigid body) [5], Mitra was co-incidentally seen as a male robot agent. This rapidly changed when people started to associate the profession of assistant with female roles, an impression that contributed to the perception of Mitra as non-conforming within gender norms. Thus, Mitri, also known as Mitra's younger sister, was later designed for meeting the gender expectations of an 'appropriate' robot assistant that could offer comfort to those around her through her female virtues, like decoding people's mood and cheering them [37], whereas Mitra is used at a car-dealership [36].

Within the logic of gender performativity, bodies are cultural foundations intertwined with discursive and symbolic practices aligned within a heterosexual matrix. This

suggests that gendered bodies become culturally intelligible when they are spatially and temporally ordered through a heteronormative discourse. According to Butler [35], gender is not something innate but an action that demands a 'doing' which is often related to repeating 'oppressive and painful gender norms to force them to resignify' [38, p. 84]. For instance, consider how the language of "do feminine woman" and "do masculine man" is all tied to the idea of gendering robots in ways that is easy to decipher [39] which is, in turn, connected to gender norms and reinforcing stereotypes. This practice of 'doing' not only can be seen as a method that some roboticists follow to justify their gendered technology but also gives meaning to gender. That is, gender is naturalized through the repetition of bodily acts. As Pillinger [4] states:

It appears that a lot of literature and research deals with gender aspects in human robot-interaction. As described earlier, it mostly deals with differences in acceptance of 'male' and 'female' robots, whatever this should mean, or the acceptance of 'males' and 'females' of robots. These words are put in quotation marks to show, first, the degree of absurdity when saying that a robot is male or female, and second, that the literature works, for the most parts, within a gender binary (p. 10)

In the logic of neoliberal knowledge production in robotics and human-robot interactions [4], gender is used to produce publications and academic grants. There are hints of 'doing inclusive research'. Sometimes, gender is used as a wild card that substitutes for the notion of women. Or as Scott puts it, sometimes, the word gender does not denote power and inequality structures but pretends to express the 'scholarly seriousness of a work' [40, p. 1056]. Gender has been packaged into a *normal* way of knowing where bodies supposedly fit within a one size fits all approach, although now it has moved to a two size fits all approach. As I suggest elsewhere [41, 42], thinking with technology fails to be critical if there is no understanding of the historical and ongoing impacts that a 'universal' concept -like gender- has on technology and society. Thus, it is not the case that gender was not present in academic papers, but gender is tied to immobile notions. Following Cordero et al. [43] and Pillinger [4], I, too, point out that the way gender is being reported in human-robot interactions (HRI) does not reflect the complexity of gender considerations.

2 InsideTheBinaryBodyofAnthropomorphic Robots

Gender is a key coercive formulation in the traditional social scientific practice that prompts us to interpret potential ‘lack of fit’ as a form of logical impossibility. For example, the multiplying and endless requests to ‘select gender’ when filling in forms can propagate narrow understandings of embodied genders. ‘If you chose to create an account, you will be asked for your name, gender and profile image’ represents one of the countless methods of labeling and datafying bodies, where data has become extensions of gendered bodies. Technological artefacts are underpinned by stable notions of gender that structure human and material interactions. Aibo, the robotic dog of Sony that is no longer in production, is an example which shows how the gender categorization processes applies beyond the human. This robot used an app called *My Aibo* for setting it up and to ‘help you enjoy your life with aibo more comfortably’ [44]. Here, the user could choose the *sex* of the robot between *boy*, *undecided* and *girl*. After the initial configuration, when the *gender* or *sex* was selected, (the terms are interchangeably used by the manufacturer), it could not be modified. Sony’s website *Can I Set the Gender of My aibo?* [45] mentions that the *gender* selected by the user will be reflected just in the robot’s voice pitch and in the way Aibo moves but won’t affect its personality. Nevertheless, Aibo’s personality and tricks are defined by its imaginary *sex*¹ [46].

These binary identities may create exclusionary effects on some bodies, which is the reasoning that lay behind a campaign by primary school children who requested a Swedish toy-shop company, selling games and toy robots, to change the images in their catalogue for less sex-stereotyped pictures [47]. Within a structural approach, gender is made of signifiers linked with sexually dimorphic bodies that structure social practices of male/female and masculine/feminine [48]. That is, when attributing gender, genitals are invoked whether they are visible or not. For instance, generally, makeup and dresses signify that the body wearing them has a vulva and breasts, whereas suits and ties are related with a body with penis and testicles. In the case of robots, Robertson calls these anatomical characteristics ‘cultural genitals’ [7]. Thus, by changing the sex stereotyped photographs of the toy catalogue where girls are to play with vacuum cleaners and boys with robots, the company could have assigned new gender representations and symbols to

the above-mentioned toys [49, p. 44]. Another way of thinking about gender is, for example, as a signifier. Saussure understands that the mental image (signified) created when hearing a word (signifier), for example *he*, does not have a fixed meaning but is relational and changeable [50]. This suggests that the meaning ascribed to the words *he*, *she*, or *it*, is differential as it depends on its counterpart. As Robertson [7] notes, people attribute a different gender to robotic agents like Wakamaru depending on the context. Wakamaru is a yellow robot named after a samurai. It was designed as a “communication and companion robot for household use” [7, p. 23]. At first sight Westerns tend to gender Wakamaru as feminine due to its petticoat, whereas in Japan it has been male-gendered. In summary, like the primary school children observed, if robots are only (re)presented through binary configurations of men/masculinity and women/femininity, human and machine gender performances will remain immutable.

In some learning spaces within the field of human-robot interaction, gender has become a material or a constructed commodity. Gender labeling is increasingly categorizing our human bodies and the mechanical ones. On the one hand, we are told that when assigning human characteristics like gender to robots, our social reactions become similar to the ones performed in human-human interactions [51]. Yet, at the same time ‘social roboticists want to exploit the assumed human tendency of anthropomorphizing machines and interacting with them in a social way by shaping them either woman-like, like an infant or like a pet’ [5, p. 2011]. Gender through readable cues affects the self-(re)presentation of bodies. This is captured in the words of students at the University of Washington testing robots for domestic use:

‘(...) she’s slim and she has hair. She just has the human girl features about her’. ‘The feminine form is typified as being weak or fragile in some form, but really inviting and warm and more interactive. Whereas if it were a male robot and masculine design, then there’s a safety issue of, ‘OK. I gotta protect myself possibly’(...). No matter how simplistic or mechanical it is, a male robot just seems more... I don’t want to say competitive, but... I’m thinking of the word... A male robot would be not competitive, but it would be a challenge in some way.’ [52, p. 263]

Bodies reflect our imaginaries and expectations of gender as well. As Balsamo [49] argues, the engagement of gender through representations and symbols normalizes assumptions of what men and women’s bodies should look like, want, behave and be able to do. As Stacey & Suchman [53] state, gender has become a tool against which to ‘perfect

¹ This is what I found in a video where a user was configuring their Aibo. The app demands the user to enter a name for their Aibo and select its sex between boy, undecided and girl. When this is done, there is a legend that says “Sex affects to your aibo’s tricks and personality. You cannot change your aibo’s sex”. See “Aibo Setup & Naming My Puppy” <https://www.youtube.com/watch?v=HPzZDRly0w4>.

the feminine form, or indeed femininity as form' in terms of the degree of conforming to traditional male and female representation. However, I would also add that gender and bodies have become tools of (re)presentation. Static Eurocentric notions of gender are employed to sort bodies into opposing categories such as fragile/competitive, communal/agentive, affectionate/authoritative, delicate/assertive, and family-oriented/organized; in the process, most of the *neutral* characteristics come to stand outside of what is considered as legible. The concept of gender not only functioned to demarcate soft from hard skills in human bodies in the nineteenth century [54] -although it could be argued that it still prevails-, but now, it also structures the labor and capabilities of mechanical bodies. For example, some HRI studies suggest that activities that are normally reported as male, like transporting goods and handcrafting, are commonly perceived as more appropriate for male robots [55]. This has led roboticists to assign a gender identity to their creations at the design stage. This is the case of Alice, the robot girl that was initially designed for alleviating elderly people's loneliness [56]. However, as Wajcman [6] reminds us, the gendering of technologies is much more than the design and manufacturing process, it involves the appropriation as well by their users, and the discourses produced around them.

3 Human and Robotic Bodies as Sources and Objects of Gender Knowledge

Gender takes command of human and robotic bodies by programming them to embody and perform certain movements and expressions that contribute to gradually exhibiting stable gendered subjectivities. First, gender, as an alienated category of analysis, reduces or disrupts our attention on bodies and the relations between them. In everyday life, there is always a routine to follow, something to do, a place to go, or someone or something to interact with, and because of that bodies become developmental tools for performing these acts. In the process, these tools come into being as gendered bodies without us knowing it. We pay attention to bodies when they do not function nor perform as we expect or when they manifest non-conforming identities, movements, or behaviors. Within a pervasive tendency to cosmetically validate reductionist representations of gender [7], those parts of the body tied to 'gender cues' such as eyes, lips, hair, and voice are foregrounded. Yet, what about other elements that are ceaselessly co-producing bodies, like discourses e.g., [6, 35, 57], objects e.g., [18, 58, 59], relationality e.g., [17, 60, 61] and embodied practices e.g., [19, 22, 59]? Amid easy-to-decode gender traits often engaged in design, these invisible 'parts' of the body are rendered unacknowledged.

In a dominant culture that privileges coherent gendered bodies, gender is created through repetitive acts that are reproduced by bodies and eventually normalized in language, culture, and the symbolic representation dimension [16]. As bodies navigate spaces, they become 'objects' to be serviced toward the ends of materializing identities that matter, which are also known as hegemonic forms of gender. But an alternative approach would see bodies appreciated as active knowledge agents. That is, by acknowledging the importance of bodies as sources and objects of gender knowledge we can begin to recognize that human bodies and the bodies of anthropomorphic robots are dynamic actors constantly in the process of being constructed or materialized.

I suggest that to bring awareness to the human and anthropomorphic body of the robot in the learning of human-robot interaction, we need to be emotional agents, be responsible for how we interact with technological artifacts, as well as how we use our own agency for understanding our past, constructing our present and imagining our future through symbolic representations, and be open to embrace more than human-to-human relations. *How can we (re)imagine and (re)(de)construct bodies? How can we embody 'alive genders' in human-robot configurations?*

First, we must question the ethical, ontological, and epistemological foundations of knowledge production that privilege a 'straight line' notions of gender. For example, design practices that privilege the quantification and evaluation of gendered bodies of anthropomorphic robots exclude sensory forms of knowing that go beyond the sight. Being sensitive to things that we might have taken for granted before like spatial layout, body weight, our reactions and movements when interacting with a robot, and even the conditions of in the wild and control studies, among others, enables us to consciously focus on human bodies and the bodies of anthropomorphic robots. Attending to the agency of spaces and objects makes us aware of how we, as humans, enter into an entangled relationship with the material world where it is possible for human and robotic bodies to feel and reveal other agencies. The human-technology relation has been studied in HRI [62], but some indigenous studies literature, like Anishinaabe and Maori, have also long been engaged in conceptualizations of non-human agency and relational realities [63]. Deloria [60], an Indigenous thinker, suggests that our relationality with non-humans is also moral and intimately personal, rather than just practical and epistemic. This implies that 'all activities, events, and entities are related, and consequently it does not matter what kind of existence an entity enjoys, for the responsibility is always there for it to participate in the continuing creation of reality' (p. 147). For instance, bringing awareness to the corporeal allows us to inhabit the here-and-now and realize

that the key to knowledge does not reside on ‘universal’ or ‘readable’ ‘cues’ but to recognize the relational character that one has with a particular robot or a particular machine. This ‘living reality’ is particularly salient for (re)imagining bodies in human-robot interactions. Hirofumi Katsuno, in his work on the Japanese concept of a robot heart, [64] highlights this point:

‘The sense of the robot’s heart or *kokoro* emerges through two distinct but interrelated processes of ‘touch’: (1) the private process of tinkering in which robot builders replicate humanity in robotic form; and (2) the public process of exhibiting robots that touches the hearts of the audience at spectator events. In these dialogic modes of engagement, both robot builders and audiences come to develop intimacy with the robot (or ‘feel the heart in the robot’) through a web of touching rituals both physical and emotional. This anthropomorphic practice of robot-making creates an endless hermeneutic circle; it draws together subject and object, original and copy, creator and created, and watcher and watched, ultimately reconfiguring participants’ senses of their own *kokoro*. (...) It is out of this dialectical conjunction of materiality and humanity, an act of simultaneous exteriorization and internalization, that the robot’s heart emerges.’ (p. 94)

Being sensitive to learning is key to incorporating and enacting relational accountability into the practices of (re)presenting bodies. Getting into closer connection with knowledge by being aware of our relationship with the self, with mentors and supervisors, with peer scholars and bodies of literature, with friends and family, with the broader community and future generations, with robots and with technological artifacts, these are some practices through which we, as academic researchers and/or roboticists, can integrate ‘new’ ways of examining gender and recognize the alive processes where the human body and the body of anthropomorphic robots become gendered. In this sense, we locate ourselves and become aware of our potential biases, what we know and how we know it; see Absolon [65] and Kovach [66] for this debate.

Unlike in many Western theories of knowing and ‘constructing’ bodies (e.g., social constructivism, poststructuralism, qualitative observations), non-human agency and more than human-to-human relations are taken as given in some Indigenous ontologies like Anishinaabe and Maori; see Jones & Hoskins [67] and Rosiek et al. [68]. The entanglement with each other is characterized by a relational accountability through research and learning. This implies that when we, as academic researchers, acknowledge the human and mechanical body, we become aware of ourselves in relation.

Change occurs in us and in the world that surrounds us. As Rosiek, Snyder & Pratt [68] point out, ‘the question before us, therefore, is not just how the object of our inquiries is understood differently in our inquiries, but also how are we ourselves becoming different through inquiry and how our relationships with the other agents in our inquiries are transformed’ (p. 336). Non-Western philosophy sees sensibilities of objects and humans as keys to an exploration into deeper understandings of reality. For instance, in Japan, the bond between the roboticist and the robot starts from a way of relating that evokes feeling and embodiment, long before they physically interact [69]. To this end, questions such as *how the robot would interact, what types of tasks would it perform, what do I mean by gender, how do I envision my gender, gendering bodies for whom and by whom*, serve to establish a bridge where the roboticist and the robot learn from each other, but also where understandings of gender emerge. This relationality and ethical accountability are not a one-time act and do not rely exclusively on inquiring about the material world. Rather, they suggest the need of making us active agents instead of observers, for being engaged in a continuous and reciprocal transformation [61, 68]. It is in this joint reality that bodies become visible, and we start to reflect on what gender is in robots and humans while experiencing *alive genders*.

Fostering intimate and particular relations with robots, as well as incorporating a space for ‘eloquent silences’ is important when seeking knowledge. Bodies as ways of knowing enable us to enact and interpret being embodied and the feeling of embodiment [70]. This suggests shifting the focus away from reducible categories and ideas of gender to being receptive to the particularity of alive genders. Such openness generates an enactment of reciprocity where we become part of co-shaping onto-ethical relations with humans and robots. Thus, some of the knowledge embodied during this practice cannot be expressed in words but is felt and interpreted at a particular human-robot interaction. As such, fleshy and mechanical bodies exist even if there are/were no words to assign nor describe their gender nor humans who know how to name nor categorize them. This entanglement is further elaborated in the words of participants in Glasgow interacting with Pepper:

‘With interacting with it, it didn’t seem like an inanimate object you know. It just seems like as if it was... well, I mean I knew it wasn’t a person, but it was like erm, I don’t know. And I knew it wasn’t human but I (...) we had this two-way interaction.’ ‘Well, you put yourself... it sounds ridiculous, but you put yourself in the robot’s shoes because they can communicate and they’re almost like humans. You know. I mean in terms of that way that they can communicate with

certain things, very kind of literal stuff, but they can't maybe have a deeper conversation ... so in a way it's a bit like having a child around, so it's that kind of thing where you're basically just (...) 'I'm big, (the robot) you're small' [71, p. 8].

These interpretations call attention to the myriad forms we can relate to technological artifacts and how human and mechanical bodies simultaneously influence each other. One Western theory of materialism, Baradian agential realism, refers to this as 'intra-action' [61]. This implies acknowledging the real consequences, interventions, creative possibilities, and responsibilities of intra-acting within and as part of the world. [61 p. 37]. An example of the ethical co-production between human and nonhuman apparatuses is Lynx, the robot of Ubtech. Lynx is a humanoid robot companion powered by Amazon Alexa's artificial intelligence (AI). [72]. This means that while robots are normally composed of joints, sensors, and motors (hardware), they can also include AI systems like algorithms and training data (software). Thus, through human-robot interactions, mostly in the form of questions, Lynx learns from us at the same time that we learn from it. Co-shaping becomes tangible when Lynx's technology generates a response to the user question and vice versa. For example, for the purpose of this paper, the author asked Amazon Alexa's artificial intelligence: 'what is to be feminine?' and 'what is to be masculine?' The responses obtained, respectively, were: 'here's something I found on the web: according to iresearchnet.com, feminine traits, those characteristically associated with women, include helpfulness to others, gentleness, warmth, and emotionality' and 'here is something I found on the web. According to cambridge.org, to be masculine means to embrace your true self and live it authentically'². As such, this begs the question, 'how are we to be ethically responsive to the other agents that emerge with our own agency in the inquiry, as well as to others affected by these emergent agencies?' [68, p. 336].

Thinking with the concept of "alive genders" is about focusing on feeling relationships, not about being stuck on dualistic notions of male/female, mind/body, human/robot, but being open to understanding the sentience of human and robotic bodies. Hence, we must reflect on the notions of gender that underpin research and knowledge production.

² These were the responses that I received from the Amazon Alexa app when asking "what is to be feminine" and "what is to be masculine". This is the same answer when asking Google Home. The co-production between the user and the technology of the robot is also present throughout Alexa Answers. Alexa Answers is the community where any user with an Amazon account can provide a response to a question that Alexa could not respond so that next time, it could go live and be shared by Alexa. See <https://alexaanswers.amazon.com/help/GG42MLLJCSREQHM8>.

Dominant approaches in human-robot interactions suggest that 'robot gender' is mostly defined by the category of male, female or neutral, whereas 'human gender' looks at how the gender of a person influences their reactions towards robots [73]. Most of these perspectives are centered on perfecting the body of the robot while cataloguing it as an object without agency. Furthermore, the researcher is positioned as 'knower' observing from the outside the human-robot encounter without affecting their relationality and (re)presentations [74]. Thus, by limiting the researcher's role and delimiting the (re)presentations of mechanical bodies to gender normativity, bodies indeed become "legible" to some audiences, but other possible interpretations and embodied experiences are relegated to the periphery. Garroutte and Westcott [57] note:

'As researchers in the new field select different analytic tools, our remarks suggest that they should not make choices without realizing that these will affect what their stories can do: those stories' ability to evoke realities and to illuminate possible lives' (p. 76).

I still struggle with "alive genders" when talking or writing about human-robot interactions given the dominance of 'readable' genders and Western individual and universalist perspectives unleashed by the lack of spaces 'where objects can express their vitality—or, at least, where humans can experience their (objects') vitality' [67, p. 78]. Nevertheless, as academic researchers from gender, feminist technoscience studies, robotics, and AI, among others, we can engage in interdisciplinary and transdisciplinary conversations, to ask: what do *we* understand by gender in robots and humans? Who is *we*? Can *we* (re)imagine bodies? Further research is needed for looking at the ways in which relational entanglements of humans and robots affect genders and bodies in a discursive and performative relation in and outside academia and the robotics lab. This could also open the door for discussing the practices of gendering robots performing different roles and sectors (i.e. in the hospitality industry, healthcare, etc.).

4 Conclusion

In a culture of (re)presentation, legible cues, and objectification, alive genders seem to be the opposite of what should be useful in research and knowledge production. Alive genders, which combines elements of Western thought about gender with aspects of some Indigenous understandings of the human world relation, is about nurturing spaces where a continuum of intimacy between a robot and a person could be experienced, and about acknowledging that the human

body and the body of the anthropomorphic robot mutually shape each other when we become feeling agents of our bodies and the bodies of robots. Interestingly, in Tojolabal, a Mayan language in Mexico, the term ‘heart’ advocates for a ‘we’ of complementary plurality between humans and non-human others where *k’ujol* (the heart) is the one that feels and thinks [75]. It is important to (re)consider how ‘knowledge, theories and ideas are only knots in the strands of relationality that are not physically visible but are nonetheless real’ [76]. That is, we need to be open to embody relationality and different understandings of agency to access the dynamic process where the becoming of bodies and gender come into existence.

I am suggesting that gendering anthropomorphic robots requires much more than reproducing stereotypes like gendered hairstyles and shapes. Consequently, (re)presenting the intangible experience of relationality between the human body and the body of anthropomorphic robots entails more than programming actions and tasks that match specific gendered preconceptions. Instead, if we were to focus on the intimate knowledge relation between the human body and the body of anthropomorphic robots, we could come closer to (re)thinking gender from its conceptualization to its design specification and commercialization.

5 Implications for the Field of Human-Robot Interaction Research

Thinking, imagining, designing, and even bonding with alive genders provide roboticists with different and alternative forms of developing knowledge about gender and anthropomorphic robots. It also involves rethinking gender and the process of feeling and gendering robots as relational and corporeal rather than as something universal or done by the book. However, it is also noteworthy that, beyond this article and body of literature, there are learning practices, values, and ways of knowing that inform and shape each of our experiences and understandings around gender and anthropomorphic robots. Thinking about gender and sensing it in humans and robots might differ greatly from body to body. In an attempt to shed light on how the notion of alive genders could be used in the field of robotics and human-robot interaction, specifically by designers and roboticists, I propose a few fundamental principles:

- Designing with alive genders requires roboticists and designers to welcome alternative epistemologies and methodologies. Specifically, it urges to acknowledge that the process of gendering the human body and the body of anthropomorphic robots is relational and corporeal. In so doing, it invites the human-robot interaction

community to challenge the ethical, ontological, and epistemological Western foundations of knowledge production that privilege immutable practices of knowing, seeing and being [68, 77].

- It demands rethinking the ways of building anthropomorphic robots. This means that rather than planning what a “typical male” robot needs to do and how it should look like, for example, there is a need for understanding the dynamic link between culture, social practices, and the material world [77]. In other words, it not only helps designers to reflect on the gender expectations that are built into the robot but helps them to see their active role in the social and cultural construction of gender and gendering robots.
- Alive genders asks the human-robot interaction community to find alternative ways to conceptualize and experience gender beyond the lab and heteronormative discourse. Thus, it requests human designers to acknowledge that gender goes beyond the “common ‘pink’ versus ‘blue’ simplifications” [78, p.1], but it is context specific and time sensitive.
- It calls for change in the ways of doing research in the robotic lab. This implies two things. To end experimental setups in which researchers first classify robots as male, female, and sometimes gender neutral for then assess them against the assigned gendered connotation [4]. The second case involves engaging in transdisciplinary collaborations to keep the meaning of gender and gendering robots moving.
- Thinking with alive genders demands forgetting what has been learned about gender and the process of gendering anthropomorphic robots. That is, designers and roboticists should be able to unlearn, learn and relearn as many times as needed what they think gender is in the specific context of their research.
- Finally, writing with alive genders involves counteracting the practice of prioritizing the publication of heteronormative observations, like male and female robots. The aim, instead, is to encourage the human-robot interaction community to reflect critically on their interpretations of results and look for findings that might constitute other understandings and approaches of gender. This means to value what sometimes is perceived as ‘inconclusive’ or not ‘valid’ results (from the scientific opinion) and be open to observe and report the plurality of alive genders.

Although these are mostly general recommendations, they can be used as inspiration to start changing human designers’ intentions, ideas, and expectations about gendering robots. Needless to say that, paradoxically, this can’t promise any absolute, simple answers. Or as Jagger [77] argues,

this ‘does not lead to the conclusion that the duality of sexual difference is in any way inevitable’ (p. 323). Thus, what responsibility do I have towards my readers and the human-robot interaction community regarding what the notion of alive genders is actually capable of? As a decolonial feminist researcher in the field of human-robot interaction and social robots, I am ethically motivated to avoid misleading my audience by making them believe that there is a one-size-fits-all method for thinking and designing with the concept of alive genders. Alive genders does not imply atemporal contexts nor intend to create universal pedagogies, or standard formulae for that matter. It certainly can’t promise tangible results nor can be reduced to measurements through which researchers assess the level of alive genders embedded in human-robot interactions and the design of anthropomorphic robots. Alive genders, as the name suggests, is a personal living journey of feeling, experiencing, doing, and becoming in the world.

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