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A Design Perspective

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Robot Citizenship: A Design Perspective

Abstract

This paper suggests robot citizenship as a design perspective for attending to the sociality of human-robot interactions (HRI) in the near future. First, we review current positions regarding robot citizenship, which we summarize as: human analogy, nonhuman analogy and socio-relationality. Based on this review, we then suggest an understanding of citizenship that stresses the socio-relational implications of the concept, and in particular its potential for rethinking the way we approach the design of robots in practice. We suggest that designing for robot citizenship (in the terms suggested by this paper) has the potential of fostering a shift from a logic of functionality to one of relationality. To illuminate the direction of this shift in design practice, we include and discuss three robot concepts designed to address and rethink present HRI challenges in the urban environment from a relational perspective.

Keywords

Citizenship; Design Practice; Urban Robotics; Human-Robot Interaction; More-Than-Human City

1. Introduction

Current technological advancements in the fields of Artificial Intelligence (AI) and robotics have stirred a lively debate about the nature of human-nonhuman relationships and how these may be regulated. In this debate, designers often find themselves caught in between sensationalist attributions of citizenship to humanoid robots such as *Sophia* [1], and more pragmatic initiatives that contemplate the attribution of legal personhood to robots, such as the European Parliament Resolution of *Civil Law Rules of Robotics* [2]. Attempts to regulate human-robot relationships through the typically human construct of citizenship as a congruent set of rights and responsibilities can also be observed in other, more mundane cases. The widespread and unregulated presence of delivery robots in San Francisco, for example, has raised a series of social concerns to which the city has responded with a strict regulation that limits the number of delivery robots moving freely around the city [3]. In contrast, the state of Arizona has responded to similar concerns by giving the delivery robots the same rights as pedestrians [4] as a way to make them comply with the same rules.

Although robots have yet to populate the urban environment *en masse*, unresolved challenges concerning their social desirability and responsibility [5-8] call for a deep reflection on what attributing citizenship to robots may lead to. This, in turn, compels us to rethink future urban environments as more-than-human entanglements of human and nonhuman entities and needs [9].

While a socio-relational perspective of human and nonhuman coexistence has gained attention in the field of human-computer interaction (HCI), mainly in research concerned with animals and plants [10-13], it has yet to make an impact when it comes to the design of human-robot interactions. This paper responds to this gap with a speculative investigation into the idea of robot citizenship. The paper first reviews the current debate on the topic of robot citizenship as it is underlined by three different rhetorical strategies: using human analogies, using nonhuman analogies, and pointing to socio-relationality. The paper then explores the implications of robot citizenship as an instantiation of the socio-relational perspective, and in particular its potential for rethinking the way we approach the design of robots in the urban context. In doing so, the paper attempts to move away from addressing citizenship normatively as a codified set of rights and responsibilities by proposing an alternative, complementary design perspective [14] meant to challenge and inspire practitioners to shift from a logic of functionality to one of relationality.

2. Robot Citizenship

Investigations of the social implications of robots through legal categories such as rights, personhood, and citizenship, have become increasingly frequent within academe [15-21]. In the following sections, we draw upon, and extend, existing work on the topic to describe three main rhetorical strategies through which the concept of robot citizenship can be approached: human analogy, nonhuman analogy, and socio-relationality.

2.1 Human Analogy

The first perspective is grounded in the idea that in the future, robots, especially when powered by AI, will become so sophisticated that they will be practically indistinguishable from humans in terms of cognitive abilities, sentience, and self-awareness. In such Blade Runner-like scenarios robots may be eligible for rights and even citizenship. An extensive argument from this perspective is provided by Marx and Tiefensee [18]. Although they remain skeptical about robots becoming fully sentient, they envision functionally equivalent states that would enable robots to perceive and preserve their “wellbeing”, making them worthy of protection as “moral patients”, as Gunkel [21] puts it. Similarly, due to their growing complexity and sophistication, robots may also be able to detect moral demands from other agents and, accordingly, behave responsibly. Because of such ability to hold both rights and responsibilities, Mark and Tiefensee [18] argue that robots may also become citizens.

Argumentation grounded in possible future abilities of robots, however, is often contested [21-23] because it relies on overvaluations of the actual capabilities of even the most advanced robots. In this sense, such argumentation reads more like science fiction than plausible foresight [23].

2.2 Nonhuman Analogy

An alternative perspective on citizenship that better accounts for current robots’ abilities is based on attributing citizenship to “useful” nonhumans. Kymlicka and Donaldson [24], for instance, discuss animal citizenship by focusing on the concept of domestication as a qualifying relationship. Domesticated animals, they note, can be seen as citizens because of their ability to regulate their behavior according to norms of civility (thus respecting the rights of other members), and because of their ability to perform their duties (thus providing a meaningful service for the community). Although criticized when it comes to animals [18], this argumentation can be applied to robots who fulfil the same criteria. There are precedents: rights were recently granted to nonhumans by virtue of their membership, contribution and relationship with the human community. The Whanganui river in New Zealand, for instance, was granted the same legal rights as humans after a local Māori tribe fought for its recognition as an ancestor and a contributing member to the welfare and wellbeing of the tribe [25]. As Forlano [25] explains, “by granting the river legal rights, crimes against the river can now be treated as crimes against the tribe”. Similar initiatives include the attribution of rights to the Ganges and Yamuna rivers in India [26] and Lake Erie in the United States [27].

However, attributing human legal rights to nonhumans may lead to open conflicts between the interests of the two, as in is the case of Lake Erie. The attribution of rights to the lake, in fact, generated a protest from local farmers who claimed that their rights (endangered by the impossibility of fertilizing their crops because of the protection of the lake) should be anteposed to the ones of the lake [27]. Despite the merit of accounting for the expanded nature of communities and of stressing the importance of contribution to a shared good, then, this perspective remains controversial.

2.3 Socio-Relationality

While both previous perspectives provide convincing, even if controversial answers to whether and how we could consider robots as citizens, we argue that addressing robots through a logic of rights and responsibilities only provides partial answers. As Coeckelbergh [22] argues in his discussion on robots and morality, by focusing on a robot's individual features, the rights approach does not account for how relations among entities and the social context itself contribute to changes in moral considerations. Instead, we could approach moral considerations from a socio-relational perspective [21-22] in which morality should not be seen as inherent to any single entity but rather as an extrinsic quality. What this means is that a robot should not be addressed as a moral agent or "patient" [28] per se, but as an object of moral consideration by virtue of its relations within a social context.

Accordingly, the socio-relational perspective goes beyond individual abilities, and accounts for the relations between the individual and the whole. In other words, attributing citizenship to robots should not be based on the question of whether robots are "like us", or "help us", but are "part of us" – a point also made by Marx and Tiefensee [18] in their account for citizenship based on robot sophistication, and by Kymlicka and Donaldson [24] in their discussion of citizenship for domesticated animals. Going beyond rights and responsibilities, a citizen, to be qualified as such, should be engaged with other entities in interdependent relations aimed at a collective welfare.

By firmly shifting the emphasis from a logic of rights and responsibilities to one of relations, then, this perspective reveals the need for a richer vocabulary (that would, for instance, help differentiate hard from soft rights [22]), or a completely new one that would enable us to account for the different forms of moral considerations that arise from new human-robot shared performances.

3. A Design Perspective on Robot Citizenship

The preceding discussion hints at how the concept of robot citizenship may help the HRI field to extend its interest from technical concerns to social ones, shifting its focus from pragmatic and technical challenges to topics like relationality and ethics. Given that current debates on robot citizenship tend to focus on normative questions and seek resolution in policy and regulation, a process that tends to react to technological developments instead of anticipating them, we suggest there is value in considering robots as citizens as a matter of philosophical and designerly speculation. In other words, we are not interested in offering legalistic solutions for the more-than-human city or a critical speculation on the near future, but in opening up a provocative *design space*.

By introducing the notion of robot citizenship in this way (in terms of relationality and not legality), we invite designers to look at emerging human-robot interactions not as a matter of individual robotic capabilities but as a matter of the relations among robotic and non-robotic entities. Discussing robot citizenship, therefore, invites designers to approach the design of HRI from considerations of the community, its values and shared goals, instead of from the individual robot's functional capabilities. Through this conceptual shift, considering robot citizenship may not only contribute to the ongoing discussion about meaningful future partnerships between humans and computational artefacts [29-33], but also contribute to a more holistic view of HRI. The question remains, *how can this conceptual shift be translated into actionable design strategies?*

As described above, approaching design from the perspective of robot citizenship asks us to rethink the performance of robots interdependently, and thus investigate the appropriateness of the relationships between robots and other entities instead of robots on their own. As summarized in Figure 1, the design space that opens up in response to thinking about robots as citizens requires that we understand how a robot

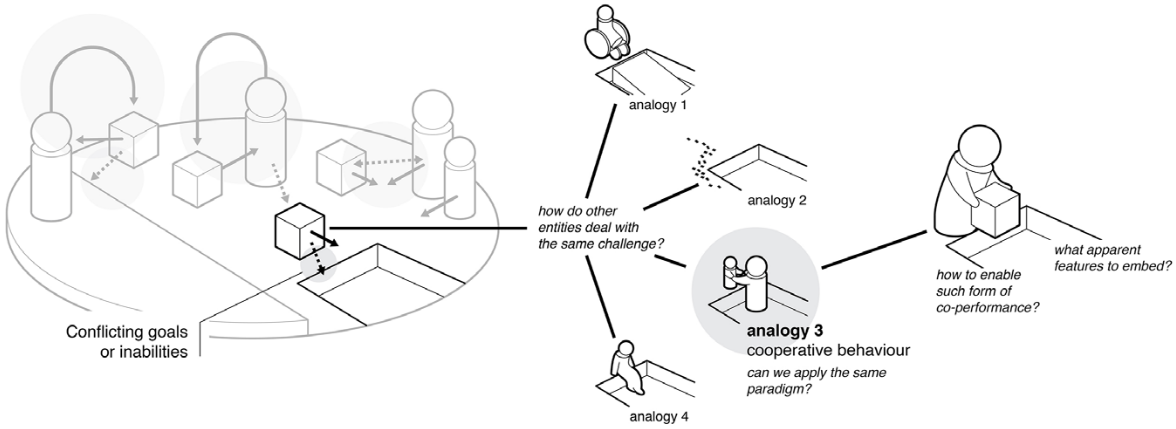

Fig. 1. Overview of the main principles involved when approaching robot design from the socio-relational perspective suggested by the concept of citizenship.

may enter into relation with both other entities and the environment. From this initial framing, then, it is possible to identify opportunities for meaningful and appropriate partnerships by reflecting on the possible roles that both human and nonhuman entities may be asked to perform together, on the basis of what Kuijer and Giaccardi [33] refer to as capabilities that are "uniquely human" and "uniquely artificial".

To this suggestion we add a specific perspective: instead of looking only at what individual entities are 'good at', we suggest considering what they are not good at. As Marenko and van Allen [31] argue, most current approaches to interaction design tend to be task-oriented and efficiency-driven, and therefore tend to produce specific narratives about devices as consistently behaving entities towards which people often build inappropriate expectations. By recognizing limits and coming to terms with unpredictability, and by suggesting narratives of "dumb-smart" [34] entities, designers can free themselves from the idea of designing for perfection and redirect their actions towards "ecologies of things that are mutually responsive and interdependent" [31].

Once they identify such inabilities, designers can explore how the same performance is successfully instantiated by other entities, as a way to envision possible design alternatives. Among these, we suggest focusing on strategies that communicate interdependency and may foster values that can be considered appropriate for human-robot interactions. This perspective helps us not only to pivot towards relationality and interdependence, but also to shift our focus to the extrinsic (rather than intrinsic) qualities of a robot that can enable appropriate forms of interaction. To do so, we need to understand what Coeckelbergh [22] calls "apparent features", according to which the features of a robot are not appropriate or morally significant on their own, but only by virtue of their interplay with other entities (much in the same way that "affordances" differ from technical features). Consequently, by addressing this socially constructed idea of appropriateness, designers are invited to *craft robot features that account for how these features would be experienced and judged by humans.*

In what follows, we illustrate the design space that opens up by considering socio-relationality as a key framing for HRI. We start with a brief discussion of urban robot challenges, and then present three robot concepts that illustrate how addressing robot citizenship can translate into tangible design strategies.

4. Urban Robots in Question

By approaching the design of robots from the perspective of robot citizenship, we developed three concepts for urban robots. These address real world challenges faced by designers of urban HRI, that were identified through interviews with five robotics researchers with expertise in autonomous navigation for unmanned ground vehicles (UGV) (a type of robot used in urban applications, e.g., delivery of goods). We started the interviews with a short introduction about the project and its objectives, stressing our interest in identifying what are the most pressing challenges in urban robotics. We then investigated further the emerging challenges through a focused review of related HRI literature. Then, for each of these challenges, we suggested an alternative approach to the problem by identifying potential cooperative strategies and envisioning apparent features that may facilitate them. We exemplify the concepts with illustrations that show a robot in a specific situation, communicating an implicit message, and provoking a desired response from humans.

4.1 Robot Challenges and Relational Alternatives

Our interviews with the roboticists helped us identify a small series of current urban robot challenges (see figure 2). These challenges include problems related to (1) the robot's need for *adapting to non-dedicated infrastructures* and related social norms, e.g. navigating sidewalks and adapting to pedestrians' speed and norms; (2) inefficiencies resulting from the need for *keeping safe distances*, as a way to appropriately navigate crowded areas and deal with the unpredictable behaviors of other entities; (3) issues emerging from the robot's difficulty of *being understood*, which may lead people to misjudgment and adverse feelings; and (4) inability of *being respected*, which makes the robot a potential victim of human malicious actions, e.g. hacking and bullying.

By reflecting on some of these issues and envisioning possible alternative approaches, we developed three concepts: the *Transparent Robot*, which responds to the issue of being (mis)understood; the *Handleable Robot*, which responds to the difficulty of dealing with non-dedicated infrastructures; and the *Shapeshifting Robot*, which addresses the challenge of keeping safe distances from others.

The Transparent Robot. This concept (Fig. 3A) illustrates situations in which a malfunctioning robot may be perceived as something mysterious and potentially dangerous, thus generating adverse feelings and attitudes in human bystanders. In fact, "if a robot is just standing somewhere looking as a generic box, without doing anything, people may think it's a bomb" stressed one of the interviewees. Common HRI strategies address this issue by preventing and detecting malfunctions with regular interval checks (e.g. [35]). However, this challenge may be reframed by considering the social environment the robot is part of, and relying on the human perception of the situation. Recalling existing practices (e.g., calling for assistance if an elevator breaks; calling the owner of a lost dog to bring it home, etc.), we suggest malfunctioning robots may be addressed not as a matter of manufacturer responsibility, but rather as a case of a community member in need of care.

From this perspective, designers may shift their focus from increasing efficiency to evoking empathy. One feature that may help facilitate this shift is the robot's

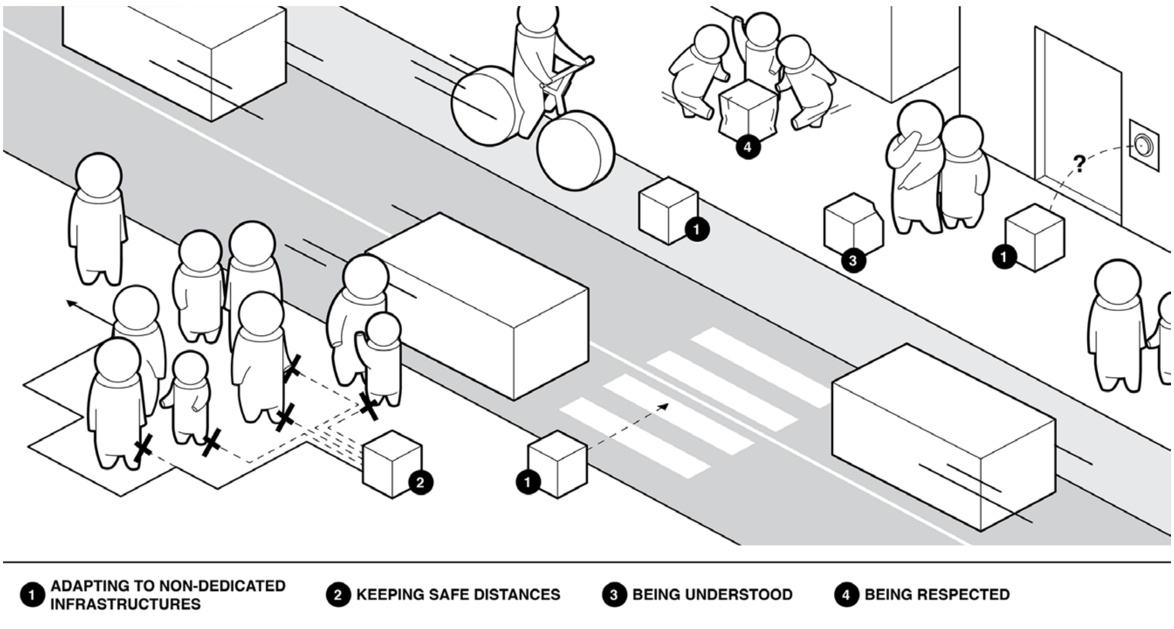

Fig. 2. Overview of urban robot challenges identified through the interviews with roboticists.

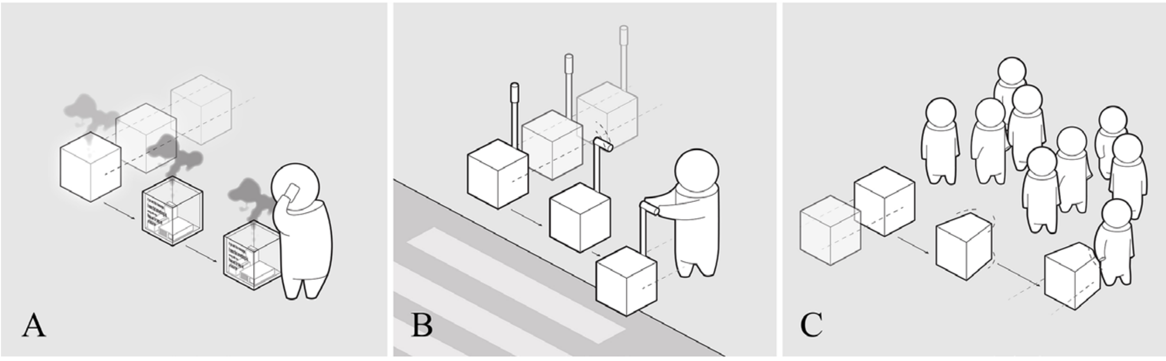

Fig. 3. Rethinking design challenges through relational strategies yielded three concepts (from left to right): the Transparent Robot (A), the Handleable Robot (B), and the Shapeshifting Robot (C).

appearance: changing its appearance from opaque to transparent (with or without additional symbolic elements), the robot can communicate its situation: *"Look what happened to me! I need your help!"* In this way, the challenge of human (mis)interpretation of the situation may become an opportunity to generate empathy and care.

The Handleable Robot. This concept (Fig. 3B) relates to the challenges faced by a robot when attempting to fit its behavior to non-dedicated urban infrastructure. In such cases, the robot's autonomy is strongly dependent on its ability to combine various skills like detection, prediction and planning. Take, for instance, the case of a robot trying to cross a street or a busy intersection on its own – a particularly complex challenge [36]. Within current HRI strategies, this challenge is addressed by improving the robot's autonomy and self-sufficiency – creating better environmental modeling and detection, and designing more sophisticated predictive algorithms. However, if we look at social encounters in similar situations, we notice that the same problem is often dealt with interdependencies generated by affinity and shared membership in the community. Recalling these existing social phenomena, then, we may consider the possibility of a robot's lack of autonomy as an opportunity to instantiate interdependent relationships. Much like children, elderly, or the disabled, robots may cross a street safely by joining a shared performance and relying on the abilities (and kindness!) of others.

When arriving at a crosswalk or needing to cross a busy street, the robot may communicate its need for help by producing a gesture that mimics the way humans reach for help by extending their hand to others. This might be achieved by rethinking the shape and purpose of the flagpoles that sometimes protrude from the robot's back. The pole, in this mode, can be used not only to signal the presence of the robot, but also to function as a steering device that indicates that the robot is flexible enough to be helped. Shifting the position of the pole, the robot implicitly says to humans: *"You can help me by handling me"*.

The Shapeshifting Robot. This concept (Fig. 3C) responds to the challenge of navigating a crowded environment, where the robot's difficulty to predict the behavior of a large number of moving agents (especially people) represents a very complex problem. Currently, designers try to solve the problem by developing algorithms based on a "preventive approach" in which the environment and other entities are detected, their behaviors are predicted, and the movements are planned for avoiding collision. Nonetheless, the complexity of the challenge and the insufficiency of current modelling efforts often lead to errors in navigation, harm to humans, or robots stopping in their tracks in order to prevent harm. As stated by one of our interviewees, "most of navigation algorithms are designed to be passive […] there is too much focus on prevention". This highlights how current design strategies do not relate to the social nature of the challenge they address. When we look at crowd behavior, however, we notice that it is often regulated by a series of tacit norms that go far beyond the desire to avoid bumping into others. From body gestures that enable a mutual understanding of intentions, to gentle physical contact, humans, as well as animals, adapt to each other. What we suggest, then, is to look at the robot as a constitutive part of the crowd and, as such, an entity that can enable such mutual understanding and gentle physical contact.

Providing a robot with a flexible soft shell, for instance, may mimic how humans acknowledge and interact in a crowd, sleekly squeezing and slipping through the crowd respectfully instead of parting it aggressively. Through these nonverbal behaviors, the robot communicates to its human surrounding: *"You can touch me as I go by, I'm safe and friendly".*

5. Discussion and Conclusions

The examples discussed above hint at practical implications of approaching robots not as tools but rather as members of a co-performing community. Subsequently, designers may be able to solve some of the challenges inherent to complex urban environments by designing robots that would be perceived, recognized, and tolerated as valuable members of the community. In this mode, the three concepts we describe above *replace self-sufficiency with interdependency; autonomy with mutuality; and a tool perspective with a civic sensibility.*

By considering the community instead of the individual robot's functional capabilities (or lack of), designers can gain a more holistic view of HRI, understanding a robot according to its embeddedness in the urban environment, its social relations and practices. In this perspective, what usually represents a limit and challenge for a robot, may become an opportunity for instantiating meaningful shared performances with humans, in which the abilities of one may become a strategy to deal with the limits of another [33]. Furthermore, by reframing HRI challenges as sociotechnical and not merely technical, the concept of citizenship helps to unfold a design space that is much less reliant on the legal system's catching up to the everyday presence of robots. Thus, while effort is being put to regulate robots from a legal perspective, designers may already move forward by thinking of urban robots as social actors and therefore anticipating regulatory and behavioral responses. The design of HRI, it follows, can become anticipatory instead of reactive.

With that said, despite its potential, this new design space is not free from complications. First, our proposal assumes that citizen robots, or, more accurately, robots that behave as citizens, will elicit certain responses from humans. But, what if nobody wants to take the extended hand of the Handleable robot and help it cross the street? What if nobody cares if the Transparent robot needs help? What if the softness of the Shapeshifting robot is only perceived aesthetically? What if people, despite those apparent features, still perceive robots as an obstruction, a burden, or even as competition?

This last question introduces a second complication. We suggested here that robots may be considered members contributing to the community's common good, but who gets to decide what that means in practice, and how? Should HRI designers be responsible for deciding what robot uses and roles are desirable? Should they hold public referendums on each and every proposal for an urban robot? And even then, what if conflicting proposals emerge from within the community?

These critical questions highlight how despite its practical implications, our approach does not provide solutions, but only opens up a larger space for discussion. This very ability to raise questions and foster further reflections, however, is what we believe represents the very meaningful nature of citizenship as a concept that can be used in the design and investigation of urban robots. In fact, "in certain circumstances asking questions is as important as solving a problem" [37]. Design can play a crucial role in this. What we suggest, then, is to look at *citizenship as a design perspective* that can be used to challenge existing norms and attitudes, provoke discussion and question established practices [38] – a way to question the drive for technical efficiency that characterizes current robot design. Through the concept of citizenship, designers are invited to question beliefs about the role of robots in society, and to rethink their approach to urban robotics from the logic of autonomy and efficiency towards relationality and interdependency.

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