Philosophy of Social Robotics: Abundance Economics

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Abstract. The aim of this paper is to present conceptual resources that address social robotics from a philosophical, social, and economic perspective. Since social robotics is an emerging and potentially high-impact area, it is necessary to consider the ethics and philosophy of social robotics and its potential impact on society. Philosophical, economic, and ethical issues are addressed first generally, revealing that social robotics is most-centrally a situation of human-machine collaboration. Second, economic issues are examined more specifically, positing that social robotics might figure prominently in both an automation economy that focuses on reduced requirements for human labor and an abundance economy that targets improved human quality of life. The stakes of social robotics are high and could mean both quantitative and qualitative benefits, and take advantage of the close connection with humans to help negotiate and buffer interactions between humans and a world with an increasing and expanding presence of technology.

Keywords: robotics · social robotics · robo-ethics · economic theory · abundance · human-machine interaction · automation economy · multispecies society · economics · quality of life

1   Introduction: Philosophy, Economic Theory, and Ethics

The aim of this paper is to understand and contextualize social robotics from a philosophical, social, and economic perspective. Since social robotics is an emerging and potentially high-impact area, it is timely to consider the potential impact of the ethics and philosophy of social robotics on society. The result of this analysis is obtaining a conceptualization of social robotics that is grounded in philosophy and economic theory, where concepts that are well-formed in the philosophical sense might be helpful in designing, building, and implementing social robotics solutions. Philosophical underpinnings can provide a more robust understanding and motivation for *what* we are trying to do and *why*, beyond the proximate motivation of labor-saving. One of my objectives is to more robustly inform our thinking about social robotics and what might be at stake. I would like to address the important qualitative question regarding the issue that beyond labor-saving, what specifically it is that we want social robotics to do to improve human quality of life. What are ways for us to articulate what *more* we want social robotics to do beyond the quantitative.

Social robots are understood to be autonomous robots that interact and communicate with humans or other autonomous physical agents, especially by following social behaviors and rules.[1] Social robotics, then, is the field concerned with the design, development, and implementation of social robots. Social robotics could be pivotal in

configuring the modes of life of the future. Two of the areas with the most significant potential impact could be economics and society. In an economic sense, social robots are one form of robotics, and more generally indicative of the move to the automation economy. A key contemporary concern is technological unemployment (job loss due to automation), where it is unclear whether technological unemployment would be a cost or a benefit, and also how quickly it may be eroding job. This is not the issue as much as the point that there is a greater need for comprehensive planning efforts involving government, business, and education than has been previously accommodated in society. It would be helpful to actively design and prepare for different trajectories of how the automation economy including technological unemployment might arrive. The stakes of social robotics could be high. Social robotics could be the linchpin in facilitating a beneficial transition to the automation economy by both easing the requirements for human labor and improving human quality of life. This paper argues that the objective of social robotics should be to improve the well-being of humans, both quantitatively and qualitatively.

One area to clarify is the distinction between on one hand, technologies for artificial intelligence (AI) and automation, and on the other hand, social robotics. Whereas AI/automation is a broad class of technology that aims to mimic complex systems and thought processes, social robotics has a variety of roles in interacting specifically with humans. Social robotics may have a focus on modeling the human response to social cues in order to either elicit specific emotional, focus, or attentional responses from the human or to signal a "motivation" behind an automated behavior to the human. Social robotics and AI/automation are similar in some areas but not in others. For example, while AI/automation might be incomprehensible (black-box) and alienating, social robotics is explicitly not. Automation is partly aimed at reducing the need for humans to do repetitive or low-level tasks and be invisible to human users, while social robotics is partly aimed at keeping people engaged, visibly and actively with robotic agents.

The structure of this paper is in two parts. First I address philosophical, economic, and ethical issues is a general sense, and second in a more specific economic sense. The objective of Part I is to understand the overall context of social robotics from a philosophical, economic, and social perspective. This analysis suggests that the contemporary situation of one of algorithmic reality, where reality is no longer comprised of man and nature as was true historically, but the three-fold presence of man, nature, and technology. Further, there is the notion of greater human decentering, isolation, and alienation in a developing multi-species society. This reveals that social robotics is really a situation of human-machine collaboration. The objective in Part II is to see social robotics in the context of economies that are also transitioning. Social robotics might figure prominently in both the phase of an automation economy that focuses on reduced requirements for human labor, and an abundance economy that focuses on an improved human quality of life. Overall, the stakes of social robotics are high where the role of social robotics might include labor-saving, and much more, taking advantage of the implied close connection with humans to help negotiate and buffer

interactions between humans and a world with an increasing and expanding presence of technology.

2 The New Three-fold Reality: Nature, Man, and Technology

The current situation is one in which technology is having an increasing presence in reality. Reality is no longer the kind of thing that has just two domains as it has for the majority of human history, nature and man. Instead, reality is starting to be comprised of nature, man, and technology. Technology in the form of tools (for example flint, arrowheads, and axes) has certainly always been present during man's existence, but current and near-term technology might be qualitatively different. One factor is the possibility of autonomous embodied agents such as social robots. Another factor is more generally the ubiquitous, pervasive, multi-dimensional, world-encircling presence of technology. These kinds of factors regarding technology are prompting important questions about the definition and role of technology, and causing man to perceive reality differently. In some ways technology is still man's tool, but in other ways perhaps technology can no longer be subsumed under this category since it is increasingly standing on its own as an existence in the world. Thus, there is an emerging triumvirate view of reality as nature, man, and technology which is forcing man to adapt and redefine himself in new ways.

In the three-fold model of reality as nature, man, and technology, the technology area might be named Algorithmic Reality. Algorithmic reality is the proliferation of computing platforms and the presence of algorithms in modern life that is increasingly interconnecting physical reality and digital reality. All major natural and social processes (for example, weather systems, infectious disease spread, and real-time bidding for advertising[2]) are in the process of being modeled and predicted in computational systems. In the contemporary world, everything has become a math problem. Some of the many readily-identifiable platforms include social robots, 3D printing, drones, self-driving cars, smarthome appliances, quantified-self wearable gadgets, personal voice assistants, smartphones, blockchain-based smart contracts, tradenets, deep-learning algorithms, big data clouds, brain-computer interfaces, neural tracking devices, DNA nanotechnology, synthetic biology, augmented reality headsets, and gaming worlds. The key point is that while there are numerous computing platforms, there is only one type of human, and the human can start to feel diminished and alienated as a result. Metaphorically, this could be like being the only kid on the block, where suddenly ten, or a hundred, families move into the neighborhood, but they do not speak your language or have your habits. This potential disconnecting of humans from current reality is precisely the kind of situation that social robotics might help us negotiate. Social robots are still a class of tools, but perhaps not what we thought most proximately, for labor-saving. The real purpose at which we might want to aim with social robotics is as a tool for allowing us to connect and operate within the new technological reality. Social robotics could be a reality buffer.

Computing platforms such as social robotics are fundamentally different from humans, but share many properties among themselves. Each species of computing technology can be seen much more extensively than within the confines of its form factor. Most technology is Internet-connected, and each species of computing technology should be conceived as a platform, a network, and an app store. Computing platforms may be connected to the Internet cloud 24/7, receive ongoing software updates to their functionality, and possibly be controlled together as a swarm entity. Moreover, computing platforms may be Turing-complete, meaning that any platform can run any other platform, for example, a robotics network could run an IoT sensor network or drone network if need be. It is impossible to imagine what all of this could mean. However, one aspect indicated by these properties of extreme portability, fungibility, connectability, and updatability is that we can see all of these computing platforms together as a juggernaut of interconnected computation blanketing the Earth. Like ether, there is a layer of always-on, interconnected computation encircling the Earth. This is like Wi-Fi was supposed to be and electricity generally is, a blanket of functionality so pervasive it can be assumed to be in place and does not need to be thought about consciously. There are both costs and benefits to the emergence of technology as a full-fledged existence in the world alongside humans and nature. On one hand, possibilities for human growth, collaboration, creativity, connection, and actualization might be expanded. On the other hand, humans might experience a real or perceived alienation or sense of diminishment through the sense of a more constrained existence per the growing presence of computing platforms. Philosophical questions arise regarding a reconsideration of the role, identity, and purpose of the human.

2.1 Human Decentering and Multi-species Society

Social robotics is a newly emerging area whose future and adoption trajectories are difficult to predict. Given its uncertainty, it should be acknowledged that social robotics is a form of a *thinkability* problem in that the full scope of what social robotics is and might be is to some degree unthinkable. This term, thinkability is the notion of becoming aware of and coming to terms with phenomena that are "bigger" than us as humans. These are features of the world that are outside our perceptual and experiential domains such as technology as just described, quantum physics, black holes, global warming, the Florida everglades, the biosphere, financial derivatives, big data, and future technologies like social robotics. Philosophers Quinten Meillassoux, Timothy Morton, Mark Hansen, and Graham Harman all consider the problem of thinkability; through notions that they label respectively ancestrality, hyperobjects, superjects, and object-oriented ontologies. For the purposes of this paper, the point is that thinkability favors a position that does not privilege human existence over the existence of nonhuman objects. A worldview is implicated that embraces a multiplicity of constituents, not merely humans; for example animals, humans, and the environment, and here by extension, technology. To the tripartite worldview (nature, man, technology), thinkability adds the point that since humans cannot fully *think* the world, that human-centric models would not necessarily have validity in any scope that is beyond humans such as the domain of technology.

Models that are not human-centric are already emerging in technology. Intelligent systems, including social robotics, are becoming more capable, and through their expanded presence in the world, a sense of the properties and features of native machine culture is starting to be visible. Some examples of where a 'native machine culture' can be seen are in the areas of law and personal identity. Machine culture's parameters may be readily identifiable because they are a differential to human cultural norms. In the domain of law, there are the legally-binding contracts with which we are familiar; and now also technologically-binding contracts. The two are different. Technologically-binding code contracts will execute inexorably even if conditions have changed, while legally-binding contracts between human parties are subject to discretionary compliance. The majority of human-based contracts are not complied with to the letter. Code-based contracts on the other hand, cannot be breached, and will execute unstoppably. The point is that the two regimes, human and machine, are different, and this start to point up the idea of plurality or multiplicity, and choosing the best tool for the job. In some situations, inexorably executing code is useful, for others, human-breachable contracts are better. Another example is the case of personal identity. Here too the technological construct of identity and the social construct of identity are different, and each has a different implied social contract. Humans are accustomed to the social construct of identity that includes the property of imperfect human memory, which allows the possibility of forgiving and forgetting, and redemption and reinvention. Machine memory, however, is perfect and can act as a continuous witnessing agent, never forgiving or forgetting, and always able to re-presence even the smallest most-irrelevant detail (such as an unforgiving photo or text comment) at any future moment.

These examples help to show that machine culture, values, operation, and modes of existence are already different from those of humans. This emphasizes the need for ways to interact that facilitate and extend the existence of all parties. The potential future world of agent multiplicity means accommodating plurality and building trust. New forms of building societal (e.g.; multi-agent) trust could be crucial. Blockchain technology, a decentralized, global, code-based ledger of transactions and smart contracts is one example of a trust-building system. The system can be used not only between human parties that do not need to know or trust each other, but also between inter-species parties, exactly because it is not necessary to know, trust, or understand the other entity, just the system. Decentralized smart networks like blockchains are an example of a system of checks-and-balances that could provide a more robust solution to situations of future uncertainty. Trust-building models for inter-species interaction could include both game-theoretic checks-and-balances systems like blockchains, and also at the higher level, frameworks that align entities on the same plane of shared objectives.

Concluding on this section, I have presented a challenge in modern society where social robotics might have a positive impact. The notion of human decentering and multi-species society is developed and supported through the argument that 1) the

world is one of nature, man, and technology, 2) that may be beyond human thinkability, 3) where there is already evidence of a nascent machine culture.

3   A New Philosophy of Economics

Beyond the more general philosophical issues in the scope of contemporary reality, social robotics might feature prominently regarding the specific philosophical issue of economic theory. While these ideas might apply to new technologies generally, their impact is developed specifically in the case of nuances motivated by social robotics here. New philosophies of economic theory might be required because current conceptual models are becoming outdated. The cornerstone of most economic theory has been the notion of scarcity. However a central focus on the production and distribution of scarce resources is no longer the case in all economic systems. Scarcity is a weak notion empirically since there is emerging and existing evidence of situations in the world where scarcity is not a parameter, and not the governing parameter. The situation of digital goods, such as software or digital images, is an example where there is essentially no cost to producing and distributing another unit by copying and sending the goods electronically. The shift to the automation economy likewise is accommodated more congruently with an economics of abundance than with an economics of scarcity. Many countries are becoming "rich enough" to pay individuals a guaranteed basic income to cover basic survival needs. Such universal or guaranteed basic income programs are being discussed, voted on, and tried in pilot implementations as an improvement over the inefficiencies of welfare systems.[3] Thus a philosophy of economics that better corresponds to a coming automation economy featuring social robotics is needed. A new philosophy of economics would need to include reconceptualizations of the concept and purpose of economics. For example some of the required shifts in thinking include labor-to-fulfillment, moving from a labor-based economy to a fulfillment-based economy, and abundance-to-scarcity; seeing the world and resources in an abundance of availability frame as opposed to scarcity.

Even the notion of abundance itself is an impoverished conceptualization. Abundance is primarily conceived as the alleviation of scarcity, which it is, but it is also more. It is the eradication of scarcity in terms of having material needs covered, in the notion of recouping a baseline, but there is also an important upside formation to abundance. Abundance also means open-ended possibility up from baseline, defining the area of social goods that humans need to thrive, not merely survive. While material goods attend to survival, social goods attend to thriving. The automation economy is concerned not just with human survival, but an improved quality of live such that humans can thrive, and it is in this domain that social robotics could feature prominently. Further, scarcity is not just a situation to alleviate, it can be seen as a situation of harm, a social pathology, and a pollutant. Scarcity in the form of income inequality has been shown to denigrate the quality of human health.[4] Possibly even more than technological unemployment and the possibility of 'robots taking our jobs,' income inequality is a threat to the future well-being of our economies. Income inequality (the

gap between the highest and lowest paid persons in an economy) has a detrimental impact on both material goods and social goods. The result of income inequality is greater social problems of every kind: health, violence, mental illness, drug addiction, obesity, imprisonment, and poorer well-being for children.[5] What most do not realize is that the effects of inequality are not confined to the poor but impact the whole of society via diminished social goods that are crucial to human thriving. Thus societies with less income inequality are better-poised to more quickly adopt the technologies of the future like social robotics, because they already have an acknowledgement of the importance of social goods, and a capability of designing and implementing strategies to realize them.

Thus a new philosophy of economics that is an abundance theory of flourishing can be developed by articulating the social goods that might be produced for humans, including with this as a specific aim of computing platforms such as social robotics. The close relationship of social robots and humans, particularly via VUI (voice user interface), places social robots in a unique position to monitor and enhance the quality of life of humans. Some of the new and contributive social goods that are unavailable in the scarcity model and could be created in the Abundance Economy include certainty, availability, reduced contingency, reduced efforting, and therefore the secondary social goods of cognitive easing and cognitive surplus. Abundance creates a psychology of certainty and availability, a reliable ongoing feeling of certainty that material survival needs will be met, as opposed to the continuous uncertainty and attending-to required by situations of scarcity. Much current human cognitive and physical effort (as individuals and groups; families, corporations, institutions, and nation-states) is devoted to anti-scarcity measures: hoarding, manipulation, and control for the purpose of ascertaining the future availability of resources. The idea would be like doing for emotional and cognitive attending what just-in-time inventories did for manufacturing. Situations of abundance invoke the social goods of certainty and reliance about the real-time availability of resources for need fulfillment. Through abundance, there could be the considerable social good of relief and certainty, where a whole class of cognitively-exertional activities drop off the reality of what has to be considered for basic living. This would be unprecedented in human history, a trustable source of having basic needs met such that we do not even have to think about this. The first tier of social goods that could be created in the Abundance Economy as a result of scarcity alleviation includes certainty, availability, reduced contingency, and reduced efforting. There could be many other tiers of social goods that are articulated, valorized, developed, and implement in future societies. What has been seen as the apogee tier of social goods that many human societies valorize is social goods related to liberation such as self-respect, self-esteem, and self-realization.

3.1   Intermediary Point: Automation Economy

The notion of the Automation Economy is an intermediary point that comprises half of the idea of the Abundance Economy, the material goods side which envisions that technology has supplemented or replaced much of the need for human labor. The

other side of the Abundance Economy is the Actualization Economy is social goods, which have the ability to create a better human quality of life beyond sustenance needs. Social robotics might help with both. Actualization is a term from psychology taken to mean self-actualization, the realization of one's potential, for example in areas such as expressing creativity, learning, being in service to society are examples of self-actualization. Carl Rogers described actualization as man's becoming his potentialities, expressing and activating all of his capacities.[6] Maslow's Hierarchy of Needs is a familiar instantiation that Maslow developed to articulate the case that humans have a set of motivation systems unrelated to rewards or unconscious desires.[7] Maslow's Hierarchy of Needs features eight needs in two tiers: four in a lower tier of 'deficiency needs' (physiological, safety, belonging and love, esteem) and four in an upper tier of 'growth needs' (cognitive, aesthetic, self-actualization, and transcendence) that cannot be met until the lower tier needs are satisfied.

The point here is that the Automation Economy might help to address the lower tier of survival needs, but to truly thrive and extend human quality of life beyond sustenance, positive psychology tools like social robotics might be required. The psychological territory beyond survival needs is sometimes characterized as Positive Psychology, the scientific study of the strengths that enable individuals and communities to thrive and lead meaningful and fulfilling lives.[8,9] Social robotics might be able to help the 'positive psychology' movement shift to the 'positive technology' movement that improves the quality of personal experience. Specifically, this might be achieved with social robotics that offer functionality to help humans in the areas of affect regulation and emotional quality, engagement, motivation, and actualization, and connectedness with others. One study found that technology with these features was able to improve the quality of life of aging persons.[10] Likewise, social robotics might implement happiness practices that have been demonstrated to improve human quality of emotional well-being.[11]

Thus to address to address the threat of human alienation, and improve human quality of live more general, social robotics is a hopeful example of a new and forthcoming technology. Abundance Economics can be posited as an economic theory that is adequate to the current and near-future moment that focuses on social goods production in addition to material goods production for the most beneficial transition to the automation economy of the future.[12] While there is an extensive literature concerning social robotics and human robotic interaction, a philosophy of economic theory that envisions a full suite of automation and actualization applications for social robotics has not yet been advanced. The literature does consider topics well beyond the algorithmic and mechanical aspects of social robotics. Many researchers espouse a systems-theory view, in that form, function, and context should all be taken into account simultaneously for optimal human-machine interaction.[13] Others focus on the capacity of robots to improve communication with human beings, highlighting the physical and social-cognitive aspects of the interaction separately.[14] Researchers note that there should be a balance between 'hard' and 'soft' tasks in social robotics, connecting with both the mechanical labor-saving and the emotional side of human

needs. For example, care is about 'taking care' (washing and feeding) and 'caring for' through a kind word or a good conversation.[15] Two-way interaction between machine and human is important, and more specifically, crafting a human-robot relationship.[16]

4   Conclusion

Abundance Economics is presented as a philosophy of economic theory that might be appropriate for the contemporary and near-future moments of an automation economy that features social robotics. On this view, social robotics might have significant benefit in helping to realize produce social goods that improve human quality of life. Since social robotics implies a much closer connection between humans and technology than other platforms, social robotics could be key in helping effectuate beneficial transitions to situations such as a shift towards the automation economy with large sectors of technological unemployment that simultaneously create an abundance economy with a focus on social goods creation that improves human quality of life. The magnitude of a rapid shift towards the automation economy could simultaneously engender a rethinking of economic principles, with significant shifts in mindset, for example from a labor economy to a fulfillment economy, from scarcity to abundance, and from exclusively human agents to multiple forms of intelligent and emotional agents comprising society. The objectives of social robotics design and implementation could be to facilitate shifts to situations such as the post-labor automation economy and improved human quality of life in s social goods economy of abundance, wherein an enabling possibility space is created for the thriving of diverse multi-species agents.

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