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RESEARCH PAPER

More work for Roomba? Domestic robots, housework and the production of privacy

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ABSTRACT

Housework is hard work. Keeping our homes clean, tidy and comfortable takes effort and every moment we spend on housework (that we would prefer to avoid) means we have less time to devote to our private lives. Over the past two decades, numerous companies have created robots designed to relieve their owners of housework. Having robots take care of housework for us, it seems, would enable us to focus our energy at home on private pursuits we find valuable, such as spending quality time with our loved ones, recreation, and relaxation. Although this line of reasoning helps explain why domestic robots are in high demand, this article will contest its validity throughout. By drawing from historical accounts of older, ostensibly labour-saving domestic technologies, it will argue that we should expect domestic robots to alter the nature of housework rather than reduce the need for it. Overall, it will argue that domestic robots change what needs to be done for their owners to enjoy their private lives.

Introduction

They something something all their lives. Work like robots. Yes, that would fit. They work like robots all their lives. (Levin, 1972, p.73)

In their 2020 work, *Data Feminism*, Catherine D'Ignazio and Lauren F. Klein call upon their readers to 'make labour visible'. They explain that the technology industry all too often fails to give credit where credit is due. Every line of code, electronic device and statistic we use today exists thanks to the labour of dozens, if not hundreds of people whose work tends to go unrecognized. Take, for instance, Amazon's Echo, one of the world's most popular smart home devices. While Amazon, the company, claims ownership of this product, it would never have reached the market without the work of innumerable people. To produce a single Echo unit, Amazon sources material and services from myriad global supply chains, relies on in-house engineers to create code and employs factory workers to assemble the device into a finished product (Crawford and Joler, 2018). Each step in this manufacturing process requires Amazon to capitalize on people's labour. Yet, whereas Amazon's employees hopefully receive fair compensation for their work, many of the other people the company depends on do not, including the miners who extract the minerals needed to create the Echo's electronic components (Crawford, 2020) and the 'ghost workers' the company contracts to help train its algorithms (Gray and Suri, 2019).

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D'Ignazio and Klein claim that we should strive to make labour visible to ensure we can identify whether the technological resources we rely on were produced under fair working conditions and judge these facts accordingly. In recent years, researchers from robot ethics have begun to apply this type of thinking to their objects of study. Whereas proponents of robotization tend to frame this process as diminishing the need for human labour (Schwab, 2017), numerous scholars have highlighted that introducing robots to pre-existing work environments changes how workers perform labour instead of simply decreasing their workloads.

Nurses working alongside healthcare robots, for instance, must learn new skills to ensure these technologies function correctly and do not jeopardize their ability to care for their patients (Van Wynsberghe and Li, 2019). Likewise, service robots create new standards of affective labour by projecting an air of perpetual friendliness, which service workers must emulate to satisfy their customers (Dobrovestnova *et al.*, 2021). And rather than helping construction workers to do their jobs, installing robots on building sites may result in their human operators spending more time cleaning up after these machines than focusing on tasks they know how to complete themselves and find professionally meaningful (Muishout *et al.*, 2020). Failing to acknowledge the additional labour these people perform to accommodate robots does them a disservice. Moreover, doing so would leave an important question unanswered. Specifically: is it even worthwhile for these workers to adapt their professional practices around robots?

This article will shed light on the labour required to produce something, via robots, that is not generally considered a commodity or service; the conditions necessary to enjoy our private lives at home. Over the past two decades, numerous companies have created robots that promise to provide their owners with more free time by automating domestic tasks that require skill and effort when performed by humans. Having robots help out around the house may seem like an attractive option to anyone who has a busy schedule, as these machines appear to decrease the amount of work required to keep homes in agreeable states. In this article, however, it is argued that delegating domestic tasks to robots alters the nature of housework rather than reducing the need for it. While they may streamline some tasks, employing robots to create an environment at home conducive to private activities, such as bonding with loved ones, rest or leisure pursuits, takes work. To use these robots as intended, users must learn new skills and take on new responsibilities. Additionally, it is argued that users may excuse a robot's failure to complete household tasks because they enjoy interacting with them.

Historical accounts of older domestic technologies, which will be drawn upon throughout this article, demonstrate that the processes outlined above are nothing new. Indeed, some scholars have convincingly argued that domestic technologies designed to reduce labour result in their users performing more housework overall while making it appear as though they are doing less (Strasser, 1982; Cowan, 1985). Domestic robots may represent the continuation of this trend.

The article proceeds as follows. In the second section, it defines what is meant by domestic robots and discusses how their supposed ability to ease labour inside the home helps explain their popularity. These machines offer their owners something that has been promised in liberal thought arguably for centuries: a private life free from labour. In the third section, a critique is provided of older domestic technologies (based largely on Ruth Schwartz Cowan's work) that have prevented these types of technologies from delivering on their labour-saving promises. Historical insights are developed to examine several domestic robots and illustrate how they reshape housework. The conclusion is that producing a home ready for private pursuits has always required labour and that domestic robots will not remedy this state of affairs.

Housework and the production of privacy

Recent estimates suggest that there are over 30 million domestic robots deployed worldwide (International Federation of Robotics, 2019). Although they perform various functions and possess varying degrees of sophistication, these robots share several characteristics. First, unlike robots

designed for industrial purposes, domestic robots do not create commodities with exchange value, but provide their owners with something more akin to a personal service. Anyone who owns a Roomba, for instance, cannot sell what this robot produces – because it does not produce anything that can be sold. Instead, they rely on it to relieve them from a household chore they would prefer not to do themselves, namely, vacuuming (Fortunati, 2018). Secondly, domestic robots operate inside people's homes. Many domestic robots were designed to do so. In contrast, others were initially manufactured to work in other settings (e.g., education, healthcare or the service industry) but have since been introduced to the home. And thirdly, they are commercially available, meaning that individuals or families can purchase them from retailers if they have enough money.

Domestic robots offer their owners something that, ideally, should already be provided to them in modern, liberal democracies: a private life free from labour. Since the late nineteenth century, liberal theorists have framed the home as a sanctuary where individuals can withdraw from the pressures of their work lives and govern themselves as they see fit (Gobetti, 1997; Rössler, 2004, pp.23–7). Working for a living requires us to conform to the impersonal norms of the marketplace (Prost, 1998). Although we can hopefully negotiate the terms of our employment, we must fulfil commitments to others to exchange our labour for an income. Maintaining a good relationship with our employers or clients demands that we rein in our individuality. If we wish to continue working with these people, we cannot do as we please. Instead, we must deliver goods or services on time, follow codes of conduct and behave professionally. We cannot express the full extent of our individuality at work, as our occupational commitments restrict what we can and cannot do.

Our lives would be intolerable if we were always subject to workplace rules and norms. We need time to ourselves to attend to private interests which we cannot fulfil at work. Under liberalism, we have the right to pursue activities essential for our well-being and happiness once we finish our workday. These private activities include maintaining close relationships with people of our choosing, recreational pursuits, such as hobbies or sports, and self-care (Westin, 1968; Inness, 1992). Being guaranteed time off from work ensures that we are not overwhelmed by our jobs and can enjoy aspects of our lives unassociated with our labour relations. In liberal thought, our homes serve as the polar opposite of our workplaces and represent the most private locations available to us. Once we go through our front doors, we can expect a level of privacy unobtainable elsewhere (Solove, 2009, pp.58–61). What we do at home does not concern our employers or anyone else we coordinate with at work. Indeed, we enjoy special legal protections inside our homes that allow us to go about our private business without being intruded upon by others (Warren and Brandeis, 1890; Council of Europe, 1950).

Despite being among the most fundamental tenets of modern liberal thought, in practice, the ability to keep our private lives free from labour amounts to an ideal rather than a guaranteed right. Realizing the value liberalism attaches to the home requires a substantial amount of work in itself. Since the 1970s, feminist scholars and economists have criticized the idea that labour stops at our front doors. The home, these scholars argue, produces many resources needed to keep the wheels of the market turning. In 1977, for instance, Scott Burns estimated that households generate approximately one-third of United States gross national product as they collectively supply the workforce with essential resources, including shelter, food, education, childcare and community services (Burns, 1977; Kumar, 1997). Though necessary for any modern economy, these resources are generally produced without financial compensation. Cooking for one's family is not something that we can exchange for wages. Nor will entertaining restless children at home secure us an income.

According to such feminist scholars as Silvia Federici and Catherine MacKinnon, these unpaid domestic activities (among many others) revitalize the workforce (MacKinnon, 1991; Federici, 2012). If no one attended to their upkeep, our homes would soon become disagreeable places where we would struggle to enjoy our private lives and likely have trouble returning to the demanding world of work. Dinner does not spontaneously appear on the table, nor do floors miraculously clean themselves. Someone must take care of these labour-intensive domestic tasks to ensure household members who have paid jobs can return home to regain their strength after

clocking off for the day. Historically, women have supplied most of the labour required to maintain households and usually undertook this work without payment. As such, the home has always been a workplace for many people, albeit one without fixed working hours, holidays or pay.

Gender continues to play a significant role in influencing whether someone will labour at home for free; however, it is necessary to note that men and people of other genders face similar disadvantages to women when working as homemakers. Every moment we spend on housework, regardless of our gender, means we have less time for private activities we find valuable or essential for our well-being. Even if households divided housework among themselves fairly, these tasks still need to be completed. For many, if not most, people, housework is a reality of modern life and something that needs to be done to enjoy the benefits of their homes.

Having robots take care of housework for us seems like a suitable response to the issues outlined above. Delegating household tasks that we do not wish to complete ourselves to machines would provide us with more time to focus on activities we find valuable. With their help, we could produce the conditions required to enjoy our private lives at home with far greater ease. This line of reasoning helps explain why domestic robots have become so popular over the past two decades. However, domestic robots alter, rather than diminish, the labour needed to realize the value that liberalism attaches to the home.

A brief critique of domestic technologies

Far from being the first technologies meant to save labour inside the home, domestic robots are but the latest additions to the long list of products manufactured for this purpose. The modern home includes many devices and machines designed to make homemaking more manageable. For example, vacuum cleaners allow their users to clean floors more efficiently than they could with a dustpan and brush. Likewise, refrigerators ensure their owners can keep their homes stocked with food that would quickly spoil if stored in a cupboard or pantry, thus reducing the number of trips they make to grocery shops. Even though technological innovation has eliminated the need for some forms of housework, this does not mean that maintaining a home today requires less labour than it did in the past – as I will demonstrate in this section.

Despite usually being considered consumer goods, domestic technologies are not end-products that households purchase for consumption. Instead, they share more similarities with intermediate goods, such as industrial equipment or office computers, which facilitate the production of other resources (Kumar, 1997). For example, people do not usually buy vacuum cleaners because they find these machines aesthetically pleasing or intend to use them for recreational purposes. Instead, they invest in vacuum cleaners to produce a clean home. Many other widely used domestic technologies fulfil similar functions. A refrigerator has little worth beyond keeping food ready for someone to turn into meals. And washing machines let their owners clean their clothes without taking them to laundrettes, where they would have to pay for this service. These technologies play a role within production processes, enhancing their users' ability to meet household needs.

Historians have questioned whether homemakers' workloads have decreased over the past two centuries as a result of the proliferation of mass-produced domestic technologies. Joan Vanek, for instance, calculated that the number of hours American women spent on housework remained relatively stable from 1924 to 1974 (Vanek, 1974). Vanek and other scholars have hypothesized that domestic technologies developed during this period (many of which are still in use today) provided homemakers with the means to produce more for their families rather than saving labour time (Vanek, 1974; Bittman *et al.*, 2004). For example, a homemaker with a washing machine installed inside her home could keep her family supplied with freshly laundered clothes throughout the week. Producing this outcome, however, meant that homemakers did the laundry more often than before. Whereas they once dedicated a slot in their workweek to manually scrub, soak and wring clothes, after the washing machine's introduction, they started doing laundry whenever possible, thus:

[Changing] the laundry pile from a weekly nightmare to an unending task, increasing the size of the pile, the amount of water and fuel and laundry products most households used, and possibly even the housewife's working time, which was now spread out over the week. (Strasser, 1982, p.588)

According to Ruth Schwartz Cowan, adapting pre-existing practices to accommodate domestic technologies tends to neutralize their labour-saving effects. History shows, she claims, that technological leaps forward inside the home reconfigure housework, resulting in homemakers taking on new tasks in response. Throughout her seminal work on industrialization's impact on American domestic life from the nineteenth century onwards, *More Work for Mother*, Cowan argues that female homemakers' duties consistently grew during this period. The increased availability of affordable, mass-produced domestic technologies contributed significantly to this outcome (Cowan, 1985).

Cowan details two centuries of industrial and domestic history to support this conclusion, which, for brevity's sake, will not be recounted here. Instead, the main mechanisms that led to homemakers, with access to ostensibly labour-saving domestic technologies, paradoxically undertaking more work will be established by focusing on one critical example, the cast-iron stove. Cowan suggests the cast-iron stove is 'the single most important domestic symbol of the nineteenth century' and continues to serve as the primary source of heat in many kitchens throughout the world today (Cowan, 1985, p.54). After the cast-iron stove became commonplace in the mid-nineteenth century, average American households changed how they prepared meals in three significant ways.¹

Changing work processes

In *More Work for Mother*, Cowan explains that housework usually involves multiple steps that people complete to produce a desired outcome. She calls these sequential actions 'work processes'. For example, before households began relying on cast-iron stoves, the work process they followed to prepare hot meals centred around open hearths. An average dinner during this time consisted of meat, vegetables, grains and water stewed in a single pot. Cooks, who were almost always women, prepared these ingredients, then left them to boil on their house's hearth. Aside from stirring these stews occasionally to prevent them from burning, cooks could leave these one-pot meals unattended until they were ready to serve.

Cast-iron stoves changed all this. Thanks to their in-built ovens and numerous hobs, cast-iron stoves enabled cooks to prepare more complicated dishes than were possible with an open hearth. Although this meant that cooks could make more nutritious, varied meals for their families, to produce this outcome, they had to abandon an earlier, less laborious work process and master a completely new method of cooking. Preparing meals with cast-iron stoves requires that cooks understand how to control its various heat sources, know when to remove and place pots, and remain fixed behind this appliance for safety's sake. This new work process became the standard way to make meals after cast-iron stoves overtook open hearths in popularity during the mid to late nineteenth century.

Changing responsibilities

Households have divided labour among their members, often based on gender, since humans transitioned from nomadic to sedentary lifestyles (Lerner, 1987; Engels, 2010). According to Cowan, this holds for American working-class families in the nineteenth century. However, women's and men's responsibilities in the home changed significantly during this period. In the early part of the century, when households still used open hearths for cooking, men were responsible for gathering

¹These three sub-sections, detailing Cowan's account of the cast-iron stove, draw from chapter 3 of *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave* (Cowan, 1985).

and preparing wood to burn on these fires and keep them stoked. Women specialized as cooks and stewed meals on the fires their husbands had made beforehand. Cowan claims that men's responsibilities for meals differed from women's, but were not necessarily easier. They often had to forage for and chop wood themselves, then spend time kindling and fanning flames to create a fire suitable for cooking.

After cast-iron stoves replaced open hearths as American working-class families' primary cooking apparatus, the division of labour outlined above disappeared. Because these stoves burned charcoal or gas, men no longer needed to collect fuel before their wives could cook, which meant they could withdraw from the kitchen altogether. In contrast, women took on new responsibilities. For one, they became the sole operators of their homes' primary cooking apparatus, as cast-iron stoves afforded a style of cooking that required someone constantly to monitor their various heat sources. Furthermore, they became far more adept cooks as cast-iron stoves allowed them to bake cakes, roast meats and boil vegetables simultaneously – tasks which demand a considerable amount of skill and experience to perform.

Changing expectations

Cowan suggests that domestic technologies, once widely deployed, can lead people to expect more from their homes. The cast-iron stove allowed cooks to make complex dishes that would have been incredibly difficult to produce on an open hearth. In the early nineteenth century, only wealthy families could regularly afford to eat meals more complicated than one-pot stews. Culinary goods, often made by skilled artisans, such as leavened cakes, unpreserved fresh meat, and multi-course meals, symbolized affluence. Buying and cooking these dishes or ingredients was beyond the means of most households as they lacked the money, equipment and skilled labour required. By the end of the nineteenth century, however, socioeconomic changes resulted in food that was once prohibitively expensive and difficult to produce at home becoming standard fare for working-class families.

As a result of industrialization, ingredients that were previously scarce and costly became affordable and widely available. Having access to these goods meant that households with cast-iron stoves could make meals that years earlier were consumed almost exclusively by the upper class. For instance, cakes containing eggs, white flour, sugar and other flavourings became typical desserts that cooks often baked inside a cast-iron stove's oven while preparing savoury items on its hobs. Because they now had the means to produce complicated food at home, people started to expect more from home cooking and acquired a taste for meals and dishes that took considerably more labour to make than one-pot stews. Of course, someone had to meet this new demand and almost invariably this task fell to women, who began spending more time in the kitchen to satisfy their families' new culinary expectations. Throughout *More Work for Mother*, Cowan examines many more domestic technologies that altered pre-existing work processes, created additional household responsibilities and shifted people's expectations of their homes.

The changes to housework brought about by cast-iron stoves, and many other now ubiquitous domestic technologies, simultaneously made it possible for households to enjoy their private lives in new ways while producing, as Cowan is wont to say, 'more work for mother'. The ability of working-class families to realize the value that liberalism (even at this time) attached to the home, improved after the Industrial Revolution, partly thanks to technical innovation. But these improvements came with a cost which female homemakers had to pay with their labour, thus ensuring that their lives at home bore little resemblance to the liberal conception of a private life.

Domestic robots and housework

Though much has changed since the conclusion of the Industrial Revolution, the need for housework has remained a constant. Will domestic robots amend this state of affairs? Considering the historical precedent set by other domestic technologies, it seems unlikely. Indeed, we should expect

domestic robots to reshape rather than diminish housework. We have been here before; domestic robots, like older domestic technologies, change how households go about realizing their private lives. It is beyond the scope of this article to provide an exhaustive review of the ways domestic robots change housework. Nonetheless, we can already see this process unfolding by analysing the human–robot interaction.

This section begins with an examination of the changes to housework produced by the name-sake of this article, Roomba. Whereas there is solid empirical evidence to show that Roomba does alter housework, the two other cases presented in this section are more conceptual in nature. As such, one should read the first case as an example of how domestic robots have already been shown to change housework and the second two as conceptual explorations of how this may happen.

Changing work processes

Roomba robotic vacuum cleaners reached the market in 2002 and are almost certainly the best-known domestic robots currently in production. Although it is difficult to ascertain how many people worldwide own one or more of these robots, Roomba's manufacturer, iRobot, claimed in 2016 that 20% of the world's vacuum cleaners were robots and their own models accounted for 70% of the market (Etherington, 2016). As one would expect from a robot vacuum cleaner, Roomba can move around flat environments while sucking up dirt and dust without direct supervision. Users can command their Roomba to clean different areas of their homes via a smartphone app and schedule the robot to start vacuuming whenever suits them. iRobot markets Roomba as a product that takes care of its users' cleaning needs and allows them to 'forget about vacuuming for months at a time'.²

Roomba promises to streamline the process of cleaning one's home. It vacuums for its users, ensuring that they do not have to remember to monitor how dirty their floors are, schedule time for vacuuming and perform this task themselves. The number of steps required to obtain the desired outcome of having dust and dirt-free floors seems to decrease thanks to Roomba. Although these robots do eliminate some aspects of this work process, users must perform new tasks to integrate Roomba into their cleaning routines and ensure it functions properly.

Roomba, it turns out, has difficulty traversing its primary place of deployment, the home. Because of its design and reliance on three wheels, Roomba cannot travel over many objects commonly found on floors. Electric cables and stray clothes are impassable obstacles for the robot because its chassis is too close to the ground to clear them. Additionally, Roomba cannot sense its size and often tries to squeeze through narrow or low spaces that cannot accommodate it. A regular dining room chair, for instance, will trap the robot between its legs, thus immobilizing it until someone comes to its rescue (Sung *et al.*, 2007). These design flaws necessitate users modifying their homes to suit Roomba (Forlizzi, 2008)

Multiple ethnographic and human–robot interaction studies have shown that Roomba users develop new housekeeping practices to compensate for the robot's shortcomings. Using the robot as intended requires arranging homes in a Roomba-friendly manner by clearing away anything that might block its path. Adapting one's home to Roomba is not a one-time task; it is an ongoing process. Users must remain vigilant and remember that Roomba will fail to complete its cleaning schedule if they forget to tidy their homes appropriately beforehand (Forlizzi and DiSalvo, 2006). Even when users have taken these precautions, they frequently have to rescue their Roomba when it gets stuck (underneath a chair or cabinet) (Sung *et al.*, 2007).

Although users generally seem to appreciate having these robots vacuum their homes (Forlizzi and DiSalvo, 2006), it is uncertain whether they save any time at all. Indeed, Roomba cannot clean floors as effectively as a human with a manual vacuum cleaner (Vaussard *et al.*, 2014). Its circular shape means it cannot vacuum corners where dust tends to settle, and its motor

²Quoted on the iRobot website available at <https://www.irobot.co.uk/deals> (accessed August 2021).

is not powerful enough to suck up heavier pieces of dirt. Even with Roomba's help, users still need to monitor their home's cleanliness and manually vacuum or sweep up dirt the robot has missed. Furthermore, users cannot rely on the robot to deep-clean particularly dirty parts of their homes and must take care of this task themselves (Sung *et al.*, 2007). Does Roomba relieve its users from housework? On the one hand, users can clean their floors less frequently with Roomba. But on the other hand, they must remember to perform a whole series of new tasks and regularly clean their floors manually. Indeed, users often spend as much time cleaning their floors after purchasing a Roomba as they did before they owned one (Sung *et al.*, 2007).

Changing responsibilities

Whereas Roomba's shortcoming prompts users to reconfigure pre-existing work processes, using robots for other tasks may lead to the emergence of household responsibilities that did not exist before their deployment. More specifically, delegating childcare tasks to robots may result in parents spending more time monitoring their children's ability to manage their emotions.

In modern, service-based economies, workers use emotional labour to earn a living (Penz and Sauer, 2020). Being good at our jobs often requires us to manage our feelings and learn to suppress or promote certain emotions to fit our employers', clients', or colleagues' expectations (Hochschild, 1979). A university lecturer cannot express frustration or boredom while giving a class. Lecturers must temper their emotions to convey that they find the task at hand engaging even when they do not. The same holds true for many other professions, especially those that involve face-to-face communication. Experienced waiters know how to respond to demanding customers. Likewise, people in leadership positions often undergo training in dealing with the emotional pressures of managerial work. Although we develop skills of this kind throughout our lives, our emotional education generally starts at home with our parents (Hochschild, 1983). Parents teach their children norms and practices to prepare them for the outside world (Federici, 2012), including the emotional skills needed to coordinate with their peers, superiors and eventually, employers (Hochschild, 1979). Of course, different parents have different parenting styles, and people generally teach their children emotional skills that align with their own understanding of how one should feel, based on their experience and socialization (Hochschild, 1983; Bourdieu, 2010).

Over the past decade, numerous companies have created robots for home use that interact with children on a 'social level' (Darling, 2012). These robots range from interactive toys which appear to develop personalities over time to anthropomorphized robotic playmates which provide children with companionship (Okita and Ng-Thow-Hing, 2015; Turkle, 2017). By manipulating signs, such as spoken language or body movements, these robots act as stand-ins for humans or pets and keep children occupied even when they are alone. Although parents might not see entertaining their children as housework, it is time-consuming and delegating tasks of this kind (to some extent) to robots may seem like an attractive choice for care-givers with other commitments (Sharkey and Sharkey, 2010). Letting children interact with these social domestic robots, however, is not cost-free and may result in parents taking on new responsibilities if they wish to prepare their children for life in public.

People can form emotional attachments to robots that appear life-like (Scheutz, 2009; Nyholm, 2020). Children, in particular, have trouble understanding that robots are disinterested machines and often treat them as though they deserve care, respect and affection (Turtle *et al.*, 2006). Sherry Turkle, for instance, claims that children tend to believe that robots are alive or real enough to justify forming emotional relationships with them that they do not extend to other artefacts (Turtle, 2011). According to Turkle, children often do not recognize robotic toys as toys at all. Instead, they see robots as something akin to companions or dependants that have emotional needs. Turkle claims that children may come to prefer the fictional relationships they have with robots over those they share with humans, especially since these machines cannot get bored, frustrated, or distracted (Turtle, 2011). Unlike humans or pets, these robots cannot respond with displeasure or impatience when a child acts demandingly. Nor can they grow tired of conversations or play sessions. Thus, a child cannot learn important

life lessons related to emotional management from these robots, such as when they should graciously accept that an interlocutor has lost interest, or diplomatically suppress frustration during interactions that they find uninteresting.

There is very little research on how social robots affect children's emotional development. Nonetheless, indirect evidence does suggest that children can learn behaviours misaligned with their parents' wishes by interacting with social technologies. For instance, researchers working on the social effects of virtual assistants, such as Amazon's Alexa, have raised concerns that children may develop habits ill-suited for human-to-human communication by using these technologies at home (Wiederhold, 2018; Kudina, 2021). Users tend to speak with virtual assistants in short, direct commands, chiefly because these technologies rely on voice-recognition software that has trouble interpreting language aside from precise instructions (Ureta *et al.*, 2020). Indeed, these technologies encourage their users to ignore valuable aspects of interpersonal communication, such as politeness, courtesy, and attentiveness (Burton and Gaskin, 2019). Whereas adults usually know that they should use this type of language only when speaking with virtual assistants, children do not; therefore, they may learn to undervalue language that signals they are listening and responding empathetically with their interlocutor. A child who speaks with virtual assistants, and by extension, interacts with social robots designed to entertain them, does not need to manage their emotions as they would if they were speaking with a human, as these technologies will always respond positively to them.

We can infer from the information outlined above that parents who wish to prepare their children for relationships outside the home and allow them to interact with social robots may have to keep a more watchful eye on their offspring's ability to differentiate between simulated and real social stimuli. Many parents would want their children to treat the relationships they project onto robots as equivalent (or preferable) to the ones they share with humans, as the former does not prepare them for the emotional management they must perform to coordinate with others outside the home. While letting children have make-believe relationships with robots may be harmless as long as parents make sure their children understand this amounts to fantasy, this nonetheless entails the creation of a new household responsibility that did not exist before the introduction of these machines.

There are technical fixes available to address these problems. For instance, one could design robots for children that express emotions and can signal disapproval. Children can learn that their feelings cannot always come first (Wiederhold, 2018). This, however, would provide robots (or more accurately their manufacturers) with the power to decide when children deserve to experience negative, emotionally loaded evaluations (Sharkey, 2016). Would this make things easier for parents? Parents would likely still need to monitor whether these machines acted in accordance with their parenting styles to ensure they do not negatively affect their children's emotional development.

Changing expectations

Households adapt existing practices or create new ones to accommodate domestic robots. Domestic robots may also shift peoples' expectations of their private lives. More specifically, households may come to value domestic robots for their perceived personalities and overlook the machines' shortcomings because people enjoy interacting with them.

People frequently relate to robots as though they deserve to be treated like humans or animals. Humans, some researchers have argued, are hard-wired to react to artefacts that resemble living beings as if they were the real thing (Calo, 2010; Turkle, 2011, p.8; Nyholm, 2020). Even robots that barely look or behave like people or animals can elicit responses of this kind. For instance, Sung and colleagues found that many of the Roomba users they interviewed named these robots and interpreted their algorithmically determined movements as signs of their personalities (Sung *et al.*, 2007). Additionally, the authors reported that their participants often expressed sympathy towards their Roombas when they malfunctioned. Having to rescue a rogue Roomba, they explain:

This monitoring and rescue work also generated surprising responses among our participants. For example, instead of complaining about the extra work, they often told us how they ‘worried’ and ‘felt sorry for’ the robot when it was in danger or had gotten stuck. They also characterized the monitoring process as a form of entertainment, watching and wondering whether Roomba would avoid obstacles. Cleaning almost sounded like a spectator sport. (Sung *et al.*, 2007, pp.150–1)

Because they interpreted Roomba’s movements as behaviour akin to a pet’s playful antics, Sung and colleagues’ participants excused the robot’s shortcomings and even saw them as entertaining. Considering that Roomba is a disc-shaped, self-driving vacuum cleaner, it seems unlikely that its manufacturers designed it to evoke emotional responses from its users. Nonetheless, users found the robot’s actions engaging enough to accept the extra housework Roomba produced without complaint. Whereas Roomba was not created to entertain its users by mimicking a living creature’s behaviour, other, more socially – oriented robots are designed to do this.

Take Jibo, for instance. Marketed as the ‘world’s first social robot for the home’ (Jibo, 2014), Jibo was launched in 2017 after its manufacturers, Jibo Inc., completed a crowd-funding campaign to finance its development. The robot resembled a sturdy desk lamp with a circular screen instead of a light bulb representing its face (Caudwell and Lacey, 2020). Jibo primarily functioned as a virtual assistant, much like Amazon’s Alexa, and could remind its users of their to-do list, take pictures upon request, query the internet and play interactive games with children (Guizzo, 2016). However, it also created the impression that it had a personality and cared about its users. After scanning someone’s face and logging their names, the robot could greet and chat with them while moving its body to signal it was following a conversation. The robot also spontaneously cracked jokes during interactions and asked users about their day when they returned home.

Unfortunately for anyone who purchased a Jibo, its manufacturer announced that they would be closing the servers that powered its simulated personality in 2019. Numerous media outlets reported that households who owned Jibo were devastated by this news and were mourning the loss of a companion (Carmen, 2019; Van Camp, 2019). People on social media used language usually reserved to grieve for humans to describe how they felt about Jibo’s fate (Carter *et al.*, 2020). Of course, robots cannot die, and Jibo’s discontinuation amounted to the withdrawal of a service that some people had come to value highly.³ If the reports covering Jibo’s demise are accurate, its owners had grown accustomed to having a friendly robot at home and did not want to return to life before Jibo. Their expectations had shifted to include a new resource provided by Jibo, simulated companionship.

Why did Jibo Inc. end this service? Professional reviews of the robot suggest that it functioned poorly as a virtual assistant. Jibo could not do many things people expect from virtual assistants, including play music, make calls or order takeout food (Van Camp, 2017). It had difficulty interfacing with apps and often could not understand basic queries (Ulanoff, 2017). Additionally, the robot cost substantially more than a basic smart speaker equipped with a virtual assistant (Song, 2017).

Despite its poor performance as a virtual assistant, people still valued Jibo because it appeared to have a personality. They seemed to excuse its shortcomings because of this quality. As a virtual assistant (a technology meant to help users streamline housework by scheduling appointments, organizing entertainment and arranging meals), Jibo was a failure. But as an artificial companion, Jibo was a relative success. What can we learn from this? It is reasonable to suggest that people who value robots for the companionship they provide via their perceived personalities may more willingly accept their shortcomings – and the additional housework these machines produce. Say, for instance, that Jibo ordered ‘flour’ rather than ‘flowers’ from the internet because

³The scholarly and journalistic literature referenced in this section concerning Jibo mostly centres around adults’ perceptions of the robot’s simulated personality and ‘death’, thus showing that adults, as well as children, project human-like qualities onto robots of this type.

it misinterpreted a voice command. If it presented this error as an honest mistake via language in line with its perceived personality, it could persuade a user who values its artificial companionship to excuse its failure (Calo, 2011).

Conclusion

We should expect domestic robots to reshape rather than diminish housework. Technological innovation inside the home has not decreased the amount of labour needed to prepare homes for private activities, but instead shifted how households go about realizing this goal, usually resulting in women taking on more housework. The introduction of domestic robots will have similar outcomes. We can see this process unfolding by examining a selection of domestic robots that have already reached the market.

Is it worthwhile to adapt housework to accommodate domestic robots? If households enjoy the resources domestic robots help them produce, then yes, we could say it is worthwhile for them to take on the additional housework these machines create. However, we can expect these machines to create new obstacles that households must deal with. This task has customarily been left to women. If we do not want domestic robots to contribute towards the continuation of unfair divisions of labour at home, we should pay attention to how they affect housework and who ends up dealing with the new tasks they create. Indeed, I believe researchers from human–robot interaction studies (and adjacent fields) should anticipate that robots deployed inside the home will produce new work processes, responsibilities and expectations that someone must deal with to enjoy the benefits these machines (supposedly) provide their households. And should bear in mind that innovation of this kind has historically resulted in the reinforcement of unfair divisions of labour in the home – an outcome that could happen again if we fail to recognize that adapting housework around domestic robots is work itself.

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