

Chapter 2

Robot Shift from Industrial Production to Social Reproduction

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This chapter analyses people's attitudes towards the use of robots in the different domains of life and, specifically, in the domain of social reproduction. The analysis is based on Eurobarometer 382 "Public Attitudes towards Robots" data ($N = 26,751$), which was carried out among EU citizens aged 15 and over in 27 member states in 2012. The results of the study show that on average European perceptions of robots are positive and permissive. The life domains in which robots have already been used for a long time (e.g. space exploration, manufacturing, military and security business, search and rescue work) turn out to be the most popular areas for the further penetration of robots. The least preferred life domains are those, which address the core functions of social reproduction (e.g. care of children, elderly people and the disabled, education, leisure). With a series of ordinal logistic regression analyses, we outline the socio-demographic factors that are associated with the willingness to have more robots in the various fields of social production. Pensioner's supportive attitude towards the use of robots in health care and educational activities is highlighted.

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2.1 Introduction

The industrialised world is experiencing a shift from industrial to social robotics. In terms of social politics, this is an epoch-making change; while automation and industrial robots first and foremost have affected the demand for mechanical human work and working conditions in the industrial work (e.g. Zuboff 1988; Rifkin 1995), social robots are being designed to deal with human care, health, domestic tasks, entertainment and various other forms of immaterial and material tasks which aim to renew human capacities. It is these typically non-monetized domestic tasks that are gathered under the concept of social reproduction (Fortunati 1995). Consequently, for the first time we have to think about the possible consequences of robots, not only for industrial production but also for social reproduction. This shift leads us to study and discuss the relationship between social robots and the policies that are framed to deal with the problems of social reproduction.

In this chapter, we analyse people's attitudes towards the use of robots in the different domains of life and, specifically, in the domain of social reproduction (e.g. care, domestic tasks, education, leisure and health). To this end, three research questions are defined. First, what is the overall attitude towards the use of robots in Europe? Second, in which domains of life are Europeans most willing to see more robots in the future? Third, who is most likely to accept robots in the field of social reproduction in Europe? The types of robots which are within the scope of this research are human-like and instrument-like robots.

The chapter begins with a description of robots as the targets of social research. We argue that while industrial robots were involved with a relationship with strong social groups (like organised labour force), social robots deal increasingly with the weak social groups, like children, disabled and the old people, which call for special attention from social researchers. Where the industrial sector means guaranteed and formalised salaries, the strong presence of unions, and highly formalised work contracts, the reproduction sphere means unwaged work (domestic), lack of support from unions, and limited formalised negotiation, because it is mainly considered a "private" sphere. We will then undertake a secondary analysis of Eurobarometer 382 "Public Attitudes towards Robots" data ($N = 26,751$), which was carried out among EU citizens aged 15 and over in 27 member states in 2012. With this analysis, we will answer our three research questions, and we will then conclude the chapter by discussing the types of social policies that are needed in the era of robot-mediated and robot-assisted social reproduction.

2.2 What Changes When Robots Enter the Social Sphere?

The societal role of robots has changed profoundly with the shift from industrial to domestic robots. There were three main reasons for using robots in industrial sectors. Robots were introduced to take care of dangerous and/or repetitive jobs, to

save human labour and human lives. They were employed to improve the quality of products (e.g. gluing, spraying, testing, gauging), and production processes (e.g. assembling). Finally, robots were superior to human labour in terms of guaranteeing the regularity of the work, including the fact that they do not go on strike. The introduction of domestic and assistive robots has enabled us to refine and update our understanding of robots beyond that of being machines that perform dangerous, dirty and monotonous work (Dautenhahn et al. 2005; Kim and Mutlu 2014).

The reasons for using robots in the domestic sphere are different from those for industrial production. In the domestic sphere, in fact, the products and processes with which social robots are expected to be involved are not dangerous for humans. Similarly, their ability to maintain the regularity and speed of work are less appreciated properties in this context. On the contrary, social robots are expected to “make good” and take care of people, work which presents serious problems of formalisation. Thus, flexibility, adaptability to personal needs and the ability of complex reasoning are more relevant properties for social robots. It can also be posited that the increasing interest in the use of robots for social reproduction might be time related. Women, especially, have increased the time spent on paid-work between 1970 and 2000, which was maybe accompanied by a decrease in their supply of unpaid domestic work (Gimenez-Nadal and Sevilla 2012). There is also evidence from some countries that the number of people helping grown-up family members has dropped between the 1990 to the 2000 (Pääkkönen and Hanifi 2011). At the same time, the spatial and temporal dispersion of families makes family-based care increasingly difficult to arrange. It is against this backdrop that social robots can be seen as a way to compensate for this lack of time.

It is equally important to realise that social robots face very different kinds of counter forces than did industrial robots. While industrial robots function in semi-public spaces (e.g. factories) which are usually controlled by managers and regulated by workplace policies and labour laws, social robots enter the private sphere of life, which unfolds in people’s own homes or in nursing homes. Therefore, the questions of privacy, intimacy and affects, as well as the issue of care labour, come to the fore. What kind of shared rules and public policies do we need to make sure that robots are introduced and used in the sphere of social reproduction in a proper manner? Second, while industrial robots faced the relatively well-organised and strong labour movement that defended employee rights, today’s trade unions are somewhat weaker in the face of the global competition over the waged and, particularly, the unwaged labour force. Actually, the protecting hand of trade unions has never reached unpaid domestic work. If a ghost in the industrial sector is the fear of losing a job due to the introduction of robots in certain sectors, in the domestic sphere this fear does not affect housewives or househusbands who work without any economic retribution. This fear might, however, affect waged-workers and professionals in the health care, education, social care and entertainment sectors. Thus, in the sphere of reproduction social robots do not need to fight against labour movements and trade unions, but they do need to win over the confidence of individuals and families, with whom they are supposed to work. Finally, earlier robots were designed for industrial work, which mostly employed male labour.

Social robots, conversely, are designed to deal with social reproduction, such as taking care of children, the elderly, the disabled and the ill, tasks which have traditionally been carried out mainly by women (Boyer 2004; Sparrow and Sparrow 2006). The importance of this kind of reproductive work has never been truly recognised by policy makers, as reflected, for example, in the fact that reproductive work is not included in the gross domestic product (GDP). All in all, social robots are mainly expected to deal with weak social groups, something which makes it important to study this new generation of robots from the perspective of social and policy studies. In addition, social robots work as a kind of boundary object, marking the line between low-tech home technologies and high-tech industry, masculine devices (robot) and feminine work (e.g. social work, health care), commodity production (robots for mass-production) and individual reproduction (e.g. personalised assistive robots).

This shift from production to reproduction was preceded and supported by the introduction and development of a series of automated processes of social behaviours, which are strongly creating an acceptance of the robotification of society. We refer here to the processes of automation which affect the areas of taste (Barile and Sugiyama 2015), communication (Bakardjieva forthcoming; Baron forthcoming), information (Vámos 2009), education and play (Fortunati 2015). These processes can be considered as forms of proto-robotification of the immaterial sphere in society, made necessary by digital technologies that allow an incredibly large number of people to express their opinions and tastes, to buy and consume goods (e.g. Shirky 2008).

2.3 From Individuals to Societies and Beyond

In spite of the fact that robots are now entering the home, the analytic level of social robot studies has been quite limited. It is somewhat paradoxical that while the role of automatisations and industrial robots has been generally considered, perceived and analysed as a societal challenge that transforms the labour market and work processes (e.g. Rifkin 1995; Frey and Osborne 2013), social robots have been so far studied largely by analysing the perception and behaviours of only small groups of individuals (Meister 2014, p. 113). More precisely, roboticists, designers, sociologists and psychologists have mostly investigated individual and situational factors, such as the perceived human-likeness of a robot (Halpern and Katz 2014) or the physical distance between a robot and human (e.g. Kim and Mutlu 2014), that might affect the acceptance and perception of robots (also, Meister 2014). We argue that it is equally—if not sometimes more—important to examine the life domains in which people at national and supranational levels are most willing to live and work with social robots (see also Enz et al. 2011; Takayama et al. 2008). Identifying the wider attitudes and perceptions, as well as the type of people behind them, contributes to a better understanding of robots. As social robots enter the reproduction sphere, including elderly people's homes,

children's rooms and kindergartens, it is crucial to understand which of these areas are receptive to robots.

To solve the large and complex social problems of contemporary societies, such as those related to the use of robots in social reproduction, both scientific knowledge and the opinions of citizens must be included in the decision-making process. While new technical solutions are certainly needed in this endeavour, it is equally important to understand how economic, social, political and cultural aspects of life shape the contemporary attitudes and opinions of citizens towards robots.

2.4 Data and Measurements

This chapter is based on a secondary analysis of Eurobarometer 382 "Public Attitudes towards Robots" data ($N = 26,751$).¹ This survey was carried out among EU citizens aged 15 and over in 27 member states in 2012. Respondents were interviewed face-to-face at home in their mother tongue (Eurobarometer 2012). To our knowledge, this survey is the most extensive so far, although not issue-free, attempting to gauge public opinion and citizens' attitudes towards robots. It covers a wide area of robotic applications and includes a good set of attitude measures. At the same time, however, it provided respondents with a rather narrow image of what robots were by presenting only two pictures of robots (Eurobarometer 2012, p. 4). The characteristics of the sample are reported in Table 2.1.

In order to investigate European attitudes towards robots in the shift from the industrial to the domestic sector, we analysed the answers given to the following two questions: "In which areas do you think robots should be used as a priority?" and "In which areas do you think that the use of robots should be banned?" A maximum of three answers per question was allowed. For both questions, the following domains of life were supplied as answer choices: Manufacturing; health-care; leisure; domestic use (such as cleaning); military and security; search and rescue; education; care of children, elderly, and the disabled; space exploration; agriculture; transport/logistics. Respondents could also choose "other domains," "none of them" or reply "I don't know." Based on these two original questions, we created a new measure to indicate the *overall attitude towards robots* (range = -3 to 3 , mean = 0.679 , standard deviation = 1.199). This variable summarises the answers regarding the use and banning of robots in the above-mentioned fields. The answers to the first questions were given a positive sign, while those to the second were given a negative sign, and thus this new variable ranges between -3 and $+3$. We then created ordinal variables indicating the willingness to see robots in the various domains. The values of these *domains-specific attitude* measures vary between -1 (ban), 0 (indifference) and 1 (use as a priority).

¹European Commission, Brussels: Eurobarometer 77.1 February–March 2012. TNS OPINION & SOCIAL, Brussels [Producer]; GESIS, Cologne [Publisher]: ZA5597, dataset version 2.0, doi: [10.4232/1.11481](https://doi.org/10.4232/1.11481).

Table 2.1 Description of the sample (non-weighted)

	%	N		%	N
<i>Gender</i>			<i>Children</i>		
• Men	48.3	12,928	• Family with children	40.3	10,786
• Women	51.7	13,823	• Family without children	58.3	15,604
Total	100.0	26,751	• No answer	1.4	361
			Total	100.0	26,751
<i>Age</i>			<i>Degree of urbanisation</i>		
• 15–17	4.9	1,322	• Rural area/village	34.0	9,095
• 18–24	9.4	2,516	• Small/medium-sized town	40.1	10,719
• 25–44	32.7	8,744	• Large town/city	25.9	6,916
• 45–64	32.2	8,623	• No answer	0.1	21
• 65+	20.7	5,545	Total	100.0	26,751
Total	100.0	26,751			
<i>Education</i>			<i>Country</i>		
• Low education	20.1	5,365	• Austria	3.9	1,031
• Medium education	42.4	11,348	• Belgium	3.9	1,051
• High education	30.8	8,227	• Bulgaria	3.8	1,006
• No Answer	6.8	1,812	• Cyprus	1.9	506
Total	100.0	26,751	• Czech Republic	3.7	1,003
			• Denmark	3.8	1,019
<i>Years of education</i>			• Estonia	3.7	1,000
• 15 or less	21.1	5,570	• Finland	3.7	1,003
• 16–19	47.6	12,540	• France	4.0	1,059
• 20 or more	31.2	8,227	• Germany	5.8	1,552
• No answer	1.6	415	• Greece	3.7	999
Total	100.0	26,751	• Hungary	3.8	1,021
<i>Activity</i>			• Ireland	3.8	1,008
• Worker	49.2	13,163	• Italy	3.9	1,036
• Housewife/-husband	7.9	2,107	• Latvia	3.8	1,024
• Unemployed	8.5	2,280	• Lithuania	3.8	1,021
• Pensioner	25.3	6,761	• Luxembourg	1.9	501
• Student	9.1	2,441	• Malta	1.9	500
Total	100.0	26,751	• Netherlands	3.8	1,014
			• Poland	3.7	1,000
			• Portugal	3.8	1,009
<i>Social class</i>			• Romania	3.8	1,020
• Low	20.5	5,487	• Slovakia	3.7	1,000
• Medium	50.7	13,552	• Slovenia	3.8	1,017
• Medium-high	26.2	7,002	• Spain	3.8	1,004
• No answer	2.7	710	• Sweden	3.8	1,016
Total	100.0	26,751	• United Kingdom	5.0	1,331

(continued)

Table 2.1 (continued)

	%	<i>N</i>		%	<i>N</i>
<i>Income</i>			Total	100.0	26,751
• Low	9.9	2,641			
• Medium	25.4	6,789			
• Medium-high	62.0	16,588			
• No answer	2.7	732			
Total	100.0	26,751			
<i>Family</i>					
• Couple with children	32.2	8,616			
• Couple without children	29.4	7,860			
• Single	28.9	7,744			
• One parent and children	6.4	1,714			
• Mixed families	1.7	456			
• No answer	1.4	361			
Total	100.0	26,751			

2.5 Results

Eurobarometer (2012, p. 6) report on the analysed data concludes that, among all EU citizens, 70 % have either a positive or very positive view of robots. To further investigate Europe's general stand on robots, we analysed the overall attitude indicator. Figure 2.1 shows that a large number of respondents, 41 %, provided the same number of answers to both questions inquiring about the areas of life in which robots should or should not be used. Almost 50 % of respondents chose more positive responses than negative ones. Only 10 % of respondents selected more domains where robots should be banned than those where they should be used. In response to the first research question, it results that on average European perceptions of robots are positive and permissive.

Regarding the second research question, Table 2.2 illustrates the life domains where Europeans would like to use robots as a priority. It turns out that life domains in which robots have already been used for a long time, such as space exploration and manufacturing, as well as life areas in which robots can clearly save human lives, such as military and security business and search and rescue work, are the most popular areas. After these four domains, the public support for robots drops quite dramatically.

Approximately 22 % of Europeans would like to see robots first and foremost in health care, 13 % in domestic activities, transportation and agriculture. Clearly, the least preferred life domains are those, which serve the core functions of social reproduction.

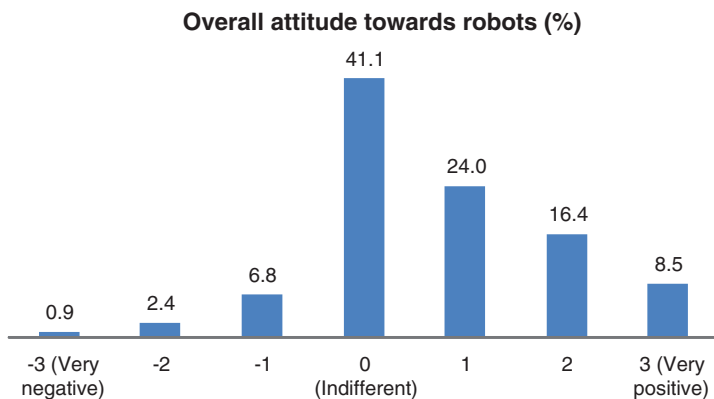


Fig. 2.1 Overall attitudes of Europeans towards robots (%)

Table 2.2 The domains of life in which robots are supported by Europeans (weighted)

Life domain	<i>n</i>	%
Space exploration	13,895	51.9
Manufacturing	13,282	49.7
Search and rescue	11,016	41.2
Military and security	10,937	40.9
Health care	6,007	22.5
Domestic activity	3,574	13.4
Transportation	2,962	11.1
Agriculture	2,813	10.5
Child/elderly/disabled care	947	3.5
Education	694	2.6
Leisure	670	2.5

Note Domains of social reproduction are in bold

These include care of children, elderly people and the disabled, education where the labour force of tomorrow is qualified and updated, and leisure, which refers to the time that people take for themselves to recover from work and their other duties.

As the shift from production to reproduction in robot use and research forms the basis of this study, we ran a series of ordinal logistic regressions in order to investigate the socio-demographic profile of the Europeans who are ready to see robots in social reproduction. Table 2.3 presents the results of these regression analyses considering health care, child/elderly/disabled care, domestic work, leisure and education, which enables us to answer our third research question.

Europeans who consider themselves as belonging to the highest social classes are more willing to see robots in health care than people who consider themselves in the lower social strata. Pensioners are more in favour of robots in health care than any other activity group, while single parent families are less receptive towards the use of robots in health care than the other family types. Willingness to have more robots in health care also increases with years of education and size of place of residence.

Table 2.3 Ordinal regression models for domain-specific attitudes

Independent variable (reference group)	Health care	Care of children, elderly, and the disabled	Domestic use	Leisure	Education
<i>Social class (lowest)</i>					
Medium	-0.065 (0.051)	-	-	-	-
High	0.170 ** (0.060)				
<i>Activity (Employee)</i>					
Housewife/househusband	-0.072 (0.083)	0.058 (0.084)	-	-	0.163 (0.085)
Unemployed	0.034 (0.073)	0.033 (0.777)			0.077 (0.778)
Pensioner	0.221 *** (0.051)	0.188 *** (0.048)			0.188 *** (0.052)
Student	-0.090 (.072)	0.224 ** (0.081)			-0.066 (0.087)
<i>Family (couple with children)</i>					
Couple without children	-0.061 (0.051)	-	0.070 (0.062)	-	-
One parent and children	-0.126 * (0.053)		0.101 (.066)		
Mixed families	-0.097 (.084)		0.206 (0.108)		
Single	-0.154 (0.122)		-0.290 * (0.144)		
<i>City (Rural area/village)</i>					
Small or medium-sized town	0.020 (.046)	0.118 ** (0.050)	-	-	-
Large town/city	0.150 ** (0.049)	0.155 ** (0.052)			
<i>Years of Education (15 or less)</i>					
16-19	0.109 * (0.055)	-	0.281 *** (0.073)	-186 ** (0.068)	-0.066 (0.059)
20 or more	0.294 *** (0.061)		0.377 *** (0.078)	-0.066 (0.071)	-0.165 * (0.065)

(continued)

Table 2.3 (continued)

Independent variable (reference group)	Health care	Care of children, elderly, and the disabled	Domestic use	Leisure	Education
<i>Age (15–18)</i>					
19–24	–	–	–0.369* (0.170)	–	–
25–44			–0.448** (0.157)		
45–64			–0.655*** (0.155)		
65+			–0.637*** (0.159)		
<i>N</i>	24,916	25,119	24,741	24,632	24,663

* = $p < .05$; ** = $p < .01$; *** = $p < .001$

Note Standard errors are in brackets. A positive coefficient indicates greater agreement with the use of robots. All models are controlled for the effect of country differences. Of other independent variables, only significant predictors were included

The use of robots for caring for children, the elderly and the disabled was predicted only by the respondents' main activity and the size of respondent's place of abode. In this respect, pensioners and students seem to be keenest to support the introduction of robots. It is particularly surprising to see that pensioners are significantly more likely to accept the use of robots in the care sectors than are the employed. People living in large towns and cities are more open to have more robots in the care sectors than people living in smaller town or villages.

Robots in the domestic activities seem to be mainly associated with three variables. First of all, singles are less likely than families with children to support the use of robots for domestic tasks. This makes sense as singles have comparatively fewer domestic duties than other kinds of family, and they would thus benefit less from domestic robots. Second, medium and long-term education is positively associated with the use of robots in domestic tasks. Third, the older the respondents are, the less likely they are to believe that there should be more robots taking care of domestic tasks.

In terms of supporting the introduction of robots to leisure activities, responses are instead particularly associated with the number of respondent's years of education. Those with from 16 to 19 years of education, which corresponds to a Bachelor's or Master's degree, are less likely than respondents with less education to support robots in leisure activities. Finally, people's willingness to see more robots in the education sector is mainly related to two factors: pensioners are more open to such robotic solutions than workers, while, conversely, the most educated people (with 20 or more years of education) are in this respect more critical than less educated.

2.6 Discussion and Conclusions

In this study we analysed European opinions on robots in general and, specifically, in the sectors of social reproduction. The analysis shows that a shift from their use in production to reproduction is not wanted by the majority of Europeans. Although the overall attitude towards robots is positive, permissive attitude towards the penetration of robots in the field of social reproduction in particular is still limited. A more careful investigation of this opposed area revealed some intriguing weak, but important signs for the future of social robotics.

First, against all prejudices, pensioners do not seem to be reluctant about the use of robots in social reproduction. On the contrary, they are significantly more supportive of the use of robots in health, care and educational activities than, for instance, workers. Thus, one may provocatively ask whether those who are concerned with the wider use of social robots might be their loved ones, who feel guilty about their inability to provide care, rather than the ageing pensioners themselves, who would benefit from assistive robots.

In terms of social policy, we must be careful not to neglect pensioners' own will by falling into stereotypic beliefs that older people are not ready for

technological innovations. Some experimental studies also hint that elderly people accept assistive social robots surprisingly well (Cavallo et al. 2014), even if the acceptance of robotic help seems to depend on the type of task. While a robot is sometimes preferred over a human by elderly people in instrumental tasks such as changing a light bulb or doing laundry, humans are favoured over robots in personal tasks, such as care and leisure activities (Smarr et al. 2014). Although they are easily seen as a weak social group (Fortunati 2014), we must remember that today's pensioners, if compared to the elderly of the past, are wealthier, live longer and more technologically savvy. Consequently, they should not be seen as passive recipients of social robotic technology, but as active co-designers and selective consumers of future robot devices and applications.

Second, as so often in the history of new technologies, large cities seem to be the most favourable places for the introduction of robots into the health and care sectors. While in villages and smaller towns attitudes towards the care and health services seem to still be more families and community oriented, in the large cities people are used to relying more on external or technological aid. Robots replacing a non-family caregiver, or an unknown medical professional, or acting as mediators between a person and a family doctor, might not be considered such a big problem as a robot replacing a family carer. It is also interesting to note that for the use of robots in domestic tasks and less intimate fields of social reproduction, such as leisure and education, the size of the place of residence does not matter.

The answers of the respondents to this Eurobarometer survey, who represent the voice of European citizens, are very important. Even if people still fear that they might lose jobs because of robots, the use of robots in the production sector is currently not their main concern when compared to social and individual reproduction sectors. In conclusion, the main concerns relate to the use of robots in care, healthcare and education. These are the areas that involve many social interactions and much human contact, and which in the age of sociable robots are presented as the new and prominent environment to which robots should be introduced. The concern regarding fewer human contacts partly relates to a misbelief that the use of social robots always aims to replace human beings or human tasks, when in fact the most frequent aim of social robots is to support and enhance user abilities or assist human carers in heavy tasks (Sparrow and Sparrow 2006; Cavallo et al. 2011). This misbelief is very probably related to the idea that the same logic that applied to the production sphere, where the introduction of robots primarily aimed to replace workers with more efficient machines, would be exported to the field of social reproduction. On the contrary, the logic that shapes the reproduction sphere is different, if not opposite, because the needs to be met are different.

From a technical point of view, social robots could be designed and developed to serve almost every aspect of daily life. Moreover, a substantial contribution from robots and other novel technologies is especially needed to ease reproductive tasks in the domestic sphere, when the double burden of work and care on women in particular is heavy in current European societies. However, at the same time there is a resistance among Europeans towards the penetration of robots in the

reproductive sphere. Taking public opinions into account in the decision making and trying to understand the reasons behind these opinions, increase the possibility that the design and implementation processes of social robots will be more suitable to European citizens' needs and not immediately rejected or prejudged.

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<http://www.springer.com/978-3-319-15671-2>

Social Robots from a Human Perspective

Vincent, J.; Taipale, S.; Sapiro, B.; Lugano, G.; Fortunati, L. (Eds.)

2015, XIII, 144 p. 12 illus., Softcover

ISBN: 978-3-319-15671-2