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Abstract

The purpose of this research is to understand what might be today—on the edge of the social robotics era—the role of robots in public spaces. In Europe, there was a strong tradition of automata exhibition in the '600 and 700' with ostensive purpose. Exposing automata in various fairs was meant to inspire awe towards the advancement of technology and science in the public who attended numerous public events. This study aims to investigatewhether in themodernworld the robot may have the same or other functions in public space. The study has analyzed the public display of the robot DORO: a technological artifact created by the Sant'Anna School during the European project ROBOT-ERA. Two distinct public moments were examined. The first was the night of researchers in Pisa on 30 September 2016 in Martiri della Libertà's square, where DORO was exhibited to the public. The second occasion was the inauguration of the 39th academic year of the University of Udine. On this occasion, DORO brought to the rector his inaugural lecture and exchanged—in front of a large auditorium—a brief dialogue with the rector of the University of Udine, prof. Alberto de Toni.

Keywords Social robot · Public space · Public events Social robot role in public space · Social robot audiences

1 Introduction

Robotics laboratories are full of prototypes of social robots that need to be tested in the everyday life spaces, we may say in the 'reproduction sphere', which includes homes, health care facilities, education systems, and so on. The aim of this study is to analyze the role of robots in public spaces as it has emerged in two different public situations. Although there is a rich corpus of scholarly work on the role of robots at home [1], in healthcare [2], in social care [3], in education [4–6], in entertainment [7] and so on, there are few studies on the object of our research [8–11]. These studies have especially focused on studying the use of robots inmuseums or shopping malls. We intend to contribute with this study to this specific area of robotics research, presenting an explorative research in two public situations, which have been scarcely studied so far. An antecedent,which inspired this study, is the experimentation carried out in Peccioli within the European funded project Robot-era (http://www.robot-era. eu), with robots circulating in the small center of Tuscany. In this study, we brought DORO [12], one of these domestic robots, in two different public events in Pisa and Udine. The first was in "The night of the researchers", an event that the universities in Europe organize every year in order to communicate to and involve citizens in the scientific discoveries they produce. In this case, we brought the robot DORO in the Martiri della Libertà's square in Pisa, a mid-sized city in central Italy. The second event we examined is the opening ceremony of the 39th academic year of the University of Udine. Here, the robot DORO was brought in a public building, and it was not open to interaction with all the audience but only with the authorities on the stage. Both these events concern the academic life and thus they are biased in terms of audience involvement and expectations. Nevertheless, they provided an interesting observation, which can stimulate researchers' self-reflection on how robots are perceived 'out of the labs', and on the methodologies which could be applied to investigate lay-people perceptions and attitudes.

2 The Robot in Public Space

The issue of the robot in public space is not a new one. It is a question, which the antiquity and middle age, renaissance and modern times have always dealt with. Automata in Hellenistic times, according to Ferrari [13], p. 225 onwards, were not only mere objects of entertainment but they were also "ostensible equipment," that is general instruments of application and demonstration of mechanical principles, and particularly pneumatic ones.

They were also silent messengers of the wonders produced by the development of science in combination with art [14]. Placed as a hybridization between nature and art, the automaton belonged in fact to the 'heterogeneous' class of wonders and 'effects and extra'.

In the Renaissance, the idea of the automaton-regained momentum and, as consequence, automata turned out to be placed in pleasant spaces, like the garden of lilies [15]. Historically, gardens are privileged places in which automata become fountains where the flow of water obeys a rhythm adjusted on the regular intervals of a gesture metric [16], p. 156 and p. 169. One of the first issues that emerges when robots are exhibited in public spaces is their two-faced nature, which is trapped in-between physicality and illusion. At the end of the eighteenth century, Jacquet-Droz developed three androids (the Scribe, the Designer and theMusician),which represent the best results obtained with traditional mechanics [17]. However, they were so perfect that the polemics on the aspect of automata flared up because of the magic halo that surrounded them and that derived from the delay with which the public could understand the truth of the artifact, or even from the impossibility on the part of the public to understand it. Beyond the religious problematic connected with scientists challenging God power to create living creatures, the difficulty to distinguish between automata and humans had to deal also with a secular issue: that of 'authenticity' [18]. The "social contract", in fact, in order to function requires a high degree of authenticity of the individuals and their social identity. Although humans do not always pursue authenticity and thus grant themselves various degrees of freedom in playing with inauthenticity, it is assumed that at a certain point one has to come back to authenticity. As Baron points out, the problem of the infringement conveyed by automata depends on the fact that their purpose was not only to surprise but also to trick the public.

The issue of authenticity becomes dramatic today, especially in their representation as androids or gynoids. Hence, the theme of authenticity brings further elements inside the question of the possible role that social robots can play in contemporary societies, that is, whether the anthropomorphic shape is actually the most suitable for robots to stay in the public places [19]. Another important issue concerning robots in public is that of art and fashion [20]. The automaton belonged to the 'heterogeneous' class of wonders and 'effects ad extra'. To which class do the contemporary robots belong? Due to their cost, they belong to the category of affluent technological artifacts for sure. For this reason, social robots require a good design. However, as Fortunati [21] showed regarding mobile phone, the new genealogies of technologies deal with design and fashion. Social robots, especially in their anthropomorphic shape, will also need to deal with fashion, because humans deal with it. Should they become fashionable or should they be dressed? There are several elements, which would point to personalization and fashionization of these artefacts. Amass production of social robotswould produce undifferentiated artefacts, but a robot entering the public space needs to be recognized by its owner. This is a problem that social robots share with the mobile devices, especially the mobile phone. The answers that ICTs have found so far are on the one hand the personalization [22] of the devices and on the other hand seeking help on from fashion. Personalization of the mobile phone, for example, is a tactic that has manifested in various practices of use such as the adoption of particular ring or music, particular ornaments and so on [23]. Fashion, instead, is a system that humankind has created in order to increase personal differences. Fashion is born as a social filter between the natural state of the body and its "civilization" [24]. In the case of humans, the clothed body embodies the social norms that the repression and regulation of sexuality have elaborated and imposed [25].

The clothed robot is set evenmore precisely in a particular social public context. As Fortunatiwrote [20], we have reasons to believe that also robotswill need to become fashionable to stay in public spaces. A personalized and fashioned robot waking in a street allows bystander's greater mutual control as it is more reassuring. A third main issue of the robots in public is the transformation they bring to the public space. Far from being merely physical settings, places acquire meanings due to their connections to individual and social activities. Place meanings involve the self (e.g. connections to individual identity and life path), the self-other relationships (e.g. meeting places), the self-environment link (e.g. symbolic and instrumental opportunities offered), and the other-environment connections (e.g. place atmosphere) [26, 27]. The public space, in particular, is the place in which encounters and social interaction take place.

It is the social arena where people expose themselves to the others and constitutes, by using the theatrical metaphor, the place of the front stage [28].

On the fore people represent themselves to the others, play social roles, provide information about themselves and their intentions but also leave other information transpiring unintentionally. All this implies a network of expectations and actuations regarding social practices as well as controlled and formal actions, which correspond to socially defined etiquette and behavior appropriateness [29]. The public space is also strongly regulated by laws, norms and institutionalized values, by daily routines and rituals, by cultural, social and political content and meanings. Public places, moreover, are relevant for defining citizenship and belongings: "Public spaces are the natural arena of citizenship, where individuals, groups, and crowds become political subjects. They are socio-physical settings where public life occurs on the basis of open visibility, scrutiny, and concern, supporting public interest and citizens' well-being" [30], p. 124.

In this sense we may also say that the public space has a particular feature of safety, because it conveys a sense of protection from the risks of the unexpected [31]. A robot entering the public space has to deal with the complex dispositive of the public space: will it be considered part of the environment, or included in the selfother relationship?Howdoes its presence interact with norms and societal regulation? In our case, we have two different public spaces: the Martiri della Libertà's square in Pisa and a building of the University of Udine. The square and the University auditorium had different scales, but they were also the stages of different interactions: an open encounter between science and citizens happened in the former, a highly ritualized ceremony involving authorities and cultural elites was held in the latter. Will the social robots be able to enter and have a space in both settings?

3 Methods

In this study,we triangulated three different research methods: non-participant observation, a brief semi-structured interview with open and closed questions to the public who approached and interacted in some way with robots, and audiovisual records

Fig. 1 The social robot DORO in Pisa

of the interactions with the robot aimed at integrating the information gleaned from interviews. The interviews collected in Pisa were N 49 and in Udine N 51. In both cases, we have two convenience samples that are self-selected on the base of spontaneous interest and willingness to participate in the research. The convenience sample consisted of 53 females and 47 males, age ranging from 8 to 80 years with amean of 38.1 (SD 18.312). Age was recoded into three broad categories: youth (8–24 years), adults (25–49 years) and elderly (50 and more).

As to education, only 9% have an elementary or junior high diploma, 27% have a high school diploma and 42% have a college degree and often a Ph.D. It is a group with a rather high level of education and with great interest in the scientific discoveries (among those who responded to the question "How much are you interested in scientific discoveries?" overall 82.5% said they were very interested compared with a 17.5% that has stated that they are moderately interested). This group is also particularly well equipped from a technological point of view: 88.0% says that they use the smartphone and even more, that is 99.0% use the computer. The answers provided during the interview to openended questions were subject to qualitative content analysis and to similarity analysis performed using open access software Iramuteq [32, 33]. Both the events were also video recorded (Figs. 1 and 2). In Pisa 39 persons (17 males and 22 females) had an interaction with DORO. By estimation these persons belong to all the age groups, with a concentration of children between 5 and 10 years. The analysis of the videos enabled us to investigate essentially three elements: the sequence of two typologies of contacts, a sequence of three actions taken by people and the dialogues that some people undertook with DORO. In Udine the main interaction happened on the stage between the Rector and Doro, the analysis of the videos enabled us to monitor the reactions of 64 spectators (30 males and 34 females). Essentially, this analysis has allowed us to analyze the reactions of the public sitting in the front left and right rows and in the second left row (the second right row was not visible).

Table 1 Interactions with DORO in a first and second moment

Contact	First moment	Second moment
1. Shake hands with Doro	31 (79.5%)	0 (0.0%)
2. Take the bottle and hand it to bystanders	0 (0.0%)	12 (30.8%)
3. No contact	8 (20.5%)	27 (69.2%)
Total	39	39

4 Results

4.1 Video Analysis

In Martiri della Libertà's Square, Sant'Anna School had prepared a display counter with two robots: DORO and Nao. DORO turned out to be the most attractive for the people who passed by. DORO did two actions: first gently took a bottle of water and handed it to bystanders [34]; second, it managed some dialogues with those who tried to talk to it [35]. Table 1 illustrates the sequence of the direct interactions with DORO on the part of bystanders. In a first moment, the large majority of people shook DORO's hand, while a fifth of them avoided any contact. In a second moment, only a third of them took the battle from DORO. This table is very interesting because it shows the majority of people tended to introduce and replicate with robots the same rituals such as to "shake hands" that they perform in public encounters with humans. But apart these direct interactions, what are the other actions performed by bystanders? In Table 2 we report the actions in sequence. It can be noted that the large majority of bystanders fundamentally looks at DORO (action 3), a fifth of people wave at DORO (action 1), and five persons try to talk to it and elicit a reaction (action 2). Five bystander do not start any action towards DORO. The contingency table coming from the cross tabulation of the actions highlights that only one person tries different approaches (waving and moving the hand).

Fig. 2 DORO leding to the chancellor of the University of Udine his inaugural lecture

Table 2 Actions taken by the public in sequence

Action typology	Action 1	Action 2	Action 3
1. Wave at Doro	8 (20.5%)	1 (2.6%)	
2. Move the hands in front of DORO to elicit a reaction		5 (12.8%)	
3. Only look at DORO			34 (87.2%)
No action	31 (79.5%)	33 (84.6%)	5 (12.8%)
Total	39	39	39

Crossing the three actions, it emerges that of the 39 persons recorded only three (7.7%) did not perform any action. Apart, we explored also the dialogues that developed during the interaction between bystanders and DORO. More than a third of the bystanders (N 15; 38.5%) had no dialogue with DORO, and these were mainly females (N 10; 66.7%). As to the dialogues with DORO, particularly interesting are those between children and the robot. DORO approached people by saying: "I am pleased to meet you. My name is DORO". Several children answered by saying their names. A strong empathy with DORO has emerged in several cases, as it often happens with animals. A child (F, 5–10 years) answered DORO greeting by saying: "I love you. Hello". Another "I like you". Others said: (F, 5–10 years) "You are very kind", (F, 5–10 years) "You are very sweet and cute", (F, 5–10 years) "You're like a good little soldier", (F, 5–10 years) "Ooh DORO, I adore you! You are so cute", "You're so funny and cute". A child was asked by DORO: "What do you think about robots?" The child answered: "You are marvelous". Then, he asked DORO: "Do you know SIRI?" Children replicate to DORO as if they were adults talking to a little child, encouraging it after an appropriate action. In fact, when DORO gives then a battle of water they say to it: (F, 5–10 years): "Thanks, little one" or (F, 5–10 years) "You have been very good". To many children DORO personifies a young woman. One (M, 5–10 year) asked: Do you have a boyfriend? Another (M, 5–10 years) "What is your favorite food?" Another one (M, 10–15 years) said to DORO: "Prepare to me a sandwich" and its peer: "DORO, sing a song". A woman (40–50 years) was asked by DORO: "What is the most beautiful thing you saw today?" and she answered: "It is you, DORO". Then, this woman said "DORO, look at me that I want to take a picture of you". DORO answered "Let us do a selfie together". In Udine, overall 85.9% of the public showed a great interest, only 12.5% were puzzled and only one person was very indifferent (it was a girl who, when DORO took action, continued to read a book). Public's behavior was recorded also in Udine and we report the actions that people took in the following Table 3. Table 3 tells us that the first reaction is to smile as we do in any public encounter with somebody. Then, a behavior that involves the public in all of the sequences of the actions is to applaud. Applauding involves more than half of the public as second action. It is surprising the few people who took a picture of the robot. Maybe because, being the inauguration of the academic year a ceremony, it is not considered appropriate to take a picture with the smartphone.

Table 3 Actions taken by the public in sequence (participants N = 64)

Action typology	Action 1	Action 2	Action 3	Action 4
1. Smile	**57** (89.1%)			
2. Talk to your neighbor	1 (1.6%)	14 (21.9%)		
3. Move to see better		6 (9.4%)	4 (6.3%)	
4. Take pictures of the robot		5 (7.8%)	1 (1.6%)	
5. Applaud	5 (7.8%)	**33** (51.6%)	15 (23.4%)	2 (3.1%)
6. Indicate the robot			4 (6.3%)	7 (10.9%)
7. No action		6 (9.4%)	40 (62.5%)	55 (85.9%)

4.2 Analysis of Self-report Questionnaires

Free words association to the term robot gave the following results. A dictionary of 317 words was created by respondents (Table 4). The eight dimensions emerged by content analysis describe the conceptual map of DORO. This map includes the elements of which the robot is made, its functions, its positive and negative characteristics at physical and at psychological levels,where robots come from and where they go. These categories are in line with those emerged in previous research that investigated the computer, the mobile phone and the Internet [36, 37]. We then investigated respondents' opinion about DORO. The first open question that we have posed was "Does DORO correspond to the idea of robot that you had before?" The qualitative content analysis of the answers to this question highlights 4 categories of meanings, as it is reported in Table 5. More than a third of respondents who answered this question found a correspondence between the idea that they had about robot and DORO. This means that this particular robot embodies people's imagination of and expectations towards robots. Nine people only have foundDOROvery different from their expectations.More than a quarter of the attributions to DORO are positive in the sense that DORO overcomes the expectations and as many are negative in the sense that DORO is less than what they thought. To investigate more deeply inside the expectations of people towards robots we also asked: "To what extent DORO has satisfied your expectations?" on a 10 points scale. The answers obtained were very positive: the averagewas 7.28, SD 1.983. A univariate ANOVA ($F(3)$ 6.282, $p < 0.01$) shows that the most satisfied by DORO (M 8.20) were those who found DORO different from the idea of robot they had were, followed by those who found DORO more beyond their expectations (M 7.79) and then by those who found DORO very in line with their expectations

Table 4 What is a robot?

Dimensions	Frequencies	Content
What the robot is made of?	82	Cables, circuit, gears, tin, metallic 5, humanoid 3, automation 18, automaton 2, mechanics 6, machine 8, electronic object, domestic appliances, vacuum cleaner 3, instrument, technology 18, tablet, television, Playmobil, giant, terminator game, industry 2, programming 3, artificial intelligence 4, software
The positive characteristics of the robot at psychological level	53	Reliable, amicable, beautiful 2, enjoyable, fun 2, Company 4, Interactive 4, socialization, availability, curiosity 4, amazing wonder, provocative, charm, interesting 3, kindness 2, fast 3, intelligent 5, sophisticated, smart, hardworking, brilliant, ingenious, special, complicated, funny 3, effective, efficient, special, great potential, important for children
The positive characteristics of the robot at physical level	14	Agile, color, fashion, fast 3, elasticity, flexibility, bright, alive, precise, movement, hands, view
Robot's functions	49	Aid 13, aid for existence, service, convenience, comfort, substitute 2, slave, servant, utility 24, functional 2, use, indispensable
Where does it go?	36	Innovative 8, ideas, ingenious, new 2, modernity 3, progress, one step ahead, evolutive, you really have to work more, the future 12, improvable, distant hope, progress 3
From where does it come?	15	Science 3, Asimov, science fiction, knowledge, information, scientific discoveries, inventions, engineering, learning, robotics, electronics 3
The negative characteristics of the robot at psychological level	24	Coldness 4, aloof, disturbing, disquieting, pseudo-clever, complicated, silly, simple, heartless, I do not trust, threat, strange 3, unreal, surreal, ridiculous, reductionist, imitation, spectacle, magic
The negative characteristics of the robot at physical level	12	Slow, humanoid 4, static, not autonomous, the better a fool machine, bad copy of the human being 3, snowman

(M 7.59). The lower satisfaction towards DORO was experienced coherently by those who were deluded by it (M 5.75). Finally, respondents' satisfaction does not differ in Pisa and in Udine. Second, we asked (open question) an evaluation of the dialogue with Doro. The answers are illustrated in Table 6 and show that they have been perceived by our respondents, half natural and half artificial. When we asked "Would you like to bring DORO at home?" 46.5% of the respondents answered yes, 51.5% says no or is uncertain.There are no significant differences by gender. On the contrary, age affects answers. Adults are the least ready to bring a robot like DORO at home, while youth and the elderly are more likely to do so ($\chi 2$ 9.178, df 2, p 0.010).

Table 5 Does DORO correspond to the idea of robot that you had before?

Dimensions	Frequencies	Content
Similar	28	Consistent enough, quite appropriate, close enough to the idea that I had, tight, it looks a lot like a robot I had imagination, similar to other robots developed by the university around the world, similar to the imaginary, similar 3, similar especially the face, equal 2, the same idea I had, almost respected my idea 5, mirrors 2, reflects the idea of the slow robot with recorded voice, reflects the expectations, I already know Doro, in line with the idea I had, in line with the idea of simple and experimental robots, I study robotics thus I have an idea, more or less
Different	9	Very different, different 2, away from the robots of science fiction but anyway, made as a person, humanized, human above all expectations, more humanoid than I expected, it is like an innocent and asexual child
More	22	Beautiful 2, interesting, companion, made well, very useful, simpler than the one depicted on television 2, more funny 5, it looks a bit "Star Wars", advanced robot-like autonomous with fluid movements and words, I especially liked the female voice, a first approach to what you could do, an innovation, a very good surprise, useful, a living thing that in the future will be important to every day, we come to something that can be useful
Less	22	Disappointing shape, the use of robotic voice presented various flaws, slightly clumsy, less evolved than I thought 2, less innovative, slightly smart, more stupid, I fear the slow pace of the operations + Fast, quite slow, a bit 'too slow, a bit slow', a bit 'stiff', static, I expected the robot would be useful, not very useful, this however is unusable, it seemed much less tech than the robots I see on the web, bad, primitive compared to movies, but very technological, rudimentary, it moves in a way which is slightly human

Table 6 What did the dialogue with DORO look like to?

Dimensions	Frequencies	Content
Natural	24	Nice 5, somewhat surreal, funny, interesting 2, surprise, fluid 3, natural, normal conversation between humans, alive, solid, prepared, good 2, positive but unrealistic, clear, I did not understand though if DORO interacted with the Rector autonomously or if it was silent because it understood what the rector was saying, normal, short
Artificial	27	Rather ridiculous 2, limited, trivial 3, poor, elementary, simple 4, embarrassed, little fluid, very few humane, strange, impersonal, formal, mechanical, machinic 2, artificial 3, an interaction similar to that occurring with SIRI, it gave the impression that it was planned, prepared 2

This study confirms results from the Eurobarometer survey that highlighted a need expressed by the elderly people to be helped by a social robot [38, 39]. Education also affects results, but it works in reverse of what we expected: the higher the level of the education the lowest availability there is to bring at home a robot like DORO (χ2 6.079, df 2, p 0.048).While the attitude towards scientific discoveries is not related to the availability to bring DORO at home, the type of public event and the place where it occurs have significant effects on this availability, which is higher in Pisa than Udine (χ2 9.701, df 1, p 0.002). Finally, a univariate ANOVA shows that those who would be available to bring DORO at home, are convinced more than the others that robots will not steal jobs (M 4.62 vs. M 5.96, F(1) 4.522, $p < 0.05$), that robots will help humans in their jobs (M 8.93 vs.M 7.73, F(1) 8.347, $p < 0.01$), that they feel more safe towards DORO (M 9.18 vs.M 7.87, (F(1) 9.010, $p < 0.01$) and that they had a certain sensation that DORO looked in their eyes (M 5.42 vs. M 3.33, F(1) 8.425, $p < 0.01$). Given these results, it is not surprising that to the question "Do you appreciate the presence of a robot in public space?" 83.2% of the respondents' statements were affirmative, which is an important result for this study because it confirms that these people are ready to accept that social robots could play a role in public space. Here age, gender, education and the attitude towards scientific discoveries are not producing significant differences. The typology of the event and the place have instead significant effects: in Pisa respondents appreciate the presence of a robot in public space more than in Udine ($\chi 2$ 9.248, df 1, p 0.002). Moreover, a variable that is relevant in this concern is the availability to bring a robot at home. The more people are likely to do so, the more they are likely to appreciate the robot in public space ($\chi 2$ 15.979, df 1, p 0.001). A more vivid appreciation of the presence of a robot in public space is also connected to the opinion that robots will support humans in their jobs (F3.553 15,684, p < 0.0001), that with DORO respondents felt safe (F3.593 23,863, p < 0.0001). By contrast, the fear that robots will rob people's jobs does not generate differences in this concern. To investigate the extent to which respondents appreciate the presence of a robot in public space we asked "From one to ten how much did you appreciate DORO in public space?" The answer was an average of M 8.10 (SD 1.857). Then we asked the respondents if in their opinion it could be useful a robot that give information in public space. To this question 83.2% of respondents answered yes and they expressed an average of this usefulness of M 8.38 (SD 1.612). At this point, we passed to ask also "What do you need in order to feel save in respect to a robot that moves in public space?" To this question, a third of the respondents answered they do not need anything particular because they feel safe with a robot. Some of them hoped in a better interaction with robots and for others the most important thing was that robots should "not hurt children and the elderly" or "do not suddenly go crazy". Less than 10 people wished a good control over them: "a good and fair management" and "knowing that obey the laws of robotics". Other respondents stressed the importance of knowing the purposes of their functionality, to what exactly they were designed for, who have programmed them, to know their operating instructions and safety instructions, their proper role in preventive information and on

Table 7 Feelings of danger and safety

	Robots will steal jobs	Robots will help humans in their jobs	I felt safe in respect to DORO	I have had the sensation that DORO looked into my eyes
N	96	96	96	88
Average	5.31	8.34	8.57	4.44
St. Dev.	2.996	2.025	2.111	3.376

how to intervene. Others put the accent on the need that they must be done properly, with a protected software and not hackable, well programmed and comprehensive, that they understand human commands 2, which can recognize the obstacles 2, with good sensors and programming mechanisms, made of non-ferrous material such gels and with a comfortable look. Finally, others underlined the necessity to limit their power, by having the capability to predict their movements, that they should have limited mobility, intelligence and strength, that they are easily deactivated, a switch to be informed of their presence and ability to disable functions, they are armless, that there is an easy way to lock them, to shut them down, to slow down them if they move. The robots should be safe, teasers that have not weapons. Table 7 reports that our participants, first, did not perceive any sense of danger or fear from DORO presence in the public space. Second, they are strongly convinced that robots will be of help to humans in their jobs and activities. This belief is significantly stronger than the fear regarding robots stealing jobs. The application of the non-parametric Friedman test for K dependent samples has shown that the difference among these averages is significant ($\chi 2$ 117.874, df 3, p 001). At this point, we explored also what effect did DORO's movements cause on our respondents, as Table 8 reports. Table 8 shows clearly that respondents' evaluation of the movements made by DORO was more negative than positive, meaning with this that we have to go a long way before the gestures of robots will be considered acceptable. Finally, we investigate the extent to which respondents have appreciated the presence of a robot in public space. Our respondents showed a large appreciation of their presence in public space (M 8.10).

In particular, they stated that robots could be useful to give information (M 8.38), being an attraction (M 7.98) and entertain the public (M 6.53).

5 Discussion and Final Remarks

These two studies showthat robots are amature technology to be used in public space for purposes at least of entertainment and information. Overall, our respondents have expressed a positive attitude towards them. As for the automata, it is still the illusion

Table 8 Evaluation of DORO's movements

Dimensions	Frequencies	Content
Strong points	25	Natural enough 3, arm movement was natural, normal, good 2, beautiful, I do not know how to explain, fluid 4, pretty loose, good impression, almost perfect, almost human, normal for a robot, wonder 3, curiosity 2, surprise 3 amazement 2, only the hand, it took the bottle to the kids, they were amazing I did not seem unreal, they are plausible, veritable, sweet, They have appeared familiar to me, they are well done, harmonious, interesting 3, liked to be fine but a bit slow 2, but good, coordinated, coherent, normal, very relaxing, delicate lenses of a newborn, graceful, gentle, spontaneous, delicate, calibrated, harmonic 2, at times mechanical, non-mechanical, loose movements, realistic, I liked them, precise, fairly fluid, at times fluid, that can be made more fluid or at least so hoping, robotic effect, but positive, it was what I was expecting, there were moments I expected, now I hope they start walking, well programmed 2
Weak points	37	Rigid 3, clumsy, little fluids 2, so… "impatience", lenses 6, I expected faster, fake, an unbelievable puppet, stereotyped, unnatural, I expected more naturalness, not spontaneous, they do not convey the idea of a humanoid robot, strange 3, skinny, limited, I thought it would move best, elementary, mechanical, robotic, artificial, driven, fear, lack of accuracy, no particular effect, no effect, there is no effect

and the unexpected that fascinate our participants. Thosewho were more surprised by the robot (it did not fit with their previous image) showed more positive evaluationsof DORO's affordances and capabilities. Asecond result shows that our participants overall have a positive attitude towards the presence of robots in public space, but only half of them (and namely the elders and the young participants) are ready to have one at home. Indeed, the analyses of interactions with the robot show that public patterns of behaviors are largely enacted (e.g. shaking hands), whereas it is mainly the children who show intimacy towards the robots. But children are more used than adults to cultivate a fictional world populated by puppies and toys in general, whereby they are more comfortable with the simulation expressed by the robot. Finally, even if at an exploratory level, it seems that the two different settings suggested alternative interaction with the robots and alternative positioning in public space. The interaction with DORO is treated as a self-other encounter in Pisa square (with shaking hands and selfies), whereas it is much more limited to the attendance of a public performance in the Udine ceremony. Fashion, clothing, personalization of the artifact did not emerge at this stage, but we are confident that the more robots will enter public space, the more this aspect will prevail over other factors such as illusion and surprise that are still prevalent. A last line to underline the main limit of this studies, that is the limited number of participants involved, which allows only preliminary conclusion that need to be corroborated in future by a more robust sample of respondents.

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