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Communicative AI in (Inter-)Action

Investigating Human-Machine Encounter
outside the Laboratory

[transcript]

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Programming Engagement: Shaping Human-Robot-Public Interaction in a Smart City Robot Competition

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Abstract *This chapter presents a situational analysis of SciRoc, the first ever "**S**mart **ci**ty **Ro**bots **c**ompetition", organized by the European Robotics League (ERL) in partnership with Milton Keynes City Council in the United Kingdom and a number of academic and commercial sponsors. Besides this competition, we use data collected during other ERL competitions in test beds and living labs in Madrid, Oldenburg, Bristol, mainstream media reporting and extensive conversations with participants. We argue that since competitions are constituted by different sets of rules, and since these rules intersect with the values, practices, assumptions, politics, and interests of their sponsors and organizers, they are appropriate sites for studying the institutional shaping of human-robot-public interaction. We identified three modes of human-robot-public engagement: embracing engagement, an open and attentive form of engagement that was sensitive to the needs, interests, and concerns of various participants, sponsors, and members of the audience. Second, bypassing engagement, a more constrained and constraining form of engagement that limited the possibilities of mutual understanding between competition participants and the various publics. Third, prefiguring engagement, a variety of previous commitments and expectations that brought the event into being and gave it shape, but that rigidly framed the ways in which publics and participants could engage with each other. These three modes of engagement in turn revealed and were shaped by different logics of social ordering, namely conviviality, control, and care.*

1. Introduction

On 18 September 2019, 18 year-old hairdressing student Leila Ahmed walked out from *The Hair and Makeup Academy* and into *MK:Centre* for her daily wander in this shopping mall, the largest in Milton Keynes and a central place for social life in this 1960s-founded English town. Heading for the *Costa* café, Leila was intent on a strawberry iced infusion and a browse through some shops before making her way home.

As Leila approached *Costa*, she encountered what for sure was one of the most bizarre set ups she ever saw in the shopping mall: The entire exhibition hall, an area

of nearly 60x40 m, was taken over by a large gated setting composed of a portable illumination structure reminiscent of a music concert stage, an interior wall formed by 1.20 m high hoardings, and a number of massive posters walls of nearly 5x6-10 m that sectioned the area. On the posters were cartoon-like illustrations of people enjoying beverages in a café (see Fig. 1), taking the lift (see Fig. 3), and receiving paramedic attention (see Fig. 4). On each, the poster's larger-than-life inhabitants interacted harmoniously with docile, friendly looking, big-eyed robots.

Other small hoardings with prints from *Costa* and the European Union hanged inside these premises, and one section of this odd setup was fully covered by a 5 m high protection net cage (see Fig. 4). The whole area was surrounded by barrier belts that read "for your own safety please do not enter". In the middle of all this paraphernalia, at least 60 people ran moving around unused furniture, flat screens, and spare lamps. Some others installed workplaces with laptops, and some of them unboxed and assembled, what seemed to be, real-life robots (see Figs. 1–4).

Fig. 1: The SciRoc competition arena from different angles (the authors, 2019)

Fig. 2: The SciRoc competition arena from different angles (the authors, 2019)

Fig. 3: The SciRoc competition arena from different angles (the authors, 2019)

Fig. 4: The SciRoc competition arena from different angles (the authors, 2019)

Today was the first of several days in which Leila's daily routine would be disrupted by a complex and multi-layered event, to which she came back on several occasions to observe and to make sense, little by little, of what it had to offer. Before enrolling in *the Academy*, she had considered studying computer science, and the event's visual design reminded her of a number of recurring themes from her time investigating computer science pamphlets and degree program webpages: the digital transformation is around the corner; social robots and artificial intelligence will make tremendous impacts in our daily lives; a young workforce must be prepared to take part in this exciting, if scary, technological revolution. Leila was also concerned about the idea of having robots everywhere – she was aware that hackers could take control of them and data wasn't always kept private. But most of all, Leila was intrigued by the images of people living, being and working with robots in what looked to be the most convivial of smart cities[1].

1 We thank the editors of this volume for raising up the issue that hairdressing is a traditionally gendered role. We decided to include this detail because it was indeed hairdressing that a young member of the audience – who here we call Leila – studied. Yet, she also had considered studying computer science. We include this detail to highlight that ordinary members of the audience have rich and fascinating lives, they are intelligent and critical, and scientific and technological higher education might be in their interests even though they are enrolled in non-scientific occupations.

The event that Leila walked into at the MK:Centre was the product of a multi-institutional coordination effort: *SciRoc*, the first ever "**S**mart **ci**ty **Ro**bots **c**ompetition", organized by the *European Robotics League (ERL)* in partnership with Milton Keynes City Council and a number of academic and commercial sponsors.[2] The *SciRoc* website stated that "recent developments, such as autonomous cars and service robots, provide […] evidence that smart cities are indeed a privileged environment for the introduction of robotic technologies"[3]. *SciRoc* intended to advance "the integration of autonomous systems in smart cities" by examining "difficulties of dealing with complex and large scale scenarios"[4]. The objective was to assess "how robots can integrate and co-operate with a complex city environment [and] how robots can act both as data collectors and data consumers of the cities' digital hubs"[5]. Most importantly, *SciRoc* aimed to present "the first robotics challenges where robots will interact with ordinary people (i.e. customers of the shopping mall) […] offering unique opportunities to boost the robots' social acceptance (as companions or helpers) and the smart interaction with other devices and resources"[6].

But this agenda seemed to arrive to the MK:Centre with important issues already decided. First, that accelerating the social acceptance of robots and smart cities was something desirable. Second, that competition was an appropriate means by which to do this. Third, that reproducing a convivial smart city was a form of engaging the public in which people could give their views and make decisions about technological transformations affecting their day to day lives (see Sclove[7] for a more detailed treatment of this issue).

We wanted to know how this event could address the concerns of a young citizen like Leila. More critically, following a trend on experimental involvement of society in science and innovation[8], we were there to ask *how is public engagement enacted*

2 Matthew E. Studley/ Hannah Little, Robots in Smart Cities, in: Maria I. Aldinhas Ferreira (ed.), *How Smart Is Your City? Technological Innovation, Ethics and Inclusiveness*, Cham 2021, 75–88.

3 Damian Dadswell, ERL Smart Cities (2018a), URL: http://instituteofcoding.open.ac.uk/ [last accessed: August 15, 2023].

4 Dadswell, ERL Smart Cities.

5 Dadswell, ERL Smart Cities.

6 Dadswell, ERL Smart Cities.

7 Richard E. Sclove, *Democracy and Technology* (1st edition), New York 1995.

8 Franziska Engels/Alexander Wentland/Sebastian M. Pfotenhauer, Testing Future Societies? Developing a Framework for Test Beds and Living Labs as Instruments of Innovation Governance, in: *Research Policy* 48 (9/2019), 1–25; Brice Laurent et al., The Test Bed Island: Tech Business Experimentalism and Exception in Singapore, in: *Science as Culture* 30 (3/2021), 367–90; Harriet Bulkeley/ Vanesa Castán Broto, Government by Experiment? Global Cities and the Governing of Climate Change: Government by Experiment?, in: *Transactions of the Institute of British Geographers* 38 (3/2013), 361–75; Aidan H. While/Simon Marvin/Mateja Kovacic, Urban Robotic Experimentation: San Francisco, Tokyo and Dubai, in: *Urban Studies* 58 (4/2021), 769–86.

during robot competitions? And how do robot competitions contribute to configuring the social order in the smart city?

These are questions about how practices of public engagement with, and public understanding of science[9] intersect with ideas of how societies and technologies are and should be ordered. These guide our inquiry over the remainder of this chapter. Our departure point is this: since competitions are constituted by different sets of rules, some explicit and some that go entirely unsaid, and since these rules intersect with the values, practices, assumptions, politics, and interests of their sponsors and organizers, competitions are appropriate sites for studying the institutional shaping of human-robot-public interaction.

2. Research Design and Methodology: A Situational Analysis of Human-Robot-Public Engagement

We proceed in this study by way of reporting a case narrative drawn from a situational analysis of this public robot competition. Briefly, situational analysis is an interpretive, grounded theory approach that offers a materialist constructionism by mapping the social and material phenomena that make a difference in a given situation.[10] A situation is an inventory of communities and activities that happen in a space that is considered relationally as shaped through shared discourse.

The analysis proceeds via a series of mapping techniques. First, situation maps of major human, non-human, discursive elements. Second at a meso-level collective actors and their shared or contended commitments are mapped. A third layer of mapping follows locating the major positions taken by actors in the data, noting concerns and controversies in the situation.

The analytic goal in this study was to specify which entities – of varying scale and composition – make a difference to the situation of the robot competition from the perspective of the people involved. In this case the situation consists of the settings, venues, devices, scenarios, and narratives performed by actors as they framed and enacted the competition. We pay close attention to how they articulated the ways in which robots interacted with their programmers and with diverse publics.

The method was chosen as it lets us go beyond the usual suspects of highly bounded sociological framings of organizations, institutions and social movements and allows us think about discourse based social action. Through situational analy-

9 Sarah R. Davies, An Empirical and Conceptual Note on Science Communication's Role in Society, in: *Science Communication* 43 (1/2021), 116–33.

10 Adele E. Clarke, *Situational Analysis: Grounded Theory After the Postmodern Turn* (1st edition), Thousand Oaks 2005.

sis we understand situations as distributed action and accomplishments, which are produced through the coming together of heterogeneous elements.

This is helpful as we consider robotics for seemingly different social purposes and investigate the social and material conditions that make certain practices and routines acceptable at any given time – what we call below logics of social ordering. The narrative teases out how the participants and organizers of the competition brought together their preferences, motivations and expectations; where these came from, and what tensions they brought into the situation.

In other words, using situational analysis we examine how this competition was brought into being and how it shaped, and was shaped by modes of human, robot and public engagement in particular ways – cleaving to or against certain ideas and expectations of how people and artifacts should be configured through practices, performances and standardizations aiming to establish social orders.[11] Throughout this text we explain the different modes of engagement in relation to how they weave together three different logics of social ordering: *conviviality* (appreciating mutualistic autonomy), *care* (where connections are prioritized over hierarchies), and *control* (as an imperative to maintain fictitious borders and hierarchies between subjects and objects).[12] We return to these logics in the discussion.

The data used for the situational analysis came from field notes and interviews we made at ERL competition sites in Madrid, Oldenburg, Bristol, and Milton Keynes as well as academic literature about robotics competitions, mainstream media reporting and extensive conversations with participants as part of a broader project investigating innovation practices and policies in robotics at locations across Europe from 2018–2021.[13]

This multi-method approach enabled us to open up the competition at the MK:Centre to examine its different components, to get a better grasp of the organizers' roles, and what it means to make a public engagement event under the wider frame of the smart cities discourse, in Milton Keynes in particular. We proceed by accounting for how exactly smart cities and robot competitions have ended up in a shopping mall in Milton Keynes.

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11 Sheila Jasanoff, *States of Knowledge: The Co-Production of Science and the Social Order*, London, New York 2004; Lucy Suchman, *Human-Machine Reconfigurations: Plans and Situated Actions* (2nd edition), Cambridge, New York 2006.

12 Saurabh Arora et al., Control, Care, and Conviviality in the Politics of Technology for Sustainability, in: *Sustainability: Science, Practice, and Policy* 16 (1/2020), 247–62.

13 Ola Michalec/Mehdi Sobhani/Cian O'Donovan, What Is Robotics Made of? The Politics of Interdisciplinary Robotics Research, in: *Humanities & Social Sciences Communications* 8 (2021), article 65; Cian O'Donovan, Accountability and Neglect in UK Social Care Innovation, in: *Policy Press* 7 (1/2022), 67–90; Carlos Cuevas-Garcia/Federica Pepponi/Sebastian M. Pfotenhauer, Maintaining Innovation: How to Make Sewer Robots and Innovation Policy Work in Barcelona, in: *Social Studies of Science* 54(3):352–376.

3. Smart Cities and Robot Competitions

The *SciRoc* competition is worthwhile exploring because it represents a particular instance in which robot competitions were brought into the larger techno-political vision of the smart city. Most importantly, in this competition human-robot interaction was at the Centre of the smart cities vision. Recent literature has looked at the role of robots in cities.[14] Yet, since public engagement events bringing together these two elements are uncommon, there is scant literature on the topic. This is where our study makes a novel contribution.

The notion of smart cities refers to urban environments in which digital technologies and infrastructures make all sorts of transport, energy, and communication services more efficient. Cities around the world have implemented different measures to become "smarter", attracting new companies and investors to take part in these transformations.[15] Some smart city initiatives are led by the private sector, others by the government, and others rely strongly on citizen initiatives.[16] While novel technologies can indeed improve citizens' quality of life, they also imply more permanent surveillance and the delegation of public services to foreign private companies, pointing to a number of dystopian scenarios.[17] Studies that observe that the dominant smart city imaginary was produced by IBM and Cisco call for larger citizen participation in the production of "counter-narratives that open up space for alternative values, designs, and models"[18]. Yet, citizen participation in smart city

14 Rachel Macrorie/Simon Marvin/Aidan While, Robotics and Automation in the City: A Research Agenda, in: *Urban Geography* 42 (2/2019), 1–21; While/Marvin/Kovacic, Urban Robotic Experimentation; Simon Marvin et al., *Urban Robotics and Automation: Critical Challenges, International Experiments and Transferable Lessons for the UK*, EPSRC UK Robotics and Autonomous Systems (RAS) Network.

15 Vincent Mosco, *Smart City in a Digital World*, Bingley 2019; Adrian Smith/Pedro P. Martín, Going Beyond the Smart City? Implementing Technopolitical Platforms for Urban Democracy in Madrid and Barcelona, in: *Journal of Urban Technology* (2020), 1–20; Burcu Baykurt/ Christoph Raetzsch, What Smartness Does in the Smart City: From Visions to Policy, in: *Convergence* 26 (4/2020), 775–89.

16 Adrian Smith, Smart Cities Need Thick Data, Not Big Data, in: *The Guardian*, 18.04.2018, URL: http://www.theguardian.com/science/political-science/2018/apr/18/smart-cities-need-thick-data-not-big-data; Mosco, Smart Cities in a Digital World.

17 Mosco, Smart Cities in a Digital World; Britt Paris, The Internet of Futures Past: Values Trajectories of Networking Protocol Projects, in: *Science, Technology, & Human Values* 46 (5/2020), 1021–1047; Robert Muggah/Greg Walton, Smart' Cities Are Surveilled Cities, URL: https://foreignpolicy.com/2021/04/17/smart-cities-surveillance-privacy-digital-threats-internet-of-things-5g/ [last accessed: August 15, 2023].

18 Jathan Sadowski/ Roy Bendor, Selling Smartness: Corporate Narratives and the Smart City as a Sociotechnical Imaginary, in: *Science, Technology, & Human Values* 44 (3/2019), 540–63, see 540.

politics can take different forms[19] and it occurs under conditions of "unequal relations of power, knowledge and resources"[20].

Counter-narratives of smart urbanism can be produced through "speculative prototyping"[21], or be initiated through grassroot movements, as in the case of Barcelona, where citizens, academics and new political leaders have put forward the idea of "technology sovereignty".[22] A number of experiences in Barcelona suggest that the success of smart initiatives depend not on sensors and data but on the development and implementation of community building skills and on the production of data that is truly meaningful and valuable for the citizens.[23] These variegated forms of engagement with smart cities raise important questions about the forms of public engagement that were made possible during the robot competition in Milton Keynes. First, however, we look at how and why robot competitions started to figure in the European Commission's plans.

4. Institutionalizing European Robot Competitions

Robot competitions have existed for decades.[24] However, the vision of smart cities has extended their visibility beyond the specialist circles that thus far have been their main audience and participants. Typically organized around a clear thematic focus, – playing football, destroying an opponent robot, picking up items from a shelf – competitions allow developers and programmers to think about the specific tasks that performing an action involves and about the environmental elements that the robot must be able to identify: mobile and immobile objects, walls, navigable surfaces, obstacles, voice commands, objects to grasp, and so on. In one of the first and most popular competitions, *RoboCup*, for example, participants program robots to play football: to run behind a ball, make or block passes, reach the opponents' goal and shoot the ball out of the reach of a goalkeeper robot. All these actions involve

19 Dorien Zandbergen/Justus Uitermark, In Search of the Smart Citizen: Republican and Cybernetic Citizenship in the Smart City, in: *Urban Studies* 57 (8/2020), 1733–48.

20 Helen Manchester/Gillian Cope, Learning to Be a Smart Citizen, in: *Oxford Review of Education* 45 (2/2019), 224–41, see 224.

21 Martín Tironi, Prototyping Public Friction: Exploring the Political Effects of Design Testing in Urban Space, in: *The British Journal of Sociology* 71 (3/2019), 1–17; Martín Tironi, Speculative Prototyping, Frictions and Counter-Participation: A Civic Intervention with Homeless Individuals, in: *Design Studies* 59 (2018), 117–38.

22 Evelien de Hoop et al., Smart Urbanism in Barcelona: A Knowledge-Politics Perspective, in: Jens Stissing Jensen/Matthew Cashmore/Philipp Späth, *The Politics of Urban Sustainability Transitions*, London 2018; Smith, Smart Cities Need Thick Data.

23 Smith, Smart Cities Need Thick Data.

24 RoboCup Federation, Official Website, URL: https://www.robocup.org/ [last accessed: August 15, 2023].

complex sequences of navigation, motion, and visualization that have to be patiently and carefully programmed and integrated.

Besides putting the skills of the programmers and the reliability of robotic platforms to test, robot competitions aim to foster education, team development, and public engagement with science and technology. They also aim to facilitate open innovation. In recent years, a wide range of organizations have engaged in the practice of assembling robot competitions. Prominent examples include the DARPA (Defense Advanced Research Projects Agency, US) Robotics Challenge (2012–2015); the ARGOS (Autonomous Robot for Gas & Oil Sites) Challenge, organized by the French TOTAL (2013–2017), and the Mohammed Bin Zayed International Robotics Challenge (MBZIRC), which Khalifa University of Science and Technology organizes since 2017 in Abu Dhabi. The European Commission itself started to fund robot competitions in 2013.[25]

Although all competitions have to some extent educational, entertainment, scientific, and a problem-solving value, it is possible to find significant variations when the organizers and sponsors are transnational oil and gas corporations, military organizations, academic communities, or supranational entities like the European Union. Different organizers imagine in different ways what robotic technologies are for and what robotic futures should be brought into being, and how. However, significant overlaps exist between the organizers, advisors, and participants of different competitions. Thus, there is a complicated nest of institutional structures that give shape to these competitions.

According to one of the main actors of the ERL, officers from the EC became interested in robot competitions after they were invited to the 2009 edition of *RoboCup* in Graz, Austria. The potential they saw in competitions for education, dissemination, and public engagement encouraged them to include calls dedicated to fund robot competitions in the European innovation strategy. From 2013 to 2015, the Commission funded *RockIn*, which organized tournaments in the scenarios of industrial robots (RockIn@Work) and the home environment (RockIn@Home); and *Eurathlon*, which focused on emergency and rescue robots. These competitions imported a number of features from *RoboCup*, for example, dividing the competition in different areas of application and applying test benchmarks.

The European competitions continued receiving support from the EC from 2016 to 2018 through *EuRoC* and *RockEU2*. These initiatives contributed to the foundation of the ERL and to bring all competitions under a single institutional entity. This merger enabled the establishment of common ground between different robotics

25 CORDIS 2017a, Robot Competitions Kick Innovation in Cognitive Systems and Robotics, RoCKIn Project | FP7| CORDIS | European Commission, April 22, 2017, URL: https://cordis.europa.eu/project/id/601012 [last accessed: August 15, 2023].

communities, but it also revealed conflicting understandings of the aims and rationale of robot competitions. To give an example, the organizers of competitions in the home and industrial environments intended to run competitions in standardized environments. However, for the organizers of the emergency and rescue competitions, a standardized environment had little value because emergency and rescue missions occur in random and chaotic environments, where conditions such as light, wind, and humidity are out of human control.

SciRoc was the successful grant application to a call from the EC that aimed to increase public understanding of robotics, assess public perception of robotics, strengthen the collaboration between diverse robotics communities, and increase public and private investment in robotics development through competitions[26]. *SciRoc* received funding to organize two biennial competitions, in 2019 and 2021, and other related public engagement and dissemination activities. The consortium was formed by 8 universities from the UK, Spain, Italy, Portugal and Germany, the NATO Science and Technology Organization, and euRobotics, the organization that coordinates the development of the Europe robotics community.[27] Besides the Milton Keynes competition, in January 2021 the project website announced that the second edition of *SciRoc* would take place in Bologna.

It was not a coincidence that the first edition of *SciRoc* took place in Milton Keynes. Not only was the Open University, a consortium member, based at Milton Keynes, but also, during previous years, the city council had invested efforts and resources in re-inventing itself to become more attractive to foreign investors and to portray itself as a smart city.[28] The city council established in 2015 the "MK Futures 2050 Commission", which was in charge of developing a program for the future of the city. The program included measures such as the creation of a new technological university with a strong focus on digitalization, a "new vision for the city centre, and a smart city program related to intelligent and autonomous mobility"[29]. The city also had recently welcomed the implementation of grocery delivery robots from the Estonian company *Starship Technologies*, which the citizens found useful even

26 CORDIS 2017b, "Robotics Competition, Coordination and Support." October 31, 2017. https://cordis.europa.eu/programme/id/H2020_ICT-28-2017 [last accessed: August 15, 2023].

27 Kjetil Rommetveit/Niels van Dijk/Kristrún Gunnarsdóttir, Make Way for the Robots! Human- and Machine-Centricity in Constituting a European Public–Private Partnership, in: *Minerva* 58 (1/2020), 47–69; CORDIS 2021, "European Robotics League plus Smart Cities Robot Competitions." February 25, 2021. https://cordis.europa.eu/project/id/780086 [last accessed: August 15, 2023].

28 Alan-Miguel Valdez/Matthew Cook/Stephen Potter, Roadmaps to Utopia: Tales of the Smart City, in: *Urban Studies* 55 (15/2018), 3385–3403.

29 Jeremy Coward, Why Milton Keynes Is One of the Smart Cities in the World, in: *IoT World Today*, 16.04.2018, URL: https://www.iotworldtoday.com/2018/04/16/why-milton-keynes-one-smart-cities-world/ [last accessed: August 15, 2023].

before the Covid-19 pandemic.[30] The vision of a smart and digitalized Milton Keynes facilitated the collaboration and coordination between the *SciRoc* organizers, the city council, and other local organizations.

5. Three Modes of Human-Robot-Public Engagement

In the following section, we provide a description of how the *SciRoc* competition unfolded. Emerging from a grounded and iterative process of comparing empirical material with ideas from the literature, we identified three modes of human-robot-public engagement: embracing engagement, bypassing engagement and prefiguring engagement. We organize our discussion of the empirical material by re-constructing a case narrative that makes sense of these three types of engagement before offering discussing the implications for the shaping of human-robot-public engagement in smart cities.

5.1 Embracing Engagement

SciRoc was driven by many motivations. Some of the organizers saw the event as an opportunity to increase public and democratic participation in the development of digital and robotic technologies. Months before the event, one of the organizers we talked to claimed that the main goal of the event was to get people informed about where the technology is going, to let them ask questions, and to make it possible to have a discussion. This, he said, so that decisions about what futures of robotics and artificial intelligence are and are not desirable are made collectively rather than by a few Big Tech companies like Google and Amazon. The purpose of these public competitions, according to our informant, was to explore "*how robots 'respond' to society and how society responds to the robots*". Furthermore, he argued that an additional goal of hosting robot competitions as public events in realistic environments was to search for ways to make the ERL economically sustainable, so that it could stop relying on funding from the European Commission.

In order to attract a wide range of participants and sponsors, the competition arena offered five different scenarios or "episodes" that illustrated different tasks that robots could carry out in a smart city. These included: "Deliver coffee shop orders, Take the elevator, Shopping pick and pack, Open the door, and Fast delivery

30 Alex Hern, Robots Deliver Food in Milton Keynes under Coronavirus Lockdown, in: *The Guardian*, April 12.04.2020, URL: http://www.theguardian.com/uk-news/2020/apr/12/robots-deliver-food-milton-keynes-coronavirus-lockdown-starship-technologies [last accessed: April 4, 2024].

of emergency pills"[31]. *Costa* was the sponsor of the coffee shop scenario. This resembled a usual coffee shop from the British chain and had capacity for five tables and a cashier desk (see Fig. 1). The space between the tables was wide enough so that the robot could navigate easily. To the left side located the scenario of the "Fast delivery of emergency pills" episode. A net cage was built in which drones could fly across obstacles to come close to a real-size human dummy in need of a first aid kit (see Fig. 4). On the back of the cage for drones located the "Shopping and pick and pack" scenario. This was a more simple scenario that consisted of a desk with shopping baskets on top and a few shelves a few meters back. The technology and grocery retailer and delivery company *Ocado* was the sponsor of this episode (see Fig. 2). Behind the *Costa* situated the "Take the elevator" scenario, or rather a foyer with two silver colored sliding doors (that opened manually) that resembled two elevators, with rooms the size of an ordinary elevator behind them (see Fig. 3). Behind the "Shopping and pick and pack" scenario located the "Open the door" scenario, which resembled the waiting room for an office or the corridor outside of an apartment.

The sponsors added a different layer of rules and interests to the nest of institutional values that brought the competition into being. While *Costa* benefited mainly from the publicity, *Ocado* also contributed to the design of the "Shopping pick and pack" episode. To do so, it provided ideas to develop the ERL benchmarks according to what the company considered relevant for food packing. For example, including a more strict timing, and identifying and grasping items of different shapes and sizes. Moreover, by sharing their usual activities and their logos, these sponsors contributed to bring the unfamiliar world of robot applications into a more familiar context for the audience.

The competing teams were mainly students from four British universities and single universities from Germany, Portugal, Spain, and France. A team from the Spanish branch of the Japanese telecommunications company NTT also participated. The different episodes gave teams different opportunities to try out their existing programming skills or develop new ones. Some teams focused on drone navigation, others in grasping and visualization, and others in robot navigation, voice recognition, and computer vision. The stage and the possibility to program a robot to perform in a highly populated environment made the competition appealing for teams with different skills and backgrounds. Programming a robot to carry out apparently simple tasks involves many hours of work in front of the computer. Making a robot move, react to voice commands, respond back, and grasp objects requires at least one person to be in charge of each of these different tasks. Competitions offer a caring environment in which university students and

31 Damian Dadswell, First *SciRoc* Challenge 2019 (3.08.2018b), URL: http://instituteofcoding.open.ac.uk/ [last accessed: August 15, 2023].

more experienced programmers can develop their skills in a relatively quiet and undisturbed place.

Not many universities have the capacity to support a team for robot competitions. University teams have limited resources, therefore they have to select carefully the competitions they would like to attend every year. Having a robot and transporting it is costly. In order to make it possible for a larger number of teams to participate in *SciRoc*, Barcelona based *PAL Robotics* leased their popular model *Tiago* (Take-it-and-go) at a low cost for teams that did not own a robot or were not able to bring their own. *PAL Robotics* also brought a number of technicians to provide support to the teams whenever their *Tiagos* were not responding as expected.

Other sponsors and organizations that increased the visibility of the event had exhibition stands on the back of the competition arena. Amongst them figured Cranfield University, the University of West of England, the Open University, PAL Robotics, Vodafone, Westcott 5G Step-Out Centre, the city council, a local engineering network, a national innovation networking initiative called Catapult, and a few others. Besides encouraging social acceptance, the event was also a way of making higher education more attractive for individuals who may not have considered going into it. Moreover, the non-academic institutions, by contrast, provided evidence that technologies not only would make a great impact on daily life but also generate jobs and build a new and more prosperous Milton Keynes.

One group that had the greatest chances to engage with the robots and the event were about 50 pre-selected volunteers from a local network of engineering professionals, technicians, and students. These volunteers interacted with the robots during the coffee shop and the elevator episodes. In the coffee shop, they made an order and took it from the tray when the robot brought it from the cashier desk. In the elevator, volunteers reacted to the robots' request to press a certain number. The volunteers were asked to fill questionnaires to assess their interaction with the robots. In this way, volunteers represented the most direct and explicit way in which society was brought to the robots, and the robots to society. The ERL opted for preselected volunteers to have them better informed about the situation and avoid any accidents, but this was also a way to have more control over how the society could engage with the event.

Besides the main event and the exhibitions in the shopping mall, a series of events were held in the offices of the city council and the public library, not far from there, during the week of the competition. The inaugural event included an expert panel discussion followed by a reception with wine and canapés. The audience was invited to ask questions which were addressed by the experts. Answering one question, the Open University Vice-Chancellor argued that these events and the advertisement of higher education it involved had explicit democratic ends. He stated that *"you can only democratise technology if you have an educated population"*. He further argued that *"the question is whether you want to program or to be programmed"*, thus calling

for a direct and active involvement of the population in the digital transformation of society.

The idea of engaging with the public was more actively embraced in informal conversations around the SciRoc arena in the shopping mall. In particular, one of the organizers and a representative from the city council spent a substantial amount of time walking around and talking to the audience, making them see what they saw in the event, expressing what they thought the deeper meanings of these competitions were, and listening to the thoughts from people from the audience. But these encounters were rather unusual. Only in the last days of the event volunteers and a few competitors got involved in this practice. The organizers who knew us beforehand asked us to go around and talk to people about what was going on there. As ethnographic researchers, we didn't need to be asked twice.

There were members of the audience who had seen the event and had later come back with their children. One of them said that she was interested in exposing her child to what it takes to program a robot, and possibly so that he could see how robots are built internally. Yet, she also questioned *"why are we investing in robots to do these jobs and produce more, if the population is growing anyway?"* Leila, the student we described in the introduction to this chapter, said it took her a while and multiple visits to understand that this was a competition. Moreover, she wondered how deaf people or non-English speakers could make sense of the event. She also wondered how the robots could address their needs, pointing a finger to the fact that the competition, besides all the efforts to promote public engagement with a roboticized future, was nevertheless oriented towards a limited audience.

5.2 Bypassing Engagement

Although *SciRoc* was oriented to engage publics with science and technology, different features of the setting and situation played against this goal. For the participants, this was a much more stressful environment than other local tournaments we attended in Oldenburg and Bristol earlier that year. In those competitions, only one team participated in each to have their scores compared later. While in those local tournaments participants had between three and five days to program and practice in standardized environments inside the lab without interference with other teams, during *SciRoc* the teams had little time to rehearse and to repeat their performances.

Moreover, the internet connection was weaker than back in the labs, and the robots were disturbed by the changes of light and the numerous unrecognized faces of competitors, volunteers, and the audience at the other side of the fence. Additionally, the noise made it difficult for the robot to recognize voice commands. In the case of the drones delivering the first aid kit, the wi-fi signal was so weak – due to the hundreds of mobile phones connected to the network – that they could barely perform. In the *Costa* café episode, team members had to request the volunteers to

look directly at the robot's vision cameras and speak loud and clear to make an order. In that same episode, while we were looking from the inside of the stage and standing just behind the 1.20m high hoardings, we were asked to move some steps back because the robot could not distinguish the persons sitting at the table, who it should attend, from those who it should ignore.

The technical challenges of the competition and the aim to have a good performance meant competing participants were keen to avoid being distracted by the public. During a general meeting, a participant asked in a reluctant tone if they were expected to respond to inquiries from the public. One of the organizers responded that they could try "*to evade the questions, send them somewhere else, or just ignore them*". On another occasion, a member of the audience was asking several questions to one of the participants about why to use grips rather than suction cups for the "Shopping picking and packing" episode. When the team member tried to answer, his teammates called him, annoyed and desperate, to get back to his position. The tension between holding a serious competition and facilitating the engagement between publics, robots, and experts was also reflected in discussions regarding the space that should be left between the queuing belts and the borders of the arena. Some of the organizers wanted to have these belts less than a meter closer so that the audience could get a better look. However, some of the competitors and other organizers wanted to keep them at least one meter further to avoid distractions.

The technical challenges that the competing teams faced meant that the actual performances went very slow. The time that it took for one single team to bring their robot to the starting point of an episode, for example, in the *Costa* café scenario, and making it supervise tables, take an order and bring items to the customers/volunteers, took about twenty minutes. The time between one team leaving and another one coming in was five to ten minutes. In this way, if the audience wanted to see the robots perform, they needed to be extraordinarily patient. The volunteers, sitting at the café tables inside the competition arena, also had to wait patiently.

The setup of the stage also contributed to make it hard for the public to engage with the event. In particular, there were no chairs, benches, high tables, or handle rails where the audience could relax while waiting for the robots to appear and perform. People had to wait standing in the middle of corridors for undetermined time. Many of the attendants were carrying their children, grocery shopping bags and other items, therefore they were not keen to wait for too long.

Making sense of the unfamiliar situation that the competition brought forward required a large amount of curiosity, time, and patience from the audience. One attendant who worked in the IT sector and who would count as an informed member of the audience, argued that it took him a few rounds to the stage and some 10 to 15 minutes to figure out what was going on there. However, he could not tell where the teams were from or how many they were, and neither what the scoring consisted of. Many of the people passing by would not slow down to try to make a careful reading

of the event. Those who would stop for a moment would continue walking as soon as failure occurred. A group of women that looked for a little while at a team competing on the "Fast delivery of emergency pills" episode, turned around saying *"booooys with their tooooys"* , before walking away, as soon as the drone hit an obstacle and dove to the ground.

There were members of the audience who opted for not listening even when somebody – most likely one of us – offered some orientation or intended to start a conversation. A group of elderly people argued *"well, at least it's more polite [than human staff]"* when they heard the robot taking an order. Another member from the audience argued that automation, for example in the electronic cashiers at the supermarket, are "*already taking people's jobs*" even though they *"fail all the time*'.

Finally, the complexity of the different episodes, scenarios, tasks, and teams that the competition involved meant that the audience did not have access to many of its features. To give an example, in the *Costa* café episode, the robot had to be programmed to autonomously (a) go to a table, (b) ask the volunteers if they were already being served, and if not, (c) to take their order, direct itself towards the cashier desk and request the items ordered. Then, (d) the robot had to identify if the items placed on a tray were the right ones, and if so, (e) bring them to the table that made the order. Since the cashier desk was far from the audience, they could not see or hear what (d) was about. Furthermore, on a few occasions, the buzzing sound produced by the drones made it difficult to listen to what was happening in the other scenarios, creating an unpleasant situation not only for the audience but most likely also for the competing participants.

5.3 Pre-figuring Engagement

The tension between *SciRoc*'s objectives of, on the one hand, holding a complex competition that was appealing for the robotics community, and on the other hand engaging with publics, deserves further attention. *SciRoc* built on the more than five years of experience of the ERL organizing competitions. For some members of this community, *SciRoc* represented a way of making competitions more challenging by putting them in a more realistic environment and increasing the complexity of the human-robot interaction challenges. However, the more was added to the already sophisticated scoring system and rationale, the harder it was for the lay audience to get a sense of what was going on and to engage more meaningfully with the event.

SciRoc became a complex, sophisticated, and multilayered event because it was the continuation of a series of commitments that were deeply ingrained in the institutional values of the ERL. To begin with, the five different scenarios that the competition offered built on and derived from the existing focus areas funded through *RockIn* and *Eurathlon* in previous years: industry, home, and emergency and rescue robots. The breadth of the notion of smart cities made it possible for the ERL to bring

the three existing competition scenarios under a single and more coherent narrative. But most importantly, the ERL values were to a large extent shaped by the expectations and grant conditions of the European Commission.

To be more appealing for the European Commission, the ERL had to become more compatible with the Commission's interests, including the creation of a "European identity". According to ERL representatives, the difference between the ERL and other competitions is that the former are more explicitly focused on human-robot interaction and on assessing robot performance through scientific benchmarking.[32] In addition, these competitions addressed "current European challenges" that resonated with other focal areas that the Commission had funded such as the digitalization of industries and the growing aging population. In this way, the focus on European challenges, scientific benchmarking, and human-robot interaction, provided the ERL competitions an "European flavor", to use the words of one of our informants, that made them distinctive.

Besides educational, dissemination, and competitive purposes, the ERL competitions aimed at experimenting with, and advancing, the standardization of "benchmarks" through which robots and programmers' skills could be assessed "objectively".[33] For that purpose, the ERL and partner institutions organized local and major tournaments in different locations across Europe. These were facilitated by the establishment of a number of standardized environments, or "certified test beds", where the competitions could take place. Starting with a test bed for industrial robots at the Bonn-Rhein-Sieg University of Applied Science (Germany) and a test bed for robots for the home environment in the University of Lisbon (Portugal) during the project *RockIn*, certified test beds were installed in academic robotics laboratories in Edinburgh (UK), Bristol (UK), Leon (Spain), Peccioli (Italy), Oldenburg (Germany), and in the headquarters of *PAL Robotics* in Barcelona (Spain).

In these test beds, competitions were held offering the same rules, tasks, and scores. Having multiple sites for competitions was envisioned as a way of encouraging teams to participate in more than one event and thus enabled a more reliable and statistically significant assessment of their performance. What is more, since competitions encouraged the mobility of participants between different European countries hosting competitions, the ERL promoted the formation of a European identity. To one of our informants, this consisted of making young students

32 Pedro U. Lima et al., RoCKIn Innovation Through Robot Competitions [Competitions], in: *IEEE Robotics Automation Magazine* 21 (2/2014), 8–12; Francesco Amigoni et al., Competitions for Benchmarking: Task and Functionality Scoring Complete Performance Assessment, in: *IEEE Robotics Automation Magazine* 22 (3/2015), 53–61; Sven Schneider et al., Design and Development of a Benchmarking Testbed for the Factory of the Future, in: *2015 IEEE 20th Conference on Emerging Technologies Factory Automation (ETFA)*, Luxembourg 2015, 1–7.

33 Lima et al., RoCKIn Innovation; Amigoni et al., Competitions for Benchmarking; Schneider e t al., Design and Development of a Benchmarking Testbed.

aware of their proximity to other European countries and the possibility of forming part of the same community. This, he suggested, could help to mitigate the current growth of right-wing sentiments across Europe.

With exception of the certified test bed in Bonn for the industrial scenario, the certified test beds resembled an apartment for a lone elderly person, possibly in a care home, consisting of half walls and *Ikea*-like furniture, a kitchen, a living room, a bedroom, and a few doors. To situate the competitions into a more realistic context and to make an emphasis on the sociability of robots, the rulebook of the *ERL Consumer Service Robots* provided the following *Consumer User Story*:

> Granny Annie is an elderly person, who lives in an ordinary apartment. Granny Annie is suffering from typical problems of ageing people: She has some mobility constraints. She tires fast. She needs to have some physical exercise, though. She needs to take her medicine regularly. She must drink enough. She must obey her diet. She needs to observe her blood pressure and blood sugar regularly. She needs to take care of her pets. She wants to have a vivid social life and welcome friends in her apartment occasionally, but regularly [...] For all these activities, ERL Consumer is looking into ways to support Granny Annie in mastering her life.[34]

In this way, the certified test beds contributed to reproduce and lock-in a dominant vision that robotic technologies play a key role in "ambience assisted" and "independent" living of elderly people. They also contributed to lock-in a particular vision of human-robot interaction.

In earlier competitions participants had to program robots to carry out a number of given tasks (or "episodes") oriented to cater for *Granny Annie*. These included: receiving guests and distinguishing familiar and unfamiliar faces, asking who the guests are and responding in different ways by providing different instructions; navigating the apartment autonomously, detecting new changes in the environment (e.g. by recognizing newly added items or misplaced furniture), ideally being able to manipulate objects (e.g. a cup, a TV remote control) and bringing them back to the right place. The teams received points depending on how optimally these actions were carried out, and penalized if the robot accidentally hit elements of the environment, or people. In these competitions, nobody embodies the persona of *Granny Annie*, and nobody besides the roboticists contribute to the evaluation of the teams, or of the tasks themselves.

During *SciRoc*, most of these challenges were exported from this scenario to the smart city context. Many of them became part of the episode at *Costa* café, the opening the door challenge, and the shopping pick and pack challenge. In this way, the

34 Meysam Basiri/Pedro U.Lima, European Robotic League for Consumer Service Robots, URL: https://www.eu-robotics.net/robotics_league/upload/documents-2018/ERL_Consumer_10092018.pdf [last accessed: August 15, 2023].

highly controlled environment of the lab was brought into the shopping mall in Milton Keynes; and with it, a particular way of envisioning human-robot interaction. This, however, left not much room for designing a competition that gave more active and engaging roles to the audience – or to the pre-selected volunteers.

6. Discussion: Shaping Social Orders in the Smart City

So, what does this narrative tell us about how the robot competition engaged with publics and shaped social orders in the smart city? Our narrative foregrounds three different modes in which the competition, its organizers, and sometimes its publics dealt with the notion of engagement. First, *embracing engagement,* an open and attentive form of engagement that was sensitive to the needs, interests, and concerns of various participants, sponsors, and members of the audience. Second, *bypassing engagement,* a more constrained *and* constraining form of engagement that limited the possibilities of mutual understanding between competition participants and the various publics. Third, *prefiguring engagement,* a variety of previous commitments and expectations that brought the event into being and gave it shape, but that rigidly framed the ways in which publics and participants could engage with each other.

These three modes of engagement in turn revealed and were shaped by different logics of social ordering. Here we trace three logics, namely conviviality, control, and care, which were differently articulated in each mode of engagement, and in different amounts. We expand on these briefly to better illustrate the interplay between these modes of engagement and social ordering.

6.1 Conviviality

Immediately upon entering the mall, the competition sought to project to visitors and participants alike a sense of conviviality. In the competition, conviviality between humans and robots was suggested in the poster illustrations and in the competition episodes or scenarios. Episodes were scripted to reward convivial and harmonious interactions – at least within the borders of the competition arena. But conviviality is more than being together in harmony. Conviviality describes an understanding of people and things in society that is – in principle – relational, mutualistic, and egalitarian.[35]

The establishment of convivial relations was best exemplified in the work of embracing engagement that a lead organizer and a city council representative did walking the competition arena barrier. This boundary work was critical in members of the robotics community gaining respect for their host public. They actively solicited

35 Ivan Illich, *Tools for Conviviality*, London 1973.

engagement, generously making time for shoppers as well as offering insight and sharing information. This was work of communication and translation in both directions as they conveyed sentiment in almost real time back over the barriers to competitors.

Nevertheless, mutualistic engagement that fostered deep understanding was rare. Current social theory examines conviviality through autonomy and self-realization, as a logic that resists technocratic control and coloniality and opens up possibilities for different kinds of future social orders. A convivial society is one in which social and material interdependencies are political and mediated by tools, institutions and practices across that society.[36] But this kind of expansive conviviality was not up for grabs in Milton Keynes. Ultimately there was little opportunity for collectively imagining a future smart city that wasn't already scripted in the competition episodes.

A defining characteristic of conviviality for Illich was its imperative against technologies and tools that seek to control and dominate – a problem of centralizing institutions and structures associated with modern industrialization.[37] And yet, some of the foundational sociological work critiquing the smart city emphasizes how surveillance technologies and similar infrastructural and institutional arrangements constitute a technocratic logic of control.[38] Social control can also be achieved through exclusion as well as participation. For instance in experimental settings that foster creativity, participation and innovation such as makerspaces, gender, class and race have been shown to structure who gets to participate and who doesn't.[39]

6.2 Control

We observe a logic of control – in the first instance – on how borders and boundaries were established between the competition arena and the ordinary corridors of the shopping mall around it. The barriers were there to let the competition occur without interruptions from the audience that the organizers considered unnecessary. In this way, multiple control mechanisms made it possible for participants to bypass engagement. The barriers, however, contributed to make the arena identifiable and suggested interpretative framings for the audience, thus they were about control but also about embracing engagement.

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36 Saurabh Arora et al., Control, Care, and Conviviality in the Politics of Technology for Sustainability, in: *Sustainability: Science, Practice, and Policy* 16 (1/2020), 247–62.

37 Illich, Tools for Conviviality.

38 Orit Halpern et al., Test- Bed Urbanism, in: *Public Culture* 25 (2/2013), 272–306; Jathan Sadowski/Frank Pasquale, The Spectrum of Control: A Social Theory of the Smart City, in: *First Monday* 20 (7/2015).

39 O'Donovan/Smith, Technology and Human Capabilities.

Control was also the underlying logic behind scoring mechanisms and scientific benchmarking that gave meaning to the ERL competitions, thus control was fundamental for prefiguring engagement.

The logic of control was also present in the role of the volunteers. Their participation enabled the organizers to bring in non-specialist societal actors into the competition – a form of embracing engagement –; but in contrast the volunteer roles made no room for less prescribed forms of interaction between volunteers, robots, and competing roboticists – a form of bypassing engagement. In the passive and cooperative roles that the organizers planned for the volunteers there was little room to imagine more complex and ambivalent human beings who may have gone into higher education to study computer science, but who then opted for a traditionally gendered occupational training, such as Leila.

The figure of the volunteers, however, played a key role in pre-figuring engagement because their participation increased the controlled complexity of the human-robot interaction component of the competition.

6.3 Care

By comparison with control, logics of care direct attention to neglected things and devalued doings.[40] For instance, the hidden labors of care workers[41], or marginalized groups excluded from social services. *Granny Annie* figured in previous competitions as the character who made visible the usually unnoticed challenges of elderly people living alone. In the robotics laboratories we visited for earlier competitions in Oldenburg and Bristol we learned about procedures from the researchers for engaging directly with members of the public, involving them in forms of co-creation and co-design, methods of participative innovation.[42] However, while the standardized benchmarks and tasks such as navigation and grasping objects were imported to *SciRoc*, the image and values that *Grannie Annie* evoked were not too visible in the smart city vision that the competition enacted.

A logic of care was also present in the engagement activities within and around the arena. Senior researchers took seriously the responsibility of fostering interdisciplinary capabilities in the competitors – often committing to team building mentoring and management over many years. Furthermore, one side of the arena's boundary was filled with stalls representing partner universities. For some of the senior researchers, (embracing) engagement meant not only initiating recruitment

40 María Puig de la Bellacasa, *Matters of Care: Speculative Ethics in More than Human Worlds. Matters of Care: Speculative Ethics in More than Human Worlds*, Minneapolis 2017.

41 Peter A. Lutz, Surfacing Moves: Spatial-Timings of Senior Home Care, in: *Social Analysis* 57 (1/2013), 80–94.

42 Michalec/Sobhani/O'Donovan, What Is Robotics Made of?

conversations with passers-by, but also communicating research and outreach opportunities to participate with universities in different ways.

7. Conclusion

To summarize our discussion: we have mobilized ideas about conviviality, care and control as specific logics of social ordering extant in the literature. This of course is not to say that they are the only orderings of people, things and knowledge in the story. Indeed, the point that we have tried to make is that each are visible in different parts of the situation. Some are brought into the situational maps via processes of path dependence and contingencies (the operating systems that power the Tiago robots for instance), while other examples come about through the choices people make in the moment. This tells us that there is not one singular robotic smart city framing being enacted. Rather, many smart cities are possible.

The situation of the robot competition in Milton Keynes that we opened up in this chapter made salient a number of themes that are commonplace in organization studies and institutional theory literature. The competition itself drew strongly on the path dependence[43] established by the ERL over previous years, which in turn derived from the use of competitions in different environments for the sake of innovation. The organizers could not abandon the intrinsic elements that made the competition scientifically complex precisely because those had been the reason they received funding in the first place. Put differently, neither robots nor interaction arrived value free but already carried the baggage, values, trajectories, pre-existing commitments of the organizers. Yet, feel encouraged to conclude that making a simpler competition could have contributed to forms of embracing rather than bypassing engagement with publics. A simpler competition could have also emphasized the logics of care and conviviality in different ways rather than the logic of control.

Our study also highlights the risks of reproducing controlling mechanisms intrinsic in mainstream notions of the smart city rather than searching for more caring and convivial alternatives. These, in turn, run the risk of restricting the chances to imagining and institutionalizing other futures of human-robot interaction.

43 Jorg Sydow/Georg Scheyogg/Jochen Koch, Organizational Path Dependence: Opening the Black Box, in: *Academy of Management Review* 34 (4/2009), 1–21.

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