Welcoming the Orange Collars: Robotic Performances in Everyday City Life

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ABSTRACT

In this paper we investigate kinetic displays in the form of robotic installations in the city of Hull, UK. The kinetic installations – comprising a set of orange robotic arms, light sources, mirrors and soundscapes – performed spatial and temporal rhythms in four different urban settings across Hull's Old Town. We investigate the installations as an attempt to clarify a) the visual and auditory impact of the robots on the surrounding environments; b) the social impact of the performances on each setting; and c) the temporal impact of the performances on the social behaviours and experiences around the robots. The results of the study suggest that, in the context of outdoor urban settings, people tend to perceive robots as kinetic sculptures more than as urban installations. We contribute to the discussion around pervasive displays by considering kinetic robotic installations as an emergent type of urban displays, with potentially lasting effects on the experience of city environments. We address and chart constraints and challenges for urban environment of the future.

Author Keywords

Robots; urban context; media; installation; performance; kinetic sculpture, co-existence.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Today one might fairly say that robots are leaving the laboratories and starting to penetrate our daily lives in a steadily manner. For the last couple of years, not only artists and scientists have developed projects with robotic installations, but also high-end brands have been using them in exhibitions and behind high street shop windows to create curiosity and amusement. However, opportunities offered by interactive robotic installations, in the city context, have not yet been fully explored. In this paper, we examine performative installations in the city of Hull (UK) that were commissioned as part of the UK City of Culture 2017, a major event in the British cultural calendar, taking place every four years; showcasing science fairs, art festivals and other cultural gatherings throughout the year. We report on our on-going research and explore the potentials of kinetic and performative artwork in the city, we focus, specifically, on "Where do we go from here?" with its 20 site-specific installations of robotic arms that move and perform various autonomous routines and cast light signals on the surroundings. Designed by Jason Bruges Studio [7]; a leading design studio in the field of Interaction Design with various examples of kinetic interventions within the city context using light and sound to act, for instance, as a second skin on the buildings [2, 3]. "Where do we go from here?" is, however, the studio's first implementation of ideas around extending the life span of former industrial tools to the city context with the aim to create installations that encourage Hull's community to interact with robotics [7]. To our knowledge, it is, unlike Mass Crane Dance [15], with its city scale and distributed placement in the city, the very first of its kind anywhere in the world. The research goals of this study, however, differ from the artistic goals of Jason Bruges Studio. Here, we focus on the site-specific installations as protagonists of the urban environment, rather than as mere kinetic sculptures, and expand the discussion by considering the robots as potential urban display systems.

We believe that these public robotic installations may serve as a starting point to discuss new forms and scopes of pervasive displays. If we observe how emergent media technologies have been discussed in recent years, we find, for instance, that computing is addressed as a "bridge between atoms and bits" (e.g. the TEI conference series). Others focus on the artistic potential of interactive technologies (see, for example, works from the ISEA conference series [13]); while in other venues, like MAB event series, the emphasis lies on the urban character and impact of media. An example [14] where media architecture is proposed as a city-wide platform for digital

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policy and participatory practices. We think that the creative deployment of robots in urban settings may bridge between many of the fields and potentials outlined above. The very name of the installation explored in this paper; "Where do we go from here?", represents a question about the next move in human knowledge and how cities will react to, and embrace, the ever-evolving technological implementations [7]. Following this idea, and drawing on our case study, we suggest that it is now the time for the media architecture and pervasive display research community to ask itself similar questions: what are – and what should be – the physical and conceptual boundaries of the notion of "pervasive displays"? What happens when a whole new range of urban media installations and performances (like the robots in this study) assume a *public character and presence*, making citizens reflect, share and engage, with and through them, in ways that were previously limited to screen-based platforms?

Marcus Foth et al. [10] argue that urban interfaces should be exploited to counteract the trend of "filter bubbles and echo chambers" that diminishes citizens' abilities to engage in public debates. We believe that urban robots may signal one of the alternative platforms for participatory social practices and public engagement. A concept we shall revisit at the end of this paper.

SETTING

Four kinetic installations, each features a different configuration of re-purposed industrial robots of varying sizes, have been programmed to behave in a different way alongside a set of light sources and soundscapes. They are placed in three areas of Hull (Figure 1). Two of the installations are in the centre of the Old Town: "The gatekeepers", at the entrance of the town's main shopping street, and "An Inquisitive Acquaintance", in front of the Hull's Minster. The other two are placed in the Museums Quarter, a relatively new urban setting which houses, as the name indicates, a cluster of museums. While sites 1and 2 are separated by a five-minute walk, it requires a minimum of ten-minute walk to access sites 3 and 4 from the town centre.

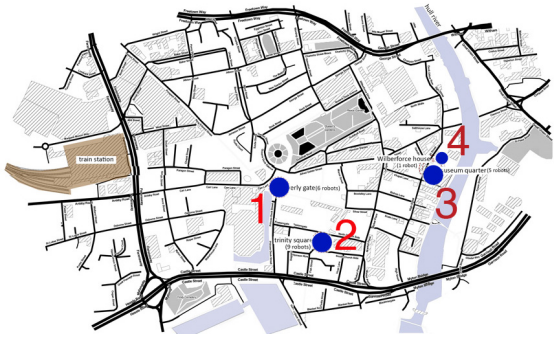

Figure 1. Robotic installations sites **in Hull's Old Town: 1-Beverley Gate "The gate keepers", 2-Trinity Square "An Inquisitive Acquaintance", 3- Streetlife Museum "Collaboration" and 4- Wilberforce House "Conversation".**

During daytime, the robots stand still and create an effective contrast with the background setting (Figure 2).

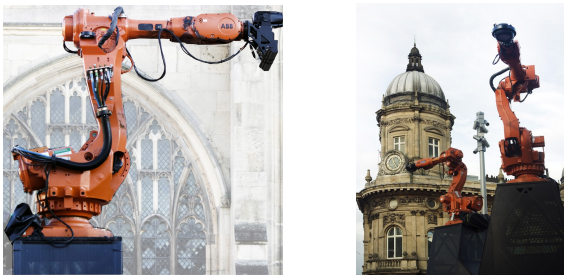

Figure 2. Left: Views of the robots during daytime: even when the robots are inactive (i.e. before 5pm), their vibrant orange bodies and industrial shapes. Right: create a stark contrast with the historic urban background of Hull.

Each robot stands on a plinth (approx. 3m tall), thus out of reach by the passers-by. This placement resulted in a twofold situation: it enhances people's safety by preventing incidents with the moving parts during the performances, but also prevents people from having a more direct contact with the robots, as shown in Figure 3.

Figure 3. Overview of the 6m tall robots installed at Trinity Square, emphasizing the position and scale of the installations in relation to their urban surroundings, with the Hull's Minster.

The elevated position of the robots (6 meter-tall) plays a significant role in how they are perceived and experienced by pedestrians. Placed on plinths, the robots assume a monumental character: people cannot touch them, but the light beams that extend from the moving arms constantly "touch" the surrounding urban surfaces, highlighting different parts of the facades, floors and other elements of the environment. The soundscape, especially commissioned for the installations, is based on slow-paced electronic compositions that play in loops of three to fifteen minutes, reinforce the solemn and inquisitive character of the performances, as their name suggest: "Where do we go from here?"

Gate Keepers at Beverly Gate (site 1)

There are six "gatekeepers" robots, divided into two groups of three each, at Beverley Gate (Figure 4). According to the designers, the robots perform the same movement as the one they used to perform in operation (i.e. before being decommissioned). For this installation, however, the speed is slowed down, and they act independently from each other. Low frequencies are dominant in the soundscape

following the movements. Each session of the performance lasts for three minutes, after which it is repeated in a loop.

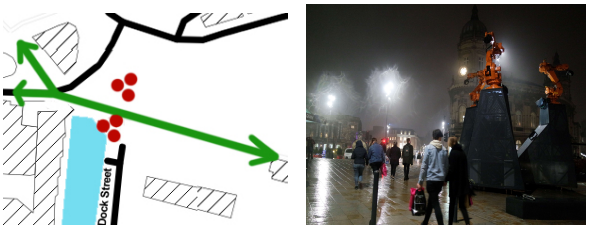

Figure 4. Left: map showing six robots (indicated with red dots) at Beverley Gate, and the local main pedestrian flows (green arrows). Right: overview of the pedestrianized shopping street leading to the core of Hull's Old Town.

While the Southern group of robots is located besides the dock, and they illuminate each other from time to time, casting shadows on the building behind them (Figure 4), the Northern group is more isolated from the local landmarks and the lights projected by the robots are mostly targeted to the pavement and to the neighbouring robots, as there are no vertical surfaces in close proximity.

An Inquisitive Acquaintance at Trinity Square (Site 2)

There are nine robots, divided into three groups of three each, at Trinity Square (Figure 5). The 13th century Minster's intricate façade, on the East side of the square, provides an impressive surface for the lights projected by the robots. On the other sides of the square there are middle-sized buildings (mostly two- to four-story high). With respect to time, only once every ten minutes of performance (one loop), the robotic lights are projected onto the surrounding facades, which creates a counterpoint to the seemingly aggressive movements of the robots. The contrast of the orange robots and the setting furnishes a dramatic effect especially during the daytime, when their industrial appearance and the venerable church can be experienced together (Figure 5).

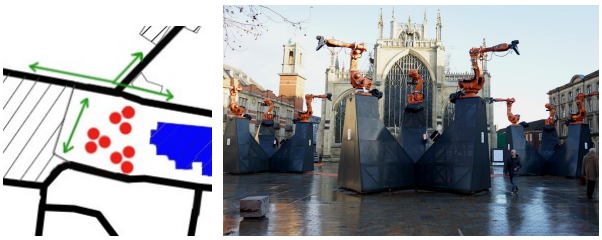

Figure 5. Left: map showing the nine robots (indicated with red dots) at Trinity Square, and the local main pedestrian flows (green arrows) and the Hull's Minster (in blue). Right: overview of the installations facing the Minster.

Collaboration at the Streetlife Museum (Site 3)

Located at the Museums Quarter, which is characterized by horizontal surfaces, with buildings of up to two-story high, the site at the Streetlife Museum consists of one group of five robots that perform a collaborative routine, in harmony with each other (Figure 6). They are located adjacent to each other, in a circular formation, which provides a "habitat" that is easy to watch. Interestingly, the Streetlife Museum features a glass façade, so that the lights from the performance reach directly the objects inside the museum, enhancing the dramatic visual effects of the performance.

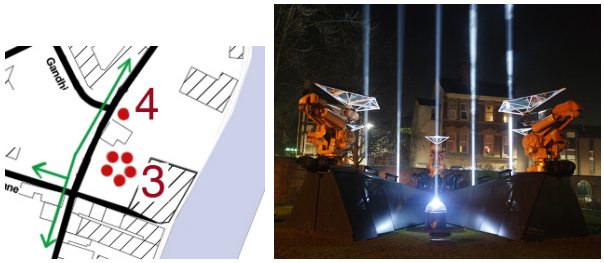

Figure 6. Left: map showing the robots in the Museums Quarter, with the five robots at Streetlife Museum (site 3) and a single robot at the Wilberforce House (site 4), and the local main pedestrian flows (green arrows). Right: overview of the installation at Streetlife Museum in the Museums Quarter.

Unlike the other settings, the robots at site 3 carry mirrors instead of lights. The light source is placed on the ground and do not move; hence, the light effects change according to the movements of the robotic arms, which cause the powerful light beams to be reflected in all directions, even to the sky, as shown in Figure 6.

The plinths at this site are approx. 1m high, thus shorter than other locations. The Museums Quarter, unlike Trinity square, features a more compact built environment; as a result, the facades at site 3 are covered with lights very often. Each performance lasts fifteen minutes, after which the same movements and soundscape repeat. As for the profile of visitors, we observed that they are the ones who are most interested in the performance. Since this area is more isolated from the town centre, with very low pedestrian flows at night, most of the visitors at site 3 came there precisely to watch the performance and they stayed for the whole duration of a full session.

Conversation at Wilberforce House (site 4)

This site features one single robot, which is smaller than those at the other sites (Figure 7). As the name of this installation suggests, an apparent 'conversation' takes place between the robot and the sculpture of Mr. Wilberforce – a local politician, philanthropist, and leader of the movement to stop the slave trade. Since passers-by and observers can only see this performance from one spot – behind the front gate of Wilberforce House – the viewing experience becomes more limited when compared to the other sites, where visitors can freely roam around the robots to experience the performances from different perspectives. Along with site 1, the performance at site 4 is the most fleeting one, lasting only for three minutes, after which the same movements and sounds repeat.

Figure 7. Overview of the installation "conversation" (site 4): the statue of Mr. Wilberforce stands in close proximity to the lone robot (illustrated in white). The person in the figure (left) highlights the viewing position and the small scale of this installation in comparison to the other sites; a gate (not shown in the figure) physically separates visitors from the robot.

METHODOLOGY

We had no prior involvement in the design or setup processes of the robotic installations. Our first methodological step consisted of visiting the four sites where the performative robotic installations were placed. Apart from the data collection process itself, visiting the sites was a fundamental step, as it provided us with firsthand experience with the robots, the performance and how they relate to the surrounding urban settings. After an initial site visit, a fieldwork was carried out for three days, from 19th to 21st December 2017, three weeks after the robots were set up in Hull. They continued running until 8th January 2018, a total of five weeks.

Through exploratory observations, video recordings, photographs, field notes and interviews, we aimed to clarify a set of key aspects including the urban context of the robots – from the micro scale, i.e. their immediate vicinity, and the position of each in relation to the other robots on the same site – to the macro scale, taking into account their placement in relation to the city layout as a whole (Figure 1). Other important aspects of the data collection consisted of finding out a) how noticeable the robotic performances were in each of the urban settings (with respect to the visual and audio features); b) the social impact of the performances in each setting, i.e. how much the installations encouraged passers-by to stop and engage in different forms of social encounters, e.g. chatting, observing, photographing; and c) the time span of each performance, and how its duration affected the social behaviour and experiences in the settings. Ultimately, we are interested in identifying possible lasting effects on the city.

Data Collection

In the following, we present a more detailed methodological account of the three days of fieldwork and introduce some key results from the interviews.

Day 1

Aims: To familiarize ourselves with the urban settings; to explore the four installations sites and to better understand their relationships with the city of Hull.

Methods: A series of visits to the four sites at varying times. Each visit lasted between fifteen and thirty minutes, and consisted of observations, photographs and field notes. The visits were distributed as follows: one visit to each site at around 3pm (when the installations were inactive), and three visits after 5pm, when the installations were running. These latter visits took place at around 5pm (so as to observe how people reacted when the robots started to move); and again, at around 7pm, to see if people were present around the robots; and at around 9pm, just before the end of the performances.

Results: As the robotic audio-visual performances start, the passers-by suddenly notice them, and some people stop to watch. Talking to the volunteers was another frequent behaviour at all sites. Depending on the location, people tend to move around the robots and perceive them from different angles. People showed amusement with the urban surfaces nearby covered with light and shadows. We observed varying age groups, both men and women, across the four sites of the performance.

When the performances were running, the number of visitors present at each location never exceeded fifteen people during our observation sessions. When the robots started to move, they created a temporary social bustle at the sites. Existing commuters stopped, and this caused some intensity and expectations. Across all sites and observation sessions, a varying number of passers-by (between one and ten) stopped and started to watch the performances; some of them took photos of the robots and others also asked questions to the volunteers. Towards the end of the session there were three to six people in distinct locations. The low temperature (2-5ºC) may have reduced the pedestrian activity, especially in the area of the Museums Quarter (sites 3 and 4), which has no other attractions during the evening, like shops, businesses or other urban amenities. The number of male and female visitors was almost the same throughout the performances and sessions. The dominant age range of the visitors was between twenty-six and fifty years old.

Day 2

Aims: To document surroundings further; learning and collecting people's feelings and impressions of the installations.

Methods: The data collection was divided into two areas: 1) Beverley Gate and Trinity Square, 2) Streetlife Museum and Wilberforce House. Onsite measurements: how long the installation lights cover the surrounding facades; how often shadow-shapes appear on the facades; total duration of the performances; people´s preferred positions to watch the performances.

Results: Each site presented distinguished outcomes due to the setting they were placed in and the choreography of the performance. While at Beverley Gate most people were concentrated in between the two groups of robots and watch them from one point of view, at Trinity Square people were

walking around them so as to experience the audio-visual performances from different angles. At the Streetlife Museum, we observed a peculiar situation: even though this area has three open sides allowing visitors to watch the performance, people tended to pile up near the entrance of the site. As for the installation at Wilberforce House, since it was designed to be watched from one single spot (behind the gate), the few visitors we observed (max. three people at the same time) had no option but to squeeze themselves in the narrow space provided.

Day 3

Aims: To refine and complete the data collection.

Methods: Observations, interviews, photographs and video recordings.

Results: The third day was the Thursday before Christmas and shops were open until 10pm. 'Beverly Gate' location was the busiest due to shopping activities. Also, there was a long queue in front of the Minster at Trinity Square to attend the Christmas Service at the church. People in the queuing line took photos and talked to each other about the robots. The general reaction was positive, and the interaction was high. There were more than fifty people staying at the location for time span of half an hour at the beginning of the ceremony at the church. On the other hand, there was no momentous change at the Museum Quarter.

Interviews

Altogether, we conducted semi-structured interviews with thirty-two people (eighteen women and fourteen men) around the four sites. From these, twenty-two people live in Hull and ten live elsewhere – most often in nearby towns. The questionnaires we used were primarily aimed at finding out more about people's feelings and thoughts about the installations, and how the robots affect their perception of the daily surroundings. The charts below summarize some important findings from the interviews:

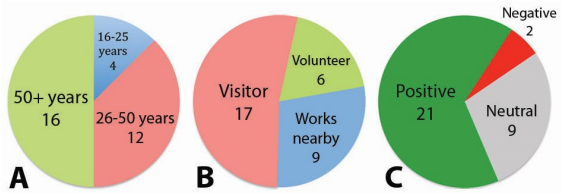

Figure 8. Key findings from the interviews: A) age groups, B) personal involvement with the area, C) personal impression about the robots.

Overall, visitors enjoyed the scale and layout of the robots. Some people particularly emphasized the atmosphere. One visitor described the Trinity Square with the robots as "science-fiction" [12]. The light coming out of them and reaching the existing surfaces is interpreted as the sound coming to street from a concert hall. The interviewees barely mentioned the urban environment surrounding the robots; instead they preferred the words: "installation", "performance", "dance", and "show". One visitor strongly rejected the relationship between the robots and the surrounding place, stating that the performances have "nothing to do with the urban environment". A selection of revealing comments and impressions from the interviewees at each site of the performance is listed below:

Beverly Gate (site 1): some confusion took place at this site as some interviewees thought that a projection mapping in a nearby façade was part of the robotic performance.

Trinity Square (site 2): the soundscape of the performance was the most mentioned feature. Four visitors considered the sound the best part of the installation, and one person compared the experience with swimming underwater.

Streetlife Museum (site 3): a returning visitor at this site commented that he would like to see the performance once again to understand it better; over time, he felt as if the robots were human beings.

Wilberforce House (site 4): no one mentioned this installation as their favourite; overall, the interviewees on this site did not find the experience significant.

General key comments and impressions:

- Many comments were directed towards the pace of movement. Almost everyone stated that they would like to see more dynamic, and faster movements.
- People seemed impressed with the background of the robots as former car factory equipment. Some explained this situation as a way of recycling. Others focused on how an innovative being such as a robot can symbolize the future in an old historic environment.
- Many people used the word "different" to describe the installations, but also expected something "more". Even though some people were uncertain in defining their experiences, the majority of visitors were pleased with the performances (Figure 8-C).
- Among the few negative impressions we collected, the most common complaint was about the pace of the performances: some interviewees found them too slow.
- Some people pointed out the similarities between robots and humans. One interviewee said: "just like people, they look all the same but act very differently. While some of them are mild, others can be very offensive."
- The majority of the interviewees stated that the installation at the Streetlife Museum was the most interesting one.
- Some first-time visitors highlighted the necessity of visiting the sites more than once to better apprehend the robotic performances.

DISCUSSION

Placing industrial robots in action in the urban setting, outside their conventional context, prompts new forms of interfaces that require a proper understanding of the challenges and potentials. Here, we suggest building on the challenges identified by Dalsgaard and Halskov [5] in relation to media facades design, particularly with regard to integrating media into their physical surroundings, and how such integration may transform social relations and lead to

emergent and unforeseen uses of places and systems. We argue that the performative and embodied nature of the robotic installations require a better understanding of the spectator's experience that links back to situated performative practices and events within the city daily life. Here we outline, in particular, the noted difference between the 'show' mode, at the Streetlife Museum (site 3) vs. (site 1) that is placed at the heart of the main pedestrian flows. .

"Where do we go from here?", pushes the boundaries of urban media art by repurposing industrial robots and giving them a new platform and setting. As Jason Bruges Studio declares, the performances aim to "animate and highlight unseen places and encourage people to see Hull in a new light" [7]. This vision brings the notion of "media architecture interfaces" to the fore [1]: the robotic performances try to entice people to step out of their habitual routine and to perceive the Old Town in new ways.

The feedback we gathered in the study highlights the positive effect of the kinetic installations on the public perception of city life. The interviewees emphasized the enjoyment they felt when watching the robots, and how this triggered existential questions in their minds. The electronic, enigmatic sounds emitted by the installations were perhaps the single most striking feature of their design, in terms of sensory experience and social impact. Interestingly, sound stimuli are more direct than visual ones, as sound does not require the deliberate redirection of one's sensory system in order to be perceived. In this respect, it is easier to trigger initial attention and engagement when the installation is using both sound and visual stimuli [11,16]. Besides, one of the key findings is the similarities pointed out by the interviewees between humans and robots. Handling the robots as individuals, seeing their attitudes and life cycle similar with ours worth a discussion about the future of organic-inorganic co-existence. However, we also identified additional aspects that affected the extent to which the installations influenced their urban and social settings:

- *Beverley Gate (site 1):* the surrounding architecture did not provide a suitable "canvas" for the projection of the robotic lights. The lack of vertical built surfaces near the northern group of robots significantly reduced the visual appeal and the noticeability of the performance. The short time span of this performance (three minutes) made observers move out of the site as soon as they realized the repetitive movements and sounds.
- *Trinity Square (site 2):* the robotic lights only targeted the surrounding facades once every ten minutes of the performance, thus reducing their visual impact.
- *Streetlife Museum (site 3)*: despite being the favourite among the people we talked to, both installations in this area (sites 3 and 4) were not able to attract more people due to their urban context; an isolated, secluded setting; moreover, the installations were not visible from a fair distance. Here, the setting could not enable discovery through natural movement in the city.
- *Wilberforce House (site 4):* the most hidden of the performances, and the only one where a physical barrier (a gate) prevented visitors from further approaching or wandering around the installation; also, the most fleeting performance, spanning three minutes.

Finally, it is necessary to emphasize the highly contextual character of this study. "In-the-wild" [17] approaches to Interaction Design call for a special attention to the myriad of factors interfering with how technologies, devices and spaces are experienced in everyday urban settings [18].

CONCLUSION

Cities are embracing the consequences of industrial and communication revolutions. Our co-existence with new technologies is transforming the environment. Welcoming the emerging "working" class, with the "orange collars", to the city context, offers a point of departure. "Where do we go from here?" has opened a door for the use of industrial robots, beyond the walls of museums and factories, with potentially great opportunities for the future [6].

The robotic performances in Hull managed to bring people together under adverse weather conditions; in this respect the robots functioned as a socializing platform for social encounters [8]. These robots can also be approached as a new typology of media interfaces embedded in the everyday city environment, pointing to a new potential application of urban HCI [9]. Building on this case study, we believe that there is a tremendous potential in using robots not only as temporary exhibits such as the installations discussed in this paper. We suggest that robots may well be considered as a permanent addition to the urban landscape; not necessarily as "special features", but as infrastructural elements embedded in the everyday city. This move from temporary to permanent robotic installations would certainly demand a careful planning and curatorial agenda, so as to fit within the urban flows rhythms [8], and avoid the drawbacks (e.g. too repetitive behaviour, slow movements), while boosting positive elements, such as the supporting sound and light sources.

Koorsgaard and Brynskov [14] argue that media architecture and urban interaction design should try to understand what happens around a design intervention, and more importantly use it as an occasion to understand and push larger topics related to digital policy, transparency, and how this changes the role of the publics. Following this idea and turning back to the points raised in the Introduction, we propose considering urban robotic installations and events and as emergent type of pervasive displays. Just like how "Where do we go from here?" encouraged citizens to stop, reflect and share their visions about their broader context, we believe future robotic installations may further improve this civic potential. Once the boundaries of pervasive displays have been thus expanded, we are able to conceive a novel range of urban platforms for civic engagement, carriers of social and perhaps political awareness –not only in the form of light emitting surfaces, but 3-dimensional, kinetic and sensory.

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