Flowing Bodies: Exploring the Micro and Macro Scales of Bodily Interactions with Urban Media Installations

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ABSTRACT
In this paper we investigate human interactions with urban media installations through the lens of two scales of analysis: the body scale (micro) and the city scale (macro). This twofold approach allows us to better understand the relationships between the design properties of outdoor installations and the urban spatial layout around them. We conducted in-the-wild studies of two urban media installations, one consisting of fixed components, and the other of movable components, which were deployed in different places and encouraged different types of whole-body interaction. We provide a detailed account of the micro and macro levels of interactions, based on observational and qualitative explorations. Our studies reveal that the urban spatial layout is a key element in defining the shared encounters that will emerge around the interface, and therefore it needs to inform the design process from the outset.

Author Keywords
Whole-body interaction; media; installation; spatial layout; urban play; marco and mirco scale.

CSS Concepts
Emerging technologies – Emerging interfaces

INTRODUCTION
Whole-body interactions are increasingly explored in the design of urban media installations. As embodied and, to some extent, tangible structures installed in public settings, these installations affect not only the behaviour of individual passers-by, but also change the spatial and social dynamics around them [7, 14]. At the same time, the existing physical space is not a mere receptacle or a passive "platform" [3] for the installation: the spatial layout plays a crucial role in defining how the interface will be approached, used and shared. Therefore, it is important to explore the intersections of these two scales of analysis: the macro scale of the urban spatial layout and the micro scale of the interface design. Such an approach could help inform the design of outdoor installations that are truly engaging and fit to their socio-spatial context.

Media architecture and urban digital interaction scholars and practitioners have discussed the social and spatial aspects of introducing so-called media installations in outdoor public settings (for example see [14, 15, 23, 35, 37]). These investigations have brought important contributions, with key concepts to the HCI research community, such as *Urban HCI* [15], *shared encounters* [14] and *social affordances* [1, 26]. We propose to build on this body of work and explore in depth an approach to mediated urban environments that focuses on spatial layout [5, 14, 16] and whole-body interactions, a prominent interaction modality within Urban HCI [9, 13, 40, 48]. This allows us to unpack significant socio-spatial implications of whole-body interactions in specific urban settings featuring urban media installations.

In this paper, we discuss the mechanisms through which individual experiences of bodily engagement with urban media installations may generate different levels of social engagement and shared encounters. This depends on the formal (e.g. shapes, materials), spatial and interactional qualities of the installation, as well as the existing urban layout within which the installation is placed.
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We present in-the-wild studies of two urban media installations that share important characteristics: firstly, they feature striking light effects as a prominent element of their designs; secondly, they encourage whole-body interactions; and thirdly, both installations were deployed in the same city district (though in different areas of the district). Apart from

these commonalities, each system encourages different modes of bodily engagement – one is a fixed, the other is a movable interface –, and the urban spatial layouts around the installations were not the same.

RELATED WORK

The deployment of digital interactive technologies – the *situated media* – in everyday urban environments often changes the ways in which we experience the city, both individually and collectively. At the individual scale, locative, situated urban media can transform our bodily experience by encouraging us to move, to feel and to interact with the interface in novel, playful and engaging ways [14, 36, 51]. On the collective scale, the public and situated character of urban media makes them act as a rich platform for various types of social encounters, for example through encouraging "triangulation" [52] – in which the media function as a stimulus that prompts strangers to talk to each other, or through "shared encounters" – where a sense of performative co-presence arises from the "mutual recognition of spatial or social proximity" [14].

Existing literature has addressed a range of social and spatial aspects of interactions with outdoor interfaces. Some works focus on the various actions and roles performed by people as they approach and use the interface [38, 45]. Other authors focus on the *spatial layout* of mediated urban interactions – a key element to our discussion, as we believe that the physical space plays a major role in supplying, modifying and amplifying whole-body interactions with urban installations. Behrens et al [5], for example, identify three interaction zones around connected vertical touch-based displays, according to the type of interactions observed: "direct interaction space", "surrounding public space" and "networked space". Fischer and Hornecker [15] classify the interaction spaces on the basis of their social affordances; these include the "gap spaces", which create a sense of distance, and "comfort spaces", where a sense of physical and psychological ease is provided. Research on urban media installations has also developed several interaction frameworks, outlined in [7], which shed light on aspects such as how the installation is used and shared, and how this affects the surrounding physical space.

Since the publication of Paul Dourish's seminal work on *embodied interaction* [12], a significant corpus of research has investigated the bodily and experiential aspects of human interactions with technologies. These approaches [13] reflect the so-called "third-wave HCI", which brings new elements of human life – such as emotion and experience – to the field of HCI. David England et al. [13], for example, define "whole body interaction" as an interdisciplinary domain encompassing the physical, physiological, cognitive and emotional aspects of interactions. Besides that, numerous perspectives of whole-body interactions have been explored. Some studies address the body itself as a sensing mechanism for supporting whole-body interaction [9], while further insights have been drawn from sporting activities [40, 48], choreography and dance techniques [27, 34], exertion interfaces [39] and experience and interaction aesthetics [11, 54].

A range of concepts has been developed to investigate the rich and nuanced relationships between the human body and interactive technologies. Some concepts emphasise the dynamic and experiential qualities of the body in motion – for example through the study of *kinesthetic interaction* [18], *movement-based interaction* [21, 34], *embodied engagement* [33] and *interaction in motion* [36], while other approaches unpack the sensory and aesthetic dimensions of interactions, highlighted in concepts such as *multimodal* and *crossmodal interaction* [29, 31, 32] and *aesthetic interaction* [42, 55].

Further research has looked more specifically at the intersections between the spatial configuration of the interface and the types of bodily input it affords. In this regard, the works by Fischer et al. [17, 16] are particularly relevant, as they discuss the two fundamental paradigms we draw on in this paper, namely *fixed and movable interfaces*. In the case of movable interfaces, [17] describes an interesting finding: the design of portable light interfaces prompted people to creatively appropriate them by including the environment into the activity – expressed in behaviours such as using public benches as goals or decorating trees with interactive lights. This finding is relevant for our discussion as it reinforces the role of the *urban space* in shaping people's experiences with interactive artefacts. With regard to fixed interfaces, we can draw a parallel between one of our case studies and literature exploring foot interaction. Augsten et al., for example, present a system that enables people to use their feet to interact with a back-projected high-resolution floor [2]. Such type of interface is noteworthy not only for allowing a larger interaction space, beyond the limits of hand-based tabletop, but also for opening up new perspectives in terms of user identification and personalization: since each person's body responds differently to the gravity that bound it to the floor, each user generates a unique sole pattern that could be used to trigger a specific response from the system. A different approach to foot interaction is presented by Jota et al. [30], who explore

kicking as an alternative way of bodily input to vertical displays. It tackles the bottom part of large-scale displays, a challenging area for interaction designers precisely because it stands out of the hand's reach and close to the floor.

Building on this multifaceted research, we propose to advance the understanding of human interactions with outdoor interfaces by bridging two scales of analysis – the *body scale* and the *city scale*. These intersections are promising [14, 5], yet have not been fully explored. We analyse two urban media installations and propose to address these intersections through a dual move: we first "zoom out" to consider the urban context of each location; we then "zoom in" to have a closer look at how people's bodies engage with the interfaces. After that, we discuss how these macro and micro scales inform each other, drawing attention to the social and spatial configurations around the urban interfaces. In so doing, we extend current research on whole-body interactions with outdoor installations by moving literally from body to place.

METHODS

We carried out exploratory field studies in different years of two temporary light-based urban installations affording whole-body interactions: *The Pool (2016)*, designed by American practice Jen Lewin Studio, and *Pixels (2018)*, by the Dutch artist Jonas Vorwerk. Both were part of the Winter Lights Festival, an annual event that runs for two weeks in January at Canary Wharf, a business district in East London.

Winter Lights 2016 included a total of 18 installations (three indoor and fifteen outdoor), with varying sizes, forms and levels of interactivity. In 2018, it featured 33 installations (twenty indoor and thirteen outdoor), with the same variety in terms of design, interaction and placement as observed in 2016. We found out, in both years of the festival, the majority of the installations were visually striking that sparked shared encounters but many were not particularly engaging from a bodily perspective. Eventually, When considering the joint aspects of direct *whole-body interactions* and *shared encounters* – our research focus –, the ones that fulfilled these criteria are *The Pool* and *Pixels*. We observed and analysed the sites of the installations during and after the festival (as the baseline for understanding the everyday social activities on each site. After initial exploratory observations of the study sites during the festival, we used cameras to photograph and to video record the interactions and social encounters around the two selected installations. Since the urban context and the study motivations did not change from 2016 to 2018, we followed the same research protocol to collect data.

Figure 1: The Pool installed in Montgomery Square.
Figure 2: The cubes of Pixels in Adams Plaza.

Ethical concerns are important to address when capturing behaviour of people through images in urban spaces. Prior to our fieldwork, we obtained formal approval from the UCL research ethics committee, and followed the strict ethics and legal procedures in terms of privacy and data protection. In line with UK regulations (ECHR, and GDPR after May 2018), and due to the context of our data collection, no further permissions (e.g. from the artists or the estate managers) were necessary. We highlight (1) image recording was a frequent behaviour among the festival attendees; and (2) no informed consent from users could have been obtained, in the interest of the study ecological validity.

We divided people into: group1) active participants, who we name players [41] ie people directly engaged in whole-body interactions. In the case of The Pool, this covered every person situated on the installation floor-based platform (e.g. standing, stepping, walking, jumping, sitting) for Pixels, players were those touching the interactive cubes, using either their hands (e.g. holding, lifting, dragging), their feet (e.g. stepping, walking, climbing) or other body parts (e.g. sitting, lying) and group 2) passive observers, who we name spectators [45]ie people taking part in shared encounters, though without engaging their bodies to interact; like observing the interactions or chatting in close proximity to the installations, taking photos or filming interactions, posing for photographs or taking "selfies" around the installations. Importantly, both (players and spectators) concern people engaged in shared encounters, yet doing so in different ways: the first as active performers involved in whole-body interactions; the latter as audience members who help create and sustain a sense of "sociable buzz" [8]. In the following, we analyse each installation.

Case Study 1: The Pool

The Pool was installed in Montgomery Square, an open area (East) of Canary Wharf surrounded by high-rise office building close to a small park and a dock. The Pool comprises multiple interactive circular pads installed close to each other and arranged in concentric circles, covering a large floor area [56]. The pads are made of a tough, translucent plastic, strong enough to withstand rain, snow and people walking, jumping or even cycling on them. Each pad is fitted with custom boards, a programmable light

source and an accelerometer. They are sensitive to different levels of pressure: an ordinary hit causes the correspondent pad to flash, while stronger hits may activate the neighbouring pads as well, forming ripples or splash effects.

Case Study 2: Pixels

Pixels was installed in Adams Plaza (North) of Canary Wharf (Figure 2). We observed that the urban character of Adams Plaza is very similar to that of Montgomery Square in being: a) an open space surrounded by office towers and a dock; b) mainly used as a passageway; c) on an everyday basis, the plaza is not particularly attractive for static activities and social encounters: it is exposed to the elements with no services or shops directly serving the plaza.

The Pixels is made up of 48 translucent plastic cubes (40x40x40cm), fitted with LED lights, Arduino electronics, accelerometer, radio frequency and infrared sensors [58]. By rotating the LED-lit cubes, people can change their colour and bright. The cubes are light enough to be freely manipulated, moved and rearranged even by small children, yet they are also sturdy enough to withstand rough usage, such as dragging, dropping and climbing.

Pixels is another example of urban, light-based media installation in which the ideas of bodily engagement and shared encounters are fundamental to the designer [58].

Data Collection

In the first part of the data collection, we identified and mapped the movement trajectories (i.e. pedestrian flows) and the static activities (e.g. standing, observing, smoking) performed by people around the two study sites. These mappings were conducted by two researchers, from 4pm to 9pm, both at times when the installations were running and one week after they were removed from the sites. In order to represent the social activities consistently and uniformly, we employed mapping techniques loosely based by the observational tools adopted by Space Syntax theory [25], particularly "static snapshots" and "movement traces" and targeted days with dry weather conditions. Videos were the primary source of data collection. In the case of The Pool, we recorded a single 45-minute long video (starting at 6.30pm); in the case of Pixels, three consecutive nights of interactions were recorded: night 1 of 31 minutes of video , (between 5.00pm and 7.00pm). From the video footages, we selected time slots of two minutes to count the number of players and spectators around *The Pool* and *Pixels.* Through preliminary analyses of the videos, we were able to estimate two minutes as being the optimal interval for the counts: 1) it was enough time to observe palpable differences in the distribution of players and spectators, 2) offered manageable interval that allowed us to accurately count the amount of players and spectators, 3) setting regular intervals of two minutes for the counts provided us with a uniform and less biased portrait of the interactions with the installations.

RESULTS

The Pool: When the installation was operating, the vast majority of people were drawn to the spaces occupied by The Pool or adjacent to it (as indicated by the red circle in Figure 3, left). Peripheral areas of the square were only occasionally and sparsely occupied during the running times of the installation. In addition, we observed that part of the people who were watching the installation from a distance would eventually come closer to The Pool, at least for a few seconds. Thus, with regard to stationary behaviours, The Pool concentrated – within and at its physical boundaries – the social activity and shared encounters in the site.

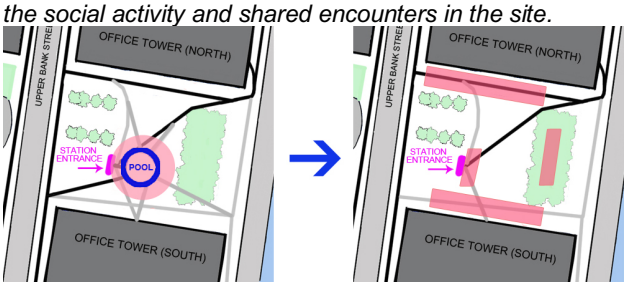

Figure 3: Montgomery Square during the day, people work in the area and traverse the square from and to nearby transport hubs; after work hours, the square is mostly empty, a segregated space devoid of facilities to attract people. Pedestrian flows (left) with and (right) without The Pool.

Looking at the stationary activities after The Pool was removed, we noted some differences, in terms of spatial distribution, but also in the amount of social encounters and the time people spent at the square. People tended to occupy three areas primarily to smoke, to chat and to use the mobile phone: 1) the spaces adjacent to the facades of the office towers, 2) the surrounds of the underground station entrance, and 3) the benches under the trees (red zones in Figure 3, right). Importantly, the frequency and duration of these static behaviours were noticeably lower than those observed when The Pool was in use. With regard to pedestrian flows, the presence of The Pool did cause alterations in the way people moved across the site, yet these were less clear than those related to the stationary activities. As shown in Figure 3 the preferred trajectories (in black) remained basically the same although the installation also motivated people to use a greater variety of secondary, alternative routes through the site (grey lines). Zooming in to the interaction space of The Pool, we observed that the installation succeeded in sparking playful behaviours and shared encounters throughout the study period. This cheerful, lively social atmosphere

persisted in spite of the cold and windy weather conditions (around 8C). Males and females of varying ages joined the setting of the installation, either as players or spectators. The majority joined the installation in pairs or groups; in the case of groups, one member of the party often performs an active role in the group, taking the opportunity to photograph or film the interactions of players, or talk to them so as to suggest movements or poses on the interactive Pool pads. The Pool succeeded in gathering people consistently over the forty-five minutes of our video (Figure 4) .

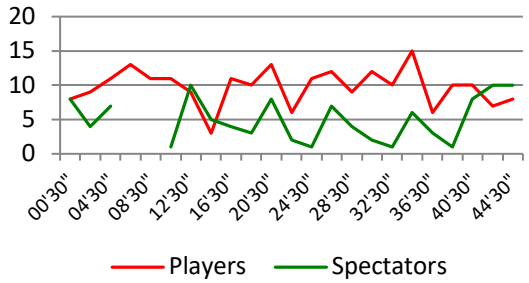

Figure 4: Distribution of participants in The Pool at intervals of two minutes over 45 minutes of video recording.

Overall, The Pool attracted an average of 14 people, who devoted at least a few seconds of their time to play, to observe or to photograph the collective performances, or simply to hang around the interface. During most of the recording, though, players significantly outnumbered spectators: on average 9 players versus 4 spectators, with peaks of 15 players and 10 spectators. Even at times when no spectators were around (at 06'30" and 08'30" time slots), numerous players were active (13 and 11 respectively).

An important social aspect revealed by the study is the changing roles between players and spectators. The presence of several people running and jumping simultaneously on the bright, colourful pads of The Pool seemed to encourage spectators and passers-by to join the performances. Such transitions of roles, discussed in [45], were observed throughout the study. In this respect, it became clear that the urban, public character of The Pool rendered every encounter between body and tangible interface also an act of performance [44], paving the way to a web of casual, shared encounters between friends, strangers, singles and groups. Such "community of users" consisted both of visitors, who came specifically for the festival (usually in pairs or groups), and of commuters, who pass by the square on an everyday basis and were attracted to the playful spectacle.

Pixels: Looking at the socio-spatial setting of Pixels, our study found that the introduction of the numerous interactive cubes of Pixels into the Adams Plaza caused a clear alteration of the social atmosphere in the site. The installation brought together a varying but steady community of players and spectators, who occupied predominantly the spaces immediately around the cubes.

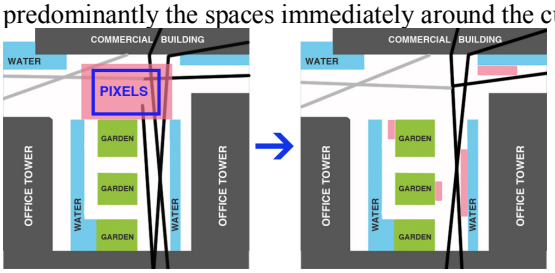

Figure 5: Pedestrian flows and occupied zones in Adams Plaza (left) with and (right) without Pixels. The blue rectangle in the left image represents the main area occupied by the cubes.

This contrasts with the sparse and occasional stationary activities observed when the installation was not in the site (red zones in Figure 5, right): few people occupying the borders of the gardens and water features of the plaza, engaged in activities like using the mobile phone, smoking, loitering or apparently waiting for someone else. Regarding the pedestrian flows in Adams Plaza, we found no important alterations in people's trajectories after the placement of installation. The most used routes people followed in the area were those along the north-south axis of the square (represented by black lines in Figure 5), and this did not change substantially with the presence of the installation. The same observation holds to the secondary, routes (grey lines in Figure 5). Unsurprisingly, we observed that the amount of people around the installation was in direct proportion to the number of passers-by in the vicinities. Passers-by seemed compelled to join the interaction space, after noticing the "sociable buzz" [8]. Another key factor was the striking visual effect of the illuminated multi-coloured cubes that caught their attention. Overall, our study revealed a demographic diversity among the players and spectators. The design of Pixels, in addition to the fact of being part of an art festival, seemed to have granted a general "license to play" [1]. With the aid of the video recordings, we were able to quantify the number and proportion of players and spectators around the installation (Figure 6). Altogether, Pixels attracted total averages of 28 people on day 1, 23 on day 2 and 65 on day 3. Unlike The Pool, the number of spectators was consistently higher across the 3 nights: ave. 23 spectators vs. 5 players on day 1; 15 spectators vs. 7 players on day 2; and 47 spectators vs. 17 players on day 3. Such variations on the amounts and distributions of players and spectators are due to two main factors. Firstly, some external circumstances – like the time of the day, the weather conditions and people's movement

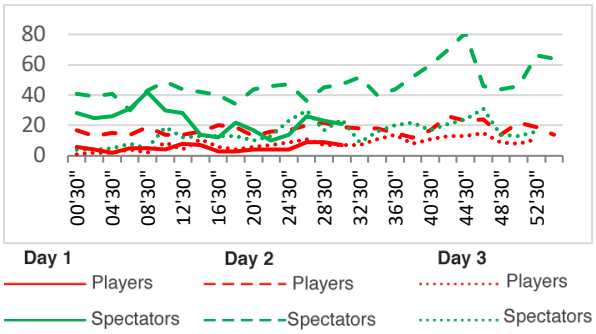

Figure 6: Distribution of participants in *Pixels* at intervals of two minutes over three days of video recordings.

around the study site – all interfered with the attendance levels and behaviours around the Pixels. Secondly, and most interestingly, the fluctuations in the number of players and spectators were a direct result of the "do-it-yourself" character of the installation: the cubes could be freely manipulated and arranged, all sorts of sculptures, piles or disordered assemblages of cubes were observed. Each one of these ephemeral groupings ended up creating own affordances, for playful behaviours, spatial negotiations and shared encounters. The way people interacted with Pixels was highly dependent on two key factors:

1) the *spatial configuration* of the cubes: when single cubes could be found scattered across the site, people would apparently feel more comfortable to appropriate one or some of the cubes, playing freely with them. On the other hand, when the cubes were grouped together, forming sculptures, piles or even disordered arrangements, people would not appropriate them so easily, so as to avoid disrupting the result of someone else's creative endeavour; and

2) the *social environment* on the site. This could involve a variety of situations, for example: the greater the proportion of children actively playing with Pixels, the fewer the number of adult players; besides, the general conduct of those entering the interactive space was found to reflect the conduct of those already present: regardless of the participants' ages or how the cubes were distributed, a more cheerful and playful social environment led newcomers to interact more freely and enthusiastically. At any rate, both the spatial configuration and the social environment of Pixels were dynamic and interdependent factors that, together, helped to shape the individual whole-body experiences and shared encounters around the installation.

DISCUSSION

We aim to address how, and to what extent, urban media installations affording whole-body interactions may transform interactions in their urban settings both spatially and socially? what role does the urban spatial layout play in supporting these interactions? In order to tackle these questions, we unpack the spatial, formal and interactional aspects of the installations, from the micro (design aspects) to macro (urban layout) scales of analysis.

Micro Scale 1: Spatial and Formal Aspects

The Pool is a fixed installation: the multiple interactive pads are securely attached to the platform beneath them. All the spatial boundaries of The Pool are very clear: one can easily notice where the interactive space – or at least where the play space – begins and where it ends. As a result, a person is unmistakably a player (within The Pool) or a spectator or passer-by (outside The Pool). This creates a stage-like performance area, with clear separations between inner space and outer space. Pixels is notably different from a spatial standpoint. Unlike The Pool, it is a movable and portable installation; its interactive elements (the cubes) are meant to be moved, piled, arranged and rearranged, and only through the bodily movements, individual and shared decisions, the installation acquires meaning. Even though the cubes themselves have a well-defined, solid shape, when put together they allow for a myriad of spatial configurations. it creates an interactive urban space that is fluid and ever-changing: as people spread the cubes across a large, open area, some media sculptures arise and spatial gaps tend to become irregular, difficult to find and to stay in.

Figure 7: The fixed spatial boundaries of The Pool (top) and the open and porous spatial boundaries of Pixels (bottom).

The main patterns of spatial configurations sparked by the interactions with the Pixels include one single, large sculpture built from all the cubes, defining one clear play space (Figure 8, left); a few sculptures scattered on the site, creating more fluid spatial transitions (Figure 8, middle); or a general dispersion of the cubes, allowing for multiple simultaneous bodily interactions (Figure 8, right). Transitions between the various spaces formed around Pixels [15] are much more fluid than in The Pool. At moments of greater attendance, players, spectators and passers-by are likely to fuse into a single mass of social activity; a "swarm" pattern arises [23], making it difficult to distinguish between the wide variety of interactions.

Figure 8: Main spatial configurations around Pixels with "dynamic environments" and "collective exploration" from a multitude of whole-body interactions, like dragging, holding or lifting the cubes ie "pixels" and creatively (re)organizing them.

Micro Scale 2: Bodily and Interactional Aspects

The fixed structure of The Pool creates a clear space for people to negotiate their positions on and around the installation. As the pads are set in a slight distance from one another, players are encouraged to explore the interaction space through leaps – each player should decide which pad to hit, and when to do that, according to the body size, ability, strength, balance and the availability of pads around. The social context and the geometrical arrangement of the pads call players to make constant and rapid decisions, which should accord not only with their bodily capacity to reach a pad, but also with attention to other people's spaces and trajectories. In moments of good attendance, one could compare The Pool to a busy system of crossroads, where a set of negotiations should be made quickly, on the move. This also help explain why some people opt for a slower, cautious pace while interacting with The Pool.

Overall, the interactions we observed in the installation Pixels differ from those in The Pool in various aspects. Firstly, the many cubes of the Pixels are freestanding elements, and light enough to be easily lifted and carried, even by children. The portable nature of the cubes gives people interacting with Pixels a strong sense of agency [23?], as they can take possession, move and rearrange the cubes as they wish, constantly altering the spatial configuration of the installation. Secondly, the interactions with Pixels are typically performed with the upper limbs, whereas The Pool encourages the use of the lower limbs. These two contrasting forms of bodily input result in equally contrasting experiences of sensorimotor and kinaesthetic engagement with the artworks. In the case of Pixels, as players manipulate the cubes, their attention is primarily turned to using their arms to lift the cubes, their hands to position and rotate them, and their fingers to stabilize and feel the structure, the plastic surfaces and the smooth texture of the cubes. To a certain extent, the interactions with Pixels depend upon the use of *fine motor skills*, which implies the coordination of small muscle movements [18]. As players touch and feel the cubes with their skin, the materiality of the installation comes to the fore, and players can experience a heightened sense of material and sensory immediacy. As for The Pool, the interactions are mainly dependent on *gross motor skills*, which involves the movement of the entire body or large portions of the body [18]. Players use their legs to enter and leave the interaction space [15], and also to move across the installation as they jump, leap, walk, run or dance on the pads. With their feet, players test how The Pool responds to their actions: the central area of the pads bears a contrasting dark circle, suggesting a target point; when entering the installation for the first time, players usually stand on a single pad and press their feet around different areas of the surface, so as to recognize how (and if) the installation reacts to their actions. Such testing of the installation's visual feedbacks and sensitiveness to pressure plays a fundamental role in the process of sense making.

Micro Scale 3: Participants' Roles

Altogether, the spatial, formal and interactional characteristics discussed above resulted in particular ways of experiencing and sharing the media installations. The Pool was proportionally more enticing for playful and performative interactions than for passive, contemplative behaviours, since the number of players significantly outnumbered that of spectators (mean of 9 players versus 4 spectators) – ie people were not so willing to watch the performance from outside as they were to be part of it. Pixels, on the contrary, in spite of its very playful character, attracted a larger amount of spectators than players, due to the characteristics of the interface. On the one hand, when many children were engaging with the cubes, adults were either looking after their children or, if they did not know the children, they would often feel embarrassed and refrain from playing. On the other hand, the formal and spatial design of the interface posed limitations. For example, the limited number of cubes meant that, at times of high attendance, people would need to take turns in playing with the cubes, with several spectators surrounding each player on the site. At other moments, when large, neat sculptures were made out of the cubes, many people would avoid touching them.

Macro Scale: Urban Spatial Layout

Zooming out, the two case studies revealed that the urban space surrounding the media installations did play an important role in defining how people approached and used the interfaces. Both installations were placed in open, crossing spaces. In the case of The Pool, a key attractor to Montgomery Square is the underground station, which means that commuters are constantly drawn to the area. In a business district like Canary Wharf, this also means that

Montgomery Square – a place occupies a relatively marginal position in the Canary Wharf offering no amenities or refuge from the winter – sees a dramatic drop in social activities and pedestrian flows after ordinary working times. From a macro perspective, the presence of The Pool did alter the spatial distribution of static activities in the square, but the pedestrian flows around the study site did not change as much. Moreover, in spite of being a large and visually striking media installation, the number of players and spectators around The Pool (14 people on average) largely reflected the number of people passing by the site on an everyday basis, when the video was recorded (from 6.30pm to 7.15pm). The Pool succeeded in making people stay longer in the area, but on an urban scale the interface did not work as a major attractor of people. Adams Plaza, the site of the installation Pixels, while also being a crossing area located, has a markedly different urban spatial function. Unlike Montgomery Square, Adams Plaza is strategically placed at a junction of key pedestrian routes (Figure 9). To the south it leads to a large shopping mall, from which people have access to a range of core facilities (from underground stations to leisure, commercial and working hubs). The north is directly connected to the Crossrail Place, a massive mixed-use building with amenities also attract a steady flow of pedestrians throughout the day.

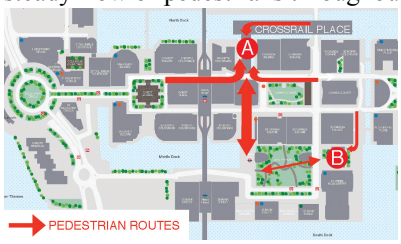

Figure 9: Main pedestrian routes in Canary Wharf towards Adams Plaza (A) and Montgomery Square (B).

During the Winter Lights Festival, the urban-scale spatial disparities between Montgomery Square and Adams Plaza become apparent: our observations of the festival over successive years reveal that, while Montgomery Square is the furthest area to the southeast of Canary Wharf to host the event installation, in every year of the festival Adams Plaza gives access to many other installations in all directions, spread to the neighbouring outdoor areas. Such distribution of installations during the festival reflects and reinforces the strength of the spatial layout and the urban position of Adams Plaza, warranting the site a steady flow of people, among visitors, and commuters. The macro spatial analysis (Figure 9) is key to understanding why number of participants in Pixels was far superior to that observed in The Pool (averages of 28 people on day 1, 23 on day 2 and 65 people on day 3). We make a fundamental claim that a broader, macro-scale consideration of urban spatial context is crucial in shaping social encounters around interactive installations, and therefore should be carefully regarded in the design of urban installations, in tandem with micro-scale aspects of materials, technologies and interaction modalities.

BROADER IMPACT

Bringing people together has been a central objective among projects of urban design and regeneration. More people using and sharing an urban space is normally associated with safe, lively communities [28]. The introduction of situated media installations– in urban environments may help to attract people and make them enjoy specific areas of the city. Yet, this type of positive urban transformation must be considered on a long-term basis, ideally reflecting the dynamic and multi-layered development of the city we inhabit. Temporary urban art and media installations, such as The Pool, Pixels and many others that run as part of special events, cannot fulfil this long-term task of urban transformation – no matter how engaging they are – simply because they *do not have time* for that. In any case, we believe that a due consideration of the macro-scale urban context of interactive interfaces, which we have addressed in our studies, represents a crucial step in the design process of urban media. This holds true for both temporary and permanent interfaces, and has the potential to positively transform the various public environments we share.

CONCLUSION

Drawing from prior research that examined the spatial and social aspects of interactions with urban media interfaces (see eg [1, 5, 14, 15, 23, 26, 35, 37, 50]), our work extends these discussions by adopting a twofold approach that, besides acknowledging the important micro-scale properties of the interfaces (expressed in design aspects such as the forms, materials and technologies used), also emphasises a broader, macro-scale analysis (in terms of urban spatial layout), that has been mostly overlooked in the literature. We demonstrate this through the study of two outdoor interfaces that encourage markedly different dynamics of whole-body interactions and shared encounters in the same urban district. Based on our findings, we argue that the micro-scale aspects of design, on their own, are not sufficient to fully understand how people approach, engage and share urban interactive interfaces. The urban spatial layout plays a vital role in shaping the overall social encounters around the interface, regardless of the design qualities and the levels of engagement afforded by the installation. Understanding this fact is crucial for the design of shared interfaces that enhance the individual and social experience of public spaces.

ACKNOWLEDGMENTS
We thank CNPq (204379/2014-8) and (Ecem's/Ava's)

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