Animating the Static. Case Study of The Project "Urbanimals"

Enhancing play in the cities through an augmented and interactive environment

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This article delineates the process of developing the project "Urbanimals" - an interactive installation designed and realised in Bristol, UK, in 2015. As the case study research, it draws attention to the difficulties in designing interactive structures in urban spaces - from an architects' idea to a construction stage. There are four areas that are being investigated: (1) Modelling interactions, (2) Negotiating locations and logistics, (3) Developing hardware and (4) Performing the on-site observations. The project draws from the idea of Smart City (SC) as the concept of the urban environment with a certain level of responsiveness through implementing a technology-driven matter that expands city offer perceivable, but gentle and not hindering way. It highlights the possible applications of projection technology and the utilisation of the 3D modelling software which provides complex tools for creating animations, movements and interactions with future users. The article gives clues how to design more engaging interactions and how to deal with implementing them in public realm.

Keywords: Smart Cities, Interactive Architecture, public realm, art installations

INTRODUCTION

The investigation presented in this paper is a case study of a development - and a further performance - of an Urban Interactive Art Installation called "Urbanimals" which was realised in Bristol, UK, in 2015 as the winning proposition for the "Playable City Award (PCA)". The concept of the project and the "PCA" is built upon an idea of implementing small urban interventions within cities to improve the appearance and perception of their deprived areas, as well as to engage citizens in active participation in urban life through play [2]. In this respect, the project relates to the notion of "urban acupuncture" (Lerner 2014) which involves the actions that, through small-scale contributions, transform and revive forgotten and neglected places.

As authors of "Urbanimals", we focused on the spaces of transition in cities - spaces that only offer an opportunity to pass through. We wanted to try to transform them into more pleasurable and vibrant places of public interest - into places that stimulate creative behaviour. By "spaces of transition" - follow-
ing Gabriel Fuentes - we understand passages, gateways or aisles and a like, which connect the attractive and well maintained public spots such as main roads, squares or parks (Fuentes 2011). These areas were chosen as a great opportunity for an urban research which intends to observe the changes in behaviour of street users.

Urban Acupuncture performed in the project and presented in this research paper is rooted in the studies of the Smart City (SC) as the specific urban testing ground for technological experiments (Saunders and Baeck 2015). In this regard, we used the Interactive Architecture as the SC-oriented tool to redesign existing urban spaces into responsive and yet creative places. To understand the main objectives of Smart Cities and Interactive Architecture that are being addressed in this study, both movements are being expounded in the next paragraphs.

**Smart City**

Smart City (SC) is one of the concepts of the city development which was widely deliberated in the turn of XXI century, both in public and academic discourse. It could be defined - following ie. Tim Campbell, Anthony Townsend or Antoine Picon (Campbell 2012, Townsend 2014, Picon 2015) - as the idea of organising the city in a sustainable and intelligent manner and making it ever more efficient through the process of learning by sensing and analysing its current states of performance. That process is based on the use of the latest advances in technologies for data collection and for sending data to citizens in response. As Servant Singh [1] points out, this fast and easy exchange of knowledge improves such aspects of the Smart City functioning, as smart governance, smart energy, smart building, smart mobility, smart infrastructure, smart technology and smart healthcare. Yet that is just one - and very top-down - side of understanding the benefits of the smart city. On the other hand, Yuan He (He et al. 2014) draws attention to more citizen-oriented aspects of urban living in SC, such as: public safety, telemedicine, home-care, interpersonal communications, social activities, and entertainment. He advocates for intelligent solutions that not only improve the efficient performance of the city, but more importantly, improve citizens themselves. From the variety of research branches, such researchers as Drew Hemment (Hemment 2013) indicate that probably the most essential fact about Smart City is that it is as intelligent as its planners and architects are, thus implying that without smart communities represented by smart inhabitants, the concept of Smart City lacks its essence and purpose.

In this regard, this research paper correlates with the technology-driven approach in designing urban environment which can increase the positive development of the society in the smart - and any other - city. To achieve this, it uses the findings in the field of Interactive Architecture as a tool to influence communities through the design with a real-time, creative approach. For the authors of this article, Interactive Architecture can be used for augmenting the Smart City with crucial layer of social well-being and healthy relations that are expected to construct such emerging form of settlement as SC.

**Interactive Architecture**

Interactive Architecture (iA) enriches the idea of the Smart City not only by making an urban environment more technologically and functionally developed, but also by creating surroundings that may evoke peoples' creativity, hence, their smartness. Ideological roots of Interactive Architecture date back to the mid-twentieth century, to the project "Fun Palace" designed by Cedric Price and to the technology-driven interactive art movement represented by such artists as Myron Krueger or Roy Ascott. The major characteristics of interactivity they advocated for, was a novel attribute of creating space that puts a man in a role of not just a passive user but rather a creator and generator of events and actions. In that sense - as Kaas Oosterhuis (Oosterhuis and Xia 2007) stresses out - "iA is based on the concept of bidirectional communication, which requires two active parties". This point of view is implemented in the "Urbanimals" project also through understanding in-
teractivity in the following way “...something is interactive when people can participate as agents within a representational context. (An agent is ‘one who initiates actions)’ (Laurel 1993, p.112). Following that understanding of interactivity, we anticipated that it gives extraordinary features for architecture to stimulate behaviour of the citizens and in a result, to increase their cognitive development. As Xu Lin (Lin et al. 2015) suggests, there is a lot of research done on Interaction Design in urban environment, however, this research paper refers specifically to the investigation conducted by Matthew Anijo Punnen, presented in “Urban Research Machines: Engaging the Modern Urban Citizen through Public Creativity” which fo-

Figure 1
The set of four Urbanimals. Pictures depict: a dolphin (top-left), a kangaroo (top-right), a rabbit (bottom-left) and a beetle (bottom-right).
cuses on using public creativity as a tool for urban engagement. Author presents the case study of the range of interactive installations on top of which he builds a framework that helps in creating more valuable interactions. Nevertheless, he draws attention to the fact that there is still “the lack of research providing guidance and advice on designing for interactivity in urban contexts” (Anijo Punnen 2015, p. 61). He stresses out that the framework for designing Urban Interactive Installation needs more complex expertise. Thus, herewith this research, authors are trying to contribute to this field of Urban Studies, by deepening the aspects of implementing art installations in a strict urban settings, and by depicting practical solutions this process requires.

Therefore, the paper tries to answer such research questions as: (1) what are the legal obstacles in developing interactive installations in urban context? (2) How the long term presence of the interactive structure on-site affects the number of interactions? (3) How the complexity of proposed interactions influences the behaviour of the users? (4) Could the Installation be multiplied and implemented in other locations to achieve similar results?

MATERIALS AND METHODS
The project called "Urbanimals" was proposed as a competition entry for the Playable City award 2015 in Bristol. It consisted of the eight installations that were built and spread across the city. Each of the structure displayed one of the four origami-shaped, colourful reminiscences of commonly liked animals such as a dolphin, a kangaroo, a rabbit, and a beetle onto a floor or a wall surfaces in the city (Figure 1). The project was designed as an experiment in a public space that was conducted to arise an invisible link between citizens and the city. Thus, the projections were designed and programmed to interact with passers-by and with occurring elements of the build environment such as stairs, gutters, windows and such. It was therefore intended that the long term provision of the project should increase peoples' conscious perception of the urban fabric.

The project was intended to run for 2 months over the autumn in all selected locations in the city of Bristol. The development of the project took 3 months and involved 8 persons on a regular, daily basis. It used commonly known technology of short throw projectors (actuators) that are able to display high quality images from the very acute angle. With such technology - allowing to reduce the occurrence of interrupting shadows - users were able to closely interact with the surfaces on which the projections appeared. This effort implied strengthening the awareness of the built environment. The "Urbanimals" project also exploited such tools as depth-cameras (sensors) for mapping human motion. Usage of these sensors and actuators in the project, was the main method for producing the final Interactive Installation.

Construction
The basic component of each installation was a waterproof box with all electronic hardware situated inside of it (Figure 2). The hart of each unit was an Intel NUC - micro-computer able to run a standard software on Ubuntu operating system. To monitor the condition of the equipment, such as its idle/stress temperature, and to control Urbanimals' program, the NUC was connected to an USB Broadband dongle which provided a wireless connection with the internet. The main actuator in a set, was the Short Throw Projector with the spherical lens sticking out of the box which was protected from being damaged by a transparent, polymeric dome. The projector had nearly 500 cd of luminosity which allowed the projection to be visible only during the late afternoon and evening hours, and mostly in the spots located far enough from street lamps. The major sensing device was the Microsoft Kinect - a depth-camera which allowed to track and digitise the motion of users. Furthermore, the box was also equipped with a cooling systems constructed from the two efficient fans, and protected from insects and birds by the fine grain metal nets. The water resistance of the unit was ensured by building it from the Spider Flight-Case that
was originally sealed with rubber gaskets. Therefore it was protected during the wet autumn months. Each of the boxes was attached to the rigid handle made from perforated, steel C-profiles, mounted at the sides of the box and fixed to the existing street elements such as lamps, roof gutters or balustrades in each location. In order to achieve the best area for sensing and displaying animations (roughly 3m x 4m), the vast majority of the boxes were situated at least 3.5 meters above the ground.
**Interactions**

The interactions - understood as the language of communication between each animal and architecture and between animal and human (Figure 3) - were designed to examine the ability of digital technology to encourage people to play and by this, introducing a new quality of the surrounding without complex and time consuming spatial (physical) rearrangements of the existing urban environment. To achieve that, the main challenge of the project was to set up an intimate connection between participants and the city structure through the behaviour of each Urbanimal. For this purpose the range of interactions and animations was produced and tested to attain the highest smoothness in their performance.

The amount of predefined situations in which Urbanimal could enter into an interplay with the user, reached tens and even hundreds per one creature. They were all created in "Blender" - an open source software which allowed to build a three dimensional body of our creatures, and to draft and record the scenarios of movements. This software gave the ability to manage all knotty models with simplified bone armatures, which ultimately made the process more efficient. The high complexity of rough animations was tackled, merged and multiplied with the "Unity 3D" gaming software which provided fluent transitions between produced assets, and thus created a smoothly animated environment in which the interactions with participant could occur.

**RESULTS AND DISCUSSION**

The whole process of the development of the installation was simultaneously conducted in three stages within which the cooperation between various specialists was crucial. The production was composed of the following actions:

- Modelling interactions
- Negotiating locations and logistics
- Developing hardware

**Modelling interactions.** The whole concept of Urbanimals was based on four animated animals brought to "life" with a 3D Open Source Software. Initially, the basic "bodies" of a dolphin, a rabbit, a kangaroo, and a beetle, was designed with the focus on a proper structure of their armature and set of movements only. The preliminary construction of the body consisted of bones with proper constraints, such as a degree of rotation in 3D axis, a ratio of re-scale while being moved, or a relation to other bones; which allowed the natural movement of each part of their trunk. Such core of each Urbanimal was a base for creating movement scenarios and it gave enough flexibility for changing the external appearance of the bodies in later stages of the design, without the necessity of re-working animations.

Subsequently each of the creatures - with a specified armature and basic postures - was exported to the Unity to setup the model for interactions between each animal, a person, and architecture. Instantaneously, all Blender models were being advanced to build a database of all required movement scenarios, as well as to acquire the final shapes of Urbanimals. The basic types of movements were: running, jumping, sniffing, turning or crouching, but each Urbanimal also consisted of characteristic movements like: a dolphin - clapping flippers, splashing water etc., a rabbit - scratching the ear or sniffing around etc., a kangaroo - making a boxing mill, jumping on the tail etc., a beetle - flipping on the back etc. These motions were the essential attributes of their behaviour. All these behaviours were taken from nature and prepared as singular actions which were able to be merged and blended into sequences in Unity, in order to achieve the naturalness of the designed 3D models. Additionally, every database of movements included a range of pre-assumed scenarios in certain situation that might occur while interacting with Urbanimal. Vast majority of such situations consisted of the "eye-contact" animations. For instance: the rabbit starring at the approaching person and jumping back while the person gets too close; the kangaroo jumping on the tail to catch somebody's attention and making angry pose if no-one comes closer; or the dolphin performing dou-
Passer-by entering into interaction with one of Urbanimals.

In summary there were almost 800 such animations developed for Urbanimals of which rabbit and Kangaroo consisted of more than 250, dolphin of nearly 150, and beetle of less than a 100.

Simultaneously, a range of varying "bodies" for Urbanimals was developed, aiming for the best quality of movement, but also maintaining the simplicity of origami shaped creatures. The final outcome was a low-poly model which was using mainly triangular surfaces and which was corresponding with the paper style models most accurately. Both, movements of Urbanimals and their appearance (including a colour) was widely consulted with graphic designers and interaction designers to achieve the best results and most appealing and fluent outcome. Thus, the hole process of designing interactions required dozens of on-site testing. In result, every Urbanimal gained its own personality that was easy to perceive by interacting person.

**Negotiating locations and logistics.** The foundational idea of the "Playable City Award" is to engage citizens from all over the city into a play. Therefore, the locations for Urbanimals were spread across every district in the city of Bristol. Each area was visited for an extended site-recognition in order to select the place with characteristics formulated by the authors of the installations. These characteristics were among all: proper lighting conditions, access to the electricity or rich composition of the architectural elements that the Urbanimal could play with. Moreover, every location needed to be consulted with local authorities in order to obtain required agreements. This stage of the development was very demanding because: (1) preselected places had to meet a strict constraints regarding their mono-functional and transitional character, in which no other activity could be normally performed and (2) they needed to be a property of the public body to attain proper permissions for installing the units. In this respect, it also involved a long term official correspondence. While granted with approval for specific location, the insurance company needed to complete the security checks on-site and recommended an external rigging company to proceed with the assembling of the units. It was due to securing the locations accordingly to the local law.

**Designing hardware.** This stage of development required a to conduct a set of tests of devices anticipated to be used in the final unit. At the beginning
there were many try-outs of cardboard, plywood and metal boxes - as the main body of the unit- before the regular flight-case was chosen as the most solid and cost-efficient option. Also few alternative projectors were borrowed to check their performance in a daylight and the quality of images they produce on the rough surfaces of the streets. Likewise, many experiments with various cooling systems for the boxes and all equipment inside were conducted to assure no overheating after a longer period of operating. Within this stage, every device was properly adjusted in terms of: (1) Kinects - the range of sensing, (2) projectors - colour, brightness, angle of image, and focus setup, (3) fans - speed of rotation, airflow direction, (4) power strip - length of the cable.

Observations
Every stage of the design process was carefully observed and recorded in order to collect all relevant information for the evaluation process. The following aspects of the development were analysed accordingly:

- Modelling Interactions - The process of developing the "Urbanimals" project was initially started with main designers working on 3D assets in Poland, and with the rest of the team operating in UK. After the first month, the authors moved to Bristol to strengthen the cooperation with other specialists. Forthcoming two months were performed as the team collaboration within one office space which highly improved the communication within the team and effectiveness of performed tasks.

- Negotiating locations and logistics - Finding proper location was a case of finding minor semiotic differences in the appearance of the site. Therefore it required presence of main designers to fully participate in that process. After the selection of several spots across the city, which were suitable for installing Urbanimals, the producer and production assistants started negotiations with local authorities in order to obtain permissions for installing Urbanimals. Unfortunately that process took more time than expected which caused the intensification of work short before the launch date. There were also many additional issues with the ownership of the street elements - such as lamp hanging on the wall or balustrades and other - which often resulted in cancellation of chosen location due to the rights obstacles. Local authorities had some reservations to some locations also regarding the smooth flow of pedestrians that might be interrupted while installation is turned on and entertain passers-by.

- Designing hardware - The flight-boxes used as a main protection for all the electronic devices within the unit worked perfectly well and protected the equipment from the weather conditions. They were also very easy in perforating them to allow the sensors and actuators to reach the area of interactions. Multiple perforation did not weaken the stiffness of the boxes, thus they securely held heavy projectors and other equipment, and solidly stood in one position once attached to the rigging structure on site. The projectors chosen due to their high luminosity were lacking of remotely controlled focus of the image. They were fitted only with manual knob which could not be adjusted while inside the box. To ensure a sharp image, each projector needed to be adjusted to pre calculated distance from the projection surface, before it was installed inside the unit.

- On-site performance - It was observed that complexity of the designed interactions and a huge amount of animations implemented within the Urbanimals' program, did not cause an increase in the amount of interactions with people participating in the venture. In fact, those Urbanimals who acted more calmly engaged more users. The actions performed by passers-by were in such
situations, often very long and with positive attitude. On the other hand, the more complicated were the movements of Urbanimals the less active were people in interacting with them. All cases of people interacting with Urbanimals were recorded as gif files and stored on the server for further analysing the participants' behaviour. The camera recorded GIF images both (1) when "Urbanimals" were displayed and (2) when they were switched off (Figure 4). The dataset obtained after the 2 months of the installations operating in the city, showed a significant change in the behaviour of the passers while "Urbanimals" were operating. Moreover, throughout the research time-span, the number of observed interactions did not change significantly, and remain on the similar level till the very end of the project.

![Figure 4](image)

Recordings from the Kinect camera, depicting behaviour of pedestrian when the installation is turned off (left) and when it is turned on (right).

**CONCLUSIONS**

Through the case study on the development of the Interactive Installation in urban context, we wanted to draw attention of prospective designers to the range of obstacles that they might face in their practice. Through an in-depth elaboration of this process we pointed out that most crucial for effective workflow is the constant communication with local authorities to secure the best locations for potential projects. We stressed out that planning the endeavour in advance is a fundamental case because property ownership and lack of required media on site might disrupt the project even at the final stage of its development.

The research proved that complexity of interactions proposed in the "Urbanimals" project, had an impact on the interactions initiated by passers-by. Less elaborated movements of animated animals turned out to more appealing for participants. Long periods of stagnancy in fact triggered the curiosity of pedestrians. While on the other hand, those diversified movements seem as a closed spectacle with not too much room for other participants.

Within the two months of displaying "Urbanimals" no significant reduction of interactions recorded by the system, was observed. Thus, the project proved that a long term exposition does not affect the amount of interactions performed in the selected areas. Yet we must admit, that those measures might be different depending on the time of the year, the city and location within the city, and the type of exhibited project too.

The process of producing each installation showed that with just a portion of effort to prepare the first installation the other seven were easily manufactured and, with slight changes, implemented into varying sites. Thus, the methods of developing "Urbanimals" might represent a good practice in dealing with activating large number of neglected, mono-functional and unattractive areas. Nevertheless, the results obtained from various locations are not comparable due to their different spatial affordances. Thus, it was impossible to identify whether the same installation has the same impact on the behaviour of passers-by in each spot.

Project "Urbanimals" was a joint collaboration of designers, architects, urban planners, programmers, creative technologists and theatre producers; and as such elaborated initiative, it resulted in highly complex digital environment for composing interactions in urban environment. It was not only a great attraction for participants but we hope it become a valuable case study for prospective designers dealing with interactive projects in public realm.
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