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INTERACTIVE DESIGN AND SAFETY IN URBAN SPACES: TWO CASE STUDIES OF A MOBILITY EXPERIENCE

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1. Introduction

This paper explores some potentialities of interactive design, showing the range of its possible applications in the field of the quality and safety of urban environments today. Current design skills represent a broad spectrum of methodologies and technologies for handling everyday situations in the contemporary city. Communication systems, the ability to connect people, and the visibility of environments at a distance become decisive factors in increasing safety and social control in the urban environment, as well as being an opportunity to improve the aesthetic quality of specific places. Immaterial or minimally invasive technologies are in fact suited to environments of natural, architectural or historical value.
The paper thus presents two design projects developed at the Second University of Naples, both based on the use of communication technologies and interaction systems that, by means of interactive design, converge on the objective of improving living conditions and a feeling of safety while using design tools at different levels.
The first case study concerns a predominantly natural environment, the Bosco Reale di Capodimonte (the Capodimonte Royal Woods), a historic urban forest in the upper part of the city of Naples, and is related to pedestrian mobility.The second case study concerns the development of an information system for the Circumvesuviana train network, a railway line serving the area around Mount Vesuvius, the volcano located to the east of the city of Naples.

2. Toward an *open source* space

Pervasive computing, ubiquitous computing, everyware, wearable computing, mobile computing, calm computing, continuous computing, ambient intelligence, mixed reality, things that think, digital-physical computing, internet of things, networked objects, augmented reality, geospatial web, locative media... All of these words allow digital-physical convergence and indicate what may be called the revolution of our times. In our case, this new paradigm has profoundly influenced not only the project in terms of result, making its nature uncertain and elusive, but has changed the very idea of the disciplines involved in the project.
An important fact emerges: in the project, the boundary between material artifacts and intangible things is increasingly blurred, and that is what often leads to the question of what are today the necessary skills in the design and management of urban space. But it is equally clear that there is a profound convergence of views between design and information technology when we no longer think of them in the abstract, but in relation to their ability to solve practical problems that affect public space and the dynamics that take place in it.

In fact, as noted by Hans Frei and Marc Böhlen, “of all the art-forms and technologies currently in circulation, architecture and information technology has something particular in common. Architecture is the most public of the arts and information technology is likely also the most public of technologies” [Frei and Böhlen 2010]. Often, those who propose and manage today's most interesting experiments in urban computing and interactive design are not experts with a traditional education in the field of design and architecture.

Coming to some basic definitions, *ubiquitous computing* (or ubicomp), in contrast with desktop computing, is a model of human computer interaction (HCI), characterized by the fact that the elaboration of the information is integrated within everyday objects and activities, and distributed on all scales throughout everyday life. This new paradigm is also described as *everyware* by Adam Greenfield, who describes unicomp as “information processing dissolving in behaviour” [Greenfield 2006].

The field of interest of urban computing finds its role in this context, as an emerging field of study-that focuses on the use of information technology in public areas and aims to improve both human life and the urban environment through a process of *sensing, mining, understanding*, and increasing the global quality of the experience. The strategy of urban computing aims for *every* sensor, device, person, vehicle, building, and street in the urban areas to be usable as a component for communication. More specifically, urban computing explores the possibilities of improving the liveability of urban environments such as parks, forests, suburbs, college campuses, and areas related to transport such as railway stations or airports - designing solutions adapted to different situations of interaction [Greenfield 2006]. Designing interaction between people, and between people and objects, shifts the discourse of design as an activity aiming to produce physical objects to one where the activity aims to *shape and direct possible scenes*, namely dynamic situations in which the protagonists are the real makers of the final result.

As Husman Haque says “Most advanced spatial interaction research is these days produced by non-architects. Technologists at both academic and commercial research labs are developing responsive systems that allow people to interface with their spaces, working, for example, on projection walls, remote devices and 'intelligent' sensors. These developments throw into question the very role of designers, because such user-and-environmentally-responsive mechanisms allow people themselves to take prime position in configuring (that is, designing) their own spaces” [Haque 2005].

This approach brings us back to the ideas of the Situationists, the 50’s Movement that began to think of the city not as an organized set of buildings or constructions, but as an environment for social life rich in stimuli, whose focus is not the “building” but the “situation”. For Guy Debord, the main theorist of the movement, the “situation” must be designed and “built” in a way that devalues architectural technique in favour of vital expression [Debord 1960].

The situationist conception of the centrality of the sphere of individual and social interactions as the foundational structure of the city, the idea of a design that includes all cognitive and sensorial levels, is currently finding real, new possibilities of being implemented thanks to the spread of information technology. In particular, public participation in the project through individual and collective actions has now become the basis of many experiments in interaction design and, above all, a recognized method. Today, as Haque says, using new terminology, a space born in a collaborative manner between the designer and the user is similar to an “open source” experience: “As in architectural design, designing virtual systems involves developing spatial configurations that provoke interactions between people, and between people and their spaces. In enhanced environment design, where traditional architecture and virtual systems unite, users can be the designers of their own spaces — and, since spatial experience is a collaborative project, one might call these "open source" spaces” [Haque 2005].

Interactive design can help to integrate the different level of user experience, industrial design and human computer interaction expertise, as shown in Figure 1. Diverse array of skills makes it possible to conceive projects that bring together and merge technological solutions with new processes, to imagine services which include various aspects of aesthetics, language, communications, usability, functionality, information. But *sharing* and *simplification* of innovation are often in this context the most important key words.

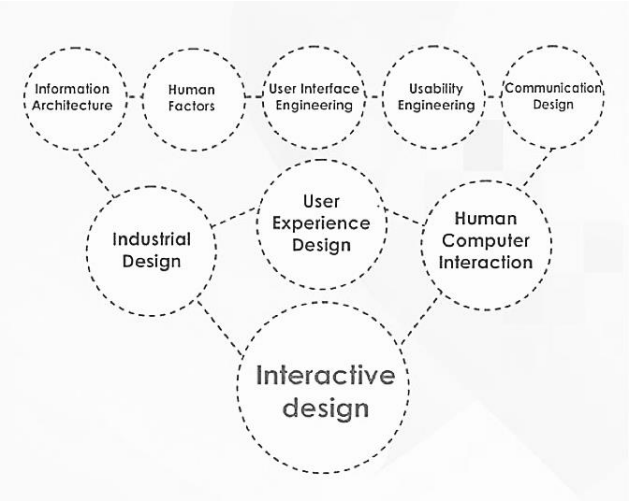

Figure 1. Relations between interactive design and other disciplines

3. The role of design culture

3.1 From the sensory revolution to interaction design

As mentioned above, the first question at this point - after the advent of the new ubicomp paradigm has largely influenced the field of design - regards *uncertainty* concerning *the nature of the object* resulting from the project: uncertainty, so to speak, about the output of the design process. As noted by Lowgren, "the practice of interaction design is knowledge-intensive and multidisciplinary at heart. Over the last two decades, *interaction design* has emerged as a design discipline alongside traditional design disciplines such as graphic design and furniture design. While it is almost tautological that furniture designers design furniture, it is less obvious what the end product of interaction design is" [Lowgren 2013].

Under these circumstances, we must ask ourselves what the more specific role is assigned to the skills of design. In the culture of contemporary design, *experience design* has been identified, and increasingly claimed, as an operative field contiguous and integrated with interaction design. To fully understand the concept of experience design, it is essential to refer to the ideas of Maurice Merleau-Ponty. In his opinion, perception is an active process of meaning-construction involving large portions of the body. As Dag Svanæs says "when I hold an unknown object in my hand and turn it over to view it from different angles, my intentionality is directed toward that object. My hands are automatically coordinated with the rest of my body and take part in the perception in a natural way." [Svanæs 2013]. For his part, Löwgren suggests that interaction design is about shaping digital things for people's use: "The notion of shaping is used consciously to suggest a designerly activity (as opposed to, for example, 'building' which suggests engineering, or 'making' or 'creating' that could refer to anything more or less)" [Lowgren 2013].

The advent of post-modern design has meant what Andrea Branzi calls a *Sensory Revolution*: a new way of thinking and designing that began to gain a foothold in the field of industrial design in the Seventies in Italy, with the research of the "Design primario" Movement [Branzi and La Rocca 2010]. Colours, sounds, tactile sensations and all those qualities neglected by rationalism that enter the body as such in space in all its dimensions, not just those of rigid ergonomics, become material for the project. While modernism has downgraded as foolish a design that did not pertain to a clearly and neatly formed world, with the *Sensory Revolution* design culture the project opens up to a world of synaesthetic and soft objects. This kind of revolution is suited to the development of a society that multiplies the flow of stimuli in which it is immersed, honing our skills of selection; a world in which new media have created simultaneous interactions between the real environment, images, sounds and voices that come from the most disparate devices. This transformation has demanded a new perceptual sensitivity of the design culture, even more than an intellectual understanding, paving the way for subsequent developments in interaction design and experience design [La Rocca 2009].

3.2 Design and *hybrid spaces*: Reconciling fragments of interaction

The existence of interactions between people located in the real world, and therefore really closes to each other, and communication between people located at a distance is currently causing many design problems.

Moving to a more operational vision of urban computing, we can identify three main activities that certainly *need* design skills:

1. visualizing activity in space
2. visualizing activity and connections (between people and things and between persons)
3. explicit invisible/implicit phenomena

In other words, we can use design skills and tools to make visible activity and connection, to make certain phenomena that are implicit/invisible more explicit, beyond the specific medium used and beyond the distinction between tangible or intangible design objects. In the reality of each individual case, therefore, design skills are critical for the *global meaning of the project.*

Media spaces *link* physical spaces through digital media: therefore, physical and virtual spaces are often difficult to distinguish, but precisely for this reason it is crucial that there be a discipline able to implement some sort of direction in space, i.e., the configuration of its global features. The design for its current specificities, for its recently developed new variations such as experience design is the discipline best suited to the contemporary stage for managing complex issues that see technical, aesthetic, communicative and functional aspects inextricably interwoven.

Crabtree and Rodden highlight how mixed reality environments *fuse* physical and digital environments. Ubiquitous computing environments *embed* the digital into physical environments. Hybrid ecologies *merge* multiple, physical and digital environments [Crabtree and Rodden 2008]. In fact, designers increasingly have to address hybrid environments where the real world and the virtual world are mixed to degrees that can be different in each case. They therefore have to learn to take on a very flexible role from an operational perspective: essentially, to control very different cognitive and sensory levels.

"The rise of ubiquitous computing has brought with it a range of 'hybrid' environments over recent years that combine the online digital interactions of remote users with the local interactions of users situated in the real world". Crabtree and Rodden thus underline that in hybrid environments, participants interact with others either online or in remote physical locations. Interaction is mediated by heterogeneous or *different* and *differentially distributed* interaction mechanisms.

The result of all this is that the interaction mechanisms "at work" in hybrid environments intentionally fragment cooperation. By this we mean that "through design, interaction is distributed across separate, distinct, and disparate interaction mechanisms, which mediate interaction in varying degrees of physicality and virtuality".

The most interesting idea of Crabtree and Rodden is the *key-role of participants* in urban computing experience: he sees them as actors capable of *reconciling the fragments of interaction*. "As a result of intentional asymmetry in design, interaction in hybrid environments requires that participants *reconcile* the distinct fragments of interaction at their disposal, and that they do so in the actual *in vivo* course of using those fragments if interaction is to proceed any further 'here and now'. The work of reconciliation enables participants to handle and/or resolve the communicative asymmetries produced through the use of disparate interaction mechanisms (e.g., talk and text respectively)".

Similarly, in the culture of design, we increasingly talk about user-centered design, meaning that the project today can not only to consider the user important as a recipient of the project itself, but increasingly the user is considered to be the co-author of the final result of the project itself.

In fact, only if we assess it from the point of view of the ordinary experience of the everyday world can we understand whether the design of a hybrid environment actually makes sense and confers real quality to a life experience.

So that "the suggestion is that fragments of interaction are reconciled through articulation, which consists in the methodical exercise of vulgar competence" [Crabtree and Rodden 2008].

It is true therefore that design, acting on different levels with different tools, is itself the element that leads to fragmentation; but it is equally true that design disciplines are the best suited for studying scientifically the close interactions between people and objects in real and daily life. Designers, then,

possess the tools to verify the actual quality of this type of project, referring to human intuition and common sense.

4. Improving mobility experience and personal safety

The large array of technologies currently available that permit a person to establish contact from wherever one finds oneself with other people or aide and correspondence service such as the other developments which permit one to be localized from a remote distance are object of specific studies [Monterde-i-Bort et al. 2010]. But, in both case studies we identified, concerning safety issues in urban public spaces, we can observe how the design methods, combined with the logic of urban computing, can help to solve otherwise very complex problems by means of simple technological interventions.

The setting of the two projects, although very different, begins first of all from the consideration of the experience of the individual actor, as usual in user-centered-design. Both in the case of the Capodimonte Royal Woods and in the case of the Circumvesuviana, the final project leads to a very significant improvement in the quality of the environment, not only functionally, but also from the aesthetic point of view. Here, we will demonstrate how, in terms of the latter aspect, only the skills of design can provide a sophisticated control of all aspects of the project.

4.1 *Sharewood*: Safe pedestrian mobility in the Capodimonte Royal Woods

The first case study concerns the Capodimonte Royal Woods in Naples and a pedestrian mobility project there, called *Sharewood*, devoted to improving the social use of the park. The project was conceived by the author and developed within the Industrial Design Degree Course of the Second University of Naples under her guidance by Antonio De Nicola and Noemi Rossetti.

The Royal Woods, the green lung of the city of Naples that extends around the Royal Palace of Capodimonte for some one-hundred-and-twenty-four hectares, came into being in 1734 as the hunting reserve of King Charles Bourbon III, who was charmed by the natural beauty of the hill. Before that time, the hill had been the site of rural settlements, monasteries and country hamlets. In 1734 the borders of the Royal Site of Capodimonte were drawn up, and they have remained more or less unchanged to this day.

We can consider the Royal Wood as a greenway, a corridor or an integrated system of paths and green areas. People will be expected to interact with the open space in such a way to maximize their well-being, including their physical safety and their social, psychological and physical comfort. The literature on actual and perceived safety in parks indicates five main principles relevant to planning. They may be categorized as follows: 1) visibility of others; 2) visibility by others 3) choice and control; 4) awareness and legibility; 5) solitude without isolation [Luymes and Tamminga 1995].

The principle 4 refers to the ability to place one's self in the surrounding landscape; to be able to see and understand the immediate environment, to find one's way without becoming confused or lost. "These related principles point to the importance of allowing the user to be in control, of knowing how to avoid and escape potentially dangerous places and being aware of connections and route to safe places". The principle 5 makes the clear distinction between the positive experience of solitude and the negative experience of isolation. This distinction is fluid, but strongly linked to the principle of control and environmental legibility. Similar consideration about the specific influence of perceived safety and security on walking in public spaces are developed in recent studies [Fyhri et al. 2010].

As noted by Frei and Böhlen "mixing people with information processes requires designers to seek new solutions for the obvious" [Frei and Böhlen 2010]. The intervention planned with the project *Sharewood* may in some ways seem trivial or obvious in relation to the sophisticated performance and technological potential of contemporary systems of urban computing; but it is a fundamental tool to improve the way people can make use the park, as well to avert serious risks, in relation also to the simple feasibility and economic viability of the proposal.

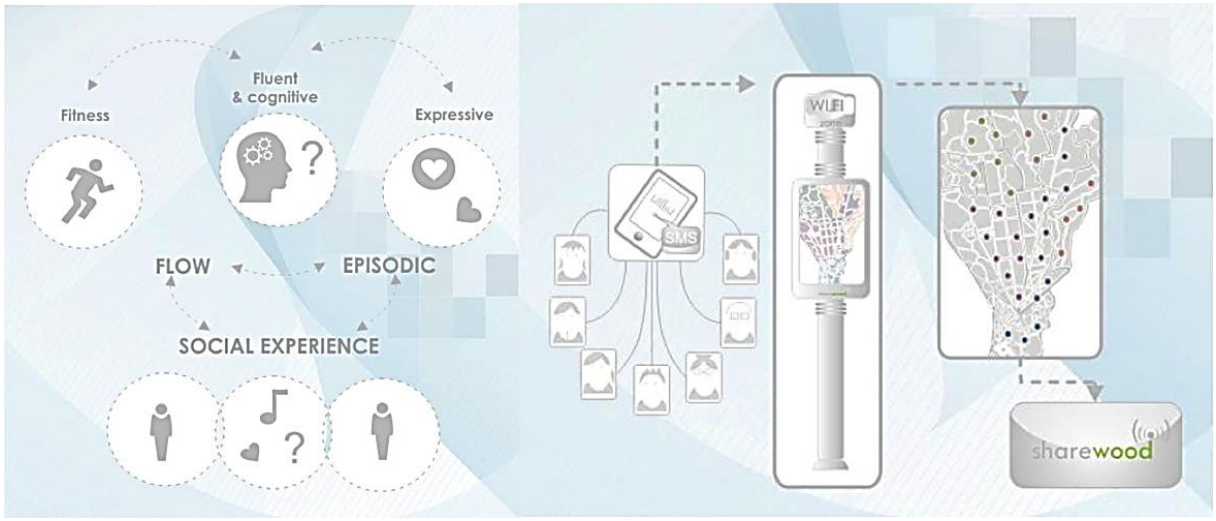

Figure 2. Scheme of the *Sharewood* interaction system

The park is very popular all year round, but in some areas there is an objective problem of security and safety. The uneven surface, the very isolated paths and lack of signs mean that a walk or sports activity, especially alone and outside daylight hours, can represent a significant risk. The problem is not only routine maintenance, but the varied orography of the park, especially in the areas called "I Valloni", which are of naturalistic importance, where there are significant differences of level or unexpected precipices. In summer 2011, a terrible accident happened in the Capodimonte Park resulting in the death of a young man while jogging: he slipped into a ravine and remained the whole night without rescue, unable to call for help or communicate his location. After this grave episode, the management of the Bosco di Capodimonte and the Security Services are being investigated by the judicial authority.

The Sharewood project includes two intervention: a non-invasive intervention of lighting design – given the need for a low impact on the natural and historical environment – and a system of interaction based on a dedicated wi-fi all around the area of the Park. This system allows users present in the woods to communicate with each other and with a control and security system entrusted to the managers of the park. The lighting design is meant to inform the user of safe routes within the park, preventing users getting lost or finding themselves in unsafe zones in the vast area of the Wood. The mini lighting devices consist of led lighting which can take on different colors depending on the path to be indicated. Leds are powered by a small solar battery, autonomously providing energy to the system, which requires a minimum amount of energy.

Figure 3. The mini LED device

The Web service allows users, once inside the park and having joined the system, to communicate both as "many to many" and "many-to-one". It allows Sharewood people in the park to connect with one another, sharing data and information. Also, once logged into the system, users who frequent the park and venture even into the most remote areas have the assurance of being visible to the management, of indicating their presence, and being helped in the event of accident or hazard. More in detail this system is realized with a purposely developed application that users of the park can download from the wood website onto their smartphones. This application allows users to develop a series of actions:

- to log in the park wi-fi as a trusted user;
- to activate the GPS receiver of the smartphone;
- to start a dialog with the park management based on the sharing of GPS positioning data of each single user;
- to read on a Google based map of the park the position of other users (also related with the LED tracked routes);
- to realize textual (and/or voice) communication with other users thanks to an array of social networks like Facebook an so on, already integrated in the app, thus providing the creation of groups of sports fans who can meet in the park for their activities.

Figure 4. View of the Capodimonte Royal Wood with the lighting project in place

4.2 *Pointsoft*: Designing a map for the Naples Circumvesuviana

Five Regional Railway Lines known as the Naples Circumvesuviana connect the city centre with the city's eastern suburbs around Mount Vesuvius. The Circumvesuviana railway service covers a wide catchment area of over 2 million people, distributed over 47 municipalities. Between the Napoli-Sorrento line and the Napoli-Poggiomarino line you can reach all of the major Vesuvian Excavation Sites, such as Pompei and Herculaneum. The Circumvesuviana is also a cheaper, and in some cases quicker alternative, to taking the hydrofoil to the city of Sorrento. Despite its important role, the delapidated state of some of the stations today is remarkable, especially when compared to other stations that have been renovated recently, showing a high degree of modernity, hospitality and efficiency. The Circumvesuviana Company has been developing procedures on Mobile & Wireless technologies to give information about the services, personnel services and interfaces for the management procedures for several years now: these activities earned the company the Smau Bari Innovation Award in 2010.

The proposed project involves the regeneration of the Circumvesuviana stations by means of interactive multimedia installations in order to improve services, providing information for travellers and helping increase their feeling of safety in stations and wagons. There is a further objective consisting in raising the quality of the sites through evocative videos, tracing some of the stages in the history of the Circumvesuviana.

Figure 5. The entry of a station with the video installations

The name given to the project, *Pointsoft*, is indicative of the method, based on light, reversible or immaterial interventions. The project was developed within the Industrial Design Degree Course of the Second University of Naples under the guidance of the author by Roberta Aita (dissertation academic year 2010).

Figure 6. *Circumvesuviana* interiors with the interactive map

An interactive map of the Circumvesuviana network with a user-friendly interface is the first project to be proposed: the map contains information about all the lines, and the interchanges with other transport media such as cable cars, highways, and shipping lines, which represent the mobility network of the province of Naples.
The map has its visual centre in Mount Vesuvius, which gives its name to the railway line that winds just around the volcano. The map is present in every station and it is designed with tourist users in mind, as it is able to identify the most attractive places in each location and show how to reach them.
A problem that his come to the fore in recent years is that of safety and security not only in the stations, but especially onboard the trains during the trip. Acts of vandalism or petty crime are

unfortunately commonplace, especially following a drastic reduction of personnel dedicated to safety and security on trains.
The project proposes also a network of CCTV cameras placed inside the train carriages, which will assure surveillance and be able to transmit continuous filming. These movies are graphically reworked – so as not to make people recognizable, in the interests of privacy - and are broadcast by projecting them onto the walls in the various stations. The visual installations designed in this way allow social control and increase the sense of security, not only discouraging misbehaviour or vandalism, but by informing passengers and raising awareness about travel conditions (e.g. crowding at certain times). So maps and video installations help to increase awareness of place, feeling of safety, ability to orient oneself.

Figure 7. The movies showing in real time the life in stations and within the wagons

Finally, considering the two case studies, we can observe that interactive design is a contemporary discipline suitable for solving a large range of problems in our cities by means of solutions involving every day technologies that is easy to implement. The quality of the results achieved, in more complex cases than those outlined in this paper, depends fundamentally on the effective synergy of interdisciplinary skills and on the directorship role taken on by the designer.
Anyway, as Mark Shepard says, the goal of urban computing is to move beyond the interface paradigm of screen, keyboard, and mouse to explore alternate models for interaction with (and through) computers that afford more subtle and complex conversations between a range of human and non-human actors [Shepard and Greenfield 2007].
In both case studies design helps people to get a practical or mental map of their temporary environment, to find their place, to meet other people.

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