Social Smart Urban Environment: A Process that Needs to Be Disrupted to Improve the User Experience

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Abstract This paper discusses the extent to which disruptive design can be an indisputable component of smart and inclusive solutions within the development of urban design in Lisbon peripheral dwelling areas. Driven by smart solutions to humanise the built environment, Lisbon urban centre design is changing and offers equipment and services, enhancing the people's appropriation of the urban space. Lisbon is growing as a smart place in its sustainable, economic, social and cultural dimensions whilst the dwelling areas, namely those peripheral adjoining, remain characterised by monofunctionally poor urban design solutions, where commuting possibilities (offered by the public and private transport) and proximity to employment (offered by the city centre) are the main assets. This model of planning the urban environment perpetuates itself in space and time, underestimating the development of technology, the sense of identity and belonging and, mostly significantly, overlooking a good experience for users. A new approach is urgent. It is argued that a user-oriented approach, attentive to the context, where creative solutions emerge as a contribution to a smart, sustainable and inclusive community and where the interactions between individuals and the environment, regardless of its physical or virtual features, contribute to a positive user experience.

Keywords Disruptive design · Lisbon peripheral urban areas · Smart solutions · User experience · User-centred design

1 From Design to Disruptive Design

> …design, stripped to its essence, can be defined as the human capacity to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives [1, p. 5].

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E. Duarte and C. Rosa (eds.), *Developments in Design Research and Practice*,
Springer Series in Design and Innovation 17,
https://doi.org/10.1007/978-3-030-86596-2_14

Academic and professional design settings establish the relationship between design and social sciences. The biunivocal relationship between design and social sciences overwhelms the functionality and/or aesthetical features of environments and products usually addressed by designers. Design has expanded its boundaries and has diverted the focus on objects, environments and communication to that onto processes, systems and services. This reality is extensively illustrated by theoretical frameworks and good practices supported and delivered by the academic research [2].

We read in the Cambridge Dictionary that design involves "make[ing] or draw[ing] plans for something… a drawing or set of drawings showing how a building or product is to be made and how it will work and look… the way in which something is planned and made". This formal definition highlights the focus on the planning, manufacture, functionality and aesthetic appearance of something regardless of the required and desirable interactions with the user.

The latest dissimilar areas of knowledge have shown a focus on the human being, developing solutions to improve human security, safety, comfort and wellbeing. Design is not excluded from this trend and the guidelines are established to encourage new fields of actuation, as well as new conceptual processes leading to concepts, such as those of user-centred design, interaction design and user experience design, among others. The choice of this trilogy has not been random; in fact, these concepts are complementary and based on similar processes. The user-centred design focuses on human heterogeneity comprehending its physical, sensory, functional and cognitive characteristics [3]. When one uses an artefact, several interactions are required. In accordance with the artefact's complexity, the required interaction can be physical and/or digital. The user's acceptance of that artefact will be closely linked to its functional performance and easiness of use. However, this rational understanding is not the key decision support. Human decisions are primarily triggered by emotional reactions. The user experience depends on time and spatial context. The way any individual perceives experience motivates emotional reactions which determine human behaviours, and, consequently, the acceptance or rejection of that artefact.

> The user experience is the totally of end-users' perceptions as they interact with a product or service. These perceptions include effectiveness (how good is the result?), efficiency (how fast or cheap is it?), emotional satisfaction (how good does it feel?), and the quality of the relationship with the entity that created the product or service (what expectations does it create for subsequent interactions?) [4, p.14].

The design of an artefact excels its physical and/or digital boundaries. It becomes the design of a context with a critical analysis of the social, cultural, economic, technical and environmental concerns; otherwise it will be the repetition of old paradigms with a new approach supported by technological development and uninformed processes.

The idea is not an update to raise the final solution for a functional performance or to guarantee an easy way of operation based on the user's technical illiteracy. The bottom line is to understand the extent to which the designed solution changes the human behaviour and contributes to a positive experience and the extent to which this

experience can be conveyed into the human sense of identity, integration, comfort and wellbeing. In order to accomplish such a complex purpose a new conceptual methodology is required. From the context of its use, the function(s) to develop, the physical and (if available) digital interactions with the user, the artefact (understood as a product, communication system, built environment or services) must be conceived within a holistic approach that recurrently disrupts the ordinary status quo. A disruptive design concept contextualises, perceives and matures intricate problems to ensure sustainable solutions in their social, environmental and economic dimensions.

> Innovation, as a concept, does not embed any social and ecological value sets, nor does the "design thinking" approach to problem solving. Creating things that don't have a social, economic and environmental conscience makes no sense in the grand scheme of things [5, p.6, 7].

The disruptive design pursues a new approach to discuss the status quo in order "to make the old obsolete and the new possible, desirable and sustainable", and comprehends the following six concepts [5, p.5]:

- Everything is interconnected
- Change is constant
- The future is undefined
- All change must be sustainable
- Challenge is part of reward
- Change is interactive.

The method moves towards a holistic approach to achieve an impact balance in all the areas that the designed solution can reach. An analysis of the context in order to understand the problems that require solution, in view of the fact that the scenario is in constant economic, social and cultural change and deserve a sustainable intervention; moreover, a positive impact needs the collaboration of a multidisciplinary community which includes users as the ones that should benefit from the final result. In the end, the main goal is to offer a positive experience to all the people involved within the contextual scenario.

The disruptive design emerges as a requirement for user-centred design solutions targeting the improvement of the user experience. The aim is to conceive intended creative interferences into a pre-existed setting to boost a different outcome and create positive social change [6]. The disruptive design introduces a method developed into 3 phases: Mining—identifying and analysing the context-, exploring research approaches; Landscaping—identifying the principal elements in the context and mapping their interactions, relations, connections, impacts..; Building—exploring possible solutions raised by anterior stages, prototype, testing and repeating them [5]. As regards the peripheral urban areas, it is easy to identify a non-humanised solution. From the conceptual spatial solution to the detail of finishing materials, the urban design does not stimulate human dimensions (physical, functional, cognitive, sensorial, emotional, behavioural and social). A solution supported by these dimensions boosts a positive user experience, encouraging the sense of belonging, the will

of permanence, the return and the identity of the place. A positive user experience impacts human sense of comfort and wellbeing [7].

In spite of the research in the area of knowledge of the built environment, spatial conceptual solutions, urban equipment, functionalities and finishing practices convey disrespect for the users' requirements and expectations. A new conceptual and practice design approach is urgent [8].

At the moment when the concept of smart cities invades important metropolitan areas, offering technical solutions that benefit the built environment with new equipment and services, when the exterior space is a scenario to improve human interactions, what is the contribution of the disruptive design to humanise the built environment? How can better user experiences from disruptive and creative solutions be conceived? Do the peripheral urban areas need a disruptive design? Is it possible to contribute to smart user centred environments through disruptive design?

2 Smart Understanding

The smart word emerges as a prefix to classify any artefact that shows some intelligence in its functional performance enabled by technology. Artefacts, occasionally more meaningful and often just updates of traditional ones, display a coherent and logic concept but no evidence of intelligence. The association of the smart expression to any artefact changes its symbolism and becomes a marketing parameter, where its advantages are emphasised and the contribution to a new way to develop a function or improve a user/community experience is (un)consciously forgotten to spread.

Retrieving information from the web for a consensual smart definition is an acronym which enunciates the standards to determine a set of goals, that lay significance on corporations, departments or sections; the acronyms' concept can be broadly applied and this can embrace the sustainability of cities, artefacts performance as well as the individual's professional and personal paths.

The significance of the Doran acronym is a rational way to understand the parameters required for a smart classification of any object, environment or system. As a matter of fact, despite the responsivity of an artefact to pattern uses and behaviours, it does show some improvement in its functioning, way of use or other parameters related to competition, and this improvement must be possible to measure. This is the essential parameter for smart objects and environments; otherwise they are just purposeless technology.

SMART is also an acronym defended by Doran [9] (Fig. 1).

The concept and rational use of this acronym to assess the smartness of each artefact is consistent with the process of thinking the disruptive design. It is not because an artefact has some technology or is trend in the digital market that it is considered a smart one. It must be focused on the experience of the user, responding to human requirements and desires, offering a good functional performance and a contribution for a sustainable environment.

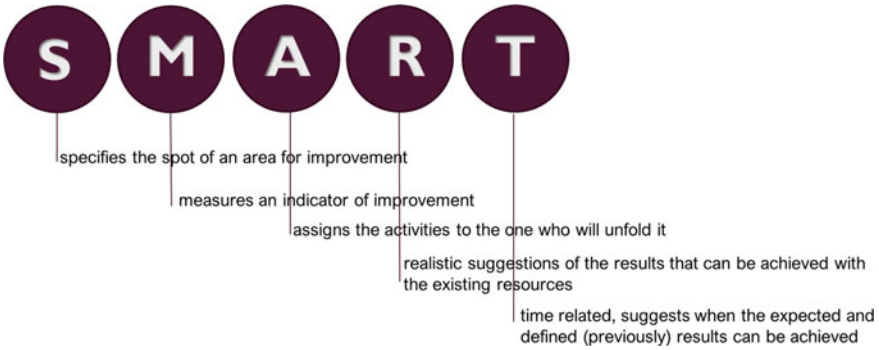

Fig. 1 SMART acronym from Doran [9]

3 Smart Solutions for Urban Environment

Since ever, and most significantly since the Industrial Revolution, technology has existed to improve the development of the built environment. The contribution of technology for the urban environment allowed an expansion of the human economic sovereignty, attracting people and, thus, depopulating the hinterland where survival resources were scarce. Technology has influenced the way people have lived and interacted, solving problems whilst new ones emerged.

The improvement of the urban environment impacted the quality of life of people, modifying the city within a continuous process of demographic gentrification, bringing people from distant geographical locations and expanding the territory to the farthest areas (social displacement), a phenomenon with an impact of the train and car (public and private) transportation with consequences. This reality has raised dissimilarities between geographical regions and has questioned the standards of human life. The expansion of cities has encouraged the construction of metropolitan areas, creating exhausting lifestyles for individuals. Services prevail in the city centres whereas the dwelling areas are mainly suburban. The distance between the city centre and suburban areas, covered by public and private transportation, entails wasting hours in commuting travel whilst it promotes unsustainable lifestyles [10].

The development of new technologies in the transition of the twentieth century to the twenty-first has promised a revolution in the way people live and interact. The emergence of the ICT (Information and communication Technologies) has offered new prospects of interacting and exchanging information, in other words, one step further to commuting people. Research (from various fields of knowledge) has pursued a desirable geographic balance, according to demographic and services distribution, reinventing the city centre and the suburban identity. Nevertheless, the gap between the academy and reality has imposed the use of technology to perpetuate existing mistakes.

The biunivocal dependence of city centres and suburban areas underpins the emergence of metropolitan centred planning on commuting, transportation and real estate

speculation regardless of the user and possible interactions between the individual and the built environment, as well as the interactions between individuals within the built environment.

Literature that does not discuss its physical or virtual source, exposes different approaches and dissimilarities to the definition of the concept of smart urban environments. The first steps of smart urban environments highlighted the importance of the ICT and its impact on the daily professional and personal human routines and mostly in our way to communicate and interact with other beings, objects, and systems. The latest advances in the concept have shifted its focus toward the enhancement of the quality of life of users [11]. Thus, we privilege the definition of Thuzar (2011 apud Berardi, 2015:6) to sustain the purpose of this piece of research:

> Smart cities are cities that have a high quality of life; those that pursue sustainable economic development through investments in human and social capital, and traditional and modern communications infrastructure (transport and information communication technology) … should also be sustainable, converging economic, social, and environmental goals. (Thuzar 2011; apud Berardi 2015:6).

The urban environment needs integrated interaction, interconnection and interdependence to reward the smart label. A smart city is a place "connected, intelligent, innovative and adaptative", where smart people imagine and design smart solutions for the routines of their urban daily life.

The smart city respects the sense of place. The place's identity built up on its cultural heritage offers features that make it unique and appealing to its inhabitants and visitors (regardless of work, entertainment and tourism purposes). The initiatives in smart cities ought to be contextualized in space and time to respond to (g)local real problems and satisfy the demands of users, and not spread technology and applications based on technology development, global trends and public and/or private interests.

The smart city must be shaped by experts as well as by ordinary people: from the people who have the knowledge to develop, implement and test solutions in close collaboration with those who have to cope with their problems on a daily basis. Co-design is urgent, and the users' participation is the key. In the end, a more humanized city will emerge, which in practice means the observation of realities, identification of different uses (and inherent requirements and desires), conceptualization of solutions and implementation with close measurement results.

Beyond technology, interactions with the physical world are crucial and depend on how the built environment supports the multidisciplinary dimensions of functions and users that describe it. People, regardless of the function performed in the city, must be the most significant providers of information as well as the ones that understand the improvement in quality of life throughout the solutions implemented. For a city to be smart, it must be conceived within a human-oriented design approach.

Therefore, the aim of a smart city is to encourage and improve the quality of living of its citizens, supported by smart technology. Although the concept of the quality of life is not easy or consistent in its definition, literature review offers different definitions from the most generalist to those oriented to the problems of individuals,

such as disease, while others use the term as an alternative to the concept of wellbeing. In the end, dissimilar definitions offered by several authors are not too far from Maslow's hierarchy of needs [12]; however, and because of this closeness, we choose the definition proposed by the WHOQOL Group: "…the individuals' perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns" [13].

The users are the ones who benefit from a smart urban environment, shaping it all over continuous interactions. A user-centred approach adds new ways of living encouraged by the ICT and reveals the label of creativity associated with a smart urban environment. This association emerges from the education, learning and knowledge encouraged by new ways of living and interacting, thus promoting people's connections and relationships [14]. As Winters points out, smart people generate and benefit from the social capital of the city, so the smart city concept acquires a new meaning with a mix of education/training, culture/arts, and business/commerce with hybrid social, cultural, and economic enterprises [15].

4 Scenario

4.1 Lisbon

The city of Lisbon belongs to the community of European smart cities, targeting the use of the ICT as a way to improve the quality of life of its inhabitants. According to municipality documents [16], the goal of the city of Lisbon city to lure people to the city throughout energy-efficient constructions, e-mobility, smart living and smart citizens solutions, with particular attention to the elderly, a significant portion of the local demography. Social cohesion and inclusion are enhanced throughout the agendas for civic participation, rehabilitation of the urban space and the boost of efficient urban services and systems. As a result, Lisbon received The European Green Award 2020, a city with 550,000 inhabitants and nearly 40,000 daily commuters [17]. The development and use of smart and sustainable services, grounded on real-time information—gathered and shared—are smoothly accepted by users with technical familiarities.

Despite the positive impact the ICT had on users' daily routines, urban answers to ageing, accessibility and inclusion towards the pleasure of the urban spatial experience are the key input for the physical and digital interactions and, consequently, to guarantee a positive and significant user experience. The changes offered by the document on the urban environment focus on the intention of giving the urban space back to people. Lisbon smart features, such as energy efficiency, construction processes and materials, e-mobility are up to date structures that contribute to more sustainable ways of living; nevertheless, they do not disrupt the traditional procedures in a way perceived by users.

Users understand the need of more sustainable solutions although most individuals continue to perform daily routines in a traditional manner. The access to services, regardless of the offered remote solutions, continue to offer (and often require) the presential status (for workers and for customers). Nevertheless, this recognised pattern is always the way to accept and use technology that means to mimic the known reality.

Despite the presented paradox between outputs and constraints, reality shows some change in the behaviours of users. Disruption is more effective with solutions that enhance the humanisation of urban space. E-mobility demands the construction of bicycle lanes at the expense of traffic lanes and parking lots—curiously, more due to leisure than mobility requirements, people start to adhere to new ways of experiencing the city. Accessible and inclusive solutions, mostly in the busiest arteries, give more flexibility of use to everyone that presents physical, functional or sensorial limitations. There is evidence of growing living spaces added by green and/or relaxation areas, cafes and commercial spots. Some neighbourhoods economically and socially weakened, are in complex rehabilitation processes: ranging from building typologies, construction process and functions, cultural expressions, and offering new dynamics; thus, attracting more and more diversified patterns of people.

These interventions in the urban tissue are in line with the principles established by the *Carta Estratégica de Lisboa* 2010–2024 (Lisbon Strategic Document 2010–2024) [18] which is based on three main axis: agreement on the public policies about the city, centralisation of Lisbon as a world embracing capital city, and Lisbon as a cosmopolitan and neighbourhoods city.

Despite the theoretical and generalist text of the document, the time spent between policy making, planning and building, the changes shown in Lisbon's urban space convey good practices that must be continued and discussed in order to preserve a more humanized city, with respect for its identity (Fig. 2).

Lisbon city is completely different from a decade ago; yet it preserves the features that establish its own identity. Nevertheless, disruption that boosts a humanised and living city demanded also a long and intense period of gentrification.

Fig. 2 Examples of the humanisation of the urban space throughout the creation of green areas and leisure spaces. Campo das Cebolas and Largo do Intendente (Author 2020)

4.2 Lisbon Peripheral Urban Areas

Lisbon metropolitan area is composed of 18 municipalities, 9 on each bank of the river. Municipalities near the Tagus and the sea have the highest concentration of people, social and cultural equipment, and services. The north bank of the river is the area with the strongest economic, social and cultural context and development.

Some municipalities, due to their proximity to the city centre and/or relationship with the river, feature higher real estate values, attracting individuals from the upper classes, with higher purchasing power. These areas also display better public and private transportation and social equipment; sometimes, construction density is lower and dwelling units offer more generous areas and more qualified finishing. Living in these areas is grounded upon the identity of the place, the social and the economic status of the residents and organisations that offer services and work opportunities (Fig. 3).

The municipalities located at the eastern side of Lisbon and the ones located on the south bank of the Tagus river are the ones that, due to their characteristics, higher construction density, rational dwelling living areas, fewer services available, distance to the city centre, private and public transportation and the interior character of some of these communities, encourage lower pressure in real estate speculation, allowing and/or demanding people from lower classes.

Regardless of the possible generosity of dwelling areas, service availability and local accessibilities, there are some patterns in all the municipalities that constitute Lisbon Metropolitan Area.

Suburban areas that comprehend Lisbon Metropolitan Area are mainly the dwelling areas, known as dormitories, with a busy weekend life and quiet times during the weekdays; these areas were conceived in accordance with real estate speculation and private transportation. Green spaces are almost non-existent or an unpleasant environment, supported by some bush beds with randomly distributed benches without any shade element, regardless of their solar orientation. The benches display the same colour as the bushes, confusing most inattentive passers-by (Fig. 4).

Fig. 3 Lisbon metropolitan area (DGT 2014) and Lisbon river side (Author 2020)

Fig. 4 Suburban peripheral areas, roundabouts with green area and sculpture, public space for users with small benches without shadow, green and leisure area (Author 2020)

Curiously, there are green areas, fountains and sculptures in roundabouts, some of them showing interesting art styles, but the users are unable to enjoy them; only the drivers can see them, but they must be attentive to the traffic and comply with driving rules.

Some communities, particularly those with good accesses to the highway, show considerable investment by technical and branding organisations, offering a pale reality of employment. These areas convey the investment spent to improve the image of the building, but the urban space has been neglected, as there are no green structures or entertainment areas for people, car parking is insufficient and paid, and traffic becomes particularly intense during the mornings and evenings. The traditional model has been applied without any previous strategy to overcome its weaknesses.

5 Conclusions

City planning involves a multidisciplinary cluster which addresses the urban and social tissue in accordance of their knowledge and objectives, although it converges to an optimised solution. The complexity of city planning requires (or is the traditional model that, regardless of technological advances, is still a common practice) time for observation/analysis of contextual problems, construction and implementation of solutions, which very often reveals obsolete and/or questionable results in face of contemporary dynamics. Planning decisions depend mainly on political and economic decisions, recurrently influenced by external models displaced from the spatial context and users' needs. Therefore, the implemented solutions, although well intended, expose inefficiency as they disregard conceptual considerations. Design as a discipline and the designer as a professional are crucial elements for a cluster committed to city planning. From the thinking process to a methodology towards a user-oriented solution, the design footprint seems to be required and needed more than ever. Design can go further than just providing good solutions grounded on

the user and repeating worn-out models; it is time to innovate and raise solutions that respond to users as well as to planet Earth, and that is why disruptive design is needed.

The technical developments and the need of sustainable solutions promote the smartness of urban environment. Cities, more than spatial layouts, are places built up throughout social and cultural interactions, where people perform dissimilar roles searching for the improvement of quality of life in its all dimensions. A smart city is a place that is responsive to human/users' needs and wishes, independent from physical and digital responses. Technology is a facilitator to encourage collaborative actions among individuals and between individuals and organisations (regardless of their nature,) towards the improvement of the quality of life of the community. Individuals need the sense of belonging, and this is strongly connected with the place and neighbourhood relationships. The sense of belonging depends on the place's identity and the answers of physical or technical structures to real problems, within a real urban and social context. It is also enabled with the user's participation in the urban environment decisions at a community and municipality level.

Research projects promoted by the public and private organisations, as well as by the European Union, have contributed to the conceptualisation and implementation of the smart city. Service delivery, where the physical and the digital world combine to improve the efficiency of traditional activities (as well as to promote new ones), promotes new ways of human behaviour every day.

However, while the city centres of the main cities are transformed into a smart and humanised environment, peripheral areas are still developed according to traditional models where the smart character is mostly the use of technology, the humanization of the urban environment and the enhancement of a sense of belonging are forgotten. Real estate development and speculation are the major goals, commuting movements are the key and the spatial layout is designed to support traditional mobility instead of users or sustainable requirements.

The sample scenario illustrates the transformation of the big cities, and the dissimilarities between them and their suburban peripheries. A new model is required; a model aware of the dynamics stimulated by technology, with a deep insight in the context, to support broader and interrelated solutions centred on user needs and expectations, while contributing for the built environment sustainability. To conceive and implement this model, disruptive design emerges as a concept and methodology of action. City planners must be more conscious of contextual problems and base their decisions on their expertise and on the users' feedback, too. For that, public participation must be encouraged, helped and valued. Implemented solutions have a direct impact on human daily routines and individual behaviours, and users deserve a positive experience. This new model is complex, grounded in dissimilar challenges, some of them with well-known outlines. It is, however, worth the risk, if only because the traditional model is exhausted and has been proven ineffective.

To answer the questions introduced within the first section, it is possible to state that:

Disruptive design contributes to the humanization of a built environment once it has a methodology centred on the user, and the solutions conceived must impact the

social, cultural, environmental and economic sustainability of the built environment. Focused on the user and aware of the context, the solutions have all the required parameters to improve the user experience. Planning cities requires a new methodological approach, particularly to pursue the improvement of the smart concept on a city's daily livings and particularly on their suburban perspectives. Knowing that a smart city is beyond the collection and the use of technological artefacts and user competencies, disruptive design is a facilitator of the conception, creation, implementation and assessment of smart solutions in (sub)urban communities.

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