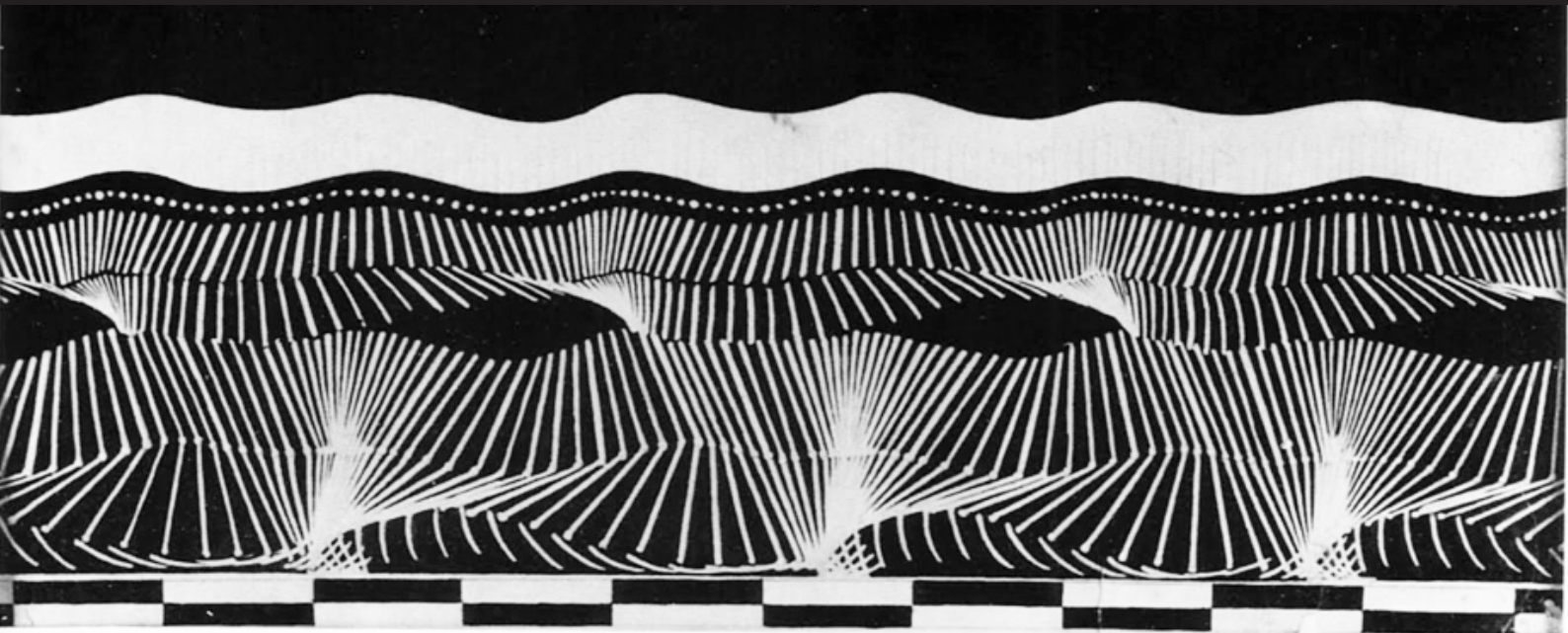


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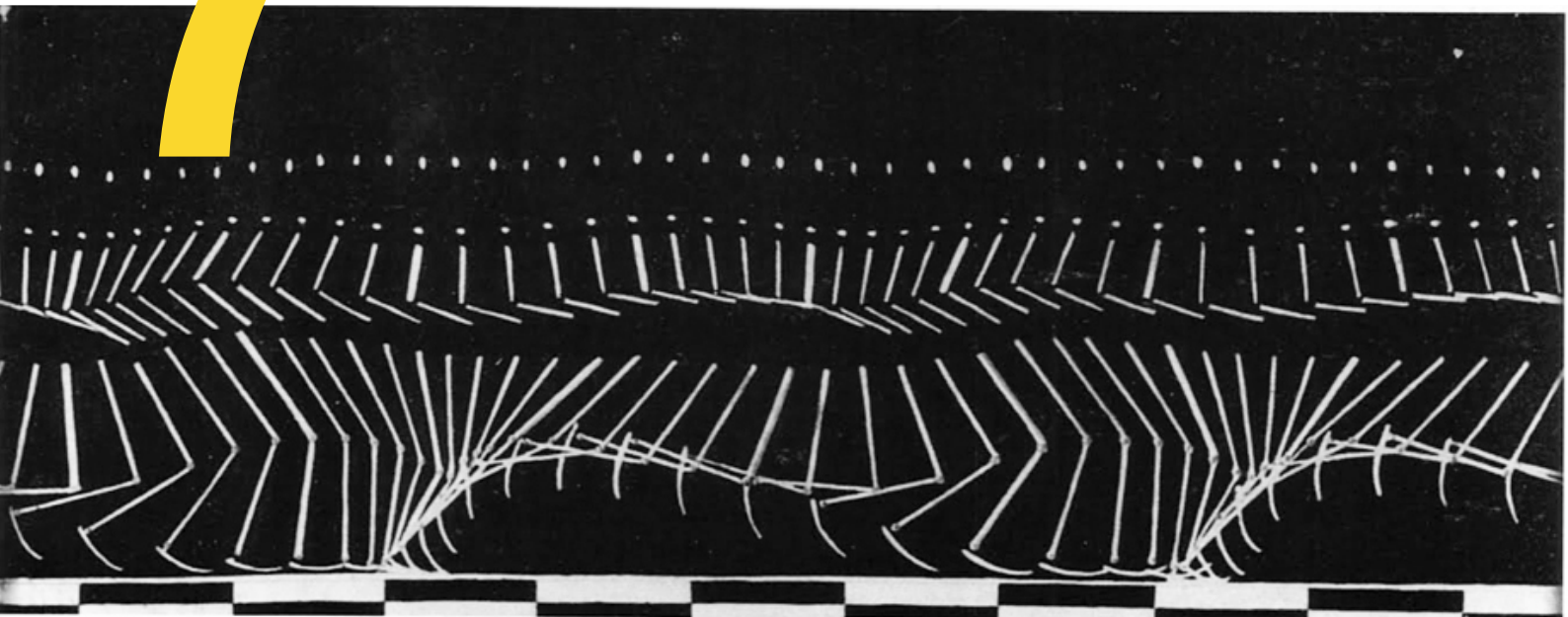
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EnAct. A responsive, cyber-physical architecture as social activator of informal gathering spaces in the city

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Abstract

Recent technological advances have changed the nature of people's interaction from physical to digital, and consequently reduced the importance of space as a means for social interaction. In this paper, the author presents this transdisciplinary research aiming to overcome this problem in a globalized and digital world. He introduces the concept of EnAct—an activator for people interacting and engaging in informal gathering spaces in the city. EnAct is the author's initial effort to understand how a responsive, cyber-physical architecture can augment social relationships within an urban setting. EnAct is a responsive, cyber-physical architectural artifact that transforms the environment, allowing people to appropriate the space differently.

Keywords

Responsive Architecture; Cyber-Physical Artifacts; Embedded Computing; Social Interaction; Urban third-places.

Background and problem statement

The subject of urban third-places for human social interaction is an important contemporary issue that urges efforts of investigation and understanding in a technological changing world. These spaces have been the real settings for people's engagement in many cultures and societies, such as the Agora in ancient Greek and tavern in colonial American. Throughout history we can see many changes in these places, especially when it involves technology. In fact, technological advances have been playing an important role in driving the way people interact with the built environment and the way the built environment serves as scenario for people interacting with each other. An example is provided by Mitchel (1999) who suggests that the well, as a place with communal function, no longer exists due to pipes that deliver water to many houses. This scenario is underlined by the premise that these technological advances were strictly connected with the built environment, and this last one was the final agent for molding social relation in urban third-places.

However, the Digital Revolution, which is the change from analog and mechanical to digital technology with the proliferation of the computer and Internet, has changed drastically this scenario. As Sassen (2011) offers, globalization and digitalization imply separation of the space from its physical form. Likewise, Oungrinis (2006) argues that many recent technological advances have been disconnected with the built environment, which consequently reduced the importance of the former in everyday life. Similarly, McLuhan (1994) says that the flow of information has become borderless and nonspatial which has, consequently, turned the space unimportant. People have gradually become dependent on portable mediums of interaction, such as smart phones, tablets and laptops, and they no longer needed to be in a physical space for interacting one another.

This "shift of importance from material to information" (McLuhan, 1994), and the phenomena of "*globalization and digitalization*" (Sassen, 2011) has changed the nature of people's interaction from physical to virtual, and consequently many third-places in urban settings have become obsolete.

In "Sentient City", Wessner (2011) highlights the issue of ubiquitous computing and its uncertain consequence over the built environment. He makes a grand question regarding this matter:

At the time that digital technology seems to be dematerializing more and more of the world around us (think of books, CDs, photographs), what impact can they possibly have on the inevitable materiality of buildings and cities?

Wessner (2011)

It is difficult to answer this question with precision, as this is an on going phenomenon that needs more time to nurture and be thought. Yet, I believe that the problematic issue involving the disconnection between technology and the built environment may render great costs for society.

Research questions

In grappling with these concerns, I posit the following questions:

- i. How can a responsive cyber-physical environment organize a person's engagement with an informal gathering space in the city?
- ii. How do people construct sense and meaning in public and semi-public space?
- iii. How does a responsive cyber-physical environment affect a person's condition of action in physical space?
- iv. How does embedded computing affect the way designers think about the organization of socio-cultural structure?

Theoretical Foundation

i. Rethinking technology, the built environment and people

Urban third-places as cherished, multicultural and diverse place are characterized by complexity interrelation of people. They work as a setting for friendly companionship and mutual interchange of ideas and political debate, which is primary important for democracy (Oldenburg, 1999). Nevertheless, technological advances changed the way people interact with each other. Urban third-places, thus, face the risk of becoming unconnected and unnatural urban spaces, which consequently would result in a lost of their physical-spatial meaning. There is a need to rethink the relationship between people, space and technology. More specifically, there is a need to redesign public/semi-public spaces as mean for people's interaction, considering these new technological circumstances.

De Waal (2011) recognizes this problematic involving technology; yet, the author thinks that technology may also provide ways to the opposite direction, enabling "*new forms of publicness and exchange*" (De Waal, 2011). I believe that the key to this problem, as Mitchel (1999) puts, is to reintegrate technology in the built environment in order to "create fresh urban relationships, processes, and patterns that have the social and cultural qualities we seek for the twenty-first century."

Still, in order to rethink people, space and technology, it is important to discuss first the connection between people and the built environment itself. After that, I will propose a way to reintegrate technology in the built environment in order to create meaningful settings for peoples' appropriation of the urban third-space.

ii. Inhabitants and the built environment

For Sayer (1992), people are social objects that have "*causal powers*" and "*liabilities*". People (i.e. social objects) have various individual and distinct features that may or may not interact between each other. Sayer's proposition sounds precise and coherent, yet, it is important to emphasize that these interactions do not happen in a vacuum, but occur in socio-physical context (Sayer, 1992). This means that the environment, and in our case the built environment, provides a setting in which people's individual and distinct features are engaged in a state of undergoing, reciprocal action. Another important point is that people are not the only entity that has tendency and capacity to cause changes by actions: the built environment also has power to affect the course of things. To be more specifically, architectural and urban entities can influence the way people interact each other in the space.

Easterling (2011) also believes that architectural and urban elements have what she calls "disposition" and "agency". This mean the capacity of an object has to act. The built environment, therefore, would have a disposition to actively change (in some level) the way others entities behave. Easterling refers to what Ryle (1949) says about humans and non-humans disposition: "*Ryle demonstrates that seemingly inert objects are actors possessing agency.*" In this sense, Easterling believes that "*infrastructure, whether composed of digital, building or urban components is dispositional*" (Easterling, 2011) – that is, it has the agency to act and thus modify things, and a tendency to be influenced by the action of others (e.g. people).

Sayer's (1992) conception regarding people's "liability" and "causal power", and Easterling's (2011) proposition involving the built environment's "agency" and "disposition" suggest a synergistic and symbiotic relationship between inhabitants and the built environment, where one influences the other.

Pask (1969) also recognized this idea of interrelation between these two entities. He proposes a shift from functionalism to what he calls "mutualism". This term means a mutual relation between "structures (any built environment entity) and men or society". The built environment, in this conception, is constructed considering human or societal context, and as such, it regulates "its humans inhabitants" (Pask, 1969).

iii. Organizing socio-cultural structures

So far, I have introduced Sayer's point regarding the variability of people's social interaction in physical space. I also pointed out that not only people but also the built environment have capability to influence things. Lastly, I presented Pask's concept of "mutualism", which gives the idea of interplay between people and the built environment. It is important to clarify, however, that there are multiple ways of interrelation between people and the built environment; also, there are multiple ways where people interact between each other in the space. People, urban-architectural elements, and the various types of relationship created between these entities form a rich and complex socio-political structure. Architects and urbanists, therefore, will be concerned not only with form and beauty, but with ways of "organizing" this socio-cultural structure as well.

Easterling (2011) also believes that designers are concerned with aspects other than aesthetics. She says that the urban environment "may be designed by immaterial parameters that may only have eventual material consequences" (Easterling, 2011). Following this line of reasoning, designers and urbanists, will design an active entity with agency and capacity to drive the way people interact each other. Yet, there are important immaterial aspects that will govern this design. Designers, hence, will "condition material and immaterial parameters, aesthetic practices and political trajectories" (Easterling, 2011).

Easterling's conception of "immaterial parameters" is very close to what Pask calls "non-tangible systems". According to Pask (1969), architects have long experience in arranging these systems in a coherent way. He adds, "the structural must be imagined as continually regulating its human inhabitants" (Pask, 1969). Likewise, McCullough suggests this notion of social organization when he says, "architecture lets life proceed more easily" (McCullough, 2004).

iv. Loose premises as catalyst for people's appropriation in urban third-places

Architects and urbanists are concerned with ways to arrange methodically the socio-cultural structure that is created from the symbiotic relationship between people and the built environment, where one influences the other. There is an embedded premise that the design, in order to be successful, must permit both inhabitants and the built environment to perform their powers and tendencies. In other words, the design should not overly dictate the way people interact; rather, the design should set loose premises that will be completed by people's actions.

Pask also believes that design should not over-govern the way people behave in a space. He believes the "goal(s) (in designing) may be and nearly always will be underspecified, i.e. the architect will no more (entirely) know the purpose of the system". Therefore, designers will "provide a set of constraints that allow for certain, presumably desirable, modes of evolution" (Pask, 1969).

Khan (2011) is also aware of this kind of relation between "people, places and things". He makes reference to interactive artworks, a type of open system, where people's participation is primary important for the completeness of the work. Referring to Burnham's (1970) conception of cyber art, Khan says, "(...) interactivity empowers the observer to engage and influence the work of art (...) by allowing her loose herself through the work" (Khan, 2011).

Likewise, Khan cites Eco who says, “The author (...) does not know the fashion in which his artwork will be concluded”, and that “(...) form will have been organized, even though it may have been assembled by an outside party in a particular way that he (the author) could not have foreseen” (Khan, 2011). Khan says, “(...) interactivity puts control into play, something to be negotiated in the performance of act” (Khan, 2011). Khan makes an association of this artwork with architecture, saying that this interaction could provide “a more intimate and unpredictable relationship with our architecture and place of habitation” (Khan, 2011).

In this discussion, it is crucial to emphasize that “human” and “non-human” entities enter in a symbiotic and mutual relationship where both have their “agency”, “disposition”, “causal power” and “liabilities”; consequently, their interaction will influence one another. This is an important point for urban third-place, where people appropriate the space spontaneously and construct sense and meaning through this appropriation. The sense of familiarity and attachment are created by active community engagement in a physical place. In fact, many times people “adjust” the surrounding themselves in order to build a more suitable form. Architects and urbanists, therefore, should organize the socio-cultural structure in a loosely manner, so that the design works as a catalyst for community engagement in urban third-places.

v. Augmenting the relationship between inhabitants and the built environment with embedded computing

These concepts of “causal powers”, “liabilities”, “agency,” and “disposition” are fundamental to advancing the idea of interdependent and reciprocal action and reaction between people and the built environment; Pask’s (1969) concept of “mutualism” corroborate with this construction. Architects and urbanists are well aware of this interplay as they have been developing ways of to deal with this matter for a long time. Although it may be obvious, it is important to highlight that, as opposed to people, the built environment is physically inanimate. Architects and urbanists, thus, have been designing physically static entities that “govern” (in some level) the way people behave in space.

The question that follows is: what if the built environment would physically interact and respond to people’s input? Would this physical animation collaborate in some way to solve the problematic involving the disconnection of technology from the built environment? Regarding this issue, Pask (1969) speculates that the implementation of computing and robotics can potentially augment the interplay between people and the built environment.

Pask’s speculation about adaptive environment is actually an expansion of “mutualism” by embedding computer on the built environment. Adaptable urban-architectural entity is able to sense, process and respond to people’s input, augmenting therefore “agency” and “disposition” of space, and consequently providing multiple ways of interaction between inhabitants and the built environment.

vi. Interactive systems

Because of the ability to intelligently adapt, cyber-physical architecture, opens opportunities to explore new ways of actively organize the socio-cultural structure. Embedded computing can augment designers’ possibilities to set loose premises that will be completed by people’s actions. As it is an open and adaptable system, it would produce different responses and consequently different outcomes according to the various inputs the system would receive from its inhabitants. In this sense, the interactive open system is a way to allow people to actively participate in the construction of the final space configuration (Pask, 1969).

Intelligent cyber-physical architecture, in this manner, is an activator for people interacting and engaging in physical spaces; the meaning and sense of a public/semi-public space would be completed with the interplay between inhabitants and the responsive architectural entity. This open interactive system permits designers to loosely set premises for people’s appropriation of the physical space; by appropriating in a active way, people would configure the environment and thus become a designer as well.

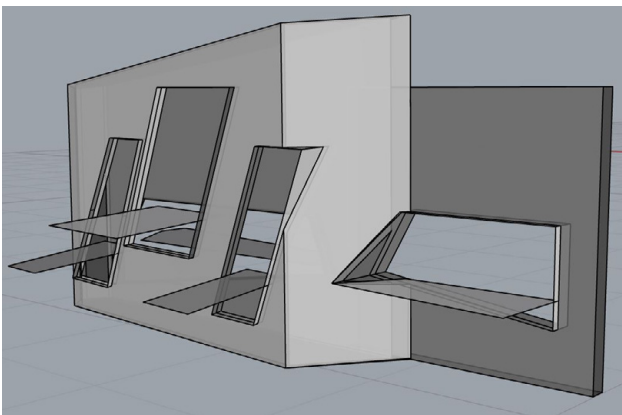


Figure 1.
EnAct.View 1

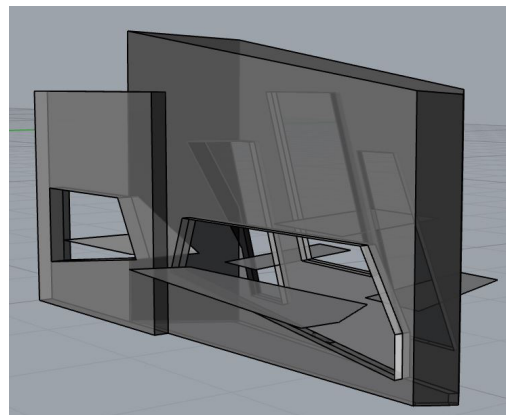


Figure 2.
EnAct.View 2



Figure 3.
EnAct as a catalyst for people's
gathering in urban space



Figure 4.
EnAct in the open city space

Dubberly et al. (2009) discuss interactive systems and how the connection of many components happens in a context. They say that the combination of linear, self-regulating and learning systems can provide a more interconnected and interactive system (Dubberly, 2009). For Khan, a system such as this is positive for interaction because designers “*can speculate on the behaviors of interactions without being bogged down by their specific mechanism*” (Khan, 2011). Khan’s point is similar to what Pask offers: “*the designer is controlling the construction of the control system and consequently design is control of control, i.e. the designer does much the same job as his system, but he operates at a higher level in organization hierarchy*” (Pask, 1969). Khan also argues that an interactive system such as this creates “*a structure (that) maintain(s) the indeterminacy of interactivity with the different actors in play exercising different controls on one another*” (Khan, 2011).

Response

Following from this consideration, this early research suggests that the traditional unintelligent and unresponsive built environment is not appropriate for the digitalized and globalized world. I name my conceptual model and developing artifact EnAct—an activator for people interacting and engaging in informal gathering spaces in the city. EnAct is a cyber-physical design intervention into public space that is completed by the interplay between inhabitants, the designed intervention, and the larger urban space. EnAct is my early attempt to understand how an intelligent, cyber-physical environment can augment social relationship in urban space. EnAct is an architectural-robotic artifact that creates various meaningful scenarios, setting premises for people’s appropriation in urban space. EnAct is envisioned as consisting of sensible and responsible cyber-physical components that have the ability to change the urban space by, primarily, unfolding movable panels (Figures 1, 2, 3 and 4). Transforming from a simple urban landmark into interactive urban furniture, EnAct serves as an informal gathering space for people in urban spaces.

Location

I envision EnAct placed in two different locations. In the first one, a courtyard of standard municipal schools in Rio de Janeiro (Figure 5 and 6), EnAct would provide a space for students’ extra-curricula activities, such as science fair and outside class. Students would also use EnAct to have lunch and hang-out during break time. The second location, under the pilotis of Palácio Capanema (Figure 7 and 8), also in Rio, is characterized by its fuzzy limits and loose constraints. EnAct would provoke people’s attachment by transforming an inhumane space into a more intimate setting, welcoming people to interact each other. EnAct provide space for non-permanent urban activities, such as book fair, art festival and outside cinema at night. EnAct can work also as a simple informal gathering space for normal day.

Methodology

The underline theory of this research is based on Dewey’s pragmatic worldview, which views the project as a “*hypothesis to be worked out in practice... giving our experience the guidance it requires*” (Dewey, 1920). This proposition suggests the necessity to engage in designing, prototyping, and testing the hypothetical response discussed in the “Theoretical Foundation.” This research also follows an important current in Human Computer Interaction that advocates designing and evaluating “*in the wild*”—the particular physical site for the artifact. Consequently, I aim to conduct this study in situ at the standard school, and at the Capanema Palacy, both in Rio de Janeiro, as opposed to our closed lab (Rogers, 2011). This is an apt design research approach because it recognizes the impact a design entity has in a real, socio-cultural structure. This research moreover considers an approach presented by McCarthy and Wright focused on evaluating how people make sense of “*experience in terms of ourselves, our culture, and our lives*” (McCarthy and Wright, 2004). I intend to record people’s engagement with EnAct and also conduct interviews.

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Figure 5.
 Standard municipal school
 RJ, Brazil.



Figure 6.
 'Fuzzy' space under Palácio Capanema
 RJ, Brazil.



Figure 7.
 Palácio Capanema
 RJ, Brazil.

Significance

Although there have been important studies regarding the use of architectural-robotics in interior spaces (to support specific functions), there hasn't been much research involving intelligent environment in urban settings. This research is significant because it addresses the problem involving the disconnection between technological advances and the built environment, which resulted in diminishing the importance of public/semi-public space, and proposes a responsive cyber-physical architecture as a catalyst for people's appropriation in urban spaces.

Conclusion

The reduction of the importance of urban third-place as a medium for people encounter and interaction is directly associated with recent technological advances. I believe that the way to revive the built environment's significance as a mean for people's interaction is not to deny technological advances, but to integrate them into the space. I believe that my developing design research EnAct implemented in situ in Rio de Janeiro, promise to expand the understanding of human-robotic interaction.

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