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Research by Design: Towards a Cognitive/Transformative Model

Juan Torres

Université de Montréal, Montréal, Québec, Canada

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ABSTRACT

According to Christopher Frayling (1993), research and design activities converge in three possible ways: a) when research is conducted as a starting point for design (research *for* design); b) when research is focused on design activities or products (research *into* design); and c) when research is conducted within design as a practice, cognitive and transformative goals being integrated as part of the same process (research *through* design or *by* design). If research-by-design projects are not the most common, they are nevertheless very promising, especially in design education. They allow students to develop reflexive skills; they also enable designers to conduct research in a context in which they are particularly well versed: the design process. Moreover, these initiatives posit design as a scientific strategy with its own epistemological approach. Drawing on two participatory design projects, this paper highlights three overlapping dimensions, or "projective levels," implicit in research-by-design. The first one (sub-projective) concerns the person-environment interaction; the second one (projective), the interaction between designers and the reality they seek to transform; the third one (meta-projective), the interaction between the designers and their own design process. These three projective levels are represented in a model that shows different kinds of knowledge produced through research-by-design.

Introduction: Design as a Twofold Activity

According to an old Platonic principle, the excellence, beauty and goodness of any object is related to its purpose and, more broadly, to its context (Platon and Chambry 1992: X-4). Designing an object thus involves understanding that context. Authors like Alexander (1964: 21) take this one step further and suggest that inventing an object and understanding the world in which it will exist are two aspects of the same process. In this sense, designing can be understood as both a transformative process –conceiving a change– and a cognitive process –understanding the context of that change (Jones 1984). Simon's broad definition of design as the activity of everyone "[…] who devises courses of action aimed at changing existing situations into preferred ones" (Simon 1969: 129) also embraces the transformative-cognitive duality: designers devise preferred situations based on their understanding of existing ones.

However, knowledge is not only a condition for making changes but also a result of changes that will eventually bring about new changes (Simon 1996: 162). Schön (1983) illustrates this reciprocity through the metaphor of the conversation between the reflexive practitioner and the situation to be understood and transformed. This metaphor suggests that the understanding of the situation affects the designer's transformative intention (purpose); in turn, the work on possible transformations affects the designer's understanding of the situation. Understanding the world and devising ways of transforming it thus appear as two simultaneous activities, each driving the other in a recursive cycle (Zeisel 2006). The following quote from Feyerabend is eloquent in this regard: "Creation of a thing, and creation plus full understanding of a correct idea of the thing, are very often parts of one and the same indivisible process and cannot be separated without bringing the process to a stop" (Feyerabend 1975: 26).

Boutinet refers to this cognitive-transformative integration, characteristic of design, as a relevant epistemological approach (Boutinet 2003: 161). This approach challenges positivism, in which theory is an additive construction of knowledge, clearly separated from practice (Le Moigne 1999, Guba and Lincoln 2000). On the contrary, the complexity of cognitive-transformative integration suggests that design is both a practice and a learning process.

I. Design and Research Convergences

Although design implies knowledge production, it converges with research in different ways. Christopher Frayling (Frayling 1993/4) recognizes three: a) research *into* design; b) research *for* design; and c) research *through* or *by* design. Research into design is perhaps the most widespread convergence. It refers to the study of particular design projects using disciplinary approaches (historic, anthropologic, etc.). Research for design refers to the studies that will eventually feed the design process. Preparatory studies about materials, production techniques and users are good examples of this kind of convergence. Finally, research by design occurs when research is conducted within the design project, cognitive and transformative goals being explicitly integrated into the very process. Here, the design

process is equivalent to the "field" in social sciences or the "laboratory" in experimental research (Findeli 2004).

Research-by-design posits design as a relevant scientific strategy (Findeli 1998, Boutinet 2003). It embodies the constructivist philosophy, an approach in which knowledge is seen as a subject-object interaction in which the individual actively participates (Piaget 1967). Constructivism builds on assumptions from three interrelated fields: the ontological (concerning reality), epistemological (concerning the knowledge we can produce from that reality) and teleological (concerning purposes). A parallel can be made between these three fields and three elements of the design situation: the object to be designed, the design process and the designer (see Table 1).

Philosophical field	Ontological	Epistemological	Teleological
Element of the design situation	Design object	Design process	Designer
Related dimension	Reality	Knowledge/ transformation	Purpose

Table. 1. Philosophical fields and elements of the design situation.

In the ontological field, constructivism assumes reality to be an observer's construction (Le Moigne 1999: 40) grasped through concepts (Schön 1969: 8). Reality is thus always partial and incomplete, local and subject-specific instead of universal, although some perceptions can be socially shared (Guba and Lincoln 1994: 110). From this stance, design is about life-worlds, that is to say about transforming people's perceived world.

In the epistemological field, constructivism assumes knowledge as the transformation of representations of reality through subject-reality interactions (Guba and Lincoln 1994). In other words, to know means to model or to devise a representation of the world. This irreversible and recursive process can be explained in Dobzhansky's terms: "By changing what he knows about the world man changes the world that he knows; and by changing the world in which he lives, man changes himself" (Dobzhansky 1962: 347). As a cognitive and transformative process, design embodies the epistemological assumptions of constructivism.

Finally, in the teleological field, constructivism assumes the subject-reality interaction as an intentional process: constructing representations of reality is a deliberate act aimed at transforming our life-world (Guba and Lincoln 1994: 113). Research-by-design meets this teleological assumption since knowledge production is not neutral insofar as understanding the world is both the condition and the result of world transformations.

Constructivist assumptions about these three philosophical fields formed the analytical framework for the study of the two research-by-design projects presented in the following section.

II. Fieldwork: Two Research-by-Design Projects

In 2005, two participatory design projects were carried out in Montreal (Canada) and in Guadalajara (Mexico) within UNESCO's Growing Up in Cities program (GUiC). Initiated in the 1970's by Kevin Lynch and resumed in the 1990's by Louise Chawla, GUiC engages children, youth and adults as collaborators in evaluating local environments, and in planning and implementing change (Driskell 2006). In both projects, participants included a group of children between 8 and 16 years of age (20 in Montreal, 27 in Guadalajara) and a group of urban planning, architecture, and landscape architecture students attending local universities (16 in Montreal, 19 in Guadalajara).

For students, the project represented an important challenge: unlike conventional studios, they had to perform in a real setting, with real partners; moreover, they had to act both as designers and as researchers. Indeed, the GUiC experience has given us relevant knowledge about the children-neighborhood relationship and about the participatory design process itself. In this sense, these GUiC projects are good examples of research-by-design processes.

In Montreal, the project was carried out in one of Montreal's densest neighbourhoods, the North-East sector of the borough of Montréal-Nord, an 80-hectare area with a multicultural, low-income population of 14,000 inhabitants, almost a third of whom had recently immigrated to Canada from Haiti, Latin America, and North Africa. Most residents in this neighbourhood rent small apartments in three-story walk-up buildings with small balconies but without backyards or any other play areas. The harsh Montreal winters, the inaccessibility of certain sports facilities and the presence of street gangs discourage children from using the three local parks.

In Guadalajara, the project was carried out in the Díaz Ordaz neighborhood, a 13-hectare low-cost housing development with 5,000 residents. The working-class community that has been living there for more than 25 years is very homogeneous. Many children live in single-parent families, often with grandparents or other relatives. The predominant housing types are four-story apartment buildings and small row houses, most units being owned by their residents. The weather is clearly not a barrier to the use of public space, but as a known drug-dealing area, the neighborhood is perceived as unsafe, discouraging children and adults from using its public space.

At both sites, the process was similar. During the first two months, the students were introduced to participatory design and research. They were trained to do interviews and other activities they would be carrying out with the children. The participatory process that followed lasted about ten weeks and was based on the activities proposed by Driskell (2002). It started with informal meetings in which the participants got to know each other and set up work teams, each made up of one or two children and one student. Then, twice a week after school, they met in local parks to engage in activities designed to help them understand the way children experience their environment. As part of these activities, the children drew the places where they lived, gave interviews, took photos of the places they liked and disliked most and took the students on a tour around the neighborhood.

Later, the children and students embarked on a process of designing changes to local public places. This stage started

with a bus tour of child-friendly public spaces outside the neighborhood. Then, brainstorming sessions were held during which local changes were proposed. These proposals resulted in several urban design projects, which the children and students developed in a design "charrette", an intensive design studio that took place over two weekends. Drawings and models of the projects were displayed in local public places. The students were subsequently invited to participate in a focus group to evaluate the whole process. Six students took part in this final activity in Montreal and seven in Guadalajara.

As a part of a doctoral research project (Torres 2007), the material produced through these GUiC projects was analyzed following the "grounded theory" approach (Glaser and Strauss 1967, Charmaz 2000). More precisely, the analysis was carried out using "conceptualizing categories" (Paillé and Mucchielli 2003), which are short textual expressions that name and articulate different aspects of the reality to be understood. These categories are analytical tools used in a "theoretical sampling" process, to create concepts and theoretical models.

III. Heuristic Model of Research by Design

A. Projective Levels

Based on constructivist assumptions, and drawing on our two GUiC projects, we propose a conceptual model that represents the complexity of research-by-design, coordinating three dimensions or projective levels. See Fig. 1.

The model places the designer as a central actor (the subject within the projective level). As reflexive practitioner (Schön 1983), the designer interacts with the world (central double-headed arrow). This interaction involves changes in both the world (transformative dimension) and the designer's perception of the world (cognitive dimension). The designer's world is represented as a complex system, consisting not of independent items, but of projective relationships between people and their own world (right double-headed arrow). In other words, the designer aims at understanding and transforming not mere objects, but complex person-environment interactions (i.e. other people's life-worlds, represented at the sub-projective level). Zooming out, at a meta-projective level, the designer-world interaction is represented as an object itself with which one may interact (left double-headed arrow). Through this interaction, we understand and transform the design process itself. We can see this as the "design of design", that is to say an effort to understand and to enhance design as a professional and scientific activity.

B. Lessons at Three Projective Levels

The model proved to be useful in organizing the lessons drawn from the GUiC experiences in Montreal and Guadalajara. It places them at three levels: those concerning the design object (sub-projective level), those concerning the design process (projective level), and those concerning the designers' understanding of that process (meta-projective level).

At the sub-projective level, the lesson concerned the nature of the children-environment interaction. Home and the neighborhood appeared as the main and interrelated elements, the perception and the activity in one being influenced by the perception and the activity in the other (Torres 2009). At the projective level, we observed an interesting transformation throughout the participatory process. Students became aware of the complexity of the person-environment relationship. They moved from an "expert" attitude, to a "collaborator" one; the neighborhood, initially understood as a physical setting determining behavior, became a socially constructed place shaped by children. And the design process, started with a view to applying objective knowledge about the area to the carrying out of physical transformations (instrumental approach), became a deliberative process aimed at

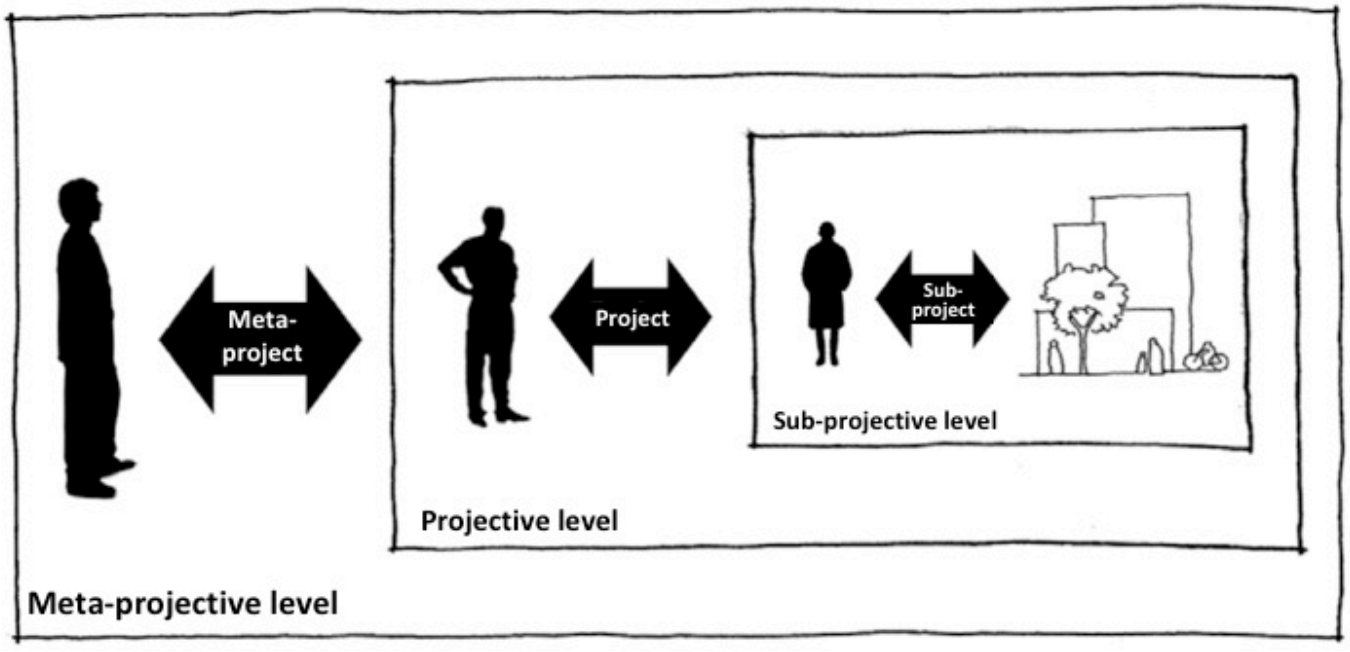

Fig. 1. Coordination of three projective levels in the research-by-design process (adapted from Torres 2007).

understanding the neighborhood through children's eyes and devising new activities with them as well as the places that can support these activities. Finally, at the meta-projective level, the experiences showed how students were aware of these changes. They acknowledged the complexity of the design process and the need for adaptability and constant reflection in action. They also considered the GUiC projects an opportunity for ethical awareness.

That said, beyond the lessons drawn at each projective level, the model illustrates the necessary coherence between the three of them: a consistency between the person-environment interaction, the cognitive-transformative integration and the emergence of ethic considerations in design. Hence, the idea of a person-environment interaction implies the acknowledgment of people as actors (not simply as mere users, as in deterministic approaches). This acknowledgement makes people's participation a necessary condition for successful transformations. Moreover, people's participation in design allows us to consider it as a process through which participants learn about their world and about themselves (Forester 1999). As a collaborative process of learning and transformation, design thus raises important ethical issues, such as the exclusion of social groups from the design process.

The relationship between the three levels is thus analogical to the relationship between the three philosophical fields discussed above: the ontological (reality), the epistemological (how we can know it) and the teleological (the purposes). This threefold model thus appears to be a useful tool, working as a monitor in which designers can see themselves while they perform as reflexive practitioners. It can be used in the construction of what Findeli (2006) calls a "strong theory" in design, that is to say a theory understood not as opposed to practice, but according to the way theoretical knowledge (traditional theory) can be related to practice. In this model, both traditional and strong theories can be coordinated and their relationship made explicit.

IV. Conclusion

Although challenging in several ways, research-by-design experiences are extremely promising, especially in design education: they enable participants to take part in complex processes in which transformation and knowledge production are deeply related. Constructivist philosophy brings a suitable framework in order to understand and to value the scientific relevance of research-by-design as an epistemological approach. Inspired by constructivist assumptions and drawing on two research-by-design projects, a model has been proposed. This model integrates three dimensions or projective levels of the design situation (sub-projective, projective and meta-projective) and proves to be useful in making explicit knowledge concerning each one them as well as knowledge produced through the design process.

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