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Sustainable and Inclusive Design: a Matter of Knowledge?

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Abstract. In analysing parallels between sustainable and inclusive design, the paper investigates reasons for architects' disappointing uptake of these approaches so far. A common reason seems to be the lack of knowledge that has the applicability required by architectural practice.

Researchers produce knowledge on why and how we should accomplish more sustainable practices in building, which hardly filters down to practicing architects. Vice versa, the knowledge developed through architects' design experiences hardly feeds back into academic research. Moreover, in case of inclusive design, the user side represents a valuable body of knowledge as well: through their specific interaction with buildings/spaces, users with disabilities appreciate qualities and detect misfits most architects are unaware of. If the uptake of sustainability and inclusiveness in architecture is to be improved, the major challenge thus seems less a need to generate more knowledge than a need to make more effective use of what is already available.

1 Introduction

This paper considers the role and significance of knowledge in designing and building a sustainable and inclusive environment. In doing so, sustainability and inclusiveness are treated as two different aspects of the built environment. In reality, however, both aspects are highly intertwined in multiple ways.

In the US, inclusive design is often used interchangeably with universal design to label a design approach that implies equity and social justice by design (Ostroff, 2001). Universal

design—a term introduced by the late Ron Mace, founder of the Center for Universal Design at the NC State University—denotes the design of products and environments to be usable, to the greatest extent possible, by all people throughout their lifespan, without adaptation or specialized design. As such, universal or inclusive design can be considered as contributing to sustainability. Vice versa, sustainability seems to be an important component of universal or inclusive design processes. In the *Universal Design Handbook*, C. J. Walsh (2001) introduces a broad person-centered view of sustainable development that he believes can be a more appropriate and powerful context for inclusive design. Leslie Kanes Weisman (2001), for her part, sees inclusive or universal design as providing the context and a base for environmentally healthy communities. She documents the connections between social and environmental health, linking environmental risk to poverty and racism.

In this paper, sustainability and inclusiveness are linked to knowledge. When considering architects' disappointing uptake of sustainable and inclusive design, a common reason seems to be the lack of knowledge that has the applicability required by architectural practice. Current discourse increasingly emphasises the need for academic knowledge production to be “relevant” and for academics to “learn” how to translate and transmit their knowledge to other users. This paper turns the issue upside down, and questions what can be expected from other major actors in addressing the lack of knowledge on how to design sustainable and inclusive environments.

Research on the role and forms of knowledge in architectural design is a relatively recent phenomenon. Not so long ago, architects tended to view knowledge with disdain, as a hindrance to unfettered creativity or an encapsulation of “freeze-dried prejudices” (Press, 1998). Recently, however, the American Institute of Architects (AIA) devoted an issue of its journal *AIA/J* entirely to the theme of knowledge, which strongly suggests that times are changing.

By way of introduction, the paper starts by briefly outlining the multiple facets and meanings of knowledge in general (Section 2), and setting the context for the discussion of knowledge in architecture in particular (Section 3). Subsequently, it zooms in on two sources of knowledge that are hardly exploited so far, c.q. architectural practice (Section 4) and experts/users (Section 5), and points out their potential role and significance in realizing a sustainable and inclusive built environment. The paper concludes with a summary and an outline of key challenges for the future (Section 6).

2 Knowledge in a nutshell

Discussing the role of knowledge in designing and building sustainable and inclusive environments raises the question: what is knowledge in the first place? In the literature, knowledge appears as a concept with many facets and layered meanings. Knowledge tends to be addressed, not so much by formulating precise definitions, but rather by making all sorts of distinctions between different knowledge types, e.g. between declarative and procedural knowledge (Ryle, 1949), or between explicit and tacit knowledge (Polanyi, 1967). The latter is used to denote knowledge based on the experience of individuals. It manifests itself in human actions in the form of evaluations, attitudes, points of view, commitments, motivation, etc. Usually tacit knowledge is difficult to express directly in words, and can be presented only through methods of expression not requiring a formal use of language, such as metaphors or drawings. On the practical level, experts are often unable to articulate all they know and are able to, or how they make their decisions and come to conclusions. Polanyi (1967) captures the essence of tacit knowledge in the phrase "*We know more than we can tell*", and further illustrates the concept with commonplace examples like the ability to recognise faces, ride a bicycle or swim without even the slightest idea of how these things are done. Rosenberg's (1982, p. 143)

description of traditional technological knowledge, accumulated in crude empirical ways without reliance upon science, provides a good definition of tacit knowledge in technology companies:

"The knowledge of techniques, methods and designs that work in certain ways and with certain consequences, even when one cannot explain exactly why."

More in general, a distinction can be made between, on the one hand, traditional epistemology, which emphasizes the absolute, static, and a-human character of knowledge and, on the other hand, the more recent theory of knowledge creation, which considers knowledge as a dynamic human process in which personal convictions are justified in search for the truth (Nonaka, 1994). In the latter view, knowledge differs from information in that it only exists in the heads of people, whereas information exists outside the human mind and can be embedded in any attribute involved in communication (e.g. text, speech or images) (Coenen, 2005). Exchanging information between people may cause change in the receiver's knowledge, i.e. lead to knowledge transfer. Yet, this transfer never produces an exact replica of the sender's knowledge in the receiver's mind, since the latter's memory is different when receiving the information and knowledge is precisely created by assimilating the information received in memory. Indeed, we understand by trying to integrate new things we encounter with what we already know (Schank, 1982).

In a professional context, a similar distinction is made between, on the one hand, the "knowledge base", i.e. the formal and codified domain expertise claimed by a profession (Habracken, 1997) and, on the other hand, the practitioner's "knowing-in-practice", which—as Donald Schön (1987) has taught us—is largely implicit and learned by doing. Medical doctors, for example, obviously must know about the human body, but if they are to diagnose an illness and cure the patient, this knowledge as such will not do. Similarly, lawyers must know more than the law if they want to apply it successfully in real-world cases.

3 Knowledge in architecture

When zooming in on the specific context in architecture, we can distinguish between several bodies of knowledge. A first one is produced in universities and research centres across the world, where researchers study various aspects of architecture (history, social, political and cultural factors, materials science, design theory, computational technology, etc.). This knowledge, however, hardly filters down to practicing architects (Neuckermans, 2002). A survey among practitioners and academics in architecture revealed an evident lack of networking between both communities (Watson & Grondzik, 1997). Meanwhile doctoral dissertations have become commonplace in most architecture departments, yet practicing architects are still surprised to hear about the existence of a Ph.D. in Architecture and people actually being engaged in it (Khemlani, 2005). Obviously, not all doctoral research is or intends to be directly relevant for architectural practice (Dunin-Woyseth, 2005), but even for the portion that does, the implications for professional practice, and ultimately for architecture as built environment, have yet to be demonstrated.

The latter brings us to a second body of knowledge, which resides in architectural practice. A good deal of the knowledge involved in architects' design process is embedded within and developed through the very act of designing. Studies in architecture (Heylighen & Neuckermans, 2002) and other design domains, such as knitwear (Eckert & Stacey, 2000) and engineering design (Eckert et al., 2005), show that designers frequently rely on past designs as sources of knowledge (Michl, 2002). Historically, this practice-based knowledge in fact precedes academic knowledge, which became institutionalized in the early 17th century when the need to articulate (and thus legitimate) the knowledge of architects became critical to the survival of the profession (Dewey, 1946). In the 500 years since its establishment, academic knowledge is claimed to have become increasingly divorced from its practical roots. Many professional

architects would attest to the great divide between what is taught in school and what must be known to practice.

A case in point is the research on sustainable building. In recent years, a considerable and growing amount of research has been conducted on the reasons why more sustainable practices in building and housing are desirable and on how these could be accomplished. Nevertheless, an assessment of housing practices in the region of Flanders over the last decade reveals sustainable development to be all but reality in the housing sector (Vandevyvere & Neuckermans, 2005). One of the reasons seems to be that the knowledge produced by the academic community does not have the applicability required by architectural practice. For instance, selecting materials that are safe to use, do not affect the occupants' health, have minimal impact on the environment and yet are cost effective and technically sound is highly complex due to the differing nature and sources of information (March & Curwell, 2004).

4 Architects/practitioners

A common route to address the problem outlined above is to call in political support and enforce sustainable practices through adequate policy strategies (Vandevyvere & Neuckermans, 2005). However, in our view, a more effective or at least complementary route may be to focus on the design process in architecture. In addition to investigating how the knowledge produced by the academic community can inform policy making, it seems worthwhile to investigate how this knowledge can infuse architects' design process, but also how architects' design experiences can feed back both into academic research.

Every design conceived by architects in practice can be considered a complex hypothesis, yet this hypothesis is rarely tested explicitly in the built reality, let alone systematically documented or studied. Architecture is lacking consistent and systematic mechanisms to establish

and maintain access to this body of practice-based knowledge. Nevertheless, some recent initiatives strongly suggest that there is a need for such systematic study and documentation. A few examples are worth mentioning here.

Vital Signs is an initiative that encourages architecture students to examine existing buildings, with attention to occupants' well-being, architectural space making and—especially relevant in relation to sustainability—energy use (Kwok & Grondzik, 2000). A set of measurement techniques, often involving novel approaches, was developed to reveal operating patterns in architectural, lighting, and mechanical systems of contemporary buildings. When incorporated as the last phase in the design/build cycle, post-occupancy evaluations (POE) as advanced by Vital Signs could positively influence the design process and the resulting building; not only in terms of sustainability, but also from the perspective of inclusiveness. Kaplan McLaughlin Diaz—an architecture and planning firm based in San Francisco—has been conducting POEs for almost 30 years and firmly believes that the impact of POE can be far reaching: *“Over the years, we’ve discovered that lessons learned from one project can help us even with different kinds of buildings. For example, studies we conducted of housing for the elderly have been applicable to the design of successful environments for the homeless, the mentally ill, and the incarcerated”* (Corry, 2001, p. 56.9-10).

While Vital Signs—and POE in general—typically focuses on the building as a finished design product, *Building Stories* adopts a broader perspective so as to include the corresponding design and building process—not so much as process per se, but in relation to its impact on the resulting product. Building Stories is a methodology that teams up seasoned architects and interns from practice with students/researchers from academia to record and explore the knowledge embedded in real-world building projects and processes through storytelling (Martin et al., 2005). Key to Building Stories is the fact that teams are inherently heterogeneous in terms of the skills

and experience team members bring to it. Judging from an evaluation after five years of experience with the approach (Heylighen et al. 2007), the expertise and hands-on experience of the architects in the team enables interns and students/researchers to develop a critical understanding of the issues at stake in architectural practice. In return, the participation of students/researchers assures a continued supply of competencies trained in the latest research skills and techniques. Moreover, the (academic) knowledge networks they have access to, and the time and energy they can invest, make them highly attractive to architectural practice. According to an architect who participated in Building Stories repeatedly, the approach equips his firm to be self-critical in an entirely new and systematic way, and to reflect on and record its process of creation for further refinement. Moreover, and perhaps most spectacularly, it makes the sharing of knowledge and experience a reality in a profession that is known to be highly secretive.

However, interesting as these initiatives may be, unfortunately they are little more than isolated pilot efforts and as such remain exceptions to the rule. Today, with architecture and design firms expanding the scope of their services, more POEs are being completed. Yet, they are not being used as a standard tool in architecture, and are not often conducted unless there are problems evident to the building users (Corry, 2001). As such, the examples above contrast sharply with widespread mechanisms in other design domains, such as the use of patterns in software design (Gamma et al., 1995). The idea of using patterns to record and reuse design solutions that have worked in the past, was first proposed by Christopher Alexander and his colleagues (1977), interestingly enough in the domain of architecture. While Alexander's idea has never taken root in architecture, it is now flourishing in the object-oriented software community, where design patterns are widely used to capture and exchange design solutions that have evolved over time.

5 Experts/users

So far we have discussed the role architects could play in developing the knowledge needed to design sustainable and inclusive environments. However, architects are not the only actors that could help address this knowledge need. For yet another body of knowledge resides at the user side. Through their daily interaction with buildings and spaces, users develop insights that are extremely relevant to architectural design. Recent research on non-designers points to tacit design knowledge among those who have no educational or professional design experience (Wakkary, 2005). So far, however, this knowledge is hardly exploited in the design process. Except in participatory design, users tend to be held at arm's length and are only allowed in as abstractions (through functional concerns) or as ideals (through notions of authentic living) (Till, 2005). At first sight, this does not seem to be too problematic, since architects are after all users themselves. Nevertheless, research has shown how architecture students over the five years of their studies become assimilated into the social mores of the profession (Wilson, 1996): they gradually take on the language codes, stylistic preferences and rituals of architects, while becoming increasingly remote from the way lay people describe and prioritise architecture. Moreover, certain user groups, such as people with specific impairments or disabilities, are able to detect misfits that most architects are not even aware of. Much like a “miner’s canary”, these people “*are the most vulnerable to exclusion by inappropriate design but at the same time the key actors par excellence to analyze the characteristics of the misfit and to help in finding better universal design solutions*” (Froyen, 2003). Their experiential knowledge is critical in directing formative building design, but also in helping to conceptualise and direct later changes and to keep a place adapted to changing needs (Imrie & Hall, 2001).

Here too one could think of taking the route of legislation and use these people’s unique knowing-in-action to inform policy making. However, as the diversity and complexity of our

global society increases, it is undesirable to establish fixed criteria for what constitutes an inclusive or universal design (Salmen, 2001). Moreover, research suggests that professionals rarely exceed the legislative minima and that information, in and of itself, is insufficient if the mechanisms for disabled people to provide professionals with their views are absent or weakly developed (Imrie & Hall, 2001).

In view of this, we would advocate the development of scenarios that provide the context for disabled people to become key informants and participants in architects' design process. Within specific organisations, such as a university or high school, a possible scenario may be to actively involve personnel and students with disabilities in the design or redesign of the organisation's buildings and larger environment (Heylighen & Michiels, 2007). Another scenario is to interview persons with disabilities about their spatial experiences and preferences, and to derive from these design parameters that architects can work with during the design process (Herssens & Heylighen, 2007).

At some level, these scenarios show striking similarities with the Building Stories approach: temporary and transdisciplinary teams collaborate in specific and localised contexts of application to produce knowledge in a more socially accountable and reflexive way. As such, both these scenarios and Building Stories seem to exemplify a relatively new mode of knowledge production—for lack of a better term labelled Mode 2—which is thoroughly reforming established institutions, disciplines, practices and policies (Gibbons et al., 1994). In contrast with Mode 1—the convenient shorthand for the form of knowledge production that is commonly considered sound scientific practice—Mode 2 is characterized as:

- operating in a context of application rather than in a context governed by the, largely academic, interests of a specific community;
- heterogeneous in terms of the skills and experience people bring to it;

- transdisciplinary, i.e. producing results that are usually beyond any single contributing discipline and thus not tailored for communication through the conventional institutional channels;
- organizationally diverse and transient, assembling people in temporary teams and networks that are less firmly institutionalized;
- more socially accountable and reflexive, not only in the definition and solution of problems, but also in the sense that individuals must reflect—try to operate from the standpoint of—all the actors involved.

Discussing in detail each of these characteristics, their causes, implications and interactions, would clearly transcend the scope of this paper. Instead, we would like to point out that, if architecture is to exploit the body of knowledge represented by experts/users with an eye to design more inclusive environments, it will likely need to call in forms of knowledge production that fall under a Mode 2 display. In doing so, a major question will be: how do we assess the quality of the knowledge produced by these transdisciplinary teams that operate in Mode 2 research environments? In general, Gibbons et al. (1994) claim, quality control too becomes more context- and use-dependent, as it involves a diverse range of intellectual, social, economic and political interests, and takes on more transient and temporary forms and fluid norms. This does not necessarily result in lower quality, but of in quality of a more composite, multidimensional kind. However, what these components and dimensions should look like in case of the scenarios above is far from clear.

6 Summary and discussion

In analysing parallels between sustainable and inclusive design, this paper has focused on what seems to be a common reason for architects' disappointing uptake of these approaches so far: the

lack of knowledge that has the applicability required by architectural practice. Instead of looking at academia to address this problem, it has shifted attention to two alternative bodies of knowledge that are hardly exploited so far: the knowledge embedded in architectural practice and the knowing-in-action of experts/users.

The sketch of these alternative bodies of knowledge already hints at why a convincing breakthrough of sustainable and inclusive design has yet to come: architecture is lacking a robust and proficient knowledge infrastructure to make the available knowledge more transparent and to disseminate it in a way that improves design practice and, ultimately, the quality of our built environment. However, the lack of such a knowledge infrastructure is not unique to architecture. Increasingly, both industry and government see the main problem we face today less as a need to generate more knowledge than as one of making effective and equitable use of what is already available (Etzkowitz et al. 1998). In other words, the key challenge now is “*to strengthen the distribution network by increasing the flow of knowledge from universities and government research establishments to the centers of wealth creation*” (Gibbons et al., 1994).

While this phenomenon is not unique to architecture, taking up this challenge may prove to be extremely difficult in this domain. Why, then, do we think that the situation in architecture is especially challenging? What, (if anything) is specific about knowledge in architecture? A first clue that may help answer this question is that architectural education looks different from much else of what goes on at universities (Lawson, 2004, p. 6). Around the world architecture schools show a very similar pattern: students work in the design studio on limited, yet realistic design projects tutored by more experienced designers. The studio setting, which is grounded in the traditional master-apprentice model, offers students a “transitory space” to the profession, where they learn through the practice of designing without being aware of what is learnt (Schön, 1985). The popularity of the studio format in architecture should not come as a surprise. As Nicolaas

Habraken (1997, p. 267) points out: “[o]f all the professional fields, architecture is where the virtue of a knowing-by-doing is most readily accepted by its practitioners.”

In fact, this exceptional cultivation of knowing-in-practice points to a second clue: architecture’s failure to claim a common knowledge base. Part of this failure may relate to the fact that architectural knowledge is not primarily textual, but wielded in more varied ways (sketches, plans, sections, models, photos, etc.). Architects—and designers in general—are known to think and work primarily in visual ways (Cross, 1982). Nevertheless, recent research suggests that architects also appreciate textual information during the design process (Segers et al., 2005). According to Habraken, however, the problem is not necessarily that architecture does not codify its knowledge base formally, as other professions such as law or medicine do: “Granted implicitness, [...] there should be some evidence that knowledge is shared among architects at all, because it is only by sharing that a professional knowledge base can be claimed” (1997, p. 268). And this is where the shoe seems to pinch: the architectural profession not only tends to be highly secretive, it also fails to incorporate innovative knowledge management theories and methodologies that have gained widespread acceptance in other fields.

Here a key role may be reserved for professional institutes such as the Royal Institute of British Architects (RIBA), the AIA or the Architects’ Council of Europe (ACE). As former RIBA President Francis Duffy contends, the function of these institutes in building up and disseminating the profession’s body of knowledge, and its responsibility in transmitting it to succeeding generations of architects, is becoming increasingly obvious (Duffy, 1997, pp. 177–178). Whether professional institutes can act as vital allies in sharing the knowledge available—and thus in catalysing sustainable and inclusive design—remains to be seen, yet is certainly a direction worth exploring.

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