Building? Stories
A hermeneutic approach to studying design practice

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ABSTRACT
In response to the lack of systematic study in design professions, the paper proposes an approach that empowers architectural practice and education to join forces in building a growing knowledge base of the profession. Following a case study methodology, teams of architecture students, interns and professionals engage into exploring the experience embodied by the best practices of significant architectural firms. Key to the methodology is the telling of 'stories' about active cases, i.e. building projects that are in the process of being designed and built. Stories result from interaction between the participants and procedures that guide the process behind these cases. As such, the methodology contrasts both with approaches that study cases as finished design products, and with approaches that study the process behind a case, yet squeeze it into a checklist of objectively knowable facts. In developing this methodology, we hope to provide a critical understanding of whether and how the best practices in the architectural profession can be recorded. Future research includes devising a format to represent and organize these records as a valuable knowledge resource of and for the profession.

1 INTRODUCTION

In a recent article, Cal Swann properly observes the lack of systematic and documented study in design professions: 'Case studies that have been a staple diet in the business world,' he writes, 'are almost non existing in design' (Swann, 2002:58). This non-existence definitely applies to architecture – and, more in general, to Architecture, Engineering and Construction (AEC) – which is all the more surprising given the particular type of knowledge involved in this field. Although architects may view knowledge with disdain, as a hindrance to unfettered creativity (Press, 1998) or an encapsulation of 'freeze-dried prejudices' (Rittel, 1985), this disdain does not make architecture an exception to the rule that every discipline has its own realization of knowledge (Scarbrough and Burrell, 1996). Since architecture tends to deal with unique projects, a good deal of the knowledge involved is experience-based and tacit (Woo et al., 2002).

In general, tacit knowledge differs from explicit knowledge by the degree to which it can exist independently of a specific context or 'knower' (Polanyi, 1964, 1967). Tacit knowledge only arises when knower and knowing become one – a phenomenon called 'indwelling' – as its acquisition tends to be staggered over time and rooted in experience (Grene, 1969). In architecture, as in other design domains, design is learned primarily by experience. Architects' education heavily relies on learning in action, i.e. learning through the practice of designing without being aware of what is learnt (Schön, 1983). This implicit process of knowledge acquisition is grounded in the dyad master-apprentice, both in the context of the studio setting and in professional practice. In addition, some knowledge might be gained from studying design products, yet products cannot reveal the constantly changing

conditions that actually structure the process of designing (Brown and Duguid, 1996). Indeed, 'conflicting demands from within the client organisation, the remoteness of the user, difficulties with the bearing capacity of the soil, an unsympathetic planning authority, changing circumstances during the design period, restricted or inflexible methods of financing scheme… and many more difficulties remain inscrutable to all but the most perceptible and insightful of architectural critics' (Lawson, 1990). Dealing with such changing and conflicting conditions requires a form of knowledge, c.q. knowing that is embedded within the very act of designing and thus escapes the static form of a design product (Schön, 1985).

Given this intimate relationship between knowing and designing in architecture,[1] it is hard to believe that architectural practice is not – and has never been – documented and studied more systematically. Despite the immense wealth of professional expertise embedded in design processes, there are, apart from a few isolated pilot efforts, no consistent and systematic actions to establish and maintain access to the profession's knowledge, let alone to extend its potential reach. By way of remedy for this remarkable lack, Swann proposes Action Research as an established methodology for documentation that can serve as a useful model for design.[2] Building Stories, the approach explored in the present paper, has much in common with Swann's proposal. As will be pointed out further in the paper, it sympathizes with Donald Schön's ***Reflective Practitioner*** (Schön, 1983), and resonates with the interpretative nature of design. At the same time, it adds an extra dimension to the entire enterprise: the dimension of education. For Building Stories is conceived to assimilate in design practice ***and*** education simultaneously, enabling both parties to join forces in building a growing knowledge base of and for the profession.

After motivating the choice for stories as key players in the methodology, the paper reports how the approach takes shape in a course of the Architecture program at the University of California-Berkeley. It describes the setting and procedure of the course, the results obtained, and the reactions and appreciation of students, interns and practitioners involved. The paper closes by situating Building Stories in relation to other case study initiatives and outlining directions for future research.

2 BUILDING STORIES

Key to the Building Stories methodology is the telling of 'stories' about active cases, i.e. building projects that are in the process of being designed and/or built. We use the term 'story' or 'narrative' for an account that employs verbs of speech, motion, and action to describe a series of mutually contingent events, and that typically focuses on one or more performers of actions. Choosing stories as a vehicle for the systematic study of design practice might look like dragging the Trojan horse into the walls of research. For inside these walls, storytelling is often viewed as, if not suspect, than at least disputable, and in any case of no more than secondary importance, at best useful for illustrative purposes. Stephen Denning expresses this silent, but solid view as follows:

> '*Analytical is good; anecdotal is bad. I know that the world of science and enlightenment emerged from an era of darkness where there was dependence on myth and fairy tale and anecdote. It is self-evident that we have entered the more reliable world of science and logic and verification through experiment. The greatest material progress that the world has ever seen has occurred because we have put storytelling behind us. Instead, we have built our world on the rigor of scientific thinking*' (Denning, 2001:52).

The antagonism toward storytelling, Denning points out, can be traced back as far as the time of Plato, who identified poets and storytellers as dangerous fellows putting unreliable knowledge into the heads of children, and reached a peak in the twentieth century with the determined effort to reduce all knowledge to analytic propositions, and ultimately physics or mathematics.

In architecture, mathematics and analytical propositions in general have proven very powerful in simulating, measuring and appraising the (physical) performance of buildings. Yet, when it comes to investigating the complex process that shaped these buildings, the least one can say is that their capacity is limited. Abstract analysis does not fully fit the uncertainty, the value-conflicts, the unexpected changes, the confusion, the chaos, in short the living core of what is involved in a real-world architectural project. Part of the business of designing and building undoubtedly obeys the rigour of analytical propositions, yet to reduce the living complexity of architectural practice to that part is just that – a reduction.

To appreciate the impact of this reduction, let us have a look at where the high level of complexity actually derives from. In general, complex systems can be characterized as consisting of large numbers of components, which in themselves can be simple and which interact dynamically by exchanging energy or information (Cilliers, 1998). Even if one component interacts with only a few others, the effects of these interactions are propagated throughout the entire system. When using 'systems' in a wider sense so as to include activities, tasks and processes, in short phenomena, then architectural practice obviously matches this definition. The components involved operate along at least six dimensions:

- actors: individuals or groups of individuals who make decisions about a project based on their specific values (clients/owners, consultants, contractors, legislators, local community, …)
- context: the physical setting in which the project is built, including climate conditions, region, geological constraints, site boundaries, accessibility, transportation, …
- organization: predetermined organizational structures that affect the outcome of a project (e.g. owner-builder delivery process, studio office structures, political control agencies, …)
- practices: operating procedures, use of tools, methodologies, precedent experiences, …
- program: user/client needs and requirements the project must accommodate within the given scope, time and budget
- resources: the time and budget within which the project should be realized, as well as any types of documents, tools, conditions that provide a firm with special capacities to do so.

On top of being numerous and diverse, these components are often contradictory and always highly interwoven. To make matters worse, they cannot be treated as invariants of the process since they are subject to constant change, hence the term ***living*** complexity (see frame). These constantly changing conditions make designing as tricky as juggling: 'a juggler who's got 6 balls … and an architect is similarly operating on at least 6 fronts simultaneously and if you take your eye off one of them and drop it, you're in trouble. There is a sequential development but it is on several fronts simultaneously' (Lawson, 1994:114). But suppose that, nevertheless, these connected and changing components can be analyzed mathematically. In that case, representing the results would involve at least a six-dimensional space, in which a single point would describe the state of the process at a specific time. Satisfactory as this might be for mathematical description, when it comes to communication a phase space with six dimensions is hard to visualize (Denning, 2001:111). People can instantly grasp two dimensions and, using perspective drawings, reasonably easily understand three. But as they move beyond that, even architects – the spatial visualizers ***par excellence*** – quickly find themselves in trouble.

At first glance, capturing and communicating something as complex as design practice thus seems extremely difficult. This expectation, however, is not confirmed by every day life. People manage to cope with and share phenomena of very complex a nature fairly well. The natural way in which they seem to do so is by telling each other stories. A story is not only direct, easy to read and entertaining; it respects the intricate relatedness of things, in a way that makes them easy to remember afterwards. As such, the story format provides a dense, compact way to deal with and communicate complexity in a short period of time.

There is neither need nor space to describe in detail how the mechanisms of storytelling work exactly, since this has been admirably done by Stephen Denning in ***The Springboard*** (Denning, 2001). His own stories about the

Two projects in one
In a residential neighbourhood just north of downtown San Jose, the city's Housing Department and the Parks and Recreation Department decided to create affordable senior housing, next to the rebuilt Northside Community Center. In an effort to make the housing blend better with the surrounding neighbourhood, the carefully selected team of Bridge Housing, David Baker & Partners Architects, and L&D Construction proposed integrating the separate projects by expanding the housing portion onto the air rights of the Community Center half of the lot. This would allow reducing the housing complex from four to three storeys, while still fulfilling the original requirement of 96 housing units. In the final plan, the Community Center essentially ends up being sandwiched between the housing units and the underground parking lots of the senior housing complex. The budget, schedule and responsibility were clearly separated, but because the same architect and developer would be working together on both projects, they were able to respond to one another and ultimately realize two projects in one (photo: David Baker + Partners).

World Bank convincingly explain and at the same time demonstrate how knowledge can be communicated effectively by storytelling, not so much through transferring large amounts of information, as through catalyzing understanding.[3] All that is necessary here is point out the applicability of stories to capture the wealth of knowledge and experience embedded in design practice, and to share and exchange this experience with others.

The use of the story format in architectural case studies is not new. ARCHIE, one of the first Case-Based Design Aids (CBDA)[4] for architecture, represents case studies of public buildings by various story types (Domeshek and Kolodner, 1992, 1993). Existing descriptions of the buildings – blueprints and specifications – are augmented with evaluations collected through surveys across several stakeholders. Obviously, not every part of a public building is equally interesting. Describing features that turned out exceptionally good or particularly bad by short pieces of text, ARCHIE slices case studies into three types of stories. ***Point stories*** describe how certain features of a design (e.g. separated entrances) contribute towards, or undermine some particular goal (e.g. privacy). ***Interaction stories*** discuss how features of a design case can be interpreted with respect to several design goals (e.g. privacy, security, circulation), perhaps advancing some while frustrating others. The third type, ***cluster stories***, serves mainly as a table of contents by summarizing several point stories that are located close to one another (e.g. all stories about a particular room).

Another CBDA called PRECEDENTS uses stories to store recognized outstanding cases, to teach architecture students about the spatial-organizational concepts in museum design (Oxman, 1994; Oxman and Oxman, 1994). For his purpose, existing graphical descriptions of the selected museums are clearly too large. Moreover, they do not explicitly express the concepts behind the design, which makes their interpretation entirely dependent on students' familiarity with the design or design field. Therefore each precedent is decomposed into ***design stories***. Annotated pieces of text, collected by analyzing critical writings on the museum at stake, describe a conceptual point that characterizes the uniqueness of the design.

As already mentioned, stories are central to the Building Stories methodology too. The main differences with ARCHIE's and PRECEDENTS' stories, however, lie in the moment and method of story collection, which flow

logically from the knowledge we aim to capture. This knowledge, we have pointed out, is essentially experience-based and implicitly embedded in the actual process of designing and building. In an observational study, Peter Medway and Bob Clarke have shown how the design process produces 'associated with or surrounding the actual design as its "context", a second construction, not visible in material form, but fully real to the designers as an object of their cognition, an "envelope" of ideas that are not dimensions, angles and indications of materials but that in some cases have had a powerful determining effect on those characteristics' (Medway and Clarke, 2002). If we are to develop a more profound understanding of architectural practice, our understanding ought to include this invisible cluster of criteria, intentions, values and associations, which exert a powerful formative influence on what is being designed. Once finished, however, unmistakable erosion wears down the contours of the project, by the disappearance of so many constituents in the realization of its existence. For besides construction documents, often very few records are made, and we can only conjecture what the envelope of a project may have been.

Under these circumstances, telling a story that captures the experience and knowledge that shaped the project is far from trivial, if not impossible a task. Therefore, the Building Stories approach tells stories about projects that are still in the process of being designed and/or built. Moreover, for a story to communicate the tacit knowledge and experience embedded in this process, it seems but logical that the storyteller be someone who is to a greater or lesser extent involved. Stories should reflect an understanding gathered from living within the project and its process, as experienced by the narrator as participant, not merely as spectator.[5] At the same time, telling the story forces the narrator to step back and take some distance to reflect on what is happening, as if the implicit mechanism of reflection in action is made explicit (Schön, 1983). In this way, the Building Stories technique fosters a learning attitude that both situates storytelling in and articulates critical reflection on concrete experiences of design practice.

3 BUILDING BUILDING STORIES

In light of the underlying motivation of Building Stories, the method and moment of story collection may look logical in theory. But how will the idea work – indeed – in practice? What will it mean for the average architect, the people who work in a design firm? How will it affect their working lives?

A first report from the future is given by 'Building Stories: A Case Study Analysis of Practice', an experimental course offered in the Architecture program at UC Berkeley. The course crystallizes the Building Stories methodology by providing teams of architecture students, architectural interns and seasoned architectural professionals hands-on engagement in exploring the knowledge embodied by the best practices of significant architectural firms in the San Francisco Bay area.

To this end, the course combines a guided set of activities in a case-based method of instruction. Students enrolling in the course (some of which are interns in professional practice) follow two parallel and complementary learning agendas. One provides a theoretical and methodological framework for undertaking a case study through storytelling. The second constitutes the active engagement into building one or more building stories about a selected case, by analyzing primary source documents ***and*** interacting with practitioners responsible for the project under study (and possibly construction). Through a series of weekly lectures/discussions, students and interns become familiar with the materials of the case-based method, and with the critical questions needed to explore the richness of the stories embedded in an active project, while opening a dialogue on the rigorous study of the broader aspects of the profession. In addition, teams have weekly meetings with professionals in the office executing the project. The meetings provide opportunities to discuss, clarify, and elaborate these issues as well as give students and interns a chance to discuss and evaluate the progress of their case study fieldwork.

Each case study team is composed of two students, plus one intern and one contract/project advisor from the firm designing the project. The student faction contains at least one Master of Architecture student and two

recent graduates serving as interns in an architectural practice. Professional students are given formal IDP (Intern Development Program) credit toward their requirements for internship and licensure. The contract/project advisor and other major participants of the firm receive AIA (American Institute of Architects) continuing education learning units for their involvement.

The contract/project advisor provided by the firm acts as a conduit for access to the materials for the case under study. The advisor, or any other person designated by the office, discusses key issues relating to the project that address general aspects of the profession, using the case as an example of the issues discussed. The firm coordinates access needed by the research team, including contact with the consultants and other professionals involved in the design, management and construction of the project. The contract/project advisor discusses and evaluates progress of the investigation and the structure of the case study report.

During the first seven weeks of the course, each of the research teams investigates the – up to that moment – entire history of their case, using the following categories as a guideline to organize and direct their investigations:

- project definition, clients' aspirations
- marketing process, project team organization and work plan
- design process from schematic design to construction documents
- project construction management and administration
- commissioning, measuring of project success, post occupancy evaluation
- examples of practice innovations.

The first half of the course concludes with an interim case report and presentation that illustrates the specific detail characteristics noted above. In addition, each team identifies a series of issues or threads that provide an opportunity to construct 'building stories' during the second part of the course. These threads represent themes like unique clients' circumstances, special financial conditions, or particular organizational structures that give direction to unfolding the specific 'building story.'

The first case report includes the above-mentioned topics and any unique circumstances uncovered from the investigation. The documented information is recorded in a dynamic, electronic format on the web, accessible to all team members – students, interns and advisors – and allowing immediate updating of new discoveries as the investigation proceeds.

The second half of the course concentrates on 'putting flesh on the skeleton', that is on formally constructing the details of the 'building story.' The story is developed much in the same manner as one would write a novel. The plot or thread is positioned – a failed bond issue; the characters are illuminated – the introduction of a construction advisor as the client; and the settings of the actions established – a revised firm organization to value engineer the originally proposed scope, schedule, and budget. Over the next six weeks, new chapters are added, giving meaning and understanding to the 'building story.'

The final case study report includes the analysis and conclusions produced by the team, along with the information collected during the investigation, and is posted in a digital format on a public web site. The site serves both as a repository of stories about design practice, and as a foundation for further research on the cases in future courses. So far the site features more than 22 stories about 12 different cases, largely covering the six dimensions mentioned above. Cases studied range from the San Francisco Zoo (designed by Field Paoli Architects for the City of San Francisco), the Mount Zion Outpatient Cancer Center (by SmithGroup for UC San Francisco) to the new De Young Museum (by Herzog & de Meuron in collaboration with Fong & Chan Architects for the Corporation Of the Fine Arts Museums).

The outcome of the course is as diverse as the cast involved, both at short notice and in the long run.

Throughout the course, students and interns acquire a critical understanding of the common issues and tasks in design practice, as well as the unique and special conditions resulting from exposure to a diverse set of active architectural projects in the Bay area. As a student formulates it, 'There are a lot of great things about being in the moment where decisions are made and you lose that when the building is finished.' Grounded in the everyday activities of an architectural office, the course introduces a level of realism rarely reached in the traditional studio setting.

For interns, the case study offers a unique opportunity to gain broad experience in all areas of the design process, and to demonstrate their abilities beyond wearing headphones in front of a computer day in day out. 'In the firm where I worked before,' an intern testifies, 'I never had the opportunity to really ***walk through*** a construction site, meet with consultants, being exposed to all that.'

Finally from the practitioners' point of view, the set-up equips firms to be self-critical in an entirely new and systematic way, and to reflect on and record their process of creation for further refinement. Like in Action Research, the implicit process of learning from experience becomes explicit: each practitioner involved, as well as the firm as a whole, learns consciously from the case study and thus becomes empowered through the process (Swann, 2001). One advisor especially appreciated the larger perspective provided by the case study, as opposed to the detailed, day-to-day view practitioners tend to have: 'It's beginning to start a process for myself to analyze what happened, how the project evolved, … I enjoyed going back through the documents and realize: "Oh my god, we really did this. I have to remember this for the next project!"'

In the long run, the overriding goal of the course is to contribute, however modestly, to the development of a valuable knowledge base of and for the profession. Access to a growing repository of 'building stories' will confront architecture students with the real-world complexity of design practice, while enabling practicing architects to learn from each other's experiences and, doing so, interweave continuing education with their every day activities. On a more general level, such repository may help architecture schools bridge the so-called educational gap, and enhance the body of knowledge of the profession substantially by stimulating reflection on current trends and methods in practice (Heylighen, 2003).

4 FUTURE AND RELATED WORK

In response to the lack of systematic study of the architecture profession, Building Stories has been proposed as a methodology that calls in storytelling to do justice to the full complexity of architectural practice. The methodology takes shape in an experimental course that engages students, interns, and professionals in exploring the knowledge and experience embedded in concrete projects and their processes. In developing and testing this methodology, we hope to provide a critical understanding of whether and how the best practices in the architectural profession can be recorded, understood and learned from in a more systematic way.

With about four teams participating in the course annually, we expect the repository of 'building stories' slowly but steadily to accumulate into a sizeable collection, valuable not only to the participants of the course, but also to architectural education and practice at large. For the collection to become a useful knowledge resource, however, merely providing access to a large archive of stories will not do. Instead it should provide students and professionals with a selection of those stories that are relevant to their task or topic of interest. For instance, facing a particular problem, practitioners will want not every best practice under the sun, but just the lessons of experience that are relevant to the issue they are struggling with. Future research therefore includes devising a format to represent and organize these stories in a systematic and easily searchable way.

Awaiting these future developments, let us close by situating Building Stories with regard to related case study approaches. As already mentioned, the application of the case study method to architectural design is remarkably limited, notwithstanding some isolated initiatives.

One of the earliest – and most straightforward – examples to our knowledge is the 18th century pedagogical technique of Jean-François Blondel, who made a regular habit of taking his students on weekly tours of Paris, explaining the relative merits and defects of the buildings visited. Besides the learning experience for the students, Blondel's habit brought about four enormous illustrated volumes of critical building reports (Collins, 1971:100-101).

More recently, the Vital Signs Project encourages architecture students to examine existing buildings, with attention to energy use, occupant well-being, and architectural space making (VitalSigns_Web, 2002). A set of measurement techniques, often involving novel approaches, was developed to reveal operating patterns in architectural, lighting, and mechanical systems of contemporary buildings.

The Whole Building Matrix studies cases through a totally different pair of glasses (Gardner, 1999). The approach uses semiotics, the formal discipline of signs, to determine the features buildings must have to count as (sustainable) architecture. Through a semiotic system adapted from Charles Peirce's, students analyze a building by investigating its function and environmental sustainability, but also features that present evidence of the architect's intentions, features that have unintended or surprising physical effects, the feelings and emotions the building arouses, sensations regarding its materials, and the overall art/aesthetic experience.

These approaches share with Building Stories a profound belief in the richness of concrete cases, but differ from it in that they treat the project as a finished design product, independently of the way it was designed and built. By contrast, the Building Stories approach 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 project. The teams in the Building Stories course are asked to construct a story about projects that will do justice both to project and process, both to end and means, both to the destination and the journey to get there. This purpose raises the familiar dilemma between fact and interpretation, but to neglect either product or process, either destination or journey, is likely to deform our comprehension of architectural practice.

A similar perspective characterizes the nationwide case study documentation program set up by the AIA to help improve American practice education (Malecha, 2001). The intent is to develop a new body of knowledge regarding architectural practice through rigorous preparation and publishing of case studies, for traditional as well as non-traditional projects. Like Building Stories, the approach provides both students and practitioners a context of (continued) education about design practice, grounded in the complex reality of specific projects and their processes. Unlike Building Stories, however, the AIA requires investigators to utilize a detailed Development Checklist, the most elaborate features of which scrutinize a project's delivery, services and business aspects. Stories – 'the episodes of practice' – constitute a minor feature in the checklist, and are restricted to one per project: 'Each project constitutes another story.' By contrast, Building Stories situates stories at the very core of a case study, and acknowledges the wealth of stories embedded in a single project, so as to highlight the interrelated nature of events, people and circumstances that cause it to be designed and built.

The mode of investigation that Building Stories fosters – partial involvement in and storytelling about the object under study – makes the resulting case studies as subjective as they are selective. No single story can ever reveal everything, since partial description is built into the very nature of storytelling (Denning, 2001:173). Any individual story is necessarily a subjective selection, and thus but one of the host of stories that might be told about the same project. Indeed, any project might be the subject of different stories, all of which are incomplete or inaccurate in different ways. Understanding these specific inaccuracies of a story is key to understanding its value as knowledge source.

The question then arises: What exactly is the status of the 22 subjective and selective ‘building stories’ built so far? In what frame of mind, with what intention, are we publishing these stories on a website? The answer is that we hope these stories are a first step in a profession-wide process, by which architecture firms will gradually become conscious of their own knowledge capital and will team up with architecture schools in its recording, exploitation and exchange.

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NOTES

[1] For a more elaborate discussion on the types of knowledge and ways of knowing in architecture, and their relationship to the act of designing, see (Heylighen and Neuckermans, 2000).

[2] Action Research is a participatory research methodology situated in a social practice that needs change, and proceeds through a spiral of cycles involving planning, action, observation and reflection (Swann, 2002:55).

[3] The trick of storytelling is to stop seeing communication as information transfer and to realize that people already have huge mental bins of implicit or tacit information, which can be catalyzed into a new pattern of understanding reality. Short as it may be, the story acts as a tiny fuse that establishes new connections in people's existing information, attitudes, and perceptions (Denning, 2001:82).

[4] A Case-Based Design Aid (CBDA) is a tool that applies Case-Based Reasoning techniques to support designers with cases from the past (Kolodner, 1993). The main part of these tools consists of a case base: a relevant set of specific cases stored as complete patterns of design experiences. Given a new design problem, the most relevant case in memory is retrieved, after which the user can adapt the corresponding solution to the current situation.

[5] If a story is to function as a Springboard, Denning contends, telling the story means living it, experiencing it, feeling it: "The deep feelings of the storyteller will seep into the story, and from there into the minds of the listeners, and so help take the audience to the level where deep meaning resides" (Denning, 2001:147). Only in this way will the audience in turn experience the story from inside as a participant immersed in, rather than as a kind of voyeur, looking from the outside.

REFERENCES

Brown, John S. and Duguid, Paul (1996) 'Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation', Cohen, M.D. and Sproull, L.S. (eds.) ***Organizational learning***, London: Sage, 58-82.

Cilliers, Paul (1998) ***Complexity and Postmodernism***, London: Routledge.

Collins, Peter (1971) ***Architectural Judgement***, London: Faber.

Denning, Stephen (2001) ***The Springboard***, Boston: Butterworth-Heinemann.

Domeshek, Eric A. and Kolodner, Janet L (1992) 'A case-based design aid for architecture', Gero, J.S. (ed.), ***Artificial Intelligence in Design '92***, Dordrecht: Kluwer Academic, Dordrecht, 497-516.

Domeshek, Eric A. and Kolodner, Janet L. (1993) 'Using the points of large cases', ***Artificial Intelligence for Engineering Design, Analysis and Manufacturing***, Vol.7, No.2, 87-96.

Gardner, Jean (1999) 'Teaching Because Life Depends Upon It! Matrix for Understanding Architecture'

Grene M (1969) ***Knowing and Being. Essays by Michael Polanyi***, London: Routledge & Kegan.

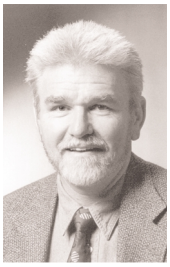
Heylighen, Ann (2003) 'A maintenance contract for the architect's degree,' ***Writings in Architectural Education,*** Leuven: EAAE (in print)

Heylighen, Ann and Neuckermans, Herman (2000) 'Design(ing) knowledge in architecture', Hanrot, S. (ed.) ***Recherche et Architecture / Research and Architecture***, Leuven: EAAE, 231-241.

Kolodner, Janet L. (1993) ***Case-based Reasoning***, San Mateo: Morgan Kaufman.

Lawson, Bryan (1990) ***How designers think***, London: Butterworth Architecture.
Lawson, Bryan (1994) ***Design in mind***, London: Butterworth Architecture.
Malecha, Marvin (ed.) (2001) ***Case Studies in the study and practice of Architecture. Development Checklist and Submission Guidelines.*** Washington DC: AIA.
Oxman, Rivka E. (1994) 'A computational model for the organization of case knowledge of a design precedent', ***Design Studies***, Vol.15, No.2, 141-157.
Oxman, Rivka E. and Oxman, Robert M. (1994) 'Rememberance of things in the past: design precedents in libraries', in Tzonis, A. and White, I. (eds.) ***Automation Based Creative Design. Research and Perspectives***, Amsterdam: Elsevier Science, 55-68.
Polanyi, Michael (1964) ***Personal knowledge: towards a post-critical philosophy***, New York: Harper and Row.
Polanyi, Michael (1967) ***The tacit dimension***, Garden City: Doubleday Books.
Press, Joseph (1998) 'Soul searching: reflections from the ivory tower', ***Journal of Architectural Education***, Vol.51, No.4, 233-242.
Rittel, Horst (1985) 'Expert design systems in design,' Statement in a seminar on expert systems at the National Bureau of Standards in Washington D.C. (referred to in Press, 1998).
Scarbrough, Harry and Burrell, Gibson (1996) 'The Axeman Cometh: The Changing Roles and Knowledges of Middle Managers', Clegg, S. and Palmer, G. (eds.) ***The Politics of Management Knowledge***, London: Sage publications, 173-189.
Schön, Donald (1983) ***The Reflective practitioner. How Professionals think in action***, New York: Basic Books.
Schön, Donald (1985) ***The Design Studio. An Exploration of its Traditions & Potential***, London: RIBA Publications.
Swann, Cal (2002) 'Action Research and the Practice of Design', ***Design Issues,*** Vol.18, No.2, Winter 2002, 49-61.
VitalSigns_Web (2002) The Vital Signs Project, http://arch.ced.berkeley.edu/vitalsigns/ (last update 09/09/2002)
Woo, Jeong-Han, Clayton, Mark J., Johnson, Robert E., Flores, Benito E. and Ellis Christopher (2002) 'Dynamic Knowledge Map: Reusing Experts' Tacit Knowledge in the AEC Industry', ***Thresholds - Design, Research, Education and Practice, in the Space Between the Physical and the Virtual***, Pomona: ACADIA, 407-411.

Biography



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Authors' brief biography

Professor **Mike Martin** is the Chair of the Architecture Department and the Undergraduate Dean of the College of Environmental Design at the University of California at Berkeley (UCB). His teaching and research focuses on the study of practice, collaborative design, work-studies of practice, and storytelling as a means of knowledge transfer. He received a B.Arch. University of Colorado, a M. Arch. University of Washington, Seattle, and a PhD. Arch, UCB. He has served as Head of Pre-Design Professions at Kansas State University, Undergraduate Dean University of Colorado, Boulder, and Head of the Architecture Department at California Polytechnic State University, San Luis Obispo. He is a Fellow of the American Institute of Architects. Served as President Elect of the San Francisco Chapter of the AIA. Served as editor of Architecture California. Received an Honorable Mention in the 2002 NCARB Prize for his Building Stories: A Case Study Analysis of Practice project.

Ann Heylighen received her M.Sc. (1996) and PhD. (2000) degrees in architectural engineering from the Katholieke Universiteit Leuven (Belgium). She is now a Postdoctoral Fellow of the Fund for Scientific Research Flanders in the Architecture Department of the Faculty of Engineering in Leuven. In addition, she is teaching assistant for a graduate course on CAAD. She worked as a Research Fellow at the Center for Design Informatics at Harvard University and in the Design Practice Group at the University of California-Berkeley. Her main areas of research are design methods, theory and cognition in general, and Case-Based Design in architecture in particular.

Humberto Cavallin – Architect, Ms in Social Psychology, and PhD Candidate (2001) and resident student at the University of California at Berkeley, Assistant Professor at the Universidad Central de Venezuela since 1992, teaching design studio and also working as a researcher for the Laboratorio de Experimentacion Espacial (LEEA). As member of the Design Practice Group (DPG) at the University of California at Berkeley, he as collaborated on several research projects on non-collocated collaboration and evaluation of software for architects, as well as participated in a multi institutional project for the developing of a case study database of design projects in architecture. His research interests include thinking and problem solving, particularly regarding the use of models for simulation and problem solving in design, as well as the study of the impact of tools, communication, and collaboration in the professional practice of Architecture.