Experts And Users

Efficiency And Accuracy In The Presentation Of Design Ideas Across Networks.

MULLINS Michael, ZUPANCIC-STROJAN Tadeja, JUVANCIC Matevz .

University of Natal, South Africa; University of Ljubljana, Slovenia.

This paper describes means to enhance projects where local communities collaborate in the design process through information and communication technologies (ICTs). Recent examples of neighbourhood-scale renewal projects illustrate experiences in the dialogue between 'experts' and 'users', and draw attention to the application of ICTs in that dialogue.

The authors' research is directed towards a quantitative and qualitative description of differences in how the general public and professionals perceive and understand architectural representations across a broad range of presentation types. Two initial studies by the authors are described. The first examines the accuracy and efficiency of architectural presentations. The second study investigates the relationship of physical to virtual environment with regard to the subjects' prior knowledge of the physical.

Analysis of the research work undertaken to date by the authors indicates an appropriate use and combination of experiential and conceptual means of presentation in communicating accurate information about spatial environments between expert and user. The analysis indicates that architectural intentions and user expectations coincide more closely through the means of experiential media, and confirms the hypothesis that there are principles that can be described to enhance their correlation.

***Keywords**. Architectural Representation; Physical And Virtual Environments; Community Participation.*

Introduction

Design and planning practice springing from theories of situated knowledge encourages the participation of resident local communities in forming the environments that they inhabit. In this regard, the possibilities offered by the internet and computer networks have considerable impact upon collaborative work patterns, and are influencing the way architecture is conceived and produced.

We will describe recent examples of neighbourhood-scale renewal projects, which facilitate the participation of residents (referred to as 'users' in this paper) in the planning process. The first of these is in the Cato Manor area of Durban, South Africa; and the following two in Copenhagen, Denmark. They draw attention to the applications of new technology, in which built environment professionals (the 'experts') have used virtual prototyping and/or other forms of information and communication technology (ICT) as representational media.

The making of models, prototypes, drawings, and simulations are the means by which experts advance their understanding and knowledge of a design problem and possible solutions to it. They are important in exploring a problem, the context and alternate design solutions. They are also the primary means by which their ideas are mediated to the end users of the designs. With wide distribution on the internet these design representations increasingly shape public expectations as well as influence the environments actually produced.

The principal difficulty with such representational systems arises from the fact that they use a given set of primitives, or language, to describe the world. "In writing a computer program, the programmer is responsible for characterizing the task domain as a collection of objects, properties, and operations, and for formulating the goals in terms of these… The program is forelimited to working within the world determined by the programmer's explicit articulation" (Winograd and Flores, 1986). Pending the development of autonomous software agents[1] (Franklin and Graesser, 1996) that may in time replace present software programmes, determinism of digital objects arises when it is uncritically assumed that the proper perceived nature of things is described by these representations of the real world. The first example of Cato Manor describes one such effect.

A dialogue, on the other hand, implies a process that takes place in a participatory framework. This means, among other things, that it is "mediated by the differences in perspective among the co-participants" (Lave and Wegner, 1991). In this situated view of cognition, "people navigate through familiar space without referring to representations" (Clancey, 1992). A situated perception does not see the environment as the array of objects that underlie digital representation, but as the context for information, identity, actions, social interaction and learning (Strojan and Mullins, in press). Relating architectural design to context therefore also invites a closer inquiry into the nature of the residents' everyday experience of their environment. The second and third examples below describe attempts in this direction.

These examples raise areas that require further research, which are described, together with the methods employed. The work discussed in this paper expands on previous research, presents new results and considers the development of means to enhance projects where local communities collaborate in the design process.

The dialogue between 'experts' and 'users'

Cato Manor

The area of Cato Manor is situated within the boundaries of the Durban Metropolitan area in South Africa, and is home to about 80 000 people (2001) with a future population estimated to be in the order of 170 000. It has at various times since its permanent settlement by colonial farmers in 1845, been characterized by subdivision, 'shack farming', and the forced removals of racial groups. The latter political intervention left the area largely vacant in the late apartheid era, until an orchestrated invasion by informal settlements in the early 1990s. Shortly after this event, and growing tensions between the 'squatters' and neighbouring formal suburbs, the Greater Cato Manor Development Forum was established as a collaborative project in which all relevant actors were invited to contribute to the area's future development. The Cato Manor Development Association (CMDA), the agency responsible for redevelopment, seeks to focus on the "stimulation of economic development and community empowerment " (Cato Manor Development Association, 2002).

[1] *For a definition and discussion of 'agent' software, see http://www.msci.memphis.edu/~franklin/AgentProg.html#agent*

However, following publication of the CMDA implementation plans, landowners formerly displaced by the apartheid regime made vigorous legal challenges against it, demanding the return of the properties to their ownership. In a mutually agreed, out-of-court settlement process, the CMDA successfully negotiated individual consensus-based agreements with each of the claimants, and were then able to proceed with the project's implementation, including community facilities and dwellings.

In pointing out that ICTs are rarely value-free, it has been recently asserted that the settlement was "essentially a GIS-driven planning exercise designed and implemented by the CMDA", and "the conflict resolution process had become a technical process, and limited in the amount of debate generated between participant and applicant" (Odendaal, 2002). A tabulation of the settlements negotiated with 446 individual claimants show results heavily weighted in the CMDA's favour, with only 5.4% of total claims deemed 'feasible to restore'. Subsequent interviews with land applicants indicated that the GIS instrument used "was a formality in confirming the 'objective' truth that was reflected in the maps produced by the CMDA" (Odendaal, 2002).

It may be drawn from this example that the information tools used had a direct influence on the mediation proceedings, and hence had spatial and cultural consequences for the built environment. The GIS presentations compiled by the developer were intended to convey an expert and persuasive narrative and, on the basis of the outcome, did so successfully. It can be argued that the descriptive language of computer generated maps, presented as objective reality, was in fact detrimental to the claimants' interests, in so far as they had a limited understanding of the language that conveyed the information, but accepted it as an indisputable mirror of reality.

Holmbladsgade: dialogue research methods

In an inner city renewal of the Holmbladsgade area in Copenhagen, the aim expressed by the architects was not so much to reach consensus in new proposals with residents as it was to facilitate the creation of new knowledge through a blending of the expert's and the resident's understanding. That is to say, knowledge that embraced the different perspectives of both professionals and residents. As such it differs in its approach to the Cato Manor study above. While the latter is driven by a rational view of development and the deterministic role of technology in a delivery-driven process, Holmbladsgade demonstrates a greater acceptance of concepts such as a community's memory, identity and sense of spatial significance.

The process had 3 stages of mapping. In step one the difference between the lived-experience of the area was considered in relation to the professional drawings created to set the scene for the architects' design intentions. Step two produced a variety of residents' views on the area by using 'dialogue' methods (Holmgren and Svensson, 2001). Step three interpreted the dialogues to reach a synthesis.

The project used innovative methods of dialogue such as 3-dimensional map interviews and photo-safaris for children as well as walk-through evaluations and picture sorting tasks. For the photo-safaris, school children were split into groups of two or three and given disposable cameras. From the resulting photographs, each group was asked to find the three 'most beautiful' places and the three 'most ugly' places and identify them on a 3-dimensional drawing[2] of the area. The children selected the best of the resulting photographs and exhibited them publicly. In reviewing these photographs, it is striking that to children significance of place, rather than physical form, is given importance (Holmgren et al., 2001).

The resultant mapping shows islands of

[2] *3-dimensional in the sense of being a birds'-eye view of the area; strictly speaking this is simulated, or representational 3D.*

homogeneity in a wholeness of complexity. The islands have their visual urban orders (Modern or Baroque for example) but the whole has complex cognitive orders of significance such as meeting places or patterns of local historical and cultural links. The tacit knowledge of the residents is analogous to the underlying structures and hidden linkages binding the inner suburbs together and giving them their identity. [3]

The synthesis of the professionals' mapping with the places pointed out by the residents encompassed the specific properties and the identity of the area. The interpretation of the dialogues resulted in a new synthesis of the general point of departure and the specific and diverse residential views. These methods entailed a mutual learning process for both the researchers and the residents involved. It represents common capacity building for future collaboration between professionals and residents, giving the latter real influence and engendering both economic interest and responsibility in the projects. The interactive and social nature of design coordination provides a more flexible process support environment in which the diverse contributions of distributed parties can be accommodated.

Nørrebro Park: the electronic neighbourhood

While the Holmbladsgade project (1997-1999) developed new methods of approaching urban renewal and public participation, a subsequent project in the Nørrebro Park kvarter (2000-2004) expands this process of dialogue between residents, professionals and authorities. Its intention is to integrate the new methods in the continuing process of urban and cultural change. 3-dimensional digital urban models had been usefully introduced to the Holmbladsgade project and had served as a common reference in the dialogue with residents. Reports from professionals indicate that these models greatly improved the users' abilities to recognise and orient themselves in the depicted buildings. In this case, methods for facilitating participatory action of residents are being further developed into a dialogue through use of a virtual urban space created on the internet (Holmgren et al., 2002). In this forum, residents are encouraged to interact among themselves and with professionals and by doing so, extend the urban topos they already experience through engagement with GIS based information systems, linked to a 3D city model. This expanded public urban space offers the opportunity to develop as a meeting place for exchange of information, opinions and for collaboration on matters regarding the regeneration process of their physical environment, and presents views and evaluations from both active and marginal groups to the politicians and professionals involved in the regeneration project.

Summary

In these three cases above, users have a lived experience of the environments under development, that is to say prior experience of the real environment, when viewing their digital simulations. It is specifically in this relation between physical and virtual worlds that further research is proposed. Networked, distance-communication of design raises questions about the media used, including: To what extent do expert intentions and user expectations coincide through the means of various media, and are there principles that can be described to enhance their correlation? In addition to qualitative, are there quantifiable differences in the understanding of spatial representations? Does prior experience of a real environment have any effect on the perception of simulations of that environment by expert and user? How can virtual representation best convey accurate spatial information between expert and user? How can education of the user best minimize perceptual variations between physical and simulated environments?

[3] Entrances, for example, tell much about the identity of the urban area. Yoshinobu Ashihara's (Ashihara, 1986) suggests that these entrances form a complex order in the apparently chaotic urban streets of Tokyo, giving the streets discreet identities and that within a mixed-use urban area there are many boundaries, not all necessarily visible. Where streets pass through these boundaries, significant "entrances" mark them.

Research

In community-based urban interventions, the first challenge facing the practitioner is to understand the existing context into which she or he is intervening. However, digital tools become, or are becoming, part of that context. Their representational character in regard to architectural spatial information will thus both interact with existing, and create new tacit knowledge of built environments in the course of their use. An enquiry into these effects must necessarily be based on the 'objective' character of the media, while bearing in mind that reality as ordinarily perceived is somewhat different from that reality conveyed by digital representation.

James Gibson has defined the visually perceived environment as "information in light". He continues: "Seeing the world at a travelling point of observation, over a long enough time for a sufficiently extended set of paths, (the observer) begins to be perceiving the world at all points of observation, as if one could be everywhere at once. Each object is seen from all sides, and each place is seen as connected to its neighbour. The world is not viewed in perspective" (Gibson, 1986). The primary distinguishing feature between real and its 2D representations is thus the locomotion of the observer – there is no frozen moment or the fixed perspective conveyed in images. This difference is compensated for, in architectural and planning presentations, by typically providing more than one drawing (plan, section, elevation) and models to communicate the design. By imparting different information in time, an approximation of real spatial experience is attempted. Real experience can here be taken as the measure of effectiveness for the representation; when seen in this way, the information transmitted in representations can be benchmarked with information transmitted by the real environment and compared for accuracy and variance.

Through empirical experience most professionals would agree that some forms of representation are more accurate and efficient than others. This hypothesis would include the advantages of perspective over elevation, for example, and the superiority of photo realistic computer renderings over conventional forms of perspectival drawing. However, internet use may include all of the above representations as scans and images, and a preliminary enquiry has been done to examine these standpoints.

The authors' research is thus directed towards a quantitative and qualitative description of differences in how the general public and professionals perceive and understand architectural representations. These will include a broad range of types, from the conceptual abstraction of sketch plans to drawings that attempt to realistically represent our experience of buildings, and will include architectural approximation of spatial experience in VR environments.

Methods

Two initial studies by the authors are described. The first examined the effect of certain forms of architectural presentations on the observing subjects. The second study will investigate the relationship of physical to virtual environment with regard to the subjects' prior knowledge of the physical.

Method 1

A series of 10 architectural images representing design proposals for a village square were presented to volunteer respondents. Each was asked a range of questions regarding the presentations. The level of conceptual abstraction and the approximation to real spatial experience conveyed by the images, served as an initial means to differentiate the presentational techniques into categories of 'conceptual' and 'experiential'.

The experiment and survey data were conducted and collected on the internet, replicating the various forms of both analogue and digital

representation presented by architects to users of design schemes in the early stages of their development. In addition to quantifiable perceptions of, for example height, distance and time required for their understanding, empirical data on the subjects' qualitative responses was also compiled.

The over 200 respondents were divided into two groups: professionals educated to create, use and deal with architectural representations (experts); and the general public who had limited experience with such representations and had to understand them in terms of tacit knowledge and everyday experience (users).

Quantifiable answers (viz. size, number) were known by the researchers in advance, giving constants to measure accuracy of response. In addition, the time taken to respond to questions was recorded. The relation between accuracy of answer and time taken to respond gives the level of efficiency of the image in conveying accurate information.

The variables analysed thus include:

- general demographic data (gender, age, degree of education, nature of education)
- accuracy of perception according to accuracy of answers to questions
- time of perception
- preference for images that assisted most in understanding and perception of the place
- preference for images used for public presentations

Types of analysis employed include:

- analysis of accuracy of answers to specific questions (accuracy of all individuals answering to the specific question)
- analysis of accuracy of all answered questions by one individual
- analysis of accuracy to direct and indirect questions[4]
- comparison of expert and user answers
- comparison of response to experiential and conceptual images

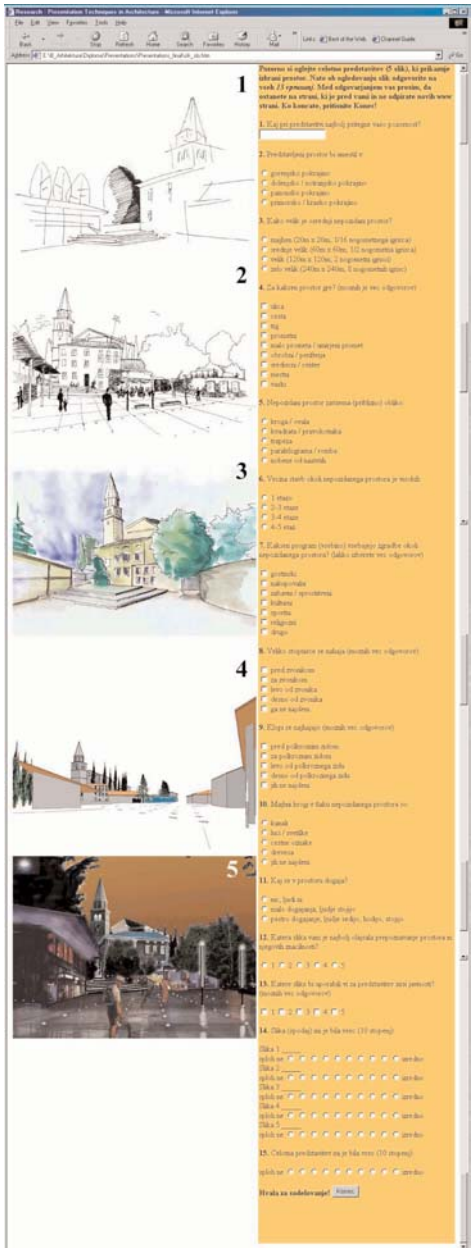

Figure 1. Images classified as 'experiential' simulate viewpoints normal to everyday perception (Source: Matevz Juvancic).

[4] Questions were grouped as either 'direct' or 'indirect': direct questions include those that involve the counting and estimation of size of objects, while indirect questions require the respondent to formulate an answer based on a variety of viewpoints and a variety of images.

question number	professional public				general public			
	indirect		direct		indirect		direct	
	experiential	conceptual	experientia	conceptual	experientia	conceptual	experientia	conceptual
2	26	18			24	19		
3			18	14			20	26
4abc			26	25			30	31
4defghi	35	35			38	54		
5			7	10			9	14
6			25	16			26	19
7	90	64			84	94		
8			25	18			28	22
9			25	15			22	18
10	25	19			27	21		
11	23	10			26	19		
number of people	28	25	28	25	32	37	32	37
index	**5,8571429**	**4,44**	**1,821429**	**1,96**	**5,03125**	**4,135135**	**1,84375**	**1,9189189**
difference experiential - conceptual	***25%***		***7%***		***18%***		***6%***	
difference direct - indirect	32%				22%			

Figure 2. Example tabulation of responses: Accuracy of answer to quantifiable questions (Source: Matevz Juvancic).

In brief, an analysis of all responses includes the following statistical indications:

- Experiential representations clearly convey information more accurately than conceptual representations to both experts and users
- experiential elicit more accurate answers to indirect questions
- experiential and conceptual convey similar amounts of information for direct questions (as counting, size, etc)
- experiential appear to contain a constant amount of information through time – time taken has little effect on accuracy accurate
- conceptual convey more accurate information in relation to time taken to exposure by respondent
- experts give more accurate answers to indirect questions than users
- experts and users are relatively equal in number of accurate answers to direct questionsexperts took longer periods of time for answers and are more accurate; users were quicker in answering – and less accurate
- experts more easily understand conceptual images than users, who generally also need much more time
- degree of education does have some influence on accuracy of answers; other demographic variables do not influence accuracy
- experts and users have difficulties in defining the geometrical shape of the presented space conveyed by experiential presentations alone, probably due to deformations of form by perspective view; conceptual presentations do not have such a problem, accuracy in that aspect much higher
- users have difficulties in reading architectural symbols, especially when conveyed by conceptual images
- the majority of both experts and users choose similar perspective drawings, which depict the subject place seen from normal eye-level, for information

Method 2

The experiments in the second study will use an existing environment, 3D digital models and virtual CAVE environments to investigate specific perceptual and behavioural references. For places and their VR representations, comparisons include the perception of height, distance, scale, light, shadow, transparency, colour, texture, sound, materials, level of detail and sense of time.

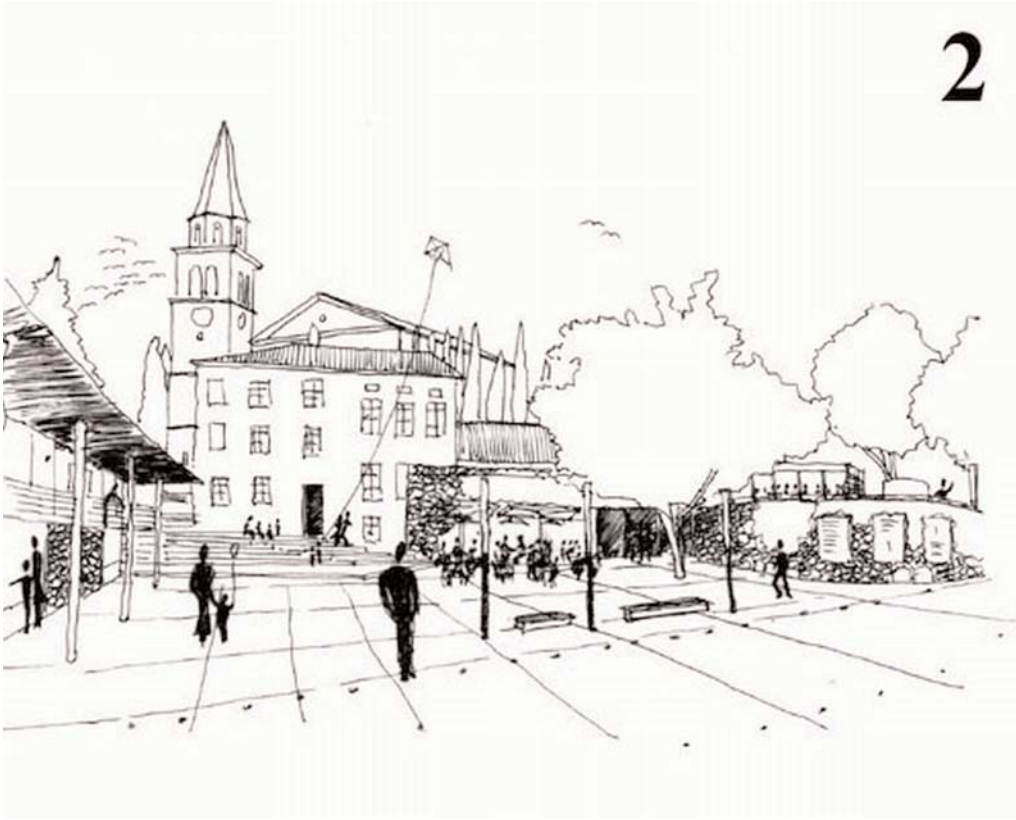

Figure 3. Picture that most experts and most users deemed to be most helpful in perception of place (Source: Matevz Juvancic).

It is thus possible to quantify and compare the results obtained from the test-groups and to assign a numerical factor of variation between them for the specific references. Further comparisons and statistical analysis can then be made between the results for the various media employed in representation.

The production of statistical data, which compares perceptions or experiences in simulated and physical environments, allows the drawing of conclusions as to those representations' accuracy in conveying the architects' intentions to the end-users. With quantifiable perceptions of physical environments as a benchmark, the degree to which having prior knowledge of an environment is important when viewing its representation indicates methods for improving the accuracy of spatial representation.

Summary

The digital medium, 'the spectacle', and VR can be assumed to be tools which will be used increasingly in the dialogue between experts and users. The focus of this paper is the improvement in this dialogue. The position taken is that the user is an equal partner in collaborative design projects. There is a need to use qualitative and quantitative methods to define the common language used by the participants, so that communication is clear and less prone to errors, erroneous expectations and misunderstandings.

The paper presents examples from recent urban renewal projects that illustrate how innovative use of information and communication technology, which facilitates the participation of residents in the planning process, shapes public expectations as well as influences the environments realised. These examples illustrate experiences in the dialogue between 'experts' and 'users', and draw attention to the language used in that dialogue.

Interpretive analysis of recent research work by the authors indicates an appropriate use and combination of experiential and conceptual means of presentation in communicating accurate information about spatial environments between the expert and user. The analysis indicates grounds for assertion that architectural intentions and user expectations coincide more closely through the means of experiential media, and confirm the hypothesis that there are principles that can be described to enhance their correlation. There are quantifiable differences between the understanding of experiential and conceptual presentations.

These conclusions form the platform for further stages of experiment in which attention will be directed to the effect of prior experience of a real environment on the perception of simulations of that environment, toward accurate and efficient communication of spatial information between expert and user.

From these experiments and data collections, it will be attempted to describe a limited set of methods toward predictable results in user perceptions of architectural representations, and to adjust and fine-tune architectural presentations to the public accordingly. In the process better control time of production and costs of presentations in connection with their effectiveness is indicated.

References

Ashihara, Y.: 1986, The Hidden Order: Tokyo through the Twentieth Century, Kodansha International, Tokyo.

Cato Manor Development Association: 2002, Cato Manor Development Project [World Wide Web]. CMDA. Available from http://www.cmda.org.za/ [cited 25th February 2002].

Clancey, W. J.: 1992, Situated Means Coordinating without Deliberation. Paper read at McDonnel Foundation, Santa Fe, N.M.

Franklin, S. and Graesser, A.: 1996, Is It an Agent, or Just a Program?: A Taxonomy for Autonomous Agents. Paper read at Third International Workshop on Agent Theories, Architectures, and Languages.

Gibson, J. J.: 1986, The Ecological Approach to Visual Perception, Lawrence Erlbaum Associates, New Jersey.

Holmgren, S., Rudiger, B., Storgaard, K. and Tournay, B.: 2001, Det Elektroniske Kvarter; En Udvidelse Af Byrummet. Paper read at Arkitekturforskning og IT, Aarhus, Denmark.

Holmgren, S., Rüdiger, B., Tournay, B. and Storgaard, K.: 2002, The Electronic Neighbourhood [World Wide Web]. Kvarterløft Nord-Vest. Available from www.e-kvarter.dk [cited 25th February 2002].

Holmgren, S. and Svensson, O.: 2001, Urban Architecture in Urban Renewal – in Dialogue between Professionals and Residents, Urban Design International, 6 (1), pp. 2-14.

Lave, J. and Wegner, E.: 1991, Situated Learning, Legitimate Peripheral Participation, Cambridge University Press, Cambridge, U.K.

Odendaal, N.: 2002, ICTs in Development – Who Benefits? Use of Geographic Information Systems on the Cato Manor Development Project, South Africa, Journal of International Development, 14, pp. 89-100.
Strojan, T. Z. and Mullins, M.: in press, The Identity of Place in Virtual Design Studios, Journal of Architectural Education.
Winograd, T. and Flores, F.: 1986, Understanding Computers and Cognition, Addison-Wesley, Reading, M.A.