Transparency In Information Architecture: Enabling Large Scale Creative Collaboration in Architectural Education over the Internet

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This paper is about networked collaboration in architectural education and about information architecture for networked collaborations. It presents results of a quantitative process analysis of two types of courses in Computer Aided Architectural Design that were taught using database-driven online environments. The main focus of the quantitative analysis is the performance of these online environments as information structures, designed to accommodate the presentation and the peer-to-peer exchange of design information for relatively large groups of between 60 and 150 participants. Using the database records to reconstruct the processes, three different quantitative analyses are described. Their results indicate that for these projects the web-environments were successful in enhancing peer-to-peer learning and that they promoted a more objective assessment of the submitted works. The study also looks at the effect that the environments themselves had on the process. Finally it draws some conclusions about these environments' information architecture: it presents tentative guidelines about how such environments must be designed to handle the dynamic display of design data, from many different authors, in a way that is transparent to the users.

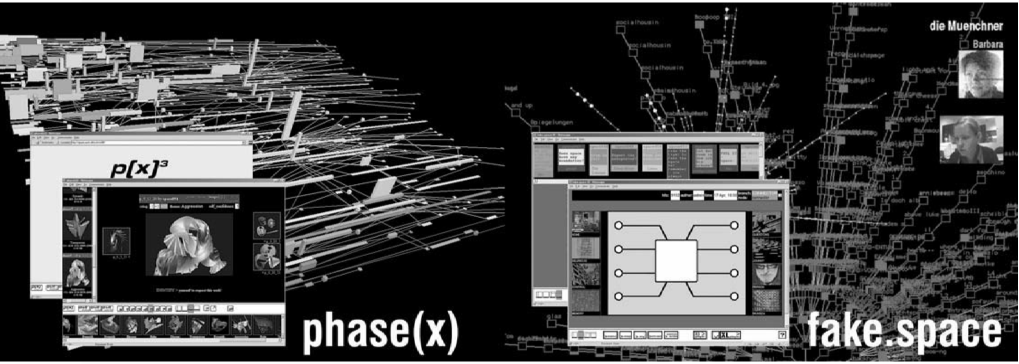
1. Introduction

Collaboration over computer networks is becoming ever more common, replacing traditional ways of working together in many fields. The promise of networked collaboration has often been pointed out: the meeting room is replaced by an information structure, which accommodates the information transfer. Through the network, this information transfer can happen almost independent of time and space. And it can be accessible to far more people than fit into any meeting room.

The early blueprints of the World Wide Web were developed at CERN in the late 1980s to enable collaboration in scientific research [1]. This type of collaboration is the classic networked collaboration: it is based on direct peer-to-peer exchange and is by definition non-hierarchical. It is referred to here as *creative collaboration*, because the goal of the sharing of insights and data in scientific research is to make progress towards a common goal for which the individual steps cannot (yet) be clearly identified. The process thus resembles a continuous, open-ended testing, rejecting or building on other people's work and ideas. While collaboration is commonly understood as the sharing of a work-load between different parties, with each party taking on responsibility for a different sub-task, creative collaboration as it is defined here must be open to all new ideas and contributions and thus must exclude any such predefined roles among its participants. Of course different roles are bound to emerge as part of the collaboration, but they can always change with the dynamics of the process and are never permanent. For well-defined or routine tasks creative collaboration is usually not the most efficient approach, but it is not only found in scientific research. Most famously, perhaps, the open source movement has applied this model of networked collaboration in their numerous projects and proven that it is not only an appropriate strategy for brainstorming and tinkering, but can also be used to develop highly dependable applications [2].

Traditional creative collaboration is also very common in architecture: design processes typically go through different stages at which preliminary solutions are presented and alternatives and problems are brought up and discussed by groups of people. Because creative collaborations also imply a continuous learning process for everyone involved, they are equally common in architectural education. Therefore it seems obvious that the architectural discipline can benefit from tapping into the collective intelligence [3] that can form through computer networks.

But networked collaboration also poses new problems. There is a widespread concern about our growing incapacity to stay "on top" of the immense amounts of data that the Internet contains. At a smaller scale the same happens in collaborative processes. Distributed creative collaboration that takes place over networks is dependent on an adequate information architecture that can enable an efficient, yet unbiased presentation of the shared content. To establish a true equality between the participants and a fair reflection of the works they contribute to the collaboration, this information architecture must have a quality that may be best described as transparency. While establishing this transparency is never a simple task, it is particularly difficult when the content is visual in nature or otherwise hard to categorize objectively, as is typically the case in design.



▲ Figure 1: Database-driven online environments of Phase(x) and fake.space (montage). Both projects were introductory courses in Computer Aided Architectural Design, taught for three consecutive years at the architecture department of ETH Zurich between 1996 and 1999.

2. Quantitative process analysis of two case studies

Various teaching projects that the author was involved in have focused on establishing creative collaboration between students and student groups. The projects, phase(x) and fake.space, are referred to here as case studies. Both were introductory courses in Computer Aided Architectural Design, taught for three consecutive years at the architecture department of ETH Zurich between 1996 and 1999 [4-6] (Figure 1). They are still of interest today, not only because they both established creative collaboration over networks in design education at a unique scale. They are also ideal objects of study, because both projects employed database-driven online environments to support and manage the collaborative processes and offer rich documentation, not only of the results but also of the process by which these results were created. Therefore it is possible to perform quantitative analyses based on their database records that allow an assessment of the collaborative process, not just the final products. This paper presents some results of a quantitative process analysis of these projects.

So what are the questions such a process analysis might be able to answer? In the following paragraphs, three questions, the assumptions they are based on, and an interpretation of the results of their quantitative analysis are described.

2.1. Did the environments enhance peer-to-peer learning?

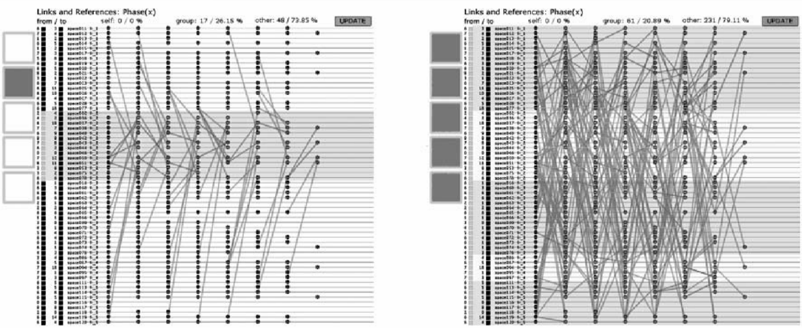
To measure the success of learning is difficult, particularly in design. A quantitative analysis of this question is only possible, when it is based on some simplifying assumption. In this case it is assumed that peer-to-peer exchange (of design information), at least potentially, equates to peer-to-peer learning. Considering how important learning from the work of others is in the traditional studio system in architectural education, this assumption seems reasonable.

Both projects, phase(x) and fake.space, are based on the exchange, that is, the linking of individual submissions of the students. As this exchange is recorded in the database, it can be evaluated between which students the exchange took place. The classroom teaching happened in two ways: a common lecture for the whole class (>100 students) and workshops for which the class was split into groups of about 20 students. These workshops in groups were led by different assistant teachers who each developed their own style, their own way of presenting the assignments and their own method of discussing the results with the students. These groups were also the units in which students would get to know each other and learn from each other much like in a traditional studio situation.

To show that the environments indeed enhanced the exchange (and thus the learning) at the peer-to-peer level the quantitative analysis has to prove that the students chose projects to develop further, or chose projects to link to that indeed transcended the boundaries of the workshop groups. If that is the case this means that the number of works the students looked at, and chose from, was not simply determined by membership of a particular group, but was expanded by the online environment to include the whole class.

Indeed the surprising result in all phase(x) classes is that there was no significant correlation between the groups and the choices. In the five groups of phase(x)3, the average percentage of works chosen from within the same group was 20.8% (Figure 2). This suggests that membership of a group was not a factor in the choices at all. The findings for the first two phase(x) courses, where there were six groups, revealed that only 16.8%, and 17.3% , respectively, of selections were within the same group. This confirms the finding from phase(x)3.

▼ Figure 2: Phase(x)3 analysis. Exchanges of designs between participants through different phases in phase(x). Only 20.89% of exchanges happened within the individual groups, which with five groups indicates that group boundaries were insignificant for the choices.



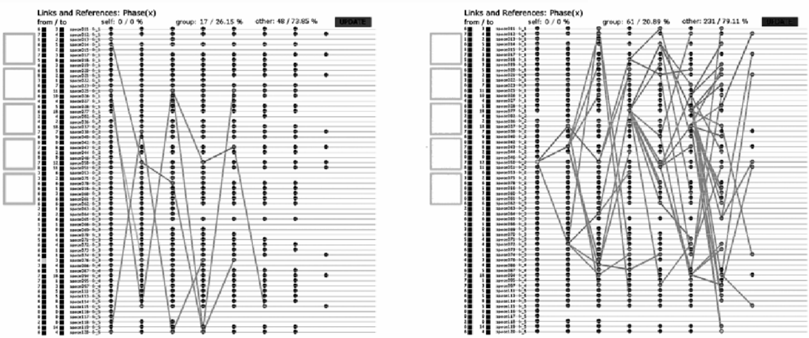
2.2. Did the environments promote a more objective assessment of the works?

The above finding confirms that the online environments were successful in creating a broader awareness of the work that was going on in the class. Rather than some showcase or control mechanism used only by the teachers, the class websites were an active part of the students' working environments. The finding also suggests that personal (subjective) reasons, like belonging to the same group, were not relevant factors in the students' choices. This could mean that the way the works are presented, means that they are perceived as detached from their authors. Such a neutralizing effect could be said to lead to a more objective assessment of the works; objective not in the sense of being rational, but in the sense of being uninfluenced by factors not directly part of the work, but by the object itself. Since authorship was always clearly attached to every work, a de-personalizing effect of the web-environment, although it was intended, is not always evident.

To verify this hypothesis quantitatively, the individual linking patterns of the participants were analyzed. The assumption the analysis was based on is that if social and interpersonal forces were not neutralized by the environments, this would lead to patterns of re-linking to the same persons' works, and, for instance, of exchanging work back and forth between the same small group of people. So the analysis had to prove the absence of significant evidence of such patterns.

The analysis of the phase(x) courses indeed shows that such patterns, although they can be found, are the rare exception rather than the rule. These patterns were detected in less than 3% of all cases and involved only a small minority of students. Since some of the patterns may have come about by accident, this supports the notion that for the vast majority of cases the criteria for the choice has only to do with the work itself, not with its author (Figure 3). Therefore according to our definition, the assessment of the works, on which the choices are based, can be regarded as objective.

▼ Figure 3: In Phase(x)3 personal selection patterns that appear to follow social reasons like exchanging works back and forth, or repeatedly taking the work of the same person were the rare exception, not the rule (left side). Here, 39 different authors from all groups contributed to the various branches that start from assignment 1 of author space050. Hence, inter-personal dynamics appear to be neutralized by the web-environments.



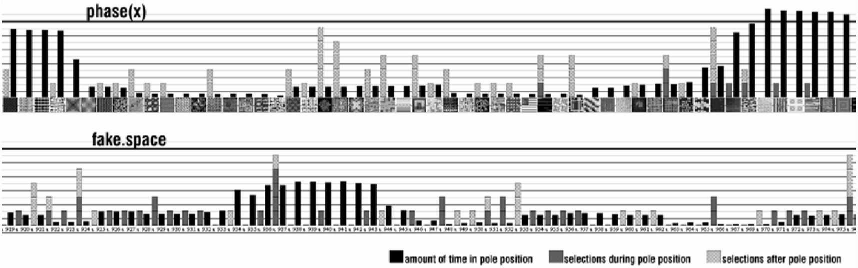
2.3. Did the environments themselves introduce a new bias?

Since the web-environments are said to have had a neutralizing effect on some of the inter-personal dynamics that could normally be expected to influence the choices, the next question is 'what types of distortions were introduced by the web-environments themselves?' Obviously there will be some, as there can be no absolute equality in the display of information. Even the best conceived way of displaying large quantities of information will not be neutral. Inequalities in sequence or positioning, due to alphabet, affiliation, time, and so on cannot be avoided, just as differences in legibility occur due to size, lengths of names, choice of colors, to name just a few. The best a designer of such displays can do is to keep these inherent distortions as small as possible and to make the reader aware of them. But that will not eliminate them.

So the question is not whether the online display of the data introduces any distortion. The question is how severe the effect of this distortion was in the case studies. As the claim was made earlier that choices of works could be made more objectively through the impersonal mediation of the website, it must be ruled out that the bias of the online display is more important for the choice than personal preference. If the bias inherent in the web environment was a strong factor, this must be considered a problem.

To investigate this question quantitatively, the influence of the default display was assessed. While various possibilities to customize and filter the listings of the works were available, the default listing (showing the most recent additions to the database first) was obviously the one most people got to see and therefore represents the strongest distorting effect of the website. As it gave a preferential treatment to the most recently submitted works, the amount of time that a submission was in 'pole position' can be expected to influence its popularity more than any other factor inherent in the web-environment. 'Pole position' is defined as being one of the last ten works accessible without clicking or scrolling – the times spent in pole position range from less than an hour to several days or even weeks.

The analysis shows that in phase(x) there was no significant correlation between the amount of time a work was in pole position and the number of times it was chosen by the peers (Figure 4). In the first fake.space project however, the correlation is significant. The most important reason for this has to do with the different content of the two classes. In fake.space people were not sharing design information, but collaborating on developing narrative threads, so it often made more sense to add to the most recently submitted end of a story than to create a new branch in the middle. Another explanation is that in phase(x) design precedents had to be chosen from the previous phase, while in fake.space participants could link to most any submitted work. Therefore the number of works to choose from was not between 50 and 150 as in phase(x), but towards the end of the project greater than 1000. Whilst various filtering and search mechanisms available as part of the interface made it easy enough to browse these works, it is not so surprising that the distorting effect of the default display is more noticeable, when the search space is bigger.



▲ Figure 4: Typical excerpts from the charts produced to analyze the influence of the default display of the case studies. In Phase(x) the amount of time a work was in 'pole position' did not influence the choice, in fake.space it did.

3. Transparency in information architecture

The absence of distorting effects of the web-environment found in phase(x) may be described as transparency (and conversely, the distortion in fake.space as a lack thereof). To avoid this distortion and to work towards developing information structures that can handle even larger amounts of design information, one may try to define what accounts for this desirable quality. A straightforward way to do this is to analyze the particular characteristics of the case study web-environments and to try to derive general rules from them.

In their book on Information Visualization, Card et al. [7] give a list of functions of information visualization that are essential in supporting the effective foraging of data as part of the process of knowledge crystallization: *"Overview, Zoom, Filter, Details-on-demand, Browse, Search query"* [7, pp. 10].

The case study environments can be said to have features that correspond to this list. They give quick overviews of all assignments, all groups, all authors, and all works. They provide functions for zooming, filtering, browsing and searching. Details about works and authors are available on demand.

The list is comprehensive and general and (although the authors make no such claims) it can serve as a helpful checklist. But it does not provide any rules or design guidelines. What is more, there are certain aspects it does not address that are relevant for the case studies. Specifically it excludes any notion of relationships between data, which, in the case studies, are essential in providing information about matters such as authorship, genealogy, groups and phases. These relationships can be seen as the structural aspects of the information.

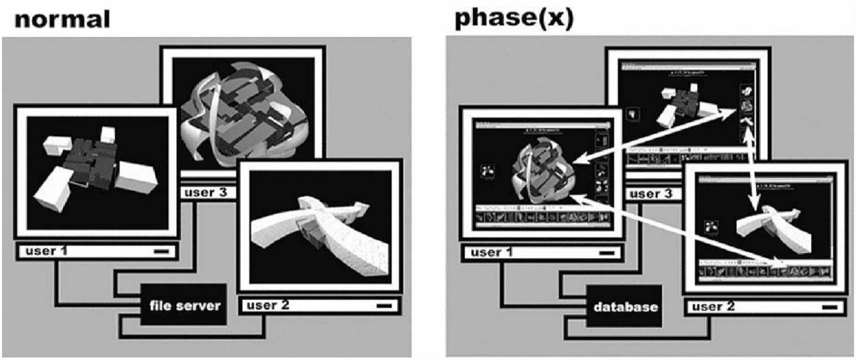
4. Patterns inherent in data

One of the three definitions Richard Saul Wurman offers for the new profession of information architect that he proposes in his book of the same name is *"the individual who organizes the patterns inherent in data, making the complex clear"* [8]. He also paints a vivid picture of why this new profession is so much needed: *"There is a Tsunami of data that is crashing onto the beaches of the civilized world."*

The organization of the inherent patterns Wurman describes has to precede the design of information displays: only when the inherent patterns are found can an overview be given, can relevant and irrelevant information be separated, can the Tsunami of data start to have any meaning for us. The structuring of information is the prerequisite to its interpretation, one might say. But this opens up a classical hen and egg problem: the structuring is in itself already an interpretation. So the structuring has to be transparent as well.

The structuring of information, as Wurman defines it, is an architectural task. Therefore it is straightforward to turn to architectural theory for hints on how transparent information structures may be defined.

▼ Figure 5: Transparency in the information architecture of phase(x). The web environment provides multiple simultaneous readings of the same information. All works can, at the same time, be read as part of a phase, offspring of a precedent or works of a particular author.



5. Phenomenal transparency

The term transparency has a tradition in architectural theory. The famous essay by Colin Rowe and Richard Slutzky [9] distinguishes between literal and phenomenal transparency. The literal or "see through" transparency is not really applicable when dealing with bits and bytes. Phenomenal transparency on the other hand is interesting. Slutzky and Rowe adapted a concept from painting and introduced it into the three-dimensional world of architecture. The challenge is whether their theory could be further expanded to become meaningful in the multidimensional realm of information architecture. Slutzky and Rowe's definition of transparency, as the condition of "clear ambiguity", can be understood as an openness of reading architectural spaces and elements as being part of multiple conceptual configurations. An equivalent of the multiple spatial readings of transparent architecture in the realm of information could be defined as the quality of providing "multiple simultaneous readings of the same information."

Looking at the phase(x) website in these terms, we find that indeed the interface possesses this quality (Figure 5): all works can at the same time be read as part of a phase, offspring of a precedent or works of a particular author. As, according to the quantitative tests described in this paper, phase(x) did display transparent characteristics, the simple formula of "multiple simultaneous readings of the same information" can be seen as providing a key to an organizational strategy to achieve transparency in information architecture. In itself this formula is hardly sufficient, though. It has to be used in conjunction with the functionalities from the list quoted above. So additional guidelines would be that the environments should support abstract overviews that allow users to visually analyze relationships between data, that should state authorship or source of any data, and that allow custom browsing, searching and filtering of information. Taken together these guidelines may be helpful in reaching the condition of transparency that we found in the phase(x) projects.

But the guidelines are not to be taken as a foolproof recipe. The real test of all these measures lies in whether they add up to form a successful whole. As the goal is to enable creative collaboration, the resulting information structure is only successful if it provides equal chances and exposure for all contributors and all contributions. Ideally the concept of providing multiple simultaneous viewing mechanisms, that is proposed as the equivalent of Slutzky and Rowe's phenomenal transparency, could form a self-regulating system of checks and balances that minimize or even eliminate the need for centralized editorial control.

The case studies show that this can be achieved for projects with as many as 150 participants. It seems entirely possible that similar environments may be developed that can accommodate even larger numbers.

6. Conclusion and future work

Computer networks have opened up the possibility for creative collaborations at an unprecedented scale. The case studies discussed in this paper successfully established creative collaboration in architectural education for groups of 60 to 150 students. A quantitative analysis based on the process records of the projects was made to test whether the information structures used to share the design information between the participants were transparent. The results indicate that the web environments did indeed successfully provide the free exchange of design information between all participants, and that they led to an objective assessment of the work, largely independent of social dynamics. The study also addressed the danger of distortions introduced by the default display of the information structure itself. While such effects could not be found in the phase(x) courses, they were present in the larger search space of the fake.space projects. Based on the findings, a set of guidelines for the design of such information structures was proposed that could be derived from the case studies.

An extensive discussion of the analysis of the case studies and the implications of its findings is under development. Presenting some tentative results of the more extensive study, the point made here is first of all that the Internet can be an environment that changes the nature of collaboration in design, among other things, by providing new ways these collaborations can be assessed and evaluated. Popular belief holds that the Internet is a perfect tool to break down all hierarchies – a view challenged by people like Lev Manovich who instead compares it to a communal apartment of the Stalin era [10]. The view expressed in this paper is that the Internet has the potential for both. Therefore we must brace ourselves against the latter by learning more about the new discipline of information architecture, which can make the difference. Making the case for the application of architectural theories to this emerging field, it also suggests that architects are well equipped to be among the designers of those new types of environments to design in.

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