What happened after the "Hype" on Virtual Design Studios?

Some Considerations for a Roundtable Discussion

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Abstract. *XThe issue of collaborative design has been elaborated extensively within the framework of previous CAAD–conferences. Today, an appreciation for traditional attitudes and methods can be observed, but interestingly, a mixture of approaches is also noticeable (computational techniques used in low–tech fabrication environments, for example). This allows for a round–table survey of the current state–of–the–art focused on experiences related to distant learning in the architectural curriculum. To make VDS viable, not only are technological solutions necessary, but so are social (among people) and professional (ways of behavior) ones. In this round–table we aim to identify critical factors of success (or failure).*
Keywords*. Education; architectural curriculum; blended learning; collaborative design; VDS*

INTRODUCTION AND SOME PROVOCATIONS

This panel will critique current patterns for the teaching of collaborative design in schools of architecture, including a review of past practices with the potential for guiding future directions. The round–table itself is limited to short opening statements so as to ensure time is allowed for the exchange of viewpoints and for conference attendees to weigh in on the issues discussed.

A pertinent issue to be regarded is whether schools even acknowledge that collaboration is at the heart of most work in practice. This is because our students are predominantly meant to work individually and pay almost no attention to collaboration. Possible solution: Starting with Day One, students collaborate while also learning to design themselves. Are we still training "star" architects or individuals, and do we assume that a good designer is also someone who can collaborate in a team?

SOCIAL ASPECTS OF THE TEACHING PROCESS IN VIRTUAL DESIGN STUDIO

We most likely have to diagnose the causes of all the hype (as well as its nature) and the reasons for the relative hush–up we are witnessing in order to answer questions concerning state–of–the–art and possible future developments of Virtual Design Studios.

Analogies

The eve of CAAD techniques usage in the early 1980s triggered a belief that computers will soon replace designers. This straightforward conviction, although quite common, was not shared by serious researchers. They were not only skeptical, but predicted different strategies for the use of computer techniques. This was reflected in the formation of an attitude relevant to design pedagogy as early as in the mid–1980s. In Pioneers of CAD (2005), Mitchell

points out the importance of students formulating design issues in computational terms rather than developing technical skills in software manipulation. Even if teachers were aware of these statements, such skills enjoyed much appreciation in the curriculums of many schools for a long time. The last decade, marked by the rapid development of widely available computational tools, concentrated mainly on the idea of parametric, and, more recently, integrated design, helped to prove this claim from twenty–five years ago to be true. All these revolutionary steps rendered some things possible (advanced process modeling, application of complex geometries, etc.), but did not eliminate the creative part of the process—always associated with designer himself. Far more sophisticated and complex technologies than those available years ago did not fulfill the predictions of those times. Design activity is of a blended nature and probably always will be.

Shifting these reflections to Virtual Design Studios - which promised not only to facilitate, but in many cases to simply enable effective distant collaboration in the early 1990s - may lead to certain conclusions. This fantastic (at that time) possibility quickly raised expectations for a completely new quality in the realm of design teaching. The social importance of it was noted by Mitchell fifteen years before Facebook (Wojtowicz, Davidson, Mitchell 1992). Such early Virtual Design Studio achievements as conducted in 1993 by Jerzy Wojtowicz (Wojtowicz 1994) were almost concurrent with the rise of the WWW, which was justly heralded as a revolution in communication. Even if we consider the Internet access speeds of those times - speeds that resulted in 1MB downloads taking about ten minutes - this was a revolutionary idea. Possibilities of synchronous communication, either text- or multimedia-based, enriched learning environments significantly. Representations of virtual worlds, including in real time, tend to simulate three–dimensional reality and thus narrow the gap between the real and virtual. But with all these advances in communication technology, there is still a gap between the two parties contributing to the process - a teacher and a student - presumably filled up by a machine. Moreover, if we build our statements on analogy to CAAD techniques usage, we should treat Virtual Design Studios as a component of the teaching process, which must be deemed of equal importance to others, including face–to–face contact, together formulating a kind of blended learning environment. It should probably be treated as a successive complementary module, rather than a radical paradigm of change in design teaching.

Master–Student Relationship

To a certain extent, the architects' profession has always been based on a master–student relationship. The sheer amount of knowledge necessary to practice architecture (most of it being procedural) justifies the need for contact with an experienced professional. The question is: What kind of contact is sufficient, appropriate, and desirable in design pedagogy? Is the form of contact mediated by distant learning environments equivalent to face–to–face meetings? There is a need for evaluation.

Direct relations during the studio hours allow for a more subtle communication process, sometimes based on beyond–verbal means. By its nature, this contact is much more continuous as compared to the discrete nature of on–line connections (even if they are real–time sessions). These on–line sessions show that both parties (teacher and student) usually tend to use connection time more efficiently, even if there is no direct time/cost dependency. Contrary – we can easily imagine the meaningful silence of the master browsing through students' drawings during face–to–face meeting. There are still many teachers who treat on–line contacts as somewhat artificial, even if they are willing to benefit from distant communication technologies. This is reflected in differences between their behavior during studio hours and in virtual contacts. Activities such as workshops are sometimes possible in physical environments only. There are certain means of communication, like sketching or working on physical models that, even

if supported to some extent by on–line systems, still perform better through direct interaction. As long as the virtual studio is so very technology–dependent there will be issues of the gap between the master and the student. The mental aspect of this gap may fade with new generations of teachers, although this matter will be discussed later.

On the other hand, there are circumstances where contacts between teacher and student are possible only via some communication systems. In this era of a globalized world everyone grasps at the opportunity to interact with global–level masters. Also confrontation of different approaches determined by various cultural conditions, barely possible on a larger scale before, are now at our fingertips.

Again, maybe a mixture of approaches to an extent as possible is the way for the future. Traditional methods of teaching (sketching, physical modeling, sensual awareness of material features, etc.) still attract significant attention that seems to be growing. This attitude to architectural creation is much appreciated by a substantial group of contemporary architects.

Socio–Cultural Context

Nowadays, students hardly remember life without Google, not to mention the WWW. Our culture took on a pictorial character much earlier with the eve of TV and high print volumes of color magazines. Today's stir, accelerated by real–time perception of simultaneous participation–in–everything, sucked all this together into an incredible whirl of mixed information of any nature and provenience. Mallgrave (2010) says after Nicholas Carr: "If the powers at Google, he offers, are attempting to perfect the search machine and relieve us of the tedium of knowing just about anything factual in the world, the down side is that we have become 'decoders' of bits of information rather than readers with the opportunity to place this information within context." There are even more critical approaches to the web–based generation of skills that are developed much more as something consumer–oriented and, concurrently, much less as something educational. Such findings, even if one disagrees with them, show some of the background of current students. The danger of being detached from physical surroundings is present and should be taken into consideration while design studio is going virtual. Most students are immersed in a constant and rapid information flow. This is something that is hard to compete with. Thus, contemporary Virtual Design Studios should offer something different. Part of this difference may be the introduction of a critical approach to contemporary socio–cultural reality. There is a strong need for such training for students, informing them of certain immanent features of computer–based representations (like lack of sense of scale in virtual environments).

All such remarks have to be made within the limits of a general attitude of appreciation of the undeniable benefits of socio–cultural advances supported (or caused) by communication technology development. The idea of the Virtual Design Studio could not have come to life outside of this realm. There is no way back and all approaches denying the importance of such methods are of a fundamentalist nature.

Another aspect to be kept in mind is the pace of these changes. When we point to the milestones that formulate the information environment, we realize that it is constantly accelerating. The idea of the WWW was born in 1992 (VDS was introduced at the same time), Google emerged in 1998, the Facebook website was launched in 2004. Thus, we measure critical changes not by generations, not even by decades. This being the case, there is a much greater possibility of a "generation gap" between students and teachers. Comparing this situation that existed two decades ago, we may claim that ten years' difference sometimes can be equivalent to a generation or even more.

Virtual design studios have always laid much stress on collaborative design. Keeping in mind architectural practice specificity (the master–apprentice relationship, as mentioned before), there is a need to place it in a larger socio–cultural context.

It is quite compelling that, with our socio–cultural formation, we have moved somewhere to the situation, where significant parts of experience and even knowledge of our students is derived from their colleagues of more or less the same age. Thus, the strategies and tools we employ should facilitate (and somehow control) peer–to–peer information flow. Such tools, already available in e–learning systems, are to be developed according to architectural education needs and recent trends (like extremely easy information sharing on social portals).

BALANCING TECHNOLOGICAL DEVELOPMENTS AND USER NEEDS

In previous work, developments in collaborative design were classified under seven major categories. More specifically, they were subdivided in nineteen sub–categories (Achten and Beetz, 2009). This categorization was based on a literature review encompassing 324 papers from the 1983–2008 period. To check the latest developments, we have extended this review to include the 2009–2011 period so as to identify the latest developments. We identified 65 papers relating to collaborative design, which were taken from 21 journals and three conference proceedings. The following Table shows the papers divided by category.

3D Virtual Environments are a steady, ongoing theme within collaborative design. The basic assumption shared by most researchers is that a 3D representation is something that is understood by all participants in the design team, and that being inside an environment helps in understanding the spatial qualities of a design (Gu et al., 2011, for example). There is less emphasis on the use of avatars to represent other design participants in some virtual worlds.

Category	Sub-category	Papers 1983-2008	Papers 2009-2011
Support	3D Virtual Environments	23	5
	Asynchronous applications	6	0
	Synchronous applications	10	0
	Comprehensive systems	31	6
	Community participation	12	1
	Tools	47	1
Methodology	Case studies	16	3
	Research methodology	20	8
Theory	Design management	23	9
	Kind of design	20	7
Model	Design modelling	10	1
	Information modelling	7	3
	Knowledge modelling	4	5
	Representations	9	0
Technology	Multi-agent systems	12	5
	Technology	25	11
Education	Pedagogical models	20	0
	Virtual Design Studios	23	0

Table 1
Publications about collaborative design in the period 2009-2011.

Asynchronous and synchronous applications seem to be disregarded, but they are more or less incorporated in the comprehensive sub–category systems. Burry and Holzer (2009) use the existing GT Digital Project to investigate collaboration, where the ValueLab (Halatsch et al., 2009), IMPROVE (Haase and Nagl, 2011), and ADVICE (Kocar and Akgunduz, 2010) are specially developed systems. Specifically, the ValueLab is developed for stakeholder support (see Kunze and Schmitt, 2010). Crosbie et al. (2011) outlined how various energy performance tools can be integrated into collaborative design.

Overall, there is major interest in the more theoretical foundations of collaborative design. Case studies are still used to understand the operation of collaborative design (see Ehsani and Chase, 2009, for example) for the use of Second Life. Research methodology involves the effectiveness of collaborative design—how to measure, compare, and evaluate it. Gress et al. (2010) focus on collaborative learning and they note that "there is … an insufficient collection of tools and measures for examining processes." Movahed–Khah et al. (2010) look at computational interaction analysis to partly automate activity analysis in collaborative design. LeDantec and Do (2009) use a Grounded Theory–based protocol analysis to investigate value–transfer between design participants.

Considerable attention is being spent on managing collaborative design. The concept of awareness (of other participants, of the process, and of team performance) is quite new (Gallardo et al., 2011, Carroll et al., 2009). Fathianathan and Panchal (2009) argue that design outsourcing and collaboration decision should also be modeled so that the ongoing process can be properly supported. A relatively new trend is large–scale collaboration, where many non–specialists are involved in the creation process (Adler and Chen, 2011, Juste et al., 2010, Fathianathan et al., 2009).

Several papers discuss the special characteristics of collaborative design. The concept is trust and how to achieve it among distant team members as stressed in Rusman et al. (2009). Ilal et al. (2009) note that there are still many hurdles to overcome before a fluent collaborative design process can be established. Juvancic et al. (2010) focus on the role of education, communication, and collaboration to achieve ongoing collaboration both in education and practice.

In order to develop tools to support collaborative design, models that these tools can use are necessary. Özener et al. (2010) demonstrate how 4D models can be used in a design studio context to enhance awareness of building realization by students. Many attempts are being made to create ontologies specific for collaborative design (Rajsiri et al., 2010, Bock et al., 2010, Fioravanti and Loffreda, 2009). Automated annotations of the design that can then be used as an information model are investigated by Hisarciklilar and Boujut, 2009 and Hsieh et al., 2009.

Ren et al. (2011) compare multi–agent systems with multi–disciplinary design optimization and aim to show where these two approaches can strengthen each other. Chu et al. (2009) show how a multi–agent system can supply various design participants with different representations of the model, given their preferences with respect to level of detail. Wang et al. (2011) demonstrate a multi–agent system in which the agents also offer suggestions to improve the performance of the system itself.

Finally, many papers deal with the technological foundations required to create collaborative design systems. Collaborative use of advanced simulation tools requires new technologies to make these instruments work (Zhang et al., 2010, Wang et al., 2010). Ma et al. (2009) show an "operation"–based multi–application oriented collaboration mechanism that can nearly achieve real–time updates among several programs over a network. Lee et al. (2010) focus on a design history mechanism to reduce redundancy and unnecessary overhead between versions. Koenig et al. (2010) present the FREAC product model to support flexibility and communication among various programs.

Although there is no longer any explicit attention being paid to Virtual Design Studios, in many cases projects in education are used to test technology or comprehensive systems. What is mostly absent, however, is reflection on pedagogical approaches. There is quite a lot of literature on collaborative learning, but this falls outside the domain of architecture as well as outside our current discussion.

BLENDED LEARNING IN THE FRAMEWORK OF THE (VIRTUAL) DESIGN STUDIO

A common characteristic of design studio teaching is established by way of "individual tutoring" in (small) groups. One design proposition after another is elaborated upon and its progress is predominantly presented verbally. Possible developmental scenarios are commented and discussed immediately following the presentation of drawings and sketches, working models, schemes and charts, etc. As the students participating in the group are working on similar or related concepts, the discussion—which is by intention open to the whole set of participants—is most likely to be advantageous for everybody.

The setting of a design studio is to be regarded as a kind of market place where information transfer is highly facilitated, striving for the further development of the design tasks. In the long term, learning activities are expected to transform information into sustainable knowledge (Garrison and Vaughan, 2007). Over the course of progressing studies, more comprehensive and complicated design themes are tackled and previously collected experiences are built upon.

Although at some educational sites the architect is still apparently stylized as a fully autonomous acting "Master Builder," today's building activities have to be regarded as collaborative teamwork with a set of hierarchically differentiated roles. Therefore, a splitting of tasks and responsibilities is on the agenda. This is, however, hard to depict within the framework of architectural education, as equality prevails among the students participating in a design studio (i.e. absence of hierarchy). Unfortunately, the key argument of creating synergies while working in groups often leads to disappointment and underperformance. There is hardly time to equipoise and a real risk is that individual team members may not input accordingly. Furthermore, it may be very hard to isolate the individual contribution. Nevertheless, it can be agreed that within a setting of architectural education, students should be able to explore and learn about communication issues.

Collaboration within the boundaries of an institution and a dedicated design assignment may be regarded as already being a demanding task, even more challenging when the singular context is expanded to include other educational sites. Besides the matter of dislocation, a shift in time may also pop up. As already stated, these phenomena have been explored extensively and were particularly boosted as a topic of study when the Internet emerged. A dedicated design issue could, for example, be tackled in a certain time slot at different sites and students would benefit from a expanded bandwidth of opinion as a result of amplified reviewing capacity. However, not only classical situations were depicted so far. Sequential procedures of generating design solutions were also tested. In this case, design stages were handed over forwards and backwards among different students.

As we have been examining a period of nearly three decades, notable progress can be observed concerning e–learning environments focused on blended learning. Blended learning is to be regarded as a didactically meaningful combination of traditional face–to–face instruction and state–of–the–art e–learning formats (Bonk and Graham, 2006). The efficiency and flexibility of computer–assisted forms of learning are combined with the social aspects of face–to–face communication. But how do virtual and face–to–face activities interlink? Blended learning means that real–world face–to–face instruction

is enriched with an additional virtual layer of tools. Teaching content may be conveyed to a consuming student through electronic means. Web–based learning platforms will, in this context, offer the following features:

- Communication media (chat, forums, etc.);
- Viewing of content, learning objects and media;
- Administration of modules (content and relevant documents);
- User administration (including the option to assigns roles and permissions).

It has to be noted, that the framework conditions of a design studio significantly differ from other non–exercise–based forms of teaching and subsequent learning activities. The intrinsic quality of face–to–face instruction probably lies in a good blend of immediacy and interaction, which is hard to trace in a virtualized context.

Notwithstanding, to a certain extent and predominantly in an early stage of the design process, the use of a mutually cultivate work space might be useful and can create access to a knowledge base, represented by way of a collectively developed analysis in form of a prospering "wiki," for example.

DISCUSSION

We have attempted to provide an overview of the developments in VDS and to raise a number of issues that in our view are central to architectural education: how to properly teach in a VDS setting, what are we teaching our students, which are the biggest bottlenecks to tackle, and how can VDS support the type of blended learning in which students and teachers alike have the biggest benefit of learning and teaching. We hope this provides a fruitful basis for the roundtable discussion.

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