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Design Collaboration Strategies

Estrategias para la Colaboración de Diseño a Larga Distancia

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Abstract

This paper explains the logistical and technical issues involved in design collaboration and how to address them strategically in projects for design, teaching and research. Five years of arranging projects, studying peer results and involving novices in exchanges point out the benefits and pitfalls of Internet partnering.

Rather than a single universal technical solution, multiple solutions exist: Technical means must be tailored to specifics concerning the task and participants. The following factors need to be considered in finding the best fit between technology and group design: 1) Collaborators' profiles, 2) Mutual value of produced information, 3) Collaboration structure, and 4) Logistical opportunities. The success of a virtual studio depends upon clear task definition, aligned participant expectations and suitable engagement methods.

We question the efforts required in the installation of expensive technologies for communication and visualization. Often technical systems support ancillary and non-beneficial activity. Matching needs and resources can be more critical than high-tech equipment. People motivated to interact will work around technical difficulties.

Resumen

Este trabajo explica los aspectos logísticos y técnicos que se encuentran en la colaboración de diseño y cómo tratarlos estratégicamente en proyectos para el diseño, la enseñanza y la investigación. Cinco años planeando proyectos, estudiando los resultados entre colegas y involucrando a principiantes en intercambios ponen en evidencia los beneficios y los obstáculos en asociarse por medio de la Internet.

En vez de una sóla solución técnica universal, existen muchas: los medios técnicos deben acordarse a los detalles específicos de cada proyecto y los participantes. Se deben considerar los siguientes factores para encontrar la mejor combinación entre la tecnología y el diseño concebido por el equipo: 1) la formación educativa y la información personal de los colaboradores 2) el valor relativo de la información encontrada 3) la estructura del esfuerzo cooperativo, y 4) las oportunidades logísticas. El éxito de un taller virtual depende de una definición muy clara del trabajo, del acuerdo entre los participantes en cuanto a sus expectativas, y también de los métodos de ejecución apropiados.

Ponemos en duda el valor de instalar equipo técnico muy caro para la comunicación y para la visualización. A menudo los sistemas técnicos favorecen la actividad auxiliar y no beneficiosa. Emparejar las necesidades y los recursos es más importante que tener la computadora más moderna. Los individuos que se sienten motivados por intercambiar ideas sabrán superar las dificultades técnicas.

1. Introduction

The availability of Internet communications makes it possible for a wide range of participants to benefit from sharing design ideas and working together. While the accessibility of web authoring, application sharing and desktop video-conferencing applications makes it simpler to communicate, getting the most utility of the exchange is not guaranteed. Our experiences with design collaboration projects have clarified what leads to vibrant and useful collaborations. This paper will explain the logistical and technical issues involved in design collaboration and how to address them strategically in setting up effective projects for design, teaching and research. The paper will explain how to tailor technical aspects to suit the task and participants.

2. Context: Sources of Observations

Observations are taken from both published papers on collaborative design (for example, Kaga, Comair and Sasada 1997, Morozumi et al 1997) and from our own experiences with architectural student collaboration projects (for example, Cheng et al, 1994, Bradford, Cheng and Kvan, 1994, Kvan 1997). The latter have taken place in a variety of settings: exchanges within a single campus, within the same city, same time-zone region and across international boundaries. The participants have variously been enrolled in design studios, digital media and research seminars in which the exchange of ideas with outsiders would be beneficial. The projects were structured to maximize sharing, building on previous virtual design studio projects (Dave and Danahy 1998).

Recent classroom efforts have engaged students in generally available media and channels, such as e-mail, web pages, listservs; with shared whiteboard, application sharing and desktop video-conferencing used for the remote partnerships. These studio-based activities have been complemented by controlled laboratory-based experiments in which subjects have used whiteboards, text chat or voice, sometimes supplemented by video communication. The range of projects used in these various settings has explored a variety of design opportunities and collaborative strategies.

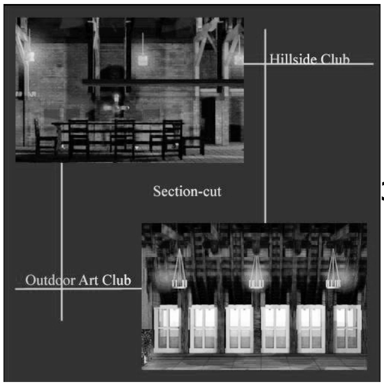

Figure 1. Student Grace Leung compared her own model of the Outdoor Art club with a model by Arief Prasasti.

3. Relevant Issues

From Virtual Design Studios, we can see what factors shapes design collaboration and use these strategically in planning new projects. In these collaborations, we bring together individuals to work on a common design task using particular digital methods for communicating design concepts.

In deciding what technologies are appropriate, we need to look at the profile of the participants, the desired outcomes and the logistics of team structure and timing.

Others have identified similar dimensions of collaboration. For example, Dave and Danahy identify seven categories, with special emphasis on the Design Brief (including site and program) which they use to promote interaction. (1998) Kalaly emphasizes that interdisciplinary teams need to have a digital P3 framework that represents the Products of collaboration (artefacts created), their Performance according to different criteria, and the Process of design. (1997) The participants' background includes their expectations for creating certain products that together satisfy their personal performance criteria. The expected outcomes are the idealized goals of the performance criteria. And the arrangement of the time schedules and team structure shape the dynamic group process. This triad is similar to a model of technologies presented in Vera et al (1998) in which it is noted that the selection of technology should depend upon the *task* (i.e. design, meeting, conflict resolution, social interaction, etc., Kalay's *Product*), *types of collaborators* (i.e. relative knowledge, social/hierarchical relationship, etc., *Process*) and *outcome measures* (i.e. quality of output, solution of problem, individual satisfaction, etc., *Performance*).

3.1 Collaborators' profiles

Figure 2. Univ. of California at Berkeley Faculty Club model by Samuel Adams (upper left) was used by Daniel Leckman in collages & animations.

Participants bring their own expertise, perspectives and objectives to a task. Within the multi-faceted world of design, team members can be trained with different sets of references and vocabularies that enrich the design process but make communication difficult. Specific to computer-supported communication, attitudes towards technology and technical preparation can facilitate or impair communication. What tools work well can depend on both experience and attitudes towards new techniques. Technical neophytes are more likely to be nostalgic over qualities of conventional design media than early adopters interested in exploring technology. Preferences for live or asynchronous media relate to the participants' working style (Kolarevic and Ng 1999). For those more introverted or prone to silent reflection, the efforts and costs associated with synchronous technologies are poorly utilized. Careful partnering can match complementary skills and attitudes for more effective teamwork. It can be postulated that design collaboration is in part a process of negotiation and, as Moore et al (1999) have noted, rapport has an effect on outcomes of negotiations. Although this is difficult to quantify in design contexts, it is a widely held belief.

Individual expectations for outcomes influence what is evaluated as a successful project. Those valuing interaction will count multiple interchanges as a positive mark. Those more efficiency-oriented, by contrast, could see frequent communications as a deterrent to individual productivity. At a certain stage of the design process, generating alternative solutions is a positive trait, but as the need for design resolution increases, introducing wide-ranging alternatives can slow-down the honing process.

3.2 Mutual value of produced information

Individual motivations need to be considered in planning the results of the collaboration. Since alliances come together because of shared goals, their intended group products should appeal to the greatest number of participants. Projects in which individuals or small groups contribute to a larger whole provide an intrinsic motivation and peer pressure for full participation. If the resulting information is useful and accessible to both participants and outsiders, such as a Web-based resource, efforts become even more worthwhile. Authors who spend long hours crafting presentations work harder knowing that their efforts will be seen. The Internet allows them to get outside feedback from professional, academic and personal audiences and critique their own work in the context of their peers'.

Figure 3. Virtual Design Studios 1993-1996 experimented with team structures.

In an example of using information as incentive, Dave and Danahy asked students to design projects for each other's location. Students were compelled to interact because each needed crucial site information from their partners. For similar reasons, we have paired students as clients for each other. In addition to reciprocal exchange, we have found that creating shared resources returns a great value for effort. At Oregon, we found sharing precedent case studies and kit of parts model components more valuable than recording early design work: the shared resources give incentive to use the web sites. We have also found that starting off design collaborations with site research to be more successful than more open-ended design collaborations because 1) the activity results in a more lasting resource, 2) individual responsibilities can be easily defined and 3) less personal investment is at stake in negotiations.

Resulting projects can be presented to reflect the teaching philosophy of the instructors. Instructors can selectively highlight quality work online or display all submissions neutrally. In the latter case, quality criteria can be discussed in class or online.

An example of team synergy took place in a Oregon Spring 2000 project for visualizing the work of Bernard Maybeck. Students were encouraged not only to share components, such as trusses, windows, furnishings and lighting fixtures, but also to work with each others' room models and renderings. They used the room models either for graphic comparisons of architectural aspects or to create fantasy compositions or animations. In sharing these products, students' high regard was evident when the most successful efforts were incorporated into other student's work. The strongest products were reused many times and contributed to the visual richness of the class's work. Weaker pieces were mercifully forgotten.(figure 1 -2)

3.3 Collaboration structure

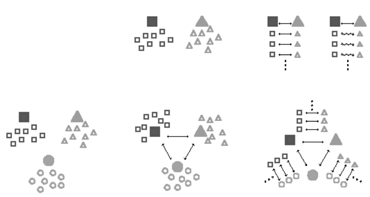

Figure 4. Simpler partnering facilitates rapport in more recent experiments

Successful collaboration is characterized by a high quality of interaction that advances joint objectives. This requires careful scheduling so that time is allotted for developing rapport An online schedule can also clarify timing of actions and expectations for deliverables.. For example, in monitoring design work, one critic had to explain when he would review the work. Otherwise, the students were expecting instant feedback as soon as they posted the work. By scheduling online interaction twice a week, he kept their expectations realistic.

Logistics of the team structure and role definition must also be considered. Group work requires careful coordination to reach a common goal and minimize redundant or contradictory efforts. To make full use of available resources, the work needs to be divided and individual responsibilities clarified. The work can be divided according to time (sequential turn-taking), location (separate territories) and team structure (roles), or a combination of the above. (Wing 1999)

The Virtual Design Studio project began in 1993 with students working in parallel from different locations. When we first tried teams spanning different schools, we had difficulty establishing strong collaboration. In the most successful teamwork of 1995, after an initial charrette, the team split the work by site and program. In spring 1996, assigned students to complementary roles so that their contributions would have less redundancy. We gave foreign students a local contact for designing a Monument to Hong Kong's 1997 changeover and we put programmers and designers together to facilitate use of the Web. (figure3)

The logistical difficulty of working with many schools lead us subsequently to simpler partnering arrangements. We have arranged a number of two and three school collaborations in which students only have to deal with one partner (fall 1996, spring 1997) or one local partner and a remote pair (spring 1999). Within the short time frame of several weeks available for most of the projects, participants find it easier to create a working relationship with just one or two remote partners. With fewer partners, tasks and roles can be parsed more casually and results can be coordinated more easily.

While the international work did not allow face-to-face interaction, local work has confirmed others' findings that face-to-face meetings much improve the rapport achievable with computer-supported interactions and accelerate the trust-building process. (Tang and Isaacs 1993, Morris et al 1999).(figure 4)

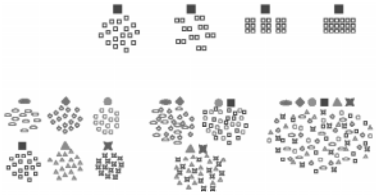

Figure 5. Progressive collaboration eases into large group interaction.

To ease the process of large group team dynamics, progressive collaboration can be used. In progressive collaboration, individual efforts are consolidated into larger and larger groups, allowing relationships to form gradually over time and special abilities to come to the fore. (Wing 1999) We did this in Fall 1999 when five sections of second year design students at Oregon shared responsibilities for documenting the downtown area of the small city of Corvallis, Oregon. Each student was responsible for contributing to a type of site documentation (physical model, digital drawings) and Web reports about a particular theme. Within each class, there were team leaders for the models, the drawings and the Web. Within each class, the subgroups worked on documenting one block of the site and researching the theme of their report, afterwards submitting them to class leaders to be consolidated onto the Web. From the results, students could download dimensioned drawings in either raster or vector form and read about aspects of the city (i.e. outdoor space, uses and users, etc.) (figure 5)

3.4 Logistics

While collaboration is easiest if schedules, objectives and participant backgrounds are similar, an exact match is neither likely nor necessary. Even small amounts of computer-supported engagement can be valuable. Creating partnerships that vary from casual, low-investment critiques to highly structured technology-intensive interchanges can expose students to a spectrum of design perspectives and collaboration possibilities. Shared interests and agendas start collaborations; logistics of time, equipment and support shape the actual form of collaborations. In practice, differences in schedules, methods and agendas can limit the duration and scope of joint projects. For scheduling conflicts with other schools, we have found that a short phase of intensive interaction can be enriched through preparatory or follow-up asynchronous phases done at the convenience of each party.

In the case of the Maybeck project, Oregon students received input from a Maybeck scholar/builder in the region, local architectural and computer graphic experts, and their peers at the University of Washington. Students' inter-school exchange was limited to peer Web site critiques and shared model components due to scheduling conflicts that prevented live video exchange. Instructors shared educational resources such as scans of original drawings and digital design resources. In this situation, e-mail critiques allowed ideas to be diplomatically worded and the relative anonymity provided the benefit of a level playing field. With a very low level of technical investment, students at both sites benefited.

We anticipate that as telecommunications technology becomes more ubiquitous, opportunities for low-threshold projects will become more common across the curriculum.

4. Tuning Technology to Fit

In determining what technology will be employed, a task's complexity and how it involves site, form and program all shape what tools work well. Technical tools are tuned for the representation of particular parts of the design process and particular content areas. For example, cultural meaning is easily delved in detail with text and still images, whereas composition questions can benefit from dynamic interaction with graphic elements. Text-based methods fit smoothly into many aspects of the design process because of their ease of use. The act of articulating designs from graphics into words encourages thoughtful reflection. (Kvan 1999).

Different phases of a project need different kinds of support. In the earlier phases, ambiguous phrases and sketches stimulate consideration of new possibilities. In construction detailing, the need to carefully examine proportions and assemblies and produce detailed construction documentation steers the project more towards CAD vector representations.

Live techniques such as video-conferencing and application sharing allow spontaneous interaction. By supporting direct interchanges, video-conferencing supports a level of familiarity unavailable through other means. Live discussion can bring faster or different resolution to issues that would otherwise take many e-mail exchanges (Tang and Isaacs 1993, Morozumi et al 1997, Morris et al 1999).

Synchronous interaction in video appears to provide no positive contribution to the design product itself when compared to text. Especially for visual tasks, seeing non-verbal responses of partners is less crucial than responsive audio accompanying shared task graphics (Dave and Danahy 1998, Tang and Isaacs 1993, Gabriel and Maher 1999). When audio and video channels are available, they are often filled with extraneous communication (Vera et al 1998).

Simpler asynchronous methods can be very suitable for group work. Work gets done when individuals are tackling tasks, not when they are in meetings (Poltrock 1999) and asynchronous methods allow individuals to work at their own pace without interruption. Indeed, graphic images can, at times, constrain exploration of design solutions when compared to text only (Kvan Yip and Vera 1999). In comparing face-to-face, text and audio/video design collaborations, both content and attributes of interactions are influenced by the medium of exchange (Gabriel and Maher 1999)

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Because live methods are dependent on available bandwidth and do not demonstrably provide much benefit, our use of these methods have diminished. Low-cost IP video-conferencing has been disappointing due to the variability of the network bandwidth. ISDN video-conferences have been too expensive for spontaneous interaction, limiting their use to more formal scheduled sessions. Lack of spontaneous access to quality audio and video has limited our ability to evaluate its utility over an extended project. As improved compression algorithms and the faster connections such as the Internet2 may make IP conferencing more viable we need to consider how best to allocate the bandwidth.

5. Conclusion

Many institutions are undertaking to support distal collaboration in design, either in teaching contexts or professional offices. Typically, these efforts proceed with the installation of expensive technologies for communication and visualization. Our experience in teaching virtual studios and related research suggests that setting up the scenario with people whose needs and resources match can be much more important to a successful collaboration than high-tech equipment. People who are motivated to interact will work around technical difficulties. Often technical systems support ancillary and non-beneficial activity. The success of a virtual studio depends upon the definition of the task, the expectations of the participants and methods of engagement.

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