

# BEYOND THE BOUNDARY OBJECT: SKETCHES, COMPUTER GAMES AND BLOGS FACILITATING DESIGN DEVELOPMENT

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**Abstract.** Developing Frosts' understanding of Leigh Star's (Star 1989) concept of the boundary object this paper seeks to answer the question "would multiple boundary objects employed simultaneously facilitate design development?" The paper reflects on and critically reviews the design, implementation, and outcomes of a first year Architectural Design course that privileged architectural representation in the form of design sketches, blogs and contemporary computer gaming technology. The review process is supported by an in depth survey of students experiences both prior to and during the course. With a large number of students enrolled in the course (158) the findings from this survey can be seen to offer a statistical reliability which is in contrast to the more usual anecdotal approach.

**Keywords.** Boundary Object, Generalist, Specialist, Sketch, Computer Game, Blog

## 1. Introduction

Frost understands Leigh Star's (Star 1989) concept of the boundary object as "a material object that facilitates the coordination of scientific work" because they can be simultaneously read by generalists and specialists. Even though the focus of their mutual attention may be quite different the boundary object allows the generalist and specialist to come together for "some common endeavor".

A first year architecture student shares many attributes with the generalist but in contrast to the generalist their goal is to become a specialist. In this way they could be considered an 'aspirational generalist' who employs a boundary object to facilitate between points of view within their own thinking to arrive at a decision (i.e. in an internal dialogue between the generalist and developing specialist aspects of their knowledge and methods of production).

Frost identifies the "design sketch" as a boundary object. In previous work the author has identified the real time visualization and simulation that is facilitated by contemporary computer gaming technology as a second example of a boundary object. One could cite Web 2 technologies and cultures, such as Google's blogger, as yet another example. This suggests

that there could be many examples of boundary objects and a consideration of this promoted the question, “would multiple boundary objects employed simultaneously facilitate design development?”

An attempt to answer this question was fundamental in the design and development of a first year architectural design studio course for 158 students. The students were introduced to three boundary objects; the design sketch (using the section, axonometric, perspective, and two dimensional textures), the computer game environment (Unreal Tournament 2004, the Unreal Editor and Google SketchUp), and the Web Log or “Blog” (using Google’s “blogger”). While particular aspects of the architectural design process were brought into focus by each boundary object the course attempted to extend and overlap the reach of each object so that in many parts of the architectural design process students were engaging with multiple boundary objects at once.

In part the resulting equivalence of use and overlap between boundary object recognizes and attempts to avoid Hanna and Barber’s previous findings “that the more one medium is used (e.g. conventional) the less we will be positive about the other (e.g. CAD) and vice versa” (1998).

This paper reflects on and critically reviews the design, implementation, and outcomes of that course. The review process is supported by an in depth survey of students experiences both prior to and during the course. With a large number of students enrolled in the course (158) the findings from this survey can be seen to offer a statistical reliability which is in contrast to the more usual anecdotal approach.

## **2. Beyond the Boundary Object: Student Survey**

The survey, entitled “Beyond the Boundary Object”, was conducted with first year students completing the Architectural Design Workshop in the last week of scheduled class time, October 2007. Due to unforeseen circumstances the survey was handed out in two parts; this resulted in 117 responses for sections one to five and 101 responses for section six. All responses were anonymous.

The survey comprised of 16 questions in six sections. The sections were titled (from one through to six); Design Sketch, Computer Gaming Technology, Web 2.0 Technologies, Networks, Comments, Design Development. The logic for the first three sections comprised using question A to establish the student’s experience as a generalist before studying Architecture at university; question B to establish the student’s aspirations towards specialization that occurred before studying Architecture at university; and questions C and D to establish the facilitation of design development through their use of multiple boundary objects. Section four looked at the blogging network set up as a part of the course to establish the rate at which other students work facilitated their design development (contrasting with the first three sections where the focus was on self reflection). As a part of the courses assessment the student’s created blogs

(on [www.blogger.com](http://www.blogger.com)) which *re-presented*, among other things, the ongoing design development of their scheme (the notion of re-presentation is used here rather than illustration to allude to the developmental aspect of the students blog that is described later). The students blogs were publicly available which meant that the students had 24/7 access to every other student's blog. Section five invited the students to make comments regarding any of the other sections. Section six sought to establish the student's perception of the order of importance to design development of each boundary object (in other words the relative levels of decision making of each boundary object).

The wording of the survey connected design development explicitly with decision making. While the author acknowledges a major contribution to the design process is tacit the intention of the survey was to focus on contributions to the design process that were quantifiable (the fact that the class was so large added a particular weight to this approach; affording the advantage of statistical reliability).

### **3. The Student as an Aspirational Generalist**

A key aspect of the notion of a boundary object is that they bring generalists and specialists together. In the case of an Architectural design course one would expect those people to be the student and their tutor or course coordinator, and in some cases possibly their classmates. One of the hypotheses of the survey was that first year Architecture students bring together aspects of both generalists and specialists (in a way I've called an Aspirational Generalist) and in doing so would employ boundary objects to facilitate between points of view within their own thinking to arrive at a decision. To determine whether multiple boundary objects facilitate design development within the thinking of these individual students one first needs to establish that certain parts of their knowledge, aptitudes, and skills reflect a generalist and certain parts of their knowledge, aptitudes, and skills reflect a specialist.

Questions 1A, 2A and 3A connected notions of drawing things that existed in the world, playing computer games and visiting websites as things reflecting the knowledge, aptitudes, and skills of a generalist. Questions 1B, 2B and 3B connected notions of drawing things from imagination (or making a "design sketch" following Frost), modifying computer games, and adding content to websites as reflecting the knowledge, aptitudes, and skills of an aspirational generalist.

While the author acknowledges that an absolutely average student doesn't exist the following paragraph attempts to broadly articulate the experience as both a generalist and aspirational generalist of this cohort of students entering studies in Architecture.

Previously to studying Architecture at university the average student in this survey would make 2.5 sketches every week. One of those would be of the things around them, portraits, landscapes, still life's etc. The greater

portion of their drawing (up by 50%) would be of things representing their imagination. The average student had played only two from 21 of the games on a list of most popular games to modify (prefacing section two) but had modified one of them. They had visited between 3 and 4 of the top 30 most popular sites on the internet that are defined by social networking, sharing content and collaboration and added content to two of them.

Looking in finer detail we see that only 6% of students were drawing things in the world very frequently (four times a week or more). In terms of drawing from their imagination we see almost three times the amount of students were making design sketches very frequently. The number of students who were making design sketches very frequently is still quite low with respect to the whole group, with the ratio being 1 in every 6.66. Excluding the less than once a week category there is a clear margin between the students who made design sketches (62%) and those that made drawings of things around them (48%) at . In other words the students were drawing to create rather than to observe or record. This supports the notion that the students were aspirational generalists with regard to sketching.

Moving on to section two of the survey it's interesting to note what seems to be a high rate of computer game modding amongst students intending to study Architecture. While there are many sources of information available that describe the key metrics of PC and Consol Video Game usage (such as game title ranked against the average amount of minutes played per week, Nielsen GamePlay Metrics, <http://www.nielsenmedia.com/> : June 2007) the author has been unable to find data that describes the rates of computer game modding within the game playing community. Against this limited background it would still be very surprising to find that in 2006 the average computer gamer is modifying 50% of the games that they play. This is about to change. In an article reviewing a conference presentation by Phil Harrison (Sony Computer Entertainment) David Radd summarizes Game 3.0; "Game 3.0 takes connected consoles to a new level by leveraging online collaboration and user-generated content" ([http://www.businessweek.com/innovate/content/mar2007/id20070309\\_764852.htm?chan=innovation\\_game+room\\_top+stories](http://www.businessweek.com/innovate/content/mar2007/id20070309_764852.htm?chan=innovation_game+room_top+stories): March 2007). He goes on to note that "Sony was influenced by the ideas put forth by web 2.0 – sites such as MySpace and YouTube that are driven by user-generated content." For now though the seemingly high rate of game modding by students intending to study Architecture supports the notion that the students are aspirational generalists when it comes to real time visualization and simulation.

In contrast to the small proportion of moddable games played by the average student they had visited approximately a third of the social networking and content sharing sites on the list prefacing section three (Web 2.0 technologies). By adding content to two of them it seems to suggest, as the list can be split into two broadly similar groups, that the average student had reviewed different opportunities for each type of service and settled on the most suitable for them.

As these sites are amongst the most popular sites on the web the corresponding high usage rate by the average student intending to study Architecture puts them firmly within normal patterns of internet use. That the social networking and content sharing sites chosen by the author occupied the intersection between those types and the internet's most popular sites exposed a weakness in the formulation of question 3B and as stated above makes it impossible to differentiate between general and more specialized use. In short it seems that to be an aspirational generalist with respect to web 2.0 technologies in 2007 the average student intending to study Architecture might have to be *creating* wiki's, forums and file sharing facilities rather than simply *using* several of them. By extension this suggests the possibility of implementing the creation of web 2.0 technologies/cultures by students within future iterations of the course.

#### **4. Facilitating Design Through Multiple Boundary Objects**

Questions A and B of sections one, two and three would determine whether students intending to study Architecture could establish an internal dialogue (between their generalist and specialist attributes) and therefore be *capable* of using boundary objects within their design thinking. Questions C and D of sections one, two and three addressed the facilitation of design development by using multiple boundary objects during the study of Architecture. The hypothesis of questions C and D was that the simultaneous use of multiple boundary objects affords different points of view and in doing so facilitates design development through highlighting areas of extreme ambiguity. Stacey and Eckert (2003), have spoken about the "myth of beneficial ambiguity" in design, and have said that "communicating imprecise, uncertain and provisional ideas is a vital part of design teamwork, but what is uncertain and provisional needs to be expressed as clearly as possible." Going into detail about how multiple boundary objects facilitate design development will be the topic of a future paper but for the purpose of this paper the author has taken the number of decisions made by students as a measure of their attempts to address or resolve ambiguous aspects of a design proposal and, consequentially, constitute design development.

In the images below we see the application of sketch textures within a game environment and sketch perspectives that interrogate the orthogonality of spaces and objects through the mapping of the textures over their surfaces.

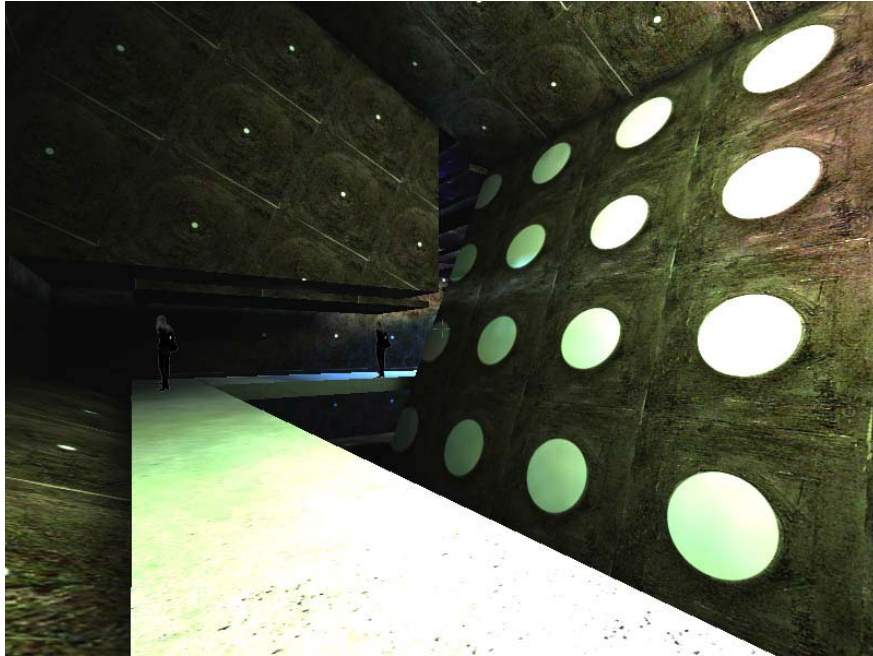


Figure 1. Image captured from UT2004 by Alfie Arcuri (<http://alfiearcuri.blogspot.com/> )

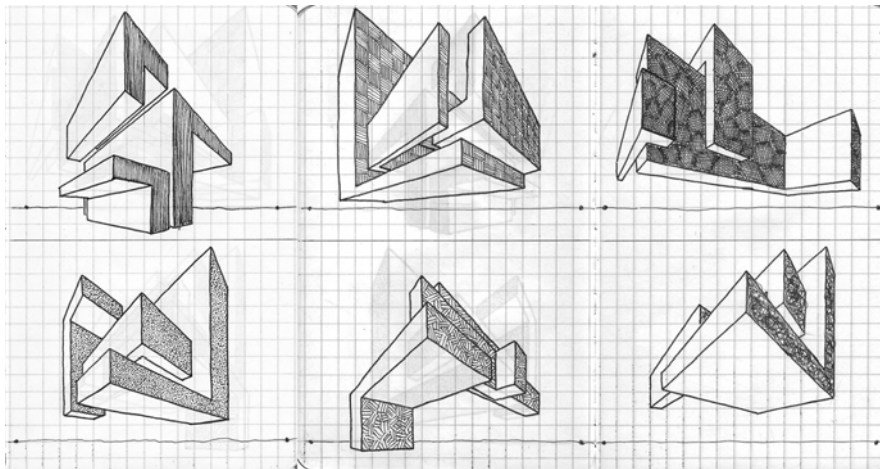


Figure 2. Sketch perspective by Carolyn Cheung (<http://www.carolyncheung.blogspot.com/> )

Please follow these links to more examples of student work from the course (select the full 2007 archive to see each students work from the entire course): <http://www.russellowedotcom.blogspot.com> where you will find links to the authors students as well as links to the blogs of the 11 tutors involved in the course, and their students, notable examples include <http://www.liang-zhu.blogspot.com/> <http://www.manusleung.blogspot.com/> and <http://sharicheung.blogspot.com/>

Returning to the ARCH1102 average student we find that their sketching influenced a decision with respect to their UT2004 environment almost twice a week but only influenced a decision with respect to their blog half as much. Their UT2004 environment influenced a decision with respect to their sketching 1.5 times a week and their blog just over once every week. Their

blog influenced a decision with respect to their UT2004 environment and their sketching just over once every week each. Adding these up we find decisions made while working within one boundary object that were influenced by work made within another boundary object were occurring at the rate of 7.5 each week, or 90 decisions over the 12 week semester. From a purely quantitative basis the most productive influenced flowed from sketching towards the UT2004 environment, with a little less (but still significantly more than between other boundary objects) flowing back in the other direction.

While flows of influence from sketching to more complex forms of representation follows accepted thinking (Verstijnen, Van Leeuwen et al) the author would argue that flows in the reverse direction (at the rate of 1.5 times a week) substantiates claims that these two boundary objects, at least, were indeed working with a level of synchronicity.

Looking at the results again we find 91% of students found their sketching influenced a decision with respect to the students UT2004 map at least once a week, with 77% of students finding the influence flowing in the other direction. To further challenge the accepted directions for flows of influence the survey found that more students sketches were influenced by their blogs than blogs by their sketches (73% to 66%). Second overall in the rankings of influence was the blogs relationship to the UT2004 map with 81% of students finding that the blog influenced a decision with respect to their UT2004 map at least once per week. The decisions flowing from the students blogs strongly implies that a productive re-reading of the real time experience of the students UT2004 maps was occurring based on two dimensional images captured from it. In other words overlapping boundary objects have brought into focus high levels of ambiguity and in doing so highlighted where decisions can or should be made (once again detail on this will be elaborated in another paper).

## **5. Boundary Networks**

As stated above the contrast between section four and the previous three sections revolves around design development facilitated by the examination of other students work as opposed to self reflection. In this section the average student visited another students blog between two to three times per week. They very rarely added comments to it (86% of students said less than once per week) but still found the visit influenced a decision made in their sketching, UT2004 map or own blog between once and twice a week.

Looking closer we find quite a large number (35%) were visiting another students blog four or more times a week. Excluding the less than once per week category we find that 93% of students visited another students blog at least once a week with 74% of students making a decision with regard to their sketching, map, or blog that was influenced by another students work. The author has encouraged students to critically examine the work of other students many times in the past but in this case the use of a blogging network has radically transformed their ability to do so. The class of 158

students was divided into 12 groups for the studio workshop component of the course. These tutorial groups occupied 10 separate rooms and ran concurrently. As such there was little chance for the students to physically sight another students sketches and as the digital components of their design work were completed outside of this scheduled time no opportunity at all to view those in person. The advantage of the blogging network was that it afforded anonymous, and presumably unselfconscious, 24/7 access to the developing design work of their cohort (students were required to update their blog at least once per week). In addition each students blog linked to Google 3dWarehouse (to store and share their sketchup models), YouTube.com (to store and share animations from sketchup) and FileFront.com (to store and share computer game maps and textures).

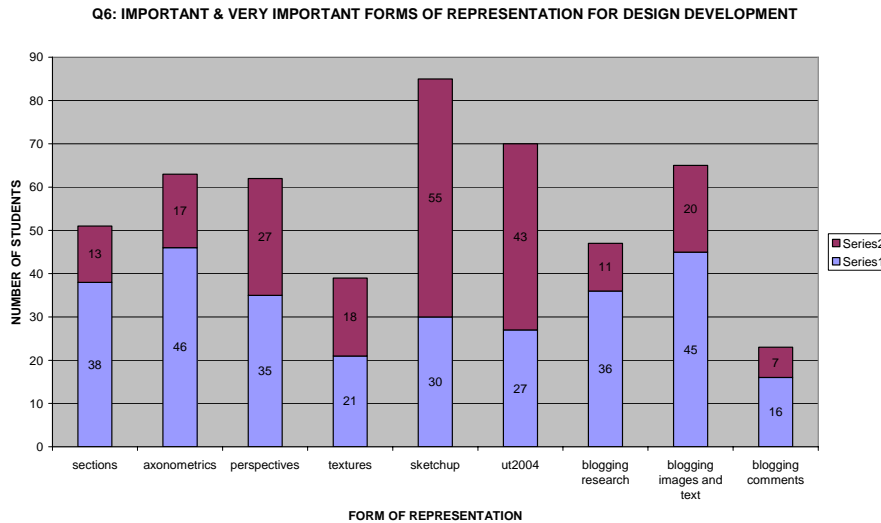
That the students did not take advantage of the ability to leave comments was disappointing but might be explained by the default position within Blogger that does not allow a visitor to leave anonymous comments. In future iterations of this course the author will require students to revise those settings so that it is possible to comment anonymously. The goal would be for a much, much, higher uptake in making critical commentary. With 93% of students visiting another students blog once or more a week the students realized that they could and were influencing other students without knowing exactly who they were influencing. In this way the boundary object facilitates work between virtual teams. One student commented “blogging is a good (central) way to present information and making it accessible to a large number of people. I imagine this will be especially valuable in professional group work”.

## 6. Relative levels of decision making for each Boundary Object

Responses to question six could range from “not important” through “of average importance” to “very important”. Table 1. combines the responses for “important” (series 1) and “very important” (series 2). Linking importance to design development with the form of representations ability to facilitate decision making (following W. Abdelhameed, among many others) allows one to make connections between importance to design development and the influences flowing between boundary objects. One such connection is to propose that the greater rate of influence from Sketching to UT2004 than the reverse (i.e. 2 times per week as opposed to 1.5 times per week for the average student) serves to increase the perceived importance of the *influenced* form of representation over the *influencing* form of representation.

Table 1. below shows responses to the question “How important were each of the following forms of representation in terms of developing your design?”

TABLE 1. Responses to question six; Beyond the Boundary Object Survey



## 7. Conclusion

While students were clearly aspirational generalists in terms of their sketching previously to studying Architecture at university it is not so clear in terms of Computer Gaming technology and Web 2.0 technologies. With respect to computer gaming technology the lack of figures for rates of modding amongst gamers prevents definitive claims, but once again it would be reasonable to expect that the rate is no where near as high as 50%; supporting the assertion that the students were aspirational generalists with respect to computer gaming technology. It has become clear that the test in this survey to qualify as an aspirational generalist in terms of Web 2.0 technologies missed the point that if a person used the internet then they were most likely using Web 2.0 technologies. In hindsight the question should not have asked how many forums (etc) they had contributed to, but how many they had *created*. The survey showed that the average student made 90 decisions that were influenced by work they had made within another boundary object over the duration of the course. The author proposes that rate of that influence serves to increase the perceived importance by the students of the influenced form of representation over the influencing form of representation. That there was a decision influenced by work made within another boundary object at least once per week in every case offers some explanation as to why students believed that all forms of representation in the course (the only exception being blogging comments) were above “of average importance”. This supports the assertion that multiple boundary objects employed simultaneously facilitates design development.

Note: The full survey, Excel spreadsheet of results and further links to student work, the course outline etc. is available at <http://www.russellowe.com/publications/caadria2008/caadria2008.htm>

**References**

- Abdelhameed, W.:2005, SIGraDi 2005 – (Proceedings of the 9th Iberoamerican Congress of Digital Graphics) Lima - Peru 21-24 November 2005, vol. 1, pp. 478-482
- Barber, T. and Hanna, R.: Appraisal of Design Studio Methodologies, Proceedings of the third conference on Compute Aided Architectural Design Research in Asia, Osaka, 1998, pp. 21-30
- Frost, P.: 2003, A real time 3d environment for collaborative design, Digital Design - Research and Practice (Proceedings of the 10th International Conference on Computer Aided Architectural Design Futures) Taiwan, pp. 203-212
- Stacey, M. and Eckert, S.: 2003, Against Ambiguity, in Computer Supported Cooperative Work **12**, Kluwer Academic Publishers, Netherlands, pp. 153-183
- Star, S. L.: 1989, The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving, in Distributed Artificial Intelligence (Vol. 2), Morgan Kaufmann Publishers Inc. San Francisco, USA, pp. 37-54
- Verstijen, IM. and Van Leeuwen, C. and Goldschmidt, and G. Hamel, and R. Hennessey, JM.: 1998, Sketching and Creative Discovery, in Design Studies, vol. 19, issue 4. Elsevier Science Ltd. pp519-546