Gather 'round the Wiki-Tree

Virtual Worlds as an Open Platform for Architectural Collaboration

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Abstract. The growth of internet based communication has facilitated the development of open source, collaborative projects. Here we describe the results of three 'Wikitecture' experiments in collaborative, open source architectural design within the virtual world Second Life. We describe the in-world platform developed and its use for a design competition entry. Issues such as contribution assessment and the role of open source collaborative design in architecture and construction are discussed, concluding with a wish list for future enhancements.

Keywords. Virtual worlds; wikis; open source architecture; collaborative design.

Introduction

With the network effects of the digital age, combined with the principles of non-exclusive, 'copyleft' licensing, the world is starting to see the beginnings of a more decentralised method of production—a method producing a surge in innovation and creativity not seen since the advent of the industrial revolution (Lessig, 2001). Projects such as Wikipedia and open-source software demonstrate how a loose and decentralised group of individuals can come together in a more bottom-up fashion and create something greater than the sum of its parts. Amazon's Mechanical Turk service (www.mturk.com: May 2008) facilitates the outsourcing of small 'human intelligence tasks'. Companies such as Crowdspirit (www.crowdspirit.com: May 2008) are demonstrating that an 'open source' method of production can be applied to physical products as well as information goods (Tapscott and Williams, 2007, pp 214-238).

How can these decentralised approaches be harnessed to improve the quality of architecture and urban planning throughout the world? To answer this question, we have been conducting 'Wikitecture' experiments in the virtual world Second Life (secondlife.com: May 2008) to determine what procedures and protocols might be necessary to practice a more open and distributed approach to architectural design. In the past, virtual worlds were not seriously considered for design collaboration, as their building tools tend to pale in comparison to those incorporated into 'traditional' collaborative design tools such as Building Information Modelling systems (Conti et al., 2003). More recent work, however, does investigate a discipline based approach to collaborative design in virtual worlds (Rosenman et al., 2006; Gu and Tsai, 2008). We believe that because of its powerful networking capabilities, Second Life is an excellent platform for exploring how an open source approach to architectural practice might operate. Here we describe what we have learned from three Wikitecture experiments.

Wikitecture experiments

Wikitecture 1.0

The first experiment involved a number of people who came together to design a small meeting kiosk. Wikitecture 1.0 was not really a true wiki in the sense that contributors could not modify or delete the contributions of others. What resulted, although interesting in its own right, was an amalgamation of ‘stuff’ with no overall coherency or unity—a result we expected (Fig. 1).

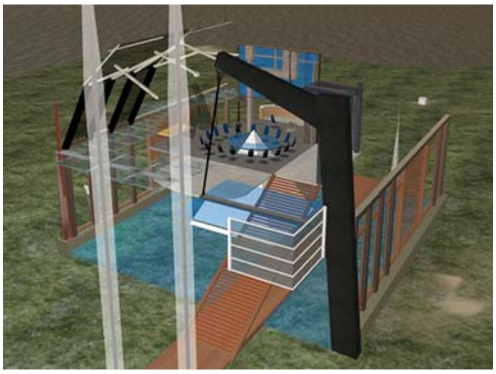

Figure 1
Wikitecture 1.0 design

Wikitecture 2.0

In the second experiment the group designed a courtyard building for in-world group meetings (Fig. 2). Unlike the first one, members were able to modify or delete other contributors’ designs. To facilitate communication, contributors uploaded descriptive snapshots of their designs to a photo-sharing website and were able to leave feedback on others’ designs. A rudimentary archiving system was introduced, which allowed members (through community consensus) to roll back the ‘live’ design to previously saved iterations. As a result of these enhancements, the final design was far more unified and coherent than Wikitecture 1.0.

One aspect of these experiments was to develop a system in which individual ownership in and contribution to the collaboratively authored design could be determined. We developed a simple system in which all contributors were asked to assess what percentage they feel they had contributed to the design as well as what percentage they feel others had contributed. When all assessments are averaged, a simple but generally reasonable judgment can be made to how much (compensation, ownership, IP rights, etc) should be allocated to each contributor. This system was used in Wikitecture 2.0 and 3.0 (Fig. 3).

Figure 2
Wikitecture 2.0 meeting within the in-progress design

	CP	EE	FL	JN	KB	[illegible]
KB	1%	4%	7%	0%	7%	[illegible]
TS	0%	1%	5%	1%	20%	[illegible]
TR	0%	0%	0%	0%	25%	[illegible]
OB	0%	5%	5%	0%	25%	[illegible]
FL	5%	0%	7%	0%	25%	[illegible]
OT	0%	0%	0%	0%	20%	[illegible]
Averages=	1.00%	1.67%	4.00%	0.17%	20.33%	16.
Adjusted Averages=	1.05%	1.76%	4.22%	0.18%	21.44%	17.

Figure 3
Contribution assessment calculation (Wikitecture 3.0).Columns represent contributors, rows are voters.

Wikitecture 3.0

The third experiment involved the design of a clinic for Nyaya Health, a community-based healthcare organisation based in one of the poorer regions in western Nepal, set as a competition project sponsored by the Open Architecture Network (OAN, openarchitecturenetwork.org/challenge: May 2008). Since the Network's mission concerns open sourcing architecture for humanitarian purposes, we thought it would be a good opportunity to submit an entry for this competition, composed in the same collaborative and open source fashion. The Wikitecture community worked on the competition over a 3½ month period during winter 2007-08. Our entry was one of those selected for the final round of judging, with the results not yet known as of this writing.

For this experiment, we wanted to go beyond just mashing up existing technologies and actually develop a unique Wikitecture platform. Based on the results of the previous experiments, we decided to collaborate with software designers from i3D Inc. (www.i3dnow.com: May 2008) and thus developed an in-world interface, in essence a 3D Wiki. An external website was also created to allow real time communication with the in-world interface (Fig. 4).

Figure 4
Wikitecture 3.0 web forum feedback page

In-world interface

The current in-world interface consists of two major components, a 'wiki-tree' and a 'viewing kiosk'. The wiki-tree is comprised of a ‘tree-trunk’ and a ‘canopy’ of colored spheres hanging above it (Fig. 5). A standard menu of geometric objects with which to build is available from the wiki-tree’s trunk (Fig. 6). Each geometric object has an embedded script that allows it to communicate with the wiki-tree.

Figure 5
Wiki tree canopy.

Figure 6
Wiki tree trunk showing interface with geometric primitives.

An individual design can be submitted to the tree at any time. Above the tree sits a canopy of leaf spheres, each containing a different design submission. The canopy visually conveys the evolution of the designs. For example, the animation ‘shooting’ between two ‘leaves’ indicates how one design was derived from another. Thus, by viewing the canopy holistically, one can quickly assess the evolutionary history of the design.

The leaves derive their color from their popularity in the community. Visitors can use the tree or the corresponding web interface to cast three positive and three negative votes. Popular designs are bright green, unpopular ones are red, with those in the middle ranks rendered in intermediate colours. As the canopy grows, the tree periodically prunes itself of the lowest ranked designs, leaving only the most popular ones as options for further refinement.

When designs are submitted, the tree communicates with the web interface, which automatically creates a corresponding area on the website where designers can upload snapshots and descriptions of their ideas. The website provides an additional way for members of the community to vote on the design and leave their own comments, thus expanding the community to include those who cannot or choose not to access Second Life.

Two parcels of land in-world are available for the design team: the first, a ‘build’ parcel which allows one to work on a design in preparation for submission to the wiki-tree; the second, a ‘viewing’ parcel to view designs stored within the wiki-tree. This allows one to simultaneously view, walk through and thus compare two designs (Fig. 7).

To augment the experience of actually occupying the space, the three screens in the viewing kiosk near the wiki-tree allow users to cycle through the snapshots and comments associated with the active design on the viewing parcel as well. This viewing kiosk is especially helpful for those who wish to communicate their designs informally with a smaller group of individuals.

Figure 7
Wikitecture 3.0 in world design meeting on the viewing parcel, with viewing kiosk and wiki tree on the right.

OAN competition design process

With this technology, we were able to focus a very diverse range of ideas into a naturally evolving process ranging from comprehensive text-based research to 2D plan diagrams, then into immersive 3D virtual models designed and built on a replica of the project site.

The first ideas submitted were simple 2D diagrams showing proposed arrangements of functions. Some ideas were studies of the architectural vernacular of the region. Others proposed concepts such as expandability and resilience. Contributions also contained extensive written documentation of material options. One community member submitted several hand-sketched layouts; another extracted the most popular layout into a 3D diagram. The concept evolved from 2D sketch into a more comprehensive 3D model, based on collaborative research on material options, sustainability and seismic considerations.

Halfway through the design process the competition organisers changed the site and design brief. With new information provided by Nyaya Health and the OAN team’s site visit, the community quickly shifted gears. One contributor modeled the new site; another submitted new sketch diagrams on the corresponding website forum. Despite these site and program changes, most of our cultural, regional and material research still applied.

In total, our design community consisted of over 40 members (about half whom had architectural backgrounds) who submitted over 50 different design contributions, left 67 comments, uploaded 92 images and placed over 200 votes. There was a tremendous variance in people's contributions. As with any open source project, some people were diehards, constantly making suggestions and tweaking the design, but the majority of participants made only one or two contributions throughout the entire design process. Ironically, the ideas from these infrequent contributors had the most impact on the overall theme of the final design.

The design submitted (Fig. 8) is only one point along a greater timeline. If our design is selected, we look forward to inviting further input from Nyaya Health and the community of end users to inform the next phases of evolution toward an ideal solution.

The virtual replica we have developed will not disappear after the competition is complete, but can live on as an evolving virtual model of the real life site in Nepal, echoing each development and opportunity as the project comes to life. Though the real life site may be challenging to access, this mirror rendition of the project site could enable many people from around the world to experience the local site and conditions as it evolves, further expanding the outreach, awareness and support for this project to a global audience throughout its entire life cycle.

We believe that our design should be reviewed and further refined with direct input from Nyaya Health and the end users of the facility. Our entire design process has been collaborative and fluid, and we have no illusions that we have reached the optimal trade-off among the many practical and aesthetic considerations. We can only achieve excellence by incorporating more local knowledge and experience into the design.

Figure 8
Wikitecture 3.0 OAN competition entry

Discussion

Although this project was successful in many ways, there are a number of aspects we would like to improve for future work.

Project modularisation

One way to improve a distributed, collaborative design project is to establish protocols in which the design itself can be subdivided into modules or chunks small enough to allow one to contribute to certain aspects of the project without requiring complete knowledge of the overall project. This modularity is a prerequisite for many successful crowdsourcing projects. We do recognise the challenges in dividing an architectural project in such a way that the assembled parts work harmoniously. By subdividing the project, this also allows the community to more accurately assess individual aspects of a design rather than a total design scheme; thus, we hope to introduce more granularity in voting for future experiments.

Contribution assessment scheme

Although the simple assessment scheme sufficed for our initial experiments, we plan to consider more robust methods as we move towards more 'live' projects, amongst these, concepts such as fair division procedures (Brams, 2008).

An initial attempt has thus far identified three factors we would wish to incorporate into an enhanced assessment scheme:

1. One's voting weight or potency should decrease as the variance increases between one's assessment and the community's average assessment. For example if you ranked yourself as contributing to 80% of the final design, but your fellow contributors' assessments averaged at 20%, your voting rank would decrease.
2. The size of the fee for a particular project would affect voting potency, e.g. the lower the fee for a project, the less one's voting potency will change for the next round.
3. The actual size of one's contribution, e.g. the smaller one's average contribution percentage, the less one can change one's voting potency.

The second and third factors would be used to prevent members from gaming the system to artificially inflate their vote ranking, i.e. to attempt to increase one's potency by either contributing to small projects and/or contributing very little. In this sense, the intellectual property or ownership is both inclusive (in that anyone can contribute and become part of the community) and exclusive (in that profits are distributed based on the community's assessment of each individual's contribution).

These issues are fundamental to new economic models that mix open and closed licensing. The pursuit of such models has been a significant issue for a number of crowdsourcing companies.

The future of open source architecture networks

As 'vast information technology arenas' congeal into networks that are more open and transparent, the projects within these networks will also become more open and transparent. Changes we might potentially see include:

- Increased opportunities for less experienced architects and smaller firms due to the potential to more easily outsource project components;
- Peer review of tendered bids, with an equitable compensation scheme for reviewers, precipitated by market pressures and the increasing importance of an integrated and decentralised model of project organisation;
- Alternative paths to professional registration, including the possibility of graduated licensure based on qualifications;
- A more collaborative relationship between designers, manufacturers and other suppliers.

Summary

What has been described here is an ongoing set of experiments in design collaboration still very much in a nascent state. A wish list of future enhancements includes: import/export of in-world designs to better CAD platforms and possibly other virtual worlds; the ability to store semantic data in the building model; streamlining of archival and communications methods; a means of flagging specific differences between designs; and, as described above, rigorous methods for contribution assessment and design modularisation.

The use of an open design environment such as Second Life in conjunction with an open source approach to design through initiatives such as the Open Architecture Network allows individuals increased opportunity to self-select and self-organise around projects that interest them most, with increased benefits of creativity, motivation, and flexibility, resulting in an altogether more efficient process.

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