Utilizing a Web-based Geographic Virtual Environment Prototype for the Collaborative Analysis of a Fragile Urban Area

An “Open-Source” International Urban Design Studio organized in Brussels

Burak Pak¹, Johan Verbeke², Chotima Ag-Ukrikul³
¹,²,³Sint-Lucas School of Architecture, Faculty of Architecture and Arts, Association KU Leuven Belgium
¹http://blog.associatie.kuleuven.be/burakpak
¹burak.pak@architectuur.sintlucas.wenk.be, ²johan.verbeke@architectuur.sintlucas.wenk.be, ³chotima.agukrikul@architectuur.sintlucas.wenk.be

Abstract. In this paper, we will discuss the opportunities and challenges of using a Web-based Geographic Virtual Environment Prototype, primarily developed in the framework of a long-term research project by Pak and Verbeke (2011), as a complementary medium to support an international urban design studio. We reconfigured and rescaled this prototype with the objective of encouraging students to make a collaborative, open-source and location-based analysis of the fragile project area (the Brussels-Charleroi Canal) and share their findings with each other. During this eight week long experimental study, the students were able to effectively use the environment during the analysis phase of the urban design studio; despite their heterogeneous profiles. They created an online inventory that covers five gigabytes of analysis findings, sketches, photos, maps, studio presentations and texts describing their experiences. This environment shows the power of crowdsourcing and online collaborative analysis. Moreover, the findings of our online student survey demonstrate a general positive attitude towards the use of the Virtual Environment Prototype.

Keywords. Urban Design Studio; Web-based Virtual Environments; Integration of CAAD Research into Design Education; Collaboration.

INTRODUCTION

Web-based Geographic Virtual Environments can be briefly defined as applications that combine various types of data, geographic information services and functionalities from different sources. Examples of these are GMapCreator and Maptube, both developed at University College London CASA Centre (Hudson-Smith et. al, 2009).

In this paper, we will discuss the opportunities and challenges of using a Web-based Geographic Virtual Environment Prototype, primarily developed in the framework of a long-term research project by the Pak and Verbeke (2011), as a complementary
medium to support an international graduate urban design studio. This prototype is specifically aimed at the representation and communication of alternative urban projects prepared for Brussels.

We reconfigured and rescaled the prototype with the objective of encouraging students to make a collaborative, open-source and location-based analysis of the fragile project area (the Brussels-Charleroi Canal) and share their findings with each other. Such an analysis was hypothesized to assist the international students in developing a better understanding of the urban environment. In addition, we aimed to collect and reflect on the progress of student works on a regular basis and create an open inventory that can be used as a future information resource. The motivations of this study were twofold:

- The potentials of web-based Virtual Environments as learning tools (and media) to improve design reflection and feedback; as illustrated by various researchers in the past (Knight and Brown, 2010) (Martens and Achten, 2008) (Chase et. al., 2008).
- The pragmatic need for an online environment to be used in our joint graduate urban design studio. This studio accommodated 40 students of which 36 were ERASMUS students from all over Europe. Most of them had no prior knowledge of the problematic project site, the Brussels-Charleroi Canal. Therefore, it was necessary for the students to develop a thorough understanding of the socio-spatial characteristics of the city in order to create designs respecting the fragile nature of this urban environment.

THE FRAGILE CONTEXT: THE CANAL AREA OF BRUSSELS-CAPITAL REGION AND THE INTERNATIONAL URBAN DESIGN STUDIO

The Charleroi Canal is a remainder of the industrial past of Belgium, cutting across the heart of the city of Brussels (Figure 1). It was constructed in 1832 with the purpose of connecting the Wallonian industries and mines with the port of Antwerp in Flanders. Since then, surroundings of the Canal -and specifically the Anderlecht neighborhood- have historically been a problematic place filled with industrial complexes and low quality housing. Inhabited by the working class, it was often excluded from the major urban development projects.

Starting from 1960s, the Charleroi Canal became partly dysfunctional due to the rise of the coal
and steel production costs, causing many mines to close down. In time, the original inhabitants gradually left the area and have been replaced by the Mediterranean and North African immigrant families who were invited to Belgium to work in the large-scale construction projects such as Expo 58 and the metro network. This cultural cocktail, combined with the international character of Brussels has created a fragile socio-spatial environment.

Currently, the Canal area is confronted with various problems such as high unemployment, poverty and wastelands. In recent years, the international and local interest in this area has significantly increased and its potentials have become more evident.

Motivated with these facts, a graduate urban design studio (uAD) was organized at the Sint-Lucas School of Architecture in the fall semester of 2010. It aimed at exploring the possibilities and undiscovered potentials of the area and involved the analysis and exploration of Brussels Canal Area through the lens of international students. The design studio was especially configured to test the use of our Web-based Geographic Virtual Environment for the “designerly” analysis of the urban setting. The first eight weeks of the studio were solely allocated for the analysis of the project site. The students worked in groups throughout this phase, sharing information and their findings with each other.

**Figure 2**
The structure of the proposed Virtual Environment Model
In order to facilitate the use of the Web-based Geographic Virtual Environment, open workshops were held every week. In these workshops, the basic concepts of virtual environments and neogeography were discussed, including crowdsourcing and fair use practices.

**THE WEB-BASED GEOGRAPHIC VIRTUAL ENVIRONMENT PROTOTYPE**

The prototype used in this study is a web application hybrid specifically developed for the representation and communication of alternative urban development projects in the framework of a three year research project. It combines Semantic MediaWiki and Google Earth API for representing textual data, imagery, concepts maps, 3D models and time-based information in a geolocated format (Figure 2).

In this framework, all placemarks, lines and areas created on the Google Earth API are automatically linked to the local MediaWiki topic and vice versa. The entered information is stored in a MySQL relational database.

![Figure 3](image)

**Figure 3**
Screenshots of the prototype used in the design studio: the main page and the gallery of uploaded files (on the top). Adding location-based notes through the interface (on the bottom left). Superposing and visualizing multiple hand sketches (on the bottom right).
UTILIZING THE WEB-BASED GEOGRAPHIC VIRTUAL ENVIRONMENT PROTOTYPE IN THE URBAN-ARCHITECTURE-DESIGN STUDIO: OBSERVATIONS

In only eight weeks, students created an impressive online inventory with 66 topics (pages), organized according to 11 themes. These topics include various analysis findings, sketches, photos, maps, studio presentations and texts describing their experiences and thoughts on their future projects (Figure 3). The total size of the uploaded data is around five gigabytes.

Every week, the students collaboratively created a new page related to their analysis theme. They edited these pages in groups of three to five. The contents of these pages were not moderated or validated by the tutors, but the pages had to include: a verbal description of group findings (linked with maps), photos of models, sketches and the PDF version of group presentations. Organizing the analysis findings according to time allowed easy tracking of the group progress.

Representation of design information of similar nature made the group works comparable and this contribution was highly appreciated by the studio coordinators. Furthermore, the proposed virtual environment promoted communication and interaction between the tutors, students and even with third parties outside the sphere of the school.

In addition, by using this online environment, the students were able to learn from each others’ projects. While constructing their own ideas, they used other students’ analysis results as an extended knowledge resource. These analysis findings helped the students to choose their project site, develop new design strategies, create novel concepts and design temporary installations to interact with the inhabitants (Figure 4).

FINDINGS FROM THE STUDENT ATTITUDE SURVEY AND WEB ANALYTICS

We have employed a variety of methods to evaluate the use of the Web-based Geographic Virtual Environment Prototype in the design studio context. Among these are the on-site web analytics, a student attitude survey, a usability questionnaire and feedback meetings. The results of these studies are too voluminous to be reported in a conference paper; therefore we will present only the most interesting findings.

In order to explore the students’ attitude towards the virtual environment and receive feedback, we have conducted an online survey. This survey covered various Likert-scale questions related to the motivations of our research.

As we have expressed in the introduction topic, one of the major research questions of this study was about the role and future potentials of the Web-based Geographic Virtual Environment. According to the results of the survey study, 87% of the students strongly, mostly or somewhat agreed that using the proposed virtual environment helped them to develop a better understanding of Brussels (Figure 5).

When students were asked if they plan to use the proposed virtual environment as an information resource in the future, 84% of the students responded positively (Figure 5). Of course, a more reliable answer to this question can be derived from long-term web analytics and follow-up surveys.

At the end of our online survey, we also asked an open-ended question related to the future development of our online environment to receive the comments and suggestions of the students. The answers reflect the students’ individual perceptions of our experimental implementation (Table 1).

Overall, the findings of the online student survey demonstrate a (general) positive attitude towards the use of the Web-based Geographic Virtual Environment Prototype. These results are encouraging for the improvement and future testability of the application, but they are not solely sufficient for the evaluation of the environment.

Besides the online student survey, we used on-site web analytics in order to gather information on the nature and intensity of the students’ online collaboration. According to these automatically generated reports, 48 out of 66 pages (79%) were
edited by more than one student (Figure 6). This finding shows that the students really collaborated through the virtual environment while creating the content. It is also in line with our observation that working in groups motivated them to share information and findings and construct a collective memory of their project sites.

When we analyze the contributions on an individual basis, the students made an average of 38.89 edits (Figure 7). The majority (26) of the students have

Figure 4
Examples of student works created during the first 8 weeks (analysis phase) of the design studio.
Figure 5
Students’ responses to two of the Likert-scale questions presented in our research.

Figure 6
Percentage of pages according to the number of students that contributed to them. 79% of the topics (pages) were edited by more than one student.

Table 1
Samples from the positive student responses to the open-ended question in our survey.

<table>
<thead>
<tr>
<th>Do you have any thoughts for the future development of the virtual environment prototype?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A: “The website itself was very easy to use, I haven’t made a website before but felt it very easy to understand how to do it and have now basic knowledge I can use later. I think the interface should be as easy/simple as now to make everyone able to understand and use it.”</td>
</tr>
<tr>
<td>Student B: “I’m not really good with computers and the idea of “virtual environment” sounded really abstract for me at the beginning. But I think I really understood and developed an interest to use it as an analysis tool.”</td>
</tr>
<tr>
<td>Student C: “It is a nice idea, because our people can see our work. I never thought that I could edit the website; it was an unknown field for me. However it turned out that it isn’t that difficult. At the end, in my group, I was the person who edited our page the most.”</td>
</tr>
<tr>
<td>Student D: “This tool is quite important for the globalized world we move in nowadays, and it’s a powerful way to explain your ideas, readable from wherever and easy to use.”</td>
</tr>
<tr>
<td>Student E: “In the future it would be more interesting to learn from other students by checking their own inspirations, creations, ideas, sketches and so on.”</td>
</tr>
</tbody>
</table>
made 1 to 50 edits whereas only 3 students made more than 100 edits. No significant gender difference was found in the number of individual edits.

As a final study for the evaluation of our experimental implementation, we compared the student grades at the end of week 8 with the total number of group edits (Figure 7). The hypothesis behind this comparison was that there should be some kind of a relation between the collaborative use of the environment and group success (grades) in the analysis phase of our design studio.

The results show that the groups who received higher grades had made relatively more collaborative edits (and/or vice versa). It is impossible to derive a direct causality out of this finding but the data points

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**Figure 7**
Histogram of individual student edits. Average edits per student is 38.89.

**Figure 8**
Scatter graph of Student Groups' grades compared with the total number of group edits.

<table>
<thead>
<tr>
<th>Group</th>
<th>Edits</th>
<th>Grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyday Life Group</td>
<td>240</td>
<td>19</td>
</tr>
<tr>
<td>Consumption Group</td>
<td>173</td>
<td>16</td>
</tr>
<tr>
<td>Fragile Group</td>
<td>247</td>
<td>15</td>
</tr>
<tr>
<td>Networks Group</td>
<td>253</td>
<td>14</td>
</tr>
<tr>
<td>Time Group</td>
<td>115</td>
<td>14</td>
</tr>
<tr>
<td>Borders-Limits Group</td>
<td>172</td>
<td>14</td>
</tr>
<tr>
<td>Density Group</td>
<td>110</td>
<td>13</td>
</tr>
<tr>
<td>Informal Group</td>
<td>79</td>
<td>12</td>
</tr>
<tr>
<td>Interaction Group</td>
<td>67</td>
<td>11</td>
</tr>
<tr>
<td>Activity Group</td>
<td>115</td>
<td>11</td>
</tr>
<tr>
<td>Contrast Group</td>
<td>58</td>
<td>n/a</td>
</tr>
</tbody>
</table>
indicate a possible correlation between collaborative edits and student performance. When combined with our design studio observations, these findings may suggest that collaborative use of the proposed virtual environment as a knowledge resource may improve the performance of the student groups (such as the “Everyday Life” group) as well as decrease them (such as the “Fragile” and “Networks” groups); depending on the profile and individual characteristics of the students (Figure 8).

**CONCLUSIONS AND FUTURE PROSPECTS**

In this study, we tested the use of a Web-based Geographic Virtual Environment Prototype as a complementary medium to support an international urban design studio. We motivated the students to make a collaborative, open-source and location-based analysis of the project area and share their findings with each other.

We found that creating transparent and open studios can enhance the communication in architectural design education. The Virtual Environment Prototype that we tested in the proposed design studio context acted as a sustainable information platform for collecting students’ design information. It was actively used for following the progress of student works online on a regular basis and also during the reflection process which took place in the design studio.

In eight weeks, the students were able to effectively use the environment for the analysis phase of the urban design studio; despite their heterogeneous profiles. They created an online inventory that covers five gigabytes of analysis findings, sketches, photos, maps, studio presentations and texts describing their experiences. This environment definitely shows the power of crowdsourcing and online collaborative analysis. In other words, it can be considered as a “proof-of-concept” for the use of a Web-based Geographic Virtual Environment in the design studio.

Moreover, our observations illustrate the students’ positive attitude towards the use of the prototype (Figure 5 and Table 1). Students proposed that they have developed a better understanding of the project site by reflecting on our virtual environment.

Furthermore, the students learned to communicate and reflect on their designs using various means, including alternative analysis topics, images and models, all of which stimulate them to think more about the conceptual foundations of their projects. The design studio coordinators noted that this process has induced more competition between the students.

In addition, the proposed prototype provided opportunities for the transfer of the rich knowledge produced within the framework of a design studio to future studios, thus establishing a basis for the sustainable development of education and design ideas. The design studio coordinators were assured that the body of knowledge represented in the virtual environment can potentially inspire their future students, and therefore we decided to use this environment as a major resource for future design studios.

On the other hand, we found a number of difficulties and challenges relating to the usability of MediaWiki and Google Earth API-based web application hybrids. Among those, the lack of an efficient WYSIWYG editing interface, (the relative) complexity of the Wiki and Keyhole markup language for the students, efforts needed for the scanning of hand sketches and students’ reluctance to comment on each other’s projects are notable ones. We believe that it is possible to overcome the first two challenges by using a sophisticated editing tool and providing students with basic information on markup languages. Moreover, learning how to use the environment and processing information to be represented online were challenging tasks for some of the students and tutors; especially at the beginning of the design studio.

In the future, with the development of affordable and portable multi-touch tablets, students can create their drawings in digital format which can make them easier to share with other students. Furthermore, combining the social networking environments with the Wiki talk pages may enhance the students’ motivation and sociability.
For the researchers who want to conduct similar experimental studies, we recommend to design the whole studio together with the coordinators. Ensuring a healthy communication and coordination between the tutors and students is also essential for effective integration.

Moreover, the technological platform to be used in the studio should be stable and easy to understand. Depending on the complexity of the proposed platform, weekly hands-on workshops proved to be useful for raising awareness on the conceptual framework of the implementation.

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REFERENCES


search in Computer Aided Architectural Design in Europe, ETH (Eidgenössische Technische Hochschule) Zurich, Zurich, pp. 51-55.


