AUTHOR(S): DOUNAS, T. and SPAETH, A.B.

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Ubiquitous Digital Repositories In the Design Studio

A Case study

Theodoros Dounas[1], Benjamin Spaeth[2]
[1]Xian Jiaotong Liverpool University [2]Cardiff University
[1]theodoros.dounas@xjtlu.edu.cn [2]SpaethA@cardiff.ac.uk

The paper investigates the usability and effect of a ubiquitous digital repository in the architectural design process. Acknowledging the post-digital era where students work with diverse media either digital or analogue, the project explores the suitability of a digital log in augmenting conceptual thinking, feedback provision and intellectual exchange by means of a studio in an architectural undergraduate course. Students integrate a digital log into their workflow resolving a design task of an architectural studio. A server-based repository serves as students' individual archive as well as a share-point for peer-students' informal exchange and tutors' feedback. The conclusion of the study is that sketching and organization habits from the analog media the students have learned persist even with a more digitally inclined generation. The use of digital tools that obliterate the analog-digital division, holding the best of both worlds are still subject to the constraints of timely introduction in the curriculum, cultural resistance in terms of organization of a project and more so void of experimentation in their use by students.

Keywords: *digital repositories, Design Studio, hybrid media*

INTRODUCTION

The main goal of the case study was to examine the effect of a ubiguitous digital log to record feedback during design studio tutorials plus the experimentation on digital sketching as a generative systems during design production. The paper presents the first part only of the case study concerning the use of the system as a digital log. The case study took place in Xian Jiaotong Liverpool University in the department of Architecture in the final year of the BEng architecture programme. Two groups of 9 architecture students at undergraduate level 3 participated in the project. The students were assigned a typical studio project representing the final year project of their bachelor degree. The design tasks were generic and formed exclusively a vehicle to conduct the presented research; one studio explores solutions for a futuristic museum in 2050 concerned with contributions of foreign and migrant workers to the local society and the second studio develops proposals for a community and surf centre at the Australian coast. The students were encouraged to integrate the portable tablet and the ubiquitous digital repository into their design work. Students were not given

special advice how to use the tablet and the repository, but certainly were introduced into the general functionalities. The digital repository (EvernoteTM) and tablet (Apple iPad AirTM), were used as students' design log during the whole process, offer multiple functions, such as original content creation, organisation features, document annotation and information sharing opportunities. Apart from the students also the two tutors supervising are equally equipped with a tablet, pen and access to the ubiquitous repository for each student. The platform was able to record all sketching data, whether performed of the tablet or not, original image files, recording of conversations, video and photographs of models etc. As such it was able to capture all possible information and feedback loops during tutorials with the students.

BACKGROUND AND CONTEXT

Studio/Learning design through digital sketching has been well documented (Cheng 2005). Digital sketching is a production tool already established in other disciplines like animation or graphic design, however architects continue to use analogue tools in their education studio mostly because of the inherent conservatism of studio education, reproducing models of the late 19th-early 20th century. Capable architecture educators focus more on their students' capacity to think rather than merely being productive in a digital environment, as some times is required for example in the profession. This makes the architecture studio an educational setting hostage to the skills that students learn on their own, at times enabling learning or at times constraining it within the confines of specific software. Sketching however is an interface that most students know and develop within their education, while tutors persist in providing formative visual feedback using sketches. Sketching, even of questionable aesthetics or skill, provides an immediate interface to express thoughts and concepts in architecture, making it ideal as the platform of communication in the tutor-student relationship. Digital tools, from journals to CAD provide structure, organisation, plus the potential for augmenting a user's capacity to think via generative processes. Thus the project proposes to augment formative visual feedback to the students but also introduce generative processes through an interface that is more accessible than classic cad systems. Researchers in the past have conducted protocol studies (Abdelmohsen et al. 2007), studies in automated understanding of design drawings (Achten 2005) Studied drawing sequences to deconstruct the manner in which architects draw, (Cheng 2005) and earlier have tested CAD platforms as a means for architecture 'sketching', leading to a distinction between creative & productive sketching and 're-creative or reproductive' sketching (Daru 1991) The innovation in this case does not lie in the employ of digital tools per se (Hannibal et al. 2004), but in situating the digital sketching in an orchestrating role, early in architectural production where both teacher and student use it formatively. As such the current paper presents the results of the ubiquitous digital repository side of the project rather than the mechanics, learning and output of digital sketching per se. To our knowledge from literature the integrative approach to digital sketching has not been attempted before and has the potential to provide innovative, new, insights into studio education. We take the position that the analogue-digital threshold is no longer clear in our era in both architectural design and education (Martens et al. 2006). The students and practitioners of architecture are employing hybrid blended media from the beginning to the end of a project in the analysis, composition, generative and production phases.

Digital repository and log

The main platform that we tested in the project is EvernoteTM, as a 'capture everything' repository of the design studio. Examining sketching as an organization and production tool, we equipped the students also with Ipad tablets and pressure sensitive pens from Wacom. The tablets were not essential for input as all other devices compatible with Evernote were used such as mobile phones, desk-

top and laptop computers etc. The inclusion of hand drawing was one notable feature in the sense that students could either take high resolution photographs of their sketches or scan their hand drawn sketches an upload into Evernote. An external service provider hosting unlimited space for clients' use provides the server based digital log. The tablets have a client software package (EvernoteTM 5.8.8.x) installed. The client is integrated into other software packages on the tablet thus information and documents processed in other applications can be transferred, stored and edited within the digital design log. The server-client system can handle all types of media such as pictures, text documents, audio and video recordings. The Evernote clients provide direct annotation opportunities to text or picture/image documents. Pictures from the camera i.e. can be directly transferred to Evernote and edited and shared within the application. Evernote can also directly process screen shots and webcam captures. The software also offers organisation opportunities to structure project information and design processes. Notes can be titled and assigned to subject areas. Students also can tag specific items with different tags. The graphic interface allows filtering and organising the information according to the multilevel structure applied to the project and its related notes respectively. A chat room allows students and tutors to discuss uploaded notes online. Sophisticated sharing options enable students and tutors to control accessibility for notes and chats individually. Students were offered a general introduction to the system to understand the working principles and potentials of the proposed systems. Students were not advised specifically how to use the system since students developing individually different approaches and uses of the system is a major objective of the research. Therefore only a general introduction to the functionalities of the system was given.

HYPOTHESIS

At the beginning of the project we made a series of hypotheses which the project and its methods were based on. The first hypothesis we developed was that the amount of digital sketching would increase with the availability of the tablet and the ubiquitous digital repository. We also as a second hypothesis speculated that the students of this generation are digital natives so they would integrate not only the tablet but also other digital devices at their hands such as mobile phones. Furthermore we assumed that the students are handy in the integral use of different types of media and their hybridisation. As a consequence of the ubiquitous availability of information and the unlimited opportunity of collecting information, inspiration and feedback we assumed that students will take advantage by increased frequency of feedback requests and shared work in progress, in peer groups. The possibilities in organising information on different levels and the implicit opportunities to structure the design process explicitly in different ways suggest that this might have impact on the design process or on the awareness of the non-linear nature of design processes. In essence we hypothesised that we would see many different modes of use of digital sketching and many different models of organising information and output in the design studio.

RESEARCH METHOD

The method we used for validation was a triangulation method from the experience and opinion of the students participating in the project, the grounded observation of the tutors through the project and the evaluation of the full data set produced through the project. 'Methods triangulation' (Perone et al. 2003) refers to employing different qualitative and quantitative research methods so that the hypothesis is examined from multiple vantage points and dimensions. The purpose in using a methodological triangulation to examine the hypothesis is to compensate and overcome the weaknesses inherent in each single social qualitative method of research. (Maginn 2008) It also leads to more reliable research findings in social sciences as triangulation allows for the design of a multifaceted, cross vali-

dated research project (Carey 2009). This entails a combination of qualitative and quantitative methods. The first method was based on running a detailed questionnaire through the 18 participants in the project. (Maginn 2008). The second method was based on grounded observations of the researchers during the tutorials and the development of the final year project using the platform (Carey 2009). The third method was based on the quantitative and qualitative validation of the first two methods, but due to space constraints is only present as summarised evaluations in the discussion. It is essentially an examination of the artefacts produced by the students in terms of qualitative classification of their work, verification of their understanding of the use of the platform by looking into the combined results of their project work and the sketching feedback, the measurement of frequency of commit logs in terms of the devices used etc.

STUDENT FEEDBACK

Retrospectively students are asked to reflect on their experience and on the impact of the proposed approach to their design approach and sketching habits. The questionnaire was completed by 18 students (100% of the participants). The online questionnaire included 17 questions. Qualitative questions are set with ratings from 1 to 5, where the rating always is qualified with a description respectively. All quantitative questions are followed up with a field for qualitative specifications on the qualitative question. Figure 1 presents the answers to the first question, on what kind of log method the students used before they participated in this study.

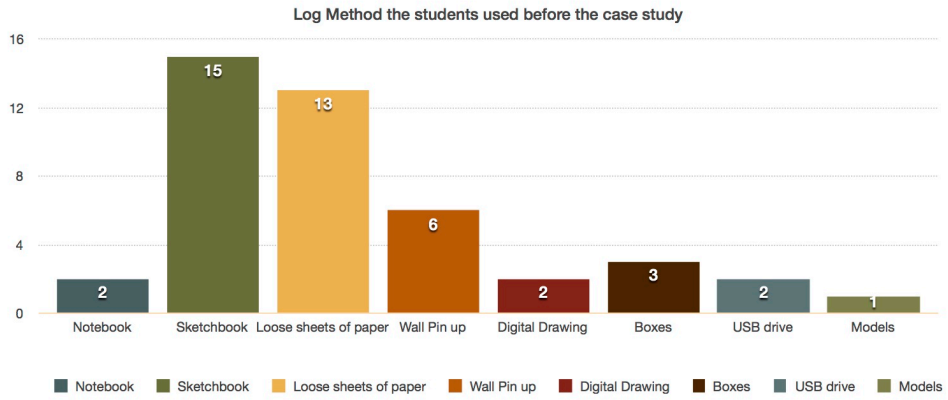
All students reported that their previous studio was predominately organised by a physical sketch book where students either bound loose collections of paper or directly sketched into the book. On the question what role sketching plays in the design process, without distinction between digital or manual sketching, most students underline the importance of sketching in design. (Figure 2)

The importance of sketching in early conceptual design stages is rated with an average of 4.1. Qualitative comments reveal sketching to be mostly understood as a tool of communication. Most students emphasise the importance of sketches to make ideas or processes explicit to others; in particular to share their work with tutors. Some also understand sketching as a way to structure design thinking in particular and design processes in general for their own purposes. Few students relate their sketching with inspiration. Four students explicitly refer to sketching as a mean to keep record of their design ideas. In reflection of how this communicative aspect of sketching was captured into evernote according to the students, figure 3 shows that the main uses were to maintain a feedback loop with the tutor and but also as a repository of all files.

9 students used the Evernote log as a diary where the design process and tutor feedback was organised continuously time based. 5 students organised their log not according to timelines but implemented distinct design ideas as the underlying organisational structure. The remaining 4 students were not explicit in their reflection on their organisational use of the digital repository.On the comparison between the organisational model of digital repository and process to the common manual approach students referred more to the difference in the nature of the materials rather the organisational model. However students appreciated the feasibility and ubiquitous availability of the produced material if included in the digital repository. Others emphasise again the quality of the repository as a means of communication. Few reflected on the repository as a means to ease exploration of "fragmented design ideas" which may be lost in a physical archive, as it can be seen in figure 4.

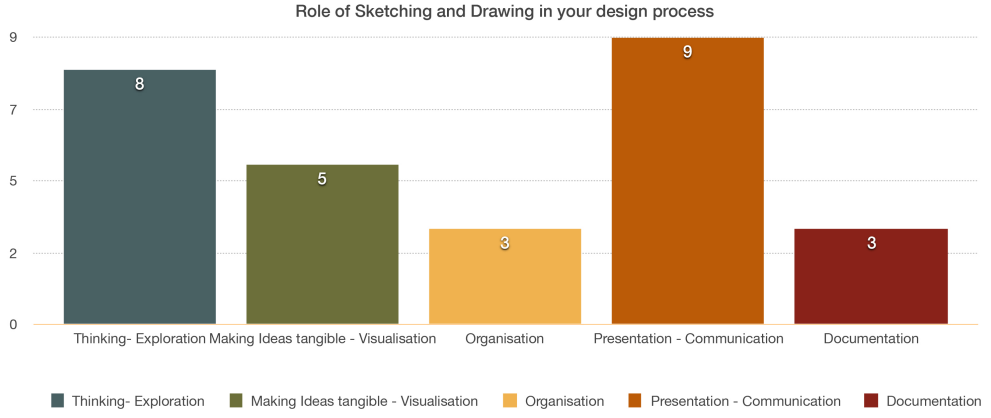
Physical work was mostly included into the repository through photographs or scans. Only one student reported on editing and working actively with the scans and photographs retrospectively the upload. One student seems to completely omit the use of physical models and reports that all his work was only created digitally. In general the students

Figure 1
Dominating log method used before the case study.



have not identified a significant difference in their organisational model applied in previous physical repository to the now digital one. All emphasise again the ubiquitous and non-physical character of the repository enabling easy transport and availability of the design material. All students have complemented the tablet software selection according to their needs. Seven students explicitly report that they have use the tablet for reading and therefore installed software accordingly. All students have installed software to ease sketching on the pad. Some have several applications other just went with the recommended one. 5 students admitted that they have installed also software for entertainment or personal use. Only 2 students have installed technical drawing software packages and only 1 person report on mind map software to support the structuring and organisation of ideas and thoughts. Almost two third

Figure 2
The role of sketching and drawing in the design process.



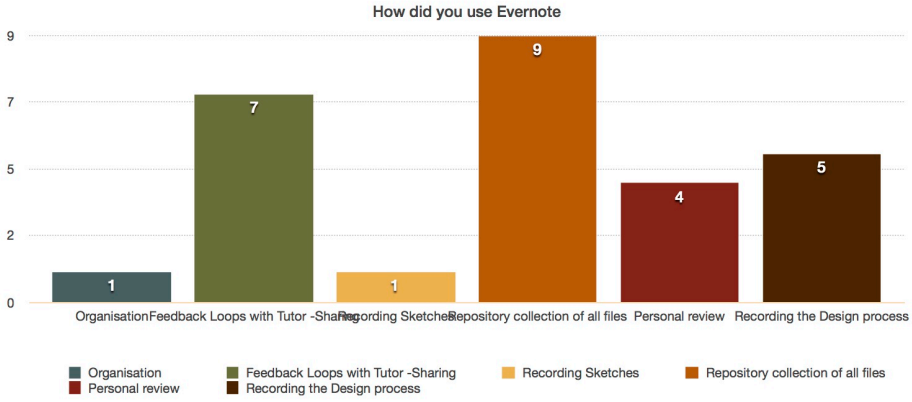


Figure 3
How students used Evernote.

of the students (11) used the repository also for self-organising purposes such as to-do-lists, reminders or timetables. 4 students even reported to use the digital repository not at all for self-organisation. The remaining 4 made use of the self-organising capacities only occasionally or seldom. On a scale from 1 to 5 ("not helpful at all" to "extremely helpful") the average rating for the helpfulness of the proposed to the design process was established at 4 ("very helpful"). Qualified comments on this question again emphasise the feasibility and all time availability of the created material. Students who didn't rate high on the helpfulness unfortunately weren't able to articulate the shortcomings in a qualified way. Also sometimes qualitative comments are not or not completely in accordance to the qualitative numerical rating. An overall overview of how physical design utput was included into Evernote is presented in Figure 5.

TUTORIALS OBSERVATION

As reported by most of the students in the questionnaire the digital archive was foremost used as to share their work in progress with the tutors. It was evident from discussions, the tutorial work, and confirmed by the questionnaires that students very often uploaded their work imminently before the tutorial would take place. These uploads where mostly paper sketches or photographs of models. Very seldom the sketches or photographs were worked over in the digital sketching application. We could also observe that, despite the students' contrary confirmation in the questionnaires, students had difficulties to actually orient well in their repository. We have observed that in most cases the students had such difficulties because of missing organisational structure where tags, titles and subject assignments were not used. A restricting factor in the whole process was indeed the internet connection. Since the sketches drawings and pictures demand a minimum level of quality an immediate upload and editing process was mostly not possible. Only students who were well prepared in advance, uploading their material constantly and not just immediately before the tutorial could benefit from direct comments, annotations and corrections in the digital repository. Where digital interaction was not possible, tutorials took place in a usual way on paper and the output was retroactively then scanned and fed into Evernote. This interruption in the process and the reluctance of some students to actually continuously use the repository as a working platform concluded in some cases in a fragmented record of works and feedback. The use of the tablet

Figure 4
Modes of organisation in Evernote.

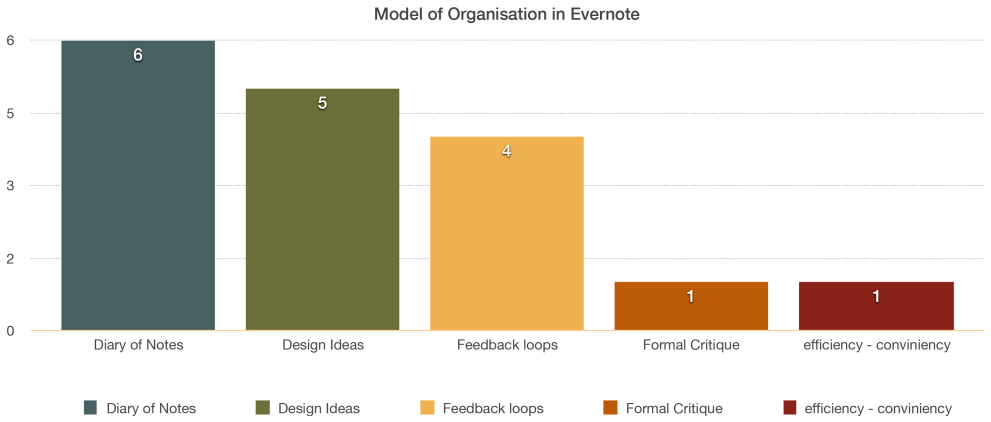
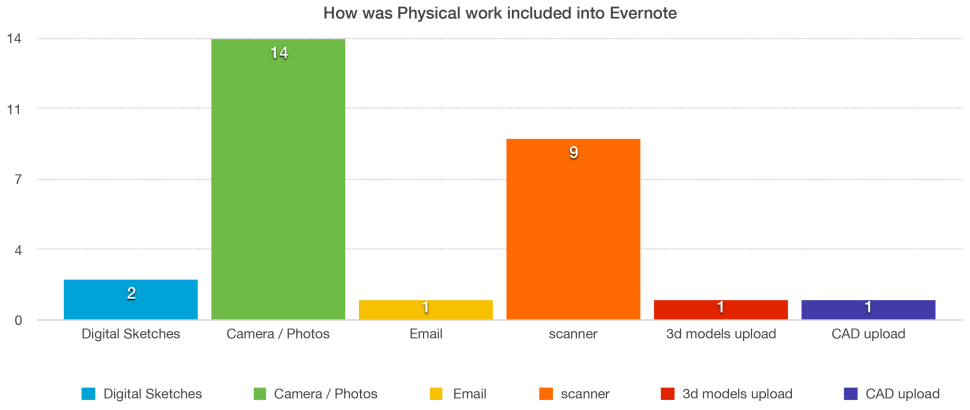


Figure 5
How was physical design output included into Evernote.



as the main means in and the basis for tutorials indeed needed some time for adaption not only for the students but also for the tutors. Doubtlessly the digital repository represented a great advance in monitoring students' progress, when upload was actually conducted. And the absence of uploads was in most cases also a helpful indicator for students facing challenges and obstacles in their design advances. In the face to face tutorials we observed that student and tutors equally referred not only to the digital and digitised material but also and constantly to the physical representations, making jumps between the digital and the physical.

RESULTS AND DISCUSSION

We started the project with high hopes that the tools were now in place to develop completely digital processes in the architectural education studio. However the students were also too entrenched in modes of operation and organization of production suited in analogue processes. This created the situation where a percentage of the students experimented in some areas of content creation and feedback, some others in making efforts to incorporate a linear aspect of organization or a folder like organization in their projects. None made a totally effective use of the software in a manner that took advantage of the complete potential of the platform: For example using links between notes to organize relevant ideas and sketches rather than folders, to create a tagging system that then would rely on search to find external references and relevant sketches or images. Although we expected this generation, as digital natives and familiar with touch interfaces and mobile devices from an early age on, to grasp intuitively the potential of an ubiquitous platform, and to engage and create novel pipelines of information and organization in the studio, the students remained in a kind of traditional studio behaviour. This effectively communicates that habits are entrenched from early on in the design studio and are difficult to shift, thus suggesting that the introduction of afore described methods in the design studio would be most effective if introduced early and en mass in architectural education. On the other hand the experiment did show that the students responded positively when provided with a repository and documentation system that captures all information in their design process. Even if they did not experiment extensively they found the fact that no information was lost, even going back to discarded sketches that otherwise would be lost during the design development, an occurrence that was rarely happening in the past. We also found that since the students worked individually and not in teams peer feedback was not picked up within the system, but relied in classic fashion in verbal feedback between the students. One other aspect where the students did not take advantage of the features the platform offers is exactly the recording of voice and sound. As such there are almost no sound recordings of tutorials or discussions in the repositories. The provision of feedback stayed within the institutionalized tutorial system, where 60% of the students prepared their work right before the tutorials rather than in a continuous fashion. However the remaining 40% who did take advantage of a constant feedback loop provided by the digital repository system considered this an advantage as they received more continuous feedback and were not reliant only on the contact time. Another positive of the system is that the tutor has the ability to overview the whole production of the student, and situations where the student falsely hides information thinking they are not important are avoided. In the same vein, students commented positively on creating their final presentation by having a consistent format and archive for all of their work, as it was already digitized and ready to be placed into production. Further afield we do see the value of an 'always on, always accessible' digital design repository and it would be great if we could use one with even more capacity and capability in integration. Some ironically could call this a BIM however BIM products do not currently have the directness, ease of use and lightness of a note taking system like Evernote. Concluding the observations the advance of ubiquitous and mobile

digital devices in our everyday lives do not allow to assume their use in the professional or educational environment. Even when the hardware is provided there seems to be a certain hesitation to use these technologies i.e. in the design studio. Whether this is due to already established habits and design routines or whether the methods are considered inferior to the established methods could not be uncovered in this study. Yet the fact that although the digital devices were used but only to emulate traditional design methods to a digital media demonstrated the urgent need to integrate a professional use of ubiquitous media and tools into the design teaching.

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REFERENCES

Abdelmohsen, S and Yi-Luen, E 2007 'Tracking Design Development through Decomposing Sketching Processes', *IASDR 2007*, Emerging Trends in Design Research, Hong Kong Polytechnic University School of Design, Hong Kong

Achten, H 2005 'Resolving some Ambiguities in Realtime Design Drawing Recognition by means of a Decision Tree for Agents', *Computer Aided Architectural Design Futures 2005 [Proceedings of the 11th International Conference on Computer Aided Architectural Design Futures]*, Vienna, Austria, pp. 311-320

Carey, M 2009, *The Social Work Dissertation*, Open University Press, McGraw-Hill House, Berkshire, England, UK

Cheng, N.Y.W 2004 'Stroke sequence in digital sketching', *Architecture in the Network Society [22nd eCAADe Conference Proceedings]*, Copenhagen, Denmark, pp. 387-393

Cheng, N.Y.W and Andrew, M 2003 'Digital Curricula: Effective Integration Of Digital Courses - A Delicate Balance', *Connecting >> Crossroads of Digital Discourse [Proceedings of the 2003 Annual Conference of the Association for Computer Aided Design In Architecture]*, Indianapolis,Indiana, USA., pp. 129-130

Cheng, N.Y.W and Andrew, M 2005 'Learning Design processes with digital sketching:copying graphic processes from animations and storyboards', *CAAD futures 2005*, Vienna Austria, pp. 291-300

Daru, R 1991 'Sketch as Sketch Can - Design Sketching with Imperfect Aids and Sketchpads of the Future', *Experiences with CAAD in Education and Practice [eCAADe Conference Proceedings]*, Munich, Germany

Hannibal, C, Knight, M and Brown, AGP 2004 'How Useful is the Digital Sketch?', *Architecture in the Network Society [22nd eCAADe Conference Proceedings]*, Copenhagen, Denmark, pp. 374-379

Maginn, JP (eds) 2008, *Qualitative Housing Analysis: an international perspective, Studies in qualitative Methodology, Volume 10*, JAI Press, Emerald Publishing group, Howard House, Wagon Lane, UK

Martens, B, Mark, E and Cheng, N.Y 2006 'Thresholds between Analog and Digital Representations.', *Communicating Space(s) [24th eCAADe Conference Proceedings]*, Volos, Greece, pp. 372-383

Perone, PJ and Tucker, TL 2003, *An exploration of triangulation of methodologies: quantitative and qualitative methodology fusion in an investigation of perceptions of transit safety*, National Center for Transportation Research, Tampa, FL, USA