

A Future Focus on Collaborative Design

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In this paper, we will report on the experiences and insights discussed during a workshop of the Special Interest Group on Collaborative Architectural Design. Participants from 12 universities and four firms (for architecture, engineering, consultancy and software) brainstormed and discussed on multidisciplinary simultaneous collaborative design and exchanged their ideas on the subject. The effort of the diverse participants covered theoretical, social and technical issues of collaborative architectural design. The topic of the workshop was explored by means of paper presentations, software tests, experiments, different types of brainstorm sessions and the formulation of future scenarios. The combination of junior and senior researchers of each university proved to be fruitful and inspiring for the discussions. As an outcome of these activities a framework for future research in the field will be presented. Special focus will be on the aspects of communication language, communication behavior, communication environment, goals and roles in the context of collaborative design.

The name {ACCOLADE} is an acronym of Architectural Collaborative Design. The name brings a number of different words together in a group. E.g. {England, Belgium, the Netherlands, Italy, ...}. The meaning of the word in English is ‘a mark of honour’ and the French meaning of the word is a ‘solemn embrace’. It also refers to the multi-disciplinary design process. These connotations can be useful for a collaboration project in which many different people and parties plan to make a joint design effort.

Keywords: {ACCOLADE}; Architecture; Collaboration; Design.

The problem

Architectural design can be denominated as a non-linear process in which many parties take place. It is well known that several design cycles are needed to refine initial ideas. It is a highly creative design process, which asks for a sophisticated tools and media for enabling the representation, manipulation and communication of three-dimensional information. In order to collaborate in an architectural design

process there is the need for systems that provide space for synchronous work sessions in which diverse design parties can be involved.

Current activities of design offices ask for methods to support their demand for multi-disciplinary and multi-located virtual collaborative architectural design. The new methods should support and enhance their economic international possibilities and activities. Human Computer Interfaces do not provide efficient

tools for communication of spatial problems and tools for virtual collaborative work do not provide good synchronous working methods. Moreover, in educational environments, virtual collaborative design becomes increasingly important. Teachers and students should be able to have virtual review sessions and to communicate remotely about their designs. New digital media might bring different approaches and cultural backgrounds together. Current initiatives for Virtual Design Studio's indicate the usefulness of collaborative design and the related exchange of different insights and practical experience. However most of these applications do not focus on synchronous and immersed meetings. It is assumed that such extensions can enrich the experience of design in groups and the exchange of different points of view.

The workshop

Twenty-nine researchers from all over Europe participated in the {ACCOLADE} Workshop and worked together during five intense days. Before the event, all participants communicated through e-mail and the ideas were known before the Workshop started: papers and future scenarios were exchanged. During the {ACCOLADE} Workshop, four keynote speakers contributed from different fields related to the {ACCOLADE} theme.

Peter Johnson {University of Bath} introduced the participants to the important aspect of the human-computer interaction in collaboration and communication. Different types of collaboration, of goals and of interaction were discussed. The concept of information brokering was discussed including design metaphors, design analysis and design evaluation.

Ranulph Glanville {CybernEthics} focused on the mutual impact of computing and collaborating. He pointed to the fact that collaborating is more than co-operation and co-ordination. It also includes novelty and the unexpected. Those aspects imply that the field of collaborative architectural design needs more than technical evolution. The human aspects of

collaboration play a very important role.

Lesley Gavin {University College London} concentrated on 3D multi-user environments and the experiences with such environments so far. She also gave reflections on issues related to the architectural design process. In a second contribution she focused on distributed social networks and the impact for collaborative design.

Finally, Arne Winkler {Vuent} introduced the participants to the state of the art from a technical point of view. He showed software that allows engineering companies to share complex product-models over the Internet. The 3D - models can be annotated and viewed in collaborative sessions. A special data-stream algorithm allows the quick exchange of very detailed geometry.

In addition to the presentations of the keynote speakers, there were the many interesting paper presentations of the other participants.

John Heinz {Technical University Delft} introduced a Design Coordination System, a tool for achieving more explicit and effective forms of design coordination. The system consists of a design project network and a series of coordination games. The tool enables to make the process of continuously rescheduling explicit. It is hoped the tool helps to reach a more successful project outcome and a better-coordinated architectural design process.

Jonas af Klercker and Jan Henriksen {Technical University Lund} focused on the possibilities offered by virtual environments. The current experiences are used to detect the problem field and to propose intentions for future research.

Gernot Pittioni {Ingenieurbüro Pittioni - München - Weilheim} brought in the experience from the current way of working in a large engineering office located in two towns. He investigated aspects that are important for successful collaborative architectural design. Starting from the way of working in the past, he described current technologies and gave his views for the near future. Exchange of digital photos and design files through networks and mobile connections

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are described as important aspects for remote work of building engineers.

Andy Brown and Phil Berridge {University of Liverpool} dealt with three aspects of the collaboration process: encouraging collaboration, the use of 3D worlds as meeting and discussion places and how architectural models and man-machine interfaces can improve the effectiveness of game environments in an architectural context. Their work shows that a broad spectrum of social- and technical- developments is needed to achieve fruitful collaboration.

Tom Maver and Jelena Petric {Strathclyde University} gave insight in the young historic past of user participation in the design decision-making process. They indicate a 10-year period (from 1972-1982) in which many case studies on this topic were performed. Thereafter, the subject of computer aided design participation virtually disappeared from the scene for a decade. Now they indicate hope for the future as multimedia, virtual reality and Internet technologies allow new developments. One of such developments, described in another paper, came from their own Virtual Environment Laboratory at the Strathclyde University. Gareth Ennis and Malcolm Lindsay, propose a set of design criteria for deploying multi-user software. The authors illustrated this by using a VNET server program as interface to their VR-Glasgow model.

Ernst Kruijff and Dirk Donath {Bauhaus Universität Weimar} described how architects could use the strengths of an immersive or semi-immersive virtual environment to create a shared understanding about a design problem. They gave an overview of particular factors and requirements that need to be considered before multi-user environments can be made. A major focus in the paper is at the transfer of spatial knowledge about architectural space.

Henri Achten and Bauke de Vries {Technical University Eindhoven} presented DDDoolz, a desktop-VR voxel sketch tool that could be extended for use in shared sketch sessions. Henri Achten proposed a number of features that are needed for software that

supports collaborative design. Amongst other features, he mentions: good multi-user sound quality, shared views, capturing of gestures and a dynamic lock that allows partial changes of the design data.

Leandro Madrazo {Universitat Ramon Llull} presented NETWORKING, a web environment for collaborative education that is used for the course "Sistemas de Representación" at the E.T.S. d'Arquitectura La Salle, Barcelona. The web-based environment promotes the exchange of ideas among students and their capacity to work collaboratively. The presentation of NETWORKING gave many new insights of a structured way of exchange and articulation of design concepts in the form of text, shapes, objects, images, space and light. The work shows a careful and innovatively developed pedagogic model that raises a new understanding specific to the new media.

Adam Jakimowicz and Jaroslaw Szewczyk {Technical University Bialystok} provided an important overview of problems that have to be solved when the current CAD systems are extended with a multi user interface. They indicate the loss of functionality of CAD programs by their overwhelming amount of tools and the amount of icons that comes along. The 'battle for space on the screen' goes between the workspace and the rest of the graphic user interface. As a solution they see the need and the chance to create a new design paradigm. The paradigm already appears in collaborative design networks, with understandable, reduced and easier interfaces.

Martijn Stellingwerff {Technical University Delft} proposed 'the concept of carrying' in collaborative virtual environments. He indicated the need for new interfaces that allow multiple users to exchange their opinions when they are 'immersed' in a shared 3D environment. The metaphor of carrying can be used to give visual cues about what other people in the shared environment are doing. The tools that are carried by avatars (virtual puppet representations of the collaborating people in a virtual environment), and the gestures (such as pointing) of the avatars can be

seen as quite natural representations to inform the people about each other's intentions.

All participants presented their ideas. These were elaborated and tested during workshops and working sessions. Brainstorming and informal discussions between the participants complemented the collaborative work. After the Workshop all papers were updated and new ideas were added. Conclusions were drawn and discussed in a collaborative process.

Results

Besides the many insights from the paper presentations, the brainstorming sessions provided a rich view on the future focus of collaborative design research. We used several methods to collect and involve all our views. One of the methods used A5 sized colored pieces of paper on which each participant had to write answers to the following questions:

- What do you see as an important quality of a good collaborative design process?
- What do you think is an important aspect of collaborative architectural design, which needs to be developed in the future?
- What is an aspect that hinders good multidisciplinary collaborative architectural design?
- What is an aspect that hinders good simultaneous collaborative architectural design?

The results were then grouped on boards and discussed intensively. Afterwards all statements on the pieces of paper were collected and rearranged in schemes. This method allowed to capture and keep all momentary thoughts of our group and is now treated as a valuable document for future focus of {ACCOLADE} research. The whole schemes are published in the {ACCOLADE} workshop book. Here follows a summary of the first two schemes:

QUALITIES of a good collaborative design process

Communication behavior: {create delight - surprises - improvement of result - better final product - gain of overall financial and timing interest - support for risk taking - educational aspects - improving inter-human interaction - a will to hear - ambition - unexpected discovery (eureka) - honesty} {good abstraction ability - listening and understanding - be able to interpret in multiple ways - existing, understanding why collaboration makes sense - openness for discussion - generosity - generosity of spirit / general willingness - discussion skills - open minds - ears - open mind - openness to criticism - to give positive constructive reasoned comments - personal skills - receptive} {ability to see the design evolve - unexpected reframing of the whole problem - preparation - information - concentration - focusing on design process rather than design outcome - free flow of ideas - not trying to replace/supporting natural communication - you learn and design at the same time} {difference - different point of view = problem - enjoyment of difference - joy in participation and discovery - ability to assess contributions - flexibility} {language - exchanged data - exchange platform - ability to share viewpoints - good borrowing from each other - common understanding - tasks, object / entities, acts / processes - effective participation of user-client bodies - group momentum - appropriate ways of describing the problem - recognition of valuable contributions - leadership / roles - nomination of a coordinator - socially a group - conversational understanding of communication - general awareness of others - social people - designing apart together - it encourages inter / multi / trans disciplinary thinking - awareness of others' point of view - expression of unshared (private) goals - have broad basis knowledge (know bits of other disciplines) - learning from each other - willingness - co-operation - trust}

Communication environment: {having public and private data repositories without "disturbing the design process" - needed data needs to be available

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- careful and discrete management - mechanisms for the right / best forms of communication - well organized information structure (keep overview) - access to related information repository (database) - saving time for the achieved goals - adequate tools - get and receive needed data in time - easy exchange of information - seriously high bandwidth - enough time - rigorous analyses design evaluation of the system - modeling and VR software development - simple language of modeling software - clear visual information transfer - multi lingual - get added value - constructivist approach and ethic)

Conflict of interest between parties: {a goal - goals consensus - clear goal - clear purposes - goal agreement on common goals - understanding of goals / intentions of other collaborators - continuous goal revision - clear understanding of aims / goals - real need - complex tasks - the aim to produce one final product - unforced collaboration and task assignment - ability to make contribution)}

Aspects to Develop

Education: {new pedagogic frameworks - what and how to teach with new media - integration of media into education - new roles for educators and students - education in collaboration - - meaningful learning environments well integrated into the teaching philosophy}

Communication language: {the language, words, symbols must be common}

Communication behavior: {ability to have a normal conversation, man to man - both talk and listen - communication skills of architects - transfer of ideas - more informal means of collaboration - facilitate contributions - accessibility to contributions - good social relations before collaborate - delight - listening in contrast to speaking - insight in the other one's goals - recognition and enjoyment of the act of collaboration in its own right - devoting more time to collaboration - understanding and accepting of disciplines other than mine - improving skills in interacting - abilities to share understanding and information - differences - analysis of procedures} {establishing a way of devising

common frameworks - for discussion in a variety of design scenarios} {live human interaction should always engage computer as just another collaborator} {computer should not replace direct human communication in any form of collaboration - virtual should never replace real no matter how fascinating it might be - real meetings - interfaces - real or virtual}

Conflict of interest between parties: {clear definition of purposes of collaborative software - working out why it's worth doing - making sure people need to collaborate - common framework of when collaborative design may apply - usable act - set (sub) goals clearly - definition of goals acceptance} {an understanding why to collaborate in general - even without using computers}

Communication environment: {procedural flexibility - development of communication structure allowing lead figure (chairperson)} {establish the optimum levels of human-human-negotiated interaction - and human-computer negotiated interaction: frequency, length and nature of meetings} {methodology - bandwidth and security of networks - cad- and communication tools - speech integration - the (task specific) 3d environment - clarity of transferred project data structures - skills in use of tools - guidelines for setting up the system based on analyses - good info-structure overview - more rigorous approach to the development and testing of tools we already have - asynchronous exchange of information - co-ordination of information and activities - improved sketching/ drawing software - better media integration (technology) - better representations integration (design representations) - single metaphor for the interface design - ubiquitous captures of design reasoning process}

The {ACCOLADE} book

The full papers and the outcome of the discussion sessions can be found in (Stellingwerff and Verbeke, 2001). It is available from the publisher and the authors.

Future

The outcomes of the Workshop are the basis of further discussions between the participants. It is the intention to prepare for a European Research Network between the participating universities. The schemes and ideas mentioned in this paper and further results presented in the book form the basis of the set-up of the research.

During the project, the participants hope to be active on four levels:

- Research on the human aspects and behavior in relation to the use of new media to foster collaborative work between architects;
- The development of a prototype environment for collaborative design (for test reasons and for the development a profound knowledge on collaborative design);
- Experiments to investigate the creative potential of collaborative design environments;
- Development of a theoretical framework for future developments in the field.

The authors welcome all input and ideas to the {ACCOLADE} theme.

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