Collaborative Teamwork - Challenges of the Future

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Abstract
Collaborative Teamwork is regarded to be one of the most outstanding fields of teaching and research within the context of Architecture, Urban and Regional Planning. This focal field is closely related to the research field of "Remote Teamwork", i.e. the substance-related cooperation of people over spatial distances in decision-situations aiming at the elaboration of suited remote-working structures for research, project transactions and teaching. The generation and manipulation of digital spatial models and their virtual transportation within large spatial distances represent the main research objectives. The Faculty of Architecture, Urban and Regional Planning therefore is stressing information technologies within academic context. The following contribution is dedicated to the description of two teaching projects, namely "BraGraLuWi" (collaborative teamwork between the universities of Technology Bratislava, Graz, Luton and Vienna) and carrying-out a VRML-workshop, furthermore to the development of Remote Teamwork-structures preferably on the basis of "ATM" (a technology of broad band telecommunications) at Vienna University of Technology.

Preface
In order to advance models in progress effectively planning requires a continuous flow of communication, i.e. the "transportation" of information on planning ideas (e.g. as spatial models) via suitable "media". Moreover, instant evaluations of the specific (simulated) state of planning and the generation of possible alternatives called for are only achieved by efficient communication inseparably attached to wholistic perception. Teamwork has become a basic requirement for spatial planning. Due to the increase of globalization and cross-linkage of problems a globally cross-linked teamwork is called for. Therefore, teamwork over spatial distance has become an essential, actual field of research.

"Collaborative Teamwork" (CT) can be defined as the substance-related cooperation of people over spatial distances ("Remote Teamwork") in decision-situations. The generation and manipulation of digital spatial models and their virtual transportation within large spatial distances represent main research objectives. Application of "Collaborative Teamwork" is to enhance planning- and modeling processes both in technical and functional terms thus creating a new planning medium. "Teamwork" requires repetition and combination of creative- and decision-stimulating working situations.

The technical-functional challenge of "Collaborative, Remote Teamwork" mainly consists of coordinating the actions of all participants in the virtual world and their impact thereon in such a way that all participants receive the view of a singular logical (consistent) world (even

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though, in reality, the world is being simulated in portions by various computers). Apart from several essentially algorithmic problems the limited band widths of long-range computer networks pose the real technological issue (Brutzman et al. 1995). The mentioned research subject is closely connected to the research field “Distributed Virtual Reality (DVR)”: Distributed Virtual Reality (DVR) may be defined as systems where geographically distributed participants connected via networks act and interact in a computer-generated world with one another as if in actual direct contact (Röhl 1995, Löffler 1995).

Some examples of approaches and attempts practiced by the authors on the university level arbe being enumerated below:

BragraLuWi: A Joint Design Project

This project encompassed the development of collaborative CAD-based design solutions for the re-use of four large brick-built gasometers located in Vienna. The foundation for the performance was laid during the eCAADe-conference in Palermo (November 1995). Following a further conceptive meeting the projects devised to that stage resulted in an concrete design-program.

Pict.1: Partners in the Joint Design Project

8 students at each of the educational institutions should participate making up 8 design teams (A-H, Pict. 2) consisting each of five students, one of which should be from one of the participating universities. Each group would be allocated a vast functional use category for their design work: circus+performance, science+technology, dance+music and new media+film. Two groups would therefor be exploring the architectural possibilities for each category. Communication between the team member was to be achieved by means of a variety of Internet electronic communication methodologies, including e-mail, ftp and world wide web. The general availability of require applications, such as e.g. www-browsers etc. for the participating students is of utmost importance. The main focus regarding communication was the design process, implementing the concept of shared modeling. Each team was to be allocated a www-homepage also to carry general information in relation to the
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new project as well as a personal presentation. The presentation was required so that the participants of the
various universities would be able to find together a group.

Hypertext links would, however, be provided between all the web sites involved with the project. The main
idea of this project was to have students from different countries working together developing design for
the Vienna gasometers using the internet. Each project had to focus on one of the gasometers and to react
on the specific (urban) environment. The revitalization of the four landmarks has to be seen as a first step
toward a new definition of this part of the city.

Pict. 2: Working Structure of the BraGraLuWi Design Project
Experiences with "BraGraLuWi"

The major part of the students will principally feel attracted to participating in such a project representing new ground for them. Therefore the administrators in charge of the project will not have to furnish them with an elaborate and well tested procedure, but rather with a kind of prototype-idea. There were, however, parts within the initial stage of the project proving quite difficult. What was envisaged was the self-formation of a design-team, i.e. following presentation of themselves and their design work hitherto the students of the participating universities were to join teams within the set structure, drawn up in order to avoid problems withing a group due to differing design approaches of the participants, a goal which was not satisfactorily achieved.

The administration proved more complex than expected, moreover, no good solutions for the drop-outs or lazy bones were available and individual achievements can hardly be pinpointed to the individual. As the major part of the students only provided of scarce HTML-experience, the compilation of the first student-homepages took much too long. Furthermore, considerable technical difficulties were due to the fact that some of the participating universities were not equipped with e-mail addresses or web-addresses. The participants were constantly changing in the first few weeks, an exchange of ideas was, however, accomplished. During project work it became evident that "self-organization" only works in parts throughout the set structure and new structures were introduced on the go. For example, a mega-group resulted out of the team studying all four project categories, central information structures developed, communication partly also did not go via the implemented bulletin board or via the e-mail contacts within the group, but rather via mails to a "mailmaster".

Principally, all participants must be aware of how the structure is composed, in order to avoid the "silent transmission principle". Therefore, the information to be distributed is to be misuder-standably clear and specific limitations have to be pointed out: "not everything goes" via net and if, it will take more effort than when meeting in person. Novel-type structures peculiarily lead to wild growth regarding quantities of information. The present project also had to deal with the problem of teams not experienced in working together, a fact that was not accounted for at the beginning of the joint design project. Getting in touch with one another was considered awkward and perhaps also superficial, this leading to somewhat "anarchic reactions": i.e. a part of the students dug right into design work not wanting to keep on waiting and waiting, this irritating the other participants.

Access and working with network computers posed an additional major problem: "computer-freaks" derived great benefits, less versed computer users were disadvantaged. If the gap becomes too great the ones will feel bored and the others will feel too much stress. Discipline in responding to e-mail messages and the regular filling of homepages undoubtedly are a must so that this project will work.

Several of the media implemented made for a reduction, actually a complete absence of transportation times. This again meaning that the participants have to be constantly on the go as to reaction. Sometimes the communication to the designs and concepts are to be regarded

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as superficial, as electronic trivial comments such as "I do not like that" show. No direct (spontaneous) reaction was rated as disinterest (e.g. responding to e-mail after three weeks).

Homepages are to be clearly structured, the message to be understood 100%. If this is not sufficiently observed the news might be noticed. In other words the administrator might not even find out that something new has arrived. Not everyone enjoys clicking into everything to discover something secret. Thus it is of utmost importance for homepage-designers to mark what has been delivered recently.

Administrators have to dedicate much more time to a Joint Design Project than to supervising on site, as "outside" students from other universities have to be taken care of in addition. The date of correcting is, however, not strictly specified and can be chosen at ones convenience. Anyway, a weekly "talking appointment" at a set time seems very beneficial.

In retrospect, the different ranking of the course at the four participating universities posed an additional problem as an optional course will naturally not be followed through with the same effort an obligatory course. The same ranking of course at the participating universities might do away with this shortcoming, e.g. the course "Architectural Design" representing a central component within the curricula of architectural studies.

A regular bulletinboard seems of more avail than glamourous homepages being up-dated by the quarter. The Yola-Server at the Department of Architecture at the Graz University of Technology has shown its strongholds, as comments in picture and text can be transmitted to the www-bulletinboard with ease. The order of registration is clearly outlined in a chronological survey list to be re-edited, so required. Both newcomers and customaries will get acquainted quickly and outsiders are welcome to give their comments and opinions on specific matters. This is one of the strong points of working with www-homepages and apart from the working effort the investments regarding the university budget can be considered low. Moreover, presentations can be issued simultaneously at various sites.

Due to the present technical limitations the idea of shared modeling was not tested. Video-conferencing came in handy, the transmission at present only being satisfactorily received with the available means (InPerson) throughout Austria. Transmission of plans and models by whiteboard instead of video interface might be of more avail, but depends on the band width available. Therefore, no satisfactory results were achieved with the University of Luton (U.K).

In discussing the present experiences the organizational and technical aspects were dealt with in detail, running the risk of neglecting the substance-related matters. The design work as centerpiece of the project is not to be treated second-class regarding time dedicated to it. The "geographic" mix of the group is to grant the spreading of information e.g. on the Vienna gasometer to other locations. The urban-constructional situation deemed as conceptual background and not as actual working goal. The question as to usefulness of working on design problems with partners you are practically unacquainted with at large distances still remains up in the air.

A Team is Looking into VRML

In order to react to current developments the optional course called "Architectural Webspace Workshop" was first added to the curriculum of architectural studies at Vienna University of Technology in the session
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of 1995/1996. Following a review of the significant technical aspects (hard- and software and remote clients) the practical use of three-dimensional components by means of VRML (Virtual Reality Modeling Language) was demonstrated. Concrete topics were dealt with either individually or in small groups and presented via Internet. The idea of a VRML-Avenue acted as the streamer for the homepages to be drawn up.

The lecture course focussed on the interactive investigation of three-dimensional models and the independent interacting to the source codes. Moreover, evaluations as to the importance of present possibilities of implementation of the three-dimensional VRML-scenario as starting point for spatial design- and planning work were to be made. Participation depended on the capabilities and interest in programming work (basic knowledge of www and HTML).

Pict.3: Redesigned VRML-Logo (Borislav Petrov)

Experiences with VRML

Though the project work is not entirely completed several experiences can be related. The papers issued by the participants - subject to integral documentation in the homepages - dealt with matters such as VRML 1.0 versus 2.0, Implementation of Media Tools, Aspects of Conversion, Manipulating of Source-Codes, Optimizing of Models and Java Program Language.

The accessability to high-end-graphic computer platform in form of the SGI Onyx RE II was of major benefit throughout the entire workshop, as also extended data stocks could be handled "without strings attached". Despite this equipment not only high-end solutions were sought. The principal aim was to work with novel-type concepts. Interlaced structures rely on connection of objects with one another by means of transformation. The problem to infinity calls for great requirements regarding navigating skills: "another
world” can be entered by means of Anchor. No single world origin exists, local coordinate axes serve as reference for so-called Inline-models, i.e. one VRML-model is transported into another VRML-model. Two different models can interact, the problem of being hard to follow up can be solved by means of modular representation.

Experiments for the connection of HTML and VRML were also carried out. A ”text-only HTML-page” was used to start with being considerably larger than conventional Browser-window. The viewer moves by scrollbars through the page. "Loopholes” for entering the VRML-level below are distributed at various locations. Depending on the link chosen the viewer arrives at the corresponding point in the VRML-model. The spatial realtions between VRML and HTML remain, the ”loopholes” are noticed in the VRML-model and the ”HTML-skin” is still realized. The technical challenge is to split the VRML-model into header part defining the viewpoint and a www-inline containing the space as it were.

The practical usefulness of VRML for architecture cannot be evaluated as of yet. Principally, this class could be offered ”remote” and thus made accessible to students of other departments of universities, such as the Graz University of Technology, this also being in line with the intention of the topic. VRML-models more or less are produced as a by-product of modeling work, the language used, however, is not platform-bound. VRML is not limited to conveying merely the three dimensional geometric information, but also permits the implementation of various qualities such as e.g. collision protection, thus making for a wider range of perceptive possibilities of space. The independent navigation in realtime calls for the investigation of spatial situation. At present appropriate viewing possibilities are only furnished by high-speed computers.

Development of Remote Teamwork Structures

Considering the substance-related, EDP-technical and organizational experience of the described projects current developments based on ATM-communication structures are being supported by the Vienna University of Technology in cooperation with other universities.

ATM (Asynchronous Transfer Mode) stands for a standardized transmission method having been specifically developed as a common platform for the transmission of language, video and data. ATM is a broadband telecommunication-technology (B-ISDN - Broadband Integrated Services Digital Network, compare Cavanaugh-Salo, 1992). ATM is not limited to a specific speed, a variety of speeds are standardized (e.g.: 155 MBit/s, 622 MBit/s, 1.2
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GBit/s). Therefore, ATM lends itself extremely well to the realization of high-speed networks. Multiple applications in future are scalable. Integration of ATM-networks and Internet (Alles, 1995) is of utmost importance, this being a substantial basis for the comprehensive utilization of ATM. The manufacturers are advancing swiftly regarding development of ATM-components. Investing into this ”new” medium seems quite safe (Yenkee, 1995).

Conclusions

Concludingly, essential questions regarding Collaborative Teamwork (CT) are enumerated accordingly to substance-related, organizational and technical aspects attempting to formulate proposals.

**Substance-related Aspects**

| Which qualities are to expected for teaching and research? | Prompotion of sophisticated working methods; capability for project management; thinking in concepts and variants; activation of criticism and possibilities for discussion; strengthening of responsibility |
| Which risks may be involved latently? | Domination of technical fascination; repressing of substance-related matters; no conclusive results |
| Which topics lend themselves to CT and which of them well? | The range comprises conceptional urban structural considerations, the planning of the complete structure right to the design of specific objects. Certain topics and working stages are, however, extremely well suited for CT |

**Organizational Aspects**

| Which position should CT receive in the curricula? | Rating and kind of lecture class |
| How should the information- and communication flow be configured? | Choice, dimensioning and presentation of information; degree of abstraction; pace of handling |
| How is competence structured and limited? | Hierarchic structures; supervising; equal status of decision-makers; laissez-faire; vertical (top-down/bottom-up) versus horizontal processes |

**Technical Aspects**
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Which techniques are suited in support of information flow?
Internet (www including e-mail, ftp, talk), HTML, VRML, video-conferencing with whiteboard- or AV-tools

Which technical limitations exist?
Transmission band widths; communication periphery; net connection; general accessibility

What is of great importance is the adjustment of substance-related, organizational and technical aspects.

Pict.4: Holistic Approach of Collaborative Teamwork (CT)

The experience made can be compared with a soccer game representing something like a CT (observation of rules of game, strategy of coaches, passing, self-responsibility when having in the ball, etc.).

References
CAVANAUGH, John D., SALO, Timothy J. (1992): Internetworking with ATM WANs, Minnesota Supercomputer Center, Inc.
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In addition, please confer following homepages:

- http://fbra.archlab.tuwien.ac.at/~bagaluwi/
- http://www.cis.tu-graz.ac.at/stdb/
- http://www.archlab.tuwien.ac.at/w2561/vrml/bo_vr1.htm
- http://fbra.tuwien.ac.at/~vrml/
- http://info.tuwien.ac.at/raumsim/
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