Adrian DOBSON

DIGITAL CREATIVITY – ARCHITECTURAL DESIGN IN THE ELECTRONIC AGE

This paper summarises the research activities of the author over a period of ten years spent investigating computer utilisation in the architectural design process. It describes three analogues or methodologies for a computer-enhanced architectural design process which have been developed and tested in both academic and practice contexts, with the collaboration of students, lecturers and professional practitioners.

Some key concepts in computer-aided architectural design:

A number of key concepts have been critical to the ideas explored in this paper. Although computer technologies have advanced rapidly in terms of processing speed and capacity, many of the basic ideas in computer-aided architectural design have remained relatively unchanged since the 1970s and 1980s, and to some extent the aspirations of academic researchers have been unfulfilled, with computer-aided design (CAD) in architectural professional practice still largely confined to the improvement of speed in the preparation of 2D production drawings and for generating high quality perspective imagery for use in project marketing and promotion. The application of CAD technologies to the creative aspects of the design process remains somewhat limited and there is little evidence of a comprehensive switch to a 3D modelling culture in the practice context. The architecture and construction sector continues to lag behind both manufacturing and media fields in its utilisation of information technologies to enhance both creativity and productivity.

The following concepts have been important:

Digitally mediated design composition:

This is the notion of making effective and appropriate use of the computer as a medium for design composition and not just a representational tool. idea is developed from the work of researchers such as Anthony Radford (1990) who used CAD systems to enable students of architecture to create abstract compositions according to established rules of architectural syntax based upon the use of 3D architectural elements. The process of architectural design is viewed as a form of computation, in which sequences of compositional operations are performed upon a set of architectural elements.

Integrated project databases:

The integrated project database concept is based upon utilising object-based digital building models to collect, manage and disseminate design and construction data of a range of different types, including cost, time and performance, in addition to the geometric data normally associated with CAD. A functioning model for an integrated project database along these lines was developed at the University of Strathclyde in the early 1990s (Rutherford and Maver 1994). A number of software developers are now producing parametric CAD programmes that attempt to build upon this type of approach.

Virtual design studios:

The virtual design studio focuses on facilitating collaborative working for geographically distributed design teams, using CAD and electronic communication technologies, in particular the Internet. In a paper published in Automation in Construction, Mitchell (1994) put forward a number of models for the future development of computer-aided architectural design. His third paradigm, 'designing as a social activity', raised the possibility of a shared virtual reality model at the centre of an electronic network of architects, consultants, builders and client representatives. A number of practical experiments with virtual design studios were carried out in schools of architecture during the 1990s. The concept was appealing to architectural educators, who saw a variety of educational benefits in offering students the opportunity of working on projects in new social and geographical contexts, gaining exposure to alternative architectural cultures, facilitating dialogue with a wider range of colleagues and critics, and providing a forum for students to utilise the emerging digital design technologies.

Virtual reality design environments:

In the mid-1990s virtual reality (VR) was a buzzword topic across a whole range of industries, including the architectural community. The concept of VR was connected with the contemporaneously evolving notion of cyberspace, a term generally credited as originating in the popular science fiction works of American author William Gibson, in particular his novel Neuromancer (1984). In Gibson's imaginary worlds the cyberspace environment enabled humans to interact both with each other and with data of any type, in an immersive and ultra-realistic, 3D digital environment. Architectural researchers have been interested in the potential use of real-time animation and interactivity to create an immersive design environment for the architectural design team, clients and building users. An important centre for the study of the application of VR to architectural design has been the Calibre Institute, established by the Faculty of Architecture at the University of Eindhoven (Achten et al 1999).

Digital city models:

Architectural and planning researchers have explored the idea of enhancing professional and public participation in urban planning and design through shared access to digital urban models. The immediacy of its appeal as a visual resource for politicians and planners has enabled the idea of digital city modelling to gain acceptance. Research carried out by the Centre for Advanced Spatial Analysis (CASA 2002) at University College, London identified over 60 different models of urban centres throughout the world.

Three analogues for computer-aided architectural design:
Developed from this research context the author has evolved three analogues for a computer-aided architectural design process:

The Digital Design Studio -
A conceptual framework for the architectural design process to be carried out primarily using digital techniques, and in which traditional design methods are evolved to create a symbiotic relationship between the computational and design processes.

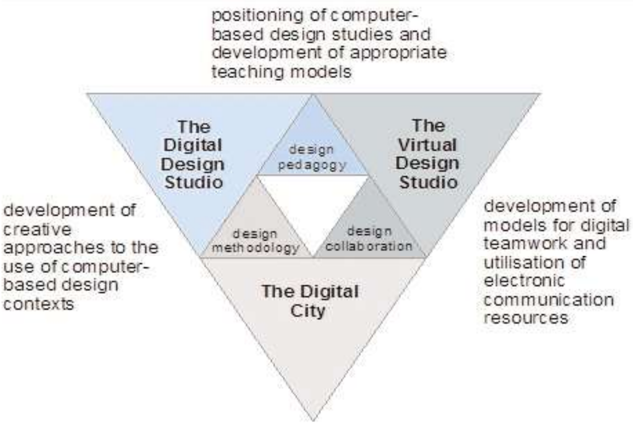
The Virtual Design Studio –
A notion of design team collaboration based upon the utilisation of electronic networking and communication technologies, and without the need for geographical co-location.

The Digital City –
A model for digital representation of the urban environment as a medium for professional and public design participation and discourse.

The inter-relationship between the three digital design analogues is summarised in fig. 1 below:

The digital design studio and digital city analogues have been tested through a sequence of experimental student design projects, undertaken within the undergraduate architectural programme at the University of Luton.

Fig 1: Inter-relationship between the design analogues.



Remote collaborative working using the virtual design studio analogue has been carried out in co-operation with partners at three other European architecture schools: the Faculty of Austria, and the Faculty of Architecture at the University of Technology, Vienna, Austria.

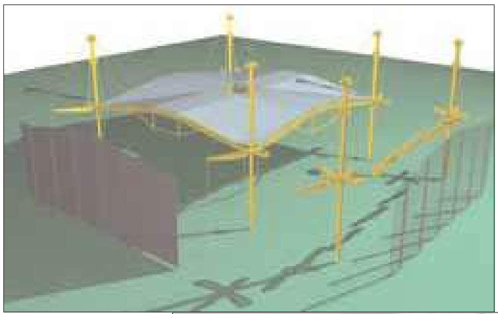
The ideas encapsulated within the analogues have also been explored in the professional practice context through their application in real-world architectural projects carried out by NPS Property Consultants Ltd.

The digital design studio:
In the experimental project work groups of undergraduate architecture students at the University of Luton undertook CAD based precedent studies and exercises in architectural composition using the digital design studio analogue.

The first part of the programme required the students to produce 3D CAD models of built architecture, using an element-based approach. This involved analysis of the building in terms of its constituent set of architectonic elements, or kit of parts, the modelling of this object set using CAD techniques, and the construction of a full digital building model using the object set.

These exercises reveal that many works of architecture are composed on an elemental basis, as illustrated in Richard White's analysis of the Renault UK Building by Foster and Partners (figs. 2 and 3).

Fig. 2: Renault UK Centre, Norman Foster - elemental CAD



The results suggest that the examples that can readily be modelled using an element-based approach exhibit certain common characteristics:

1. A strong relationship between the systems of structure and enclosure and the resultant architectural form, both internally and externally

2. A compositional structure which can be viewed conceptually as an assembly of parts, in which elements are grouped into sub-assemblies and larger assemblies

3. A clearly articulated hierarchy of primary and secondary structure/enclosure

The analytical models produced by the students demonstrated that examples of the compositional use of repetition, transformation and translation of a set of architectonic elements to realise an architectural whole are present within the architectural canon. This suggests that the adoption of such compositional rules is a viable approach to the design process.

In the second phase of the programme, the students used CAD modelling techniques to define simple libraries of architectonic elements. These element libraries were then used as the building blocks to create abstract architectural compositions.

The imposition of a strict limitation on the size of the palette of objects enabled the students to maintain a simple element library for each design. In the later phases of a real-world architectural project, additional layers of technical, cost and time data could be added to these basic elements. It proved possible to create surprisingly complex architectural compositions using a very small number of elements. A typical element library might include:

A planar or curved wall/roof element
A fenestration element
A column/post element
A beam element
A pergola or solar shading element

The elements could be manipulated using CAD operations, such as repetition, rotation, translation, re-sizing and grouping. The students experimented with different compositional approaches.

They were required to explore a variety of formal and spatial ordering systems, such as symmetrical and asymmetrical organisations, compact and dispersed groupings, linear and radial organisations, axial and clustered systems.

Examples of the range of outcomes achieved using this simple design methdology are illustrated in figs. 4, 5, 6, and 7:

Fig. 4: Abstract architectural composition by Mark Curzon.

Fig. 5: Abstract architectural composition by Tanya Stanley.

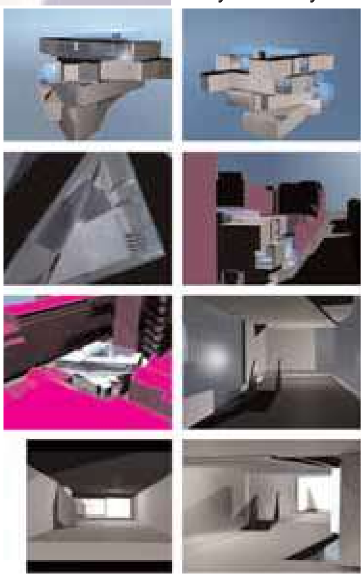
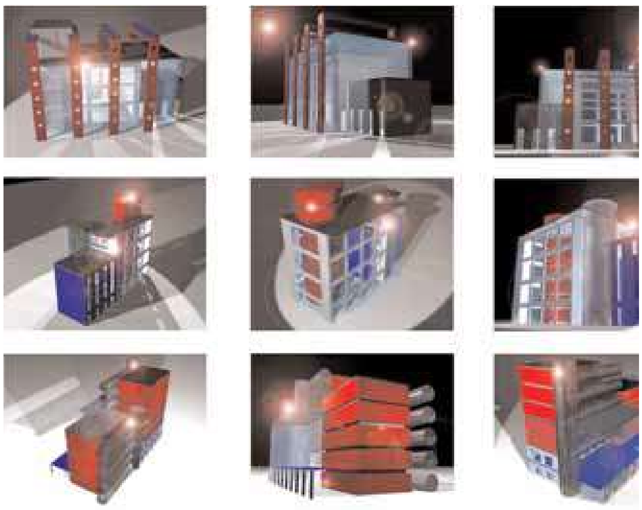


Fig. 6: Sequence of architectural compositions by Andrew Young.

Fig. 7: Sequence of abstract architectural compositions by Paul Priest.



The starting point for the final phase of the programme was a project based on the design of pavilions that exhibit bi-axial symmetry. This is an archetype for which there are a number of precedents; for example in the writing of Palladio, in his Four Books on Architecture (1570) and in his built works such as the Villa Rotunda (see fig.8), and in the eighteenth century neo-classical works of Claude Nicholas Ledoux (Vidler 1990) and his architectural designs for the Ideal City of Chaux (see fig.9).

Fig. 8: The Villa Rotunda, Vicenza (1567-70), designed by Andrea Palladio.

Fig. 9: Analytical CAD model by Adrian Dobson of design for a villa for the City of Chaux by Claude Ledoux.

The students developed element-based designs for architectural pavilions, symmetrical in plan about two axes, and with each elevation symmetrical about one axis. Bi-axially symmetrical forms, based upon repetitions of simple architectonic elements, can be modelled quickly using the generic CAD operations of reflection and rotation, and revolution of profiles about a generating axis. The rapid modelling of a large number of compositional configurations is therefore possible. The results of these exercises again showed that a rich variation of architectural expression could be achieved using a limited palette of elements and a simple set of design composition rules (see figs. 10, 11, 12 and 13):

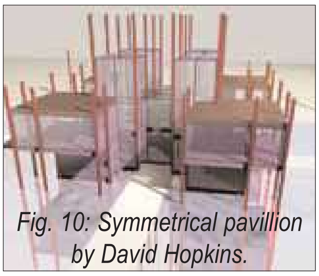


Fig. 10: Symmetrical pavillion by David Hopkins.

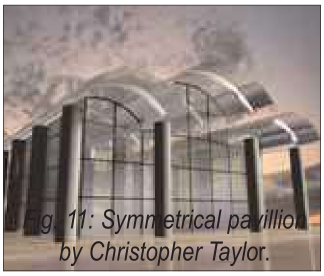


Fig. 11: Symmetrical pavillion by Christopher Taylor.

Fig. 12, 13: Symmetrical pavillion by Nadim Riaz.

Although largely rejected by the modernist tradition, symmetry has been the dominant architectural mode in most human cultures throughout history. Indeed the realisation of grand symmetrical architecture using resilient construction materials has been considered to be one of the defining manifestations of a human civilisation, and such forms continue to have a powerful impact on the human imagination. This project illustrates the effective use of a limited group of architectonic elements and a prescriptive symmetrical design rule to achieve formally and stylistically divergent design solutions within a common compositional typology. By working in a way that is philosophically compatible with CAD modelling and editing processes, the architect is able to rapidly generate and evaluate alternative design solutions.
In subsequent projects, the design methodology was tested against a broader range of more functionally specific architectural briefs. Many students reported that the restrictions imposed by the digital design studio analogue could actually assist in clarifying their creative ideas. Many architects recognise that it is often the fixed parameters and constraints of a particular brief and site context that act as the catalyst for provoking the most imaginative concepts. This is perhaps analogous to the kind of framework for creativity offered by formal structures in poetry, such as the sonnet. The digital design studio analogue requires the production of a simplified design data set, structured around individual architectural elements. The intention is always to profitably reflect the philosophy of objects in computing by the adoption of an elemental approach to composition, based on multiple use of a set of base objects.

Abdul Rob manipulated a simple set of wall, frame and roof elements using a hexagonal plan framework to produce a visually complex and structurally articulated design for a housing development (figs. 14 and 15).

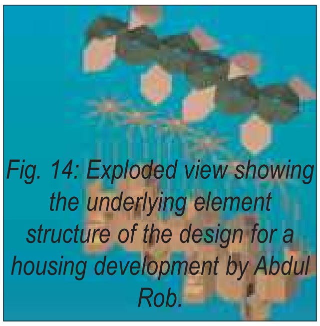


Fig. 14: Exploded view showing the underlying element structure of the design for a housing development by Abdul Rob.

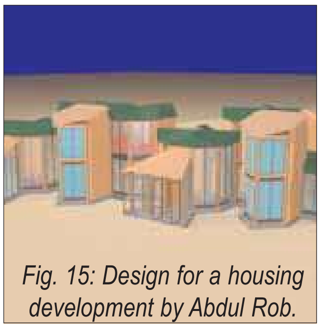


Fig. 15: Design for a housing development by Abdul Rob.

In his library design, Paul Priest utilised a larger number of elements, but followed the same principles of manipulation of a fixed set of components (figs. 16 and 17).

Fig. 16, 17: Design for a library by Paul Priest.

He applied this methodology to a larger scale of architectural intervention in his design for a film museum (figs. 18 and 19).

Fig. 18: Design for a film museum by Paul Priest.

Fig. 19: Design for a film museum by Paul Priest.

The greatest benefits to architectural practice from CAD and electronic communication technologies are likely to come through systems which provide design team members with shared digital models, with associated building databases, containing cost, programming and technical data. Such systems are likely to be based upon an object-orientated approach to modelling. Architectural composition based upon libraries of architectural elements, represents a simplified object-based design system.

The virtual design studio:

The core notion of the virtual design studio analogue is that of remote design collaboration facilitated by Internet communication technologies. Students at four European universities participated in the projects described here. The work presented is in its essence collaborative, and was co-ordinated by the following members of academic staff at the participating institutions:

Dr Igor Kosco – University of Technology, Bratislava
Dr Juraij Furdik – University of Technology, Bratislava
Dr Wolfgang Dokonal – University of Technology, Graz
Dr Annegrete Hohmann – University of Technology, Graz
Mr Adrian Dobson – University of Luton
Dr Bob Martens – University of Technology, Vienna

Initial prototype project - water tower conversion, Luton

The initial prototype project linked students at the University of Technology, Bratislava, the University of Technology, Graz, and the University of Luton. The project was modest in terms of architectural design complexity, and involved only a small number of students. It focussed on the conversion of a disused historic water tower in Luton (fig. 20).

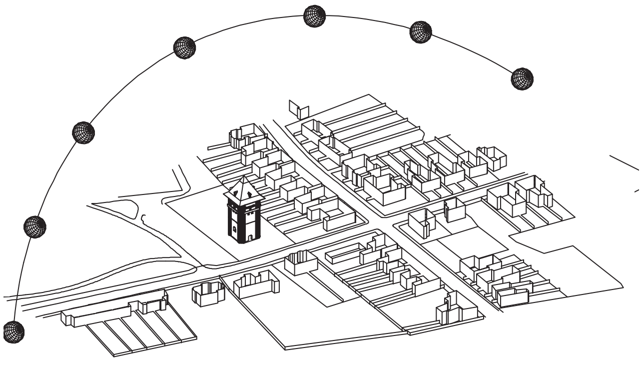


Fig. 20: Bailey Hill water tower, Luton - digital site model.

The brief required the development of proposals for the conversion of the building into an office for a graphic design company, with domestic residential accommodation for the husband and wife partners. Design information was exchanged in various electronic media formats, predominantly text and CAD files, using a variety of Internet file exchange methods, such as email and file transfer protocol (FTP).

In order to maintain compatibility of information, it was decided that a standard CAD software package, AutoCAD, should be selected. In the early stages, information was exchanged freely with no formal mechanisms for the management of data. Not surprisingly, this proved to be too relaxed a management regime, and led to confusion. Initially there was no systematic convention for the naming of files. It quickly became obvious that a file naming system was essential for the management of the network.

The initial prototype project was successful in achieving completed design proposals (see fig. 21). The students at Bratislava and Graz enjoyed working on a project on a site located at a different geographical and cultural centre, and all the students benefited from seeing design proposals produced by students outside their normal year group in their own school of architecture.

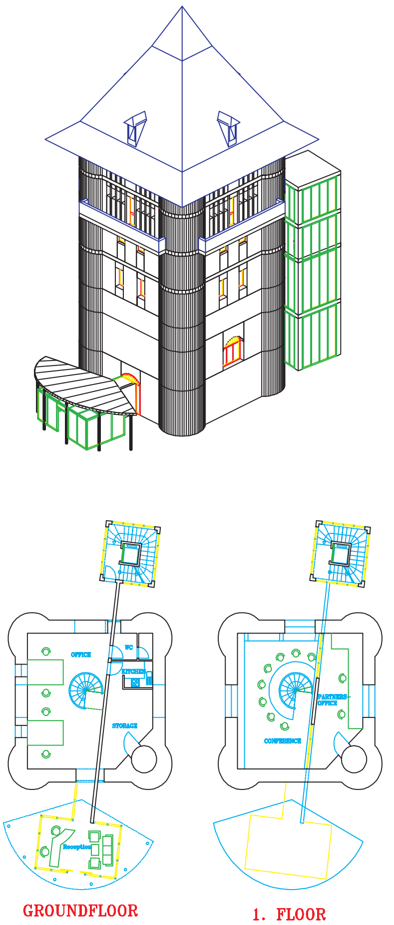


Fig. 21: Bailey Hill water tower - design proposal, Thomas Heinzl, University of Technology, Graz.

A key pedagogic benefit of the first project was the opportunity for the students at Bratislava and Graz to carry out design work in a new context, with local information being provided by the Luton participants. This contextual theme was enhanced by the decision to use the conversion of an existing building as the vehicle for the project. In educational terms the project was beneficial in developing the awareness of the students of issues connected with collaborative working, differing architectural cultures and the potential of electronic communication in architectural design.

For the second collaborative virtual studio project, carried out during the second semester of the 1995-96 academic year, a group of students from the Faculty of Architecture at the University of Technology, Vienna joined the network. The re-use of four nineteenth century brick gasometers in Vienna (fig. 51) was selected as the vehicle for the project. Small groups of four to five students were formed, every group having at least one participant at each of the other institutions in the network. The aim in this project was to develop team solutions, by collaboration between students at different centres, rather than individual solutions being produced at each centre.

Students had free access to the necessary electronic communication software, including email, FTP and web browsers. As well as working on their own solutions, exchanging information between themselves, each team was required to post “work in progress” onto a web site acting as a virtual notice board, located on a server at the University of Technology, Vienna. Contextual information about the buildings was posted on the virtual notice board, and students in Vienna produced a digital model of the gasometers, which could be downloaded from the Vienna server (fig. 22):

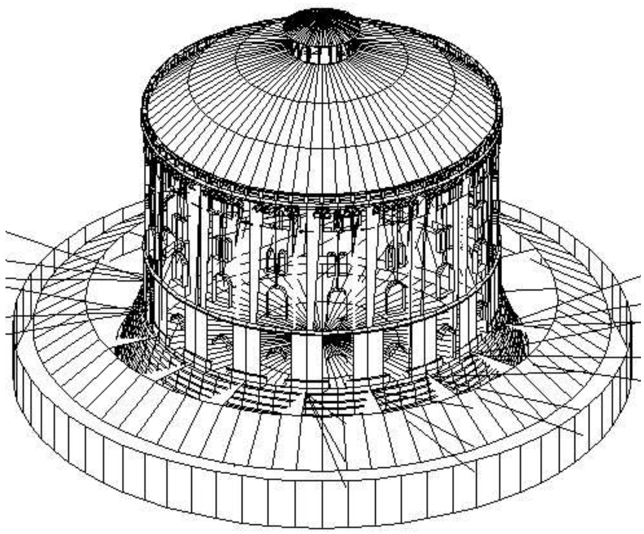


Fig. 22: Digital model of existing gasometer.

For this project desktop video conferencing and electronic whiteboard technologies were introduced. The intention was to explore shared concurrent access to digital design models, and to enhance the social interaction necessary to the to success of the project. File naming conventions were introduced. Information was generally exchanged in asynchronous modes. This seemed satisfactory for most design development activities, but there are occasions, such as an interim project review meeting, when synchronous real-time joint working can be useful. It had originally been thought that the desktop video conferencing and electronic whiteboard facilities would help to facilitate this. However, in practice, the bandwidth limitations of standard Internet connections, and the limited capabilities of the software meant that these technologies were of limited use. At the time these were emerging technologies, with poor image quality and technical reliability, and the students quickly adopted simpler on-line chat systems for synchronous communication.

The scale of the project and its multi-centre structure in reality proved overly ambitious. There was insufficient expertise and experience to support such a large increase in the number of participants. Although all the participants received training in relation to email, FTP and web-based communications, there were difficulties in establishing sufficient group interaction. As a result of the larger number of centres and participants, it was necessary to rely on a higher degree of self-management of the design process by the groups themselves. In hindsight more project management by the tutors was required, and key design review milestones should have been built into the programme.

The result was that most of the groups failed to achieve sufficient sense of common purpose, or carry out adequate planning, to achieve satisfactory outcomes within the project timescale. There was insufficient tutor involvement in the formation of the groups, which were largely self-selected, and this resulted in the mixing of students with very disparate levels of experience and expertise in both design and the use of electronic communication technologies.

In reality many groups quickly fragmented. Nevertheless some individual students were highly motivated and did not wish to abandon the process. They strove to achieve results with more limited one-to-one partnerships. A number of these partnerships did manage to achieve satisfactory design outcomes (figs. 23, 24, 25 and 26):

Fig. 23: Vienna gasometers - design proposal by Mark Curzon and Nick Dowling.

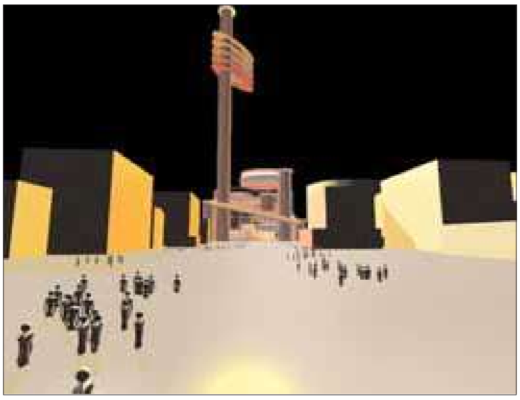


Fig. 24: Vienna gasometers - design proposal by Mark Curzon and Nick Dowling.

Fig. 25: Vienna gasometers - design proposal by Ales Fibinger and Michaela Jurkovska.

Fig. 26: Vienna gasometers - design proposal by Mark Curzon and Nick Dowling.

Although there was disappointment in relation to the overall outcomes, it was possible to draw valuable lessons. In the first project, the small numbers involved had made it relatively easy to develop effective working relationships, and there was a high level of commitment to the process by a carefully selected group of students. On the second, larger project, only those students that managed to establish effective social relationships, through the use of emails and on-line chat, were able to develop sufficient enthusiasm to be able to generate design outcomes. It became apparent that this social aspect is crucial to the success of the virtual design studio concept. We also concluded that it is important to utilise relatively mature and proven information technologies, if technical difficulties are not to frustrate the participants, and that there are advantages in using the simplest possible technological means for any given task. Thus email and on-line chat may be more appropriate in many instances than more sophisticated video-conferencing and electronic whiteboard technologies.

The final project in this sequence of experimental virtual design studios focussed on the development of proposals for the urban regeneration of the historic Danube river docks in Bratislava. Contextual information, including photographs, maps, local authority development plans, transport infrastructure plans and historical data was collated by students at the University of Technology, Bratislava, and made available on a project web site.

Fig. 27: View over existing Danube docks, Bratislava.

Fig. 28: Aerial view of existing Danube docks, Bratislava.

The students at the University of Technology, Bratislava, also worked together to produce a detailed 3D digital model of the whole docklands urban zone, and this was incorporated as a series of downloadable AutoCAD files on the web site. Following our experiences on the previous virtual studio project, it was decided to adopt a simpler project structure, with just two teams of four designers, and only two participating institutions. By extending the project over a whole academic year, it was intended to establish more permanent social working relationships, and provide the necessary timescale to achieve a stable and predictable technical and organisational infrastructure. In order to try and overcome some of the management and communication difficulties, which we had encountered previously, telephone connections were used for the first time as a regular means of communication. As part of an enhanced project management structure, a series of key dates for interim review of design proposals was established. At each of these design reviews a video-conference was held, at which all the students and tutors could exchange views on the work. A more robust video-conferencing system based upon multiple ISDN lines was utilised for this project. This offered reliable audio and visual links, and the capability to display computer-based data in real-time.

The project brief required each group to produce an urban design masterplan for the regeneration of the Danube Docklands zone in Bratislava. A second phase involved the preparation of more detailed proposals for one area of the overall site, including the development of design guidelines for the massing of individual buildings and the strategy for determining the urban grain.

Although part of the purpose of the project was to provide students with experience in the use of CAD modelling and digital visualisation techniques for architectural and urban design, the principal aim was for them to explore the use of Internet and telecommunications technologies for design collaboration, in accordance with the virtual design studio analogue. The students were encouraged to work in a range of media, including manually produced graphics and physical modelling as well as digital techniques. The more sophisticated video-conferencing techniques available for this project meant that remote discussion using a range of representational techniques, beyond the purely digital, could be facilitated relatively easily. Some of the outcomes of the project are illustrated in figs. 29, 30, 31 and 32:

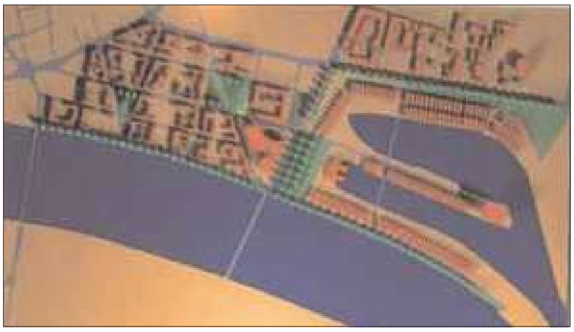
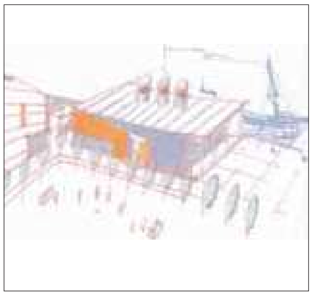


Fig. 29, 30: Bratislava docklands - design proposal by Soizic Dichard, Loďc Levin, John Leonard and Boris Schultz.

Fig. 31, 32: Bratislava docklands - design proposal by Thomas Behrendt, Neil Shepard and Matej Grebert.



The ISDN-based video-conferencing system proved to be very robust, providing clear visual and sound communication, and facilitating synchronous review of digital data. Improving digital camera technologies enabled non-digital drawings and models to be reviewed simultaneously at both centres during the video-conference sessions, and this encouraged use of a greater range of media by the students, including manual representational techniques and physical models.

A number of conclusions were drawn from our experiences on these virtual design studio projects:

1. At each stage in the design process it is important to assess which communication technology is most appropriate to the nature of the specific dialogue or data transfer. This will usually be the simplest technology that can achieve the required task.

2. In a complex project involving multiple participants, a clear project plan, with key review points, and a strict set of protocols for the naming and management of data files is essential.

3. It is vital to establish social interaction between participants as a prerequisite for effective design collaboration.

4. Tried and tested technologies offer greater reliability, but technological evolution is rapid and the available systems need to be kept under constant review.

5. The use of digital communication technologies does not necessarily imply that all materials should be produced with digital media. Input devices such as scanners and digital cameras allow design data in a variety of media to be effectively communicated using electronic means.

The importance of establishing strong social connections between design team members was a constant theme that emerged from our experiments.

Inter-personal connections become even more important when the main medium of discourse is through disembodied electronic means. Collaborative work was generally far more successful when effective social bonds were established between the participants at an early stage. It appears that it is psychologically important for participants to gain a sense of the human presence of the other team members. An important insight from our experiments is that the maintenance of the fabric of this social network is as essential to the success of a virtual design studio as the electronic infrastructure.

It is also important in the context of virtual studio projects not to neglect the utility of more traditional communication technologies, such as FAX and telephone, which have proved to have a valuable role as part of the virtual studio framework, and remain the most appropriate and immediate means of communication in many instances. Our experiences indicated that design collaboration is generally an iterative and asynchronous process, in which one member of the design team carries out work that is then commented upon, interpreted and transformed by others, before being returned in its evolved state at each cycle within the design development process. Sophisticated synchronous communication systems do not therefore need to be provided continuously at all times throughout a project. Often just a simple telephone connection is required. Video-conferencing and electronic white-boarding technologies were most useful for initial project briefing and periodic design review meetings. Their primary role was in helping to establish the social cohesion of the group, rather than as a critical means of data interchange.

A logical extension of the use of electronic networks, is the provision of links to the construction site. On larger sites, or in the case of sites in a different country or a remote location, there are obvious benefits. This is especially the case when fast track building procurement methods are involved. The speed of asynchronous electronic communication, and the option of synchronous communication, between site and design office, can lead to better collaboration between designers and the site team. Fax machines have already partly performed this function for many years.

The digital city:

Undergraduate students at the University of Luton undertook the digital city project between 2001 and 2003. In order to facilitate the project a digital urban design framework accessible via an interactive project web site was developed by the teaching and technical support staff for the programme. The teaching and technical support team responsible for the collaborative development of this electronic pedagogic infrastructure comprised:

Mr Adrian Dobson, Principal Teaching Fellow
Mr Peter Lancaric, Research Student
Mr Adam Proctor, Technical Support Officer

The digital city project focussed on an urban design study of the Plaiters Lea area of Luton. Plaiters Lea is an economically and socially marginalised area. It accommodates light industrial, commercial, retail and housing functions. Historically the area was the centre of Luton's hat making industry. It developed as an industrial zone in the Victorian period, being strategically positioned between the railway station and town centre. A significant number of Victorian and early twentieth century buildings of high quality remain within Plaiters Lea, but there are also many vacant sites and dilapidated premises. The existing buildings are mainly hat factories; buildings of unique purpose and form, and although much of the built environment is in a poor state of repair, it is significant in terms of industrial archaeology. Post-war re-development, including the Arndale shopping centre,

resulted in physical isolation of the area, which is bounded by railway lines, the bus station and the mass of the shopping centre. Nevertheless the area is a key gateway to the town centre. The Plaiters Lea area contains a number of listed buildings, and was designated as a Conservation Area in 1991. The location plan and photograph (figs. 33 and 34) illustrate the existing context:
resulted in physical isolation of the area, which is bounded by railway lines, the bus station and the mass of the shopping centre. Nevertheless the area is a key gateway to the town centre. The Plaiters Lea area contains a number of listed buildings, and was designated as a Conservation Area in 1991. The location plan and photograph (figs. 33 and 34) illustrate the existing context:

Fig. 33: Location plan, Plaiters Lea urban zone, Luton.

Fig. 34: Typical industrial and commercial premises in the Plaiters Lea urban zone.

Today the area provides for a diversity of functions and populations. Entertainment facilities, accommodation for asylum seekers, student housing, small hotels and light industries co-exist within Plaiters Lea, making for a vibrant and diverse urban zone.
The development of ideas for physical regeneration and economic and social enhancement of the area were the central theme of this project. The intention of the interventions designed by the students was to produce designs that support small-scale commercial activities, increase residential accommodation, encourage greater leisure activity by day and night, and strengthen the urban identity as experienced by pedestrians moving through the area en route to the town centre.

The core of the project was the evolution of designs for built interventions in the Plaiters Lea urban zone, within the parameters of an urban design framework. This digital model was placed within a web site structure that enabled the student groups to access it as a collaborative design tool. The location of the model within a web site meant that the students could access it at any time from any Internet connected PC.

In the first phase of the project teams of students undertook surveying and construction of the digital model of the existing townscape. The model was developed from an ordnance survey digital map, which was divided into grid squares allocated to the various teams. The model was constructed in AutoCAD using solid modelling techniques.

The teaching and technical support team within the Department of Design and Architecture also contributed to the development of the project web site, by adding historical, contextual, town planning guidance and local development plan information, and by developing the urban design framework. The urban design framework provided an overall strategy for development zoning and pedestrian and vehicular circulation patterns, as well as outline design guidelines for massing and functional mix at an individual site level.

The 3D digital urban model was also exported into a specialist interactive visualisation package: Cycore Cult 3D (Cycore 2004). This software enabled the complete 3D digital model to be published on the project web site in an interactive format. The viewer was able to manipulate the model and move through it in a real-time “walkthrough” mode, allowing the model to be experienced directly within the web browser. Communication for the project was facilitated through the incorporation of email and discussion board forums within the web site. Students could access downloadable site models from the web site. The web site also incorporated a design submission function, through which each student group could submit design proposals. Print screens from the project web site are illustrated in figs. 35 and 36:

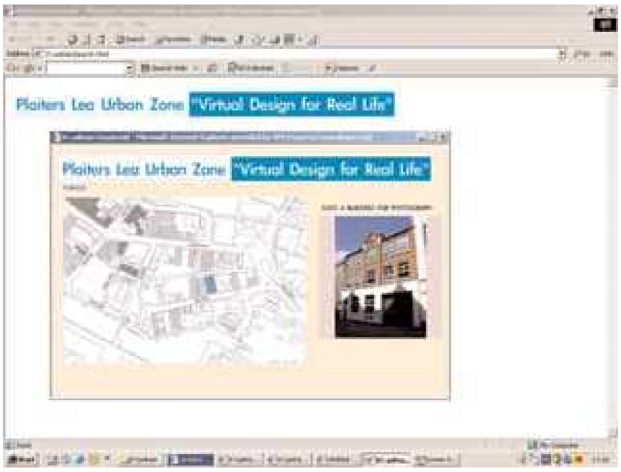


Fig. 36: Plaiters Lea interactive 3D digital urban model accessed through the project website (website development by Adrian Dobson, Peter Lancaric and Adam Proctor).

Fig. 37 illustrates the urban design framework, which identified individual sites for intervention, the need to create more accessible public space and the desire to increase pedestrian permeability.

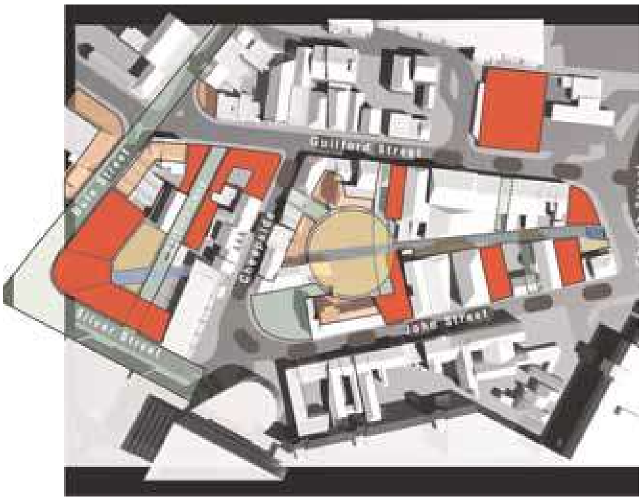


Fig. 37: Plaiters Lea Urban Design Framework, developed by Adrian Dobson and Peter Lancaric.

In the second phase of the project, each group was required to develop site specific proposals for one of the sites identified within the urban design framework, using the web-based digital model and supporting materials as their design resources. Development themes included a multi-cultural centre, a creativity block, an entertainment centre, mixed-use residential and retail units, asylum seekers' accommodation, and a social interaction complex. Images of typical design proposals are illustrated in figs. 38 and 39.

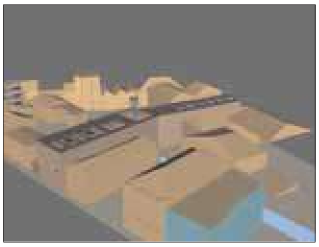


Fig. 38: Plaiters Lea project - design proposal by Tarjinder Dhillon, Anna Gkiza and Sprios Seiman.

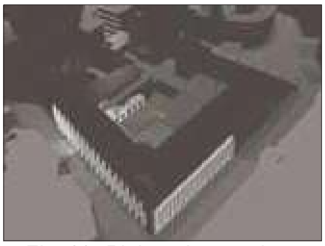


Fig. 39: Plaiters Lea project - design proposal by Gareth Maguire, Emma Kierans and David O'Keefe.

Our experiences demonstrated that a web site could successfully be used as the repository for a digital urban model, which could be accessed for design collaboration and consultation. In particular the capacity to interact dynamically with the 3D model in the web browser environment enhanced the accessibility and level of engagement with spatial aspects of the urban context.

The digital city analogue offers the potential to open up the urban regeneration debate into a wider public arena, and to offer new opportunities for public participation in determining the urban development agenda and engaging with the town planning process. By providing public access to a web site of the type used in this project it would be possible to inform residents and stakeholders about future design intentions, make available briefs and urban design guidelines to developers and architects, and enhance communication between local government, designers and the public. Architects working on proposals for specific sites would be able to download surveys and site data, as well as submit their proposals electronically. The proposals could be presented for public consultation within the web browser environment, giving local inhabitants the opportunity to influence development decisions and giving space for the expression of opinion.

Applying the digital design analogues in the professional practice context:

During the course of the research for this thesis the author undertook the role of lead architect for a new build, mixed-use community and healthcare centre. The size and timescale of the project offered the opportunity to apply the digital design analogues in commercial architectural practice, and, by making a case study examination of the design and construction process, to make an evaluation of the transferability of the principles and theoretical ideas embodied in the analogues from the academic to a practice setting.

The case study project was carried out over a period of 24 months. Conceptual design work was started in August 2003, and the construction phase commenced in September 2004, with contract completion in August 2005. From the outset it was the intention of the design team to maximise the use of computing technologies throughout the design and construction process, and to follow the general principles of the digital design analogues wherever possible.

The case study project is the Chaul End Centre in Luton; a mixed-use community building providing accommodation for the following functions:

· General local area community centre, including community/sports hall, meeting rooms, community café/commercial kitchen, IT training suite, external multi-use games area, and administrative accommodation.

· Day-care centre for the local disabled community, including social spaces, craft rooms, specialist assisted bathing facilities and training kitchen, replacing an existing, out-dated facility.

· Children's centre, including nursery/crčche, kitchen, outdoor play spaces and administrative accommodation.

· GP medical practice, including consulting and treatment rooms and rehabilitation gym.

The building has a relatively complex functional programme, including a number of shared as well as tenant-specific facilities, and is required to meet the needs of a range of different stakeholders. The design team for this project comprised an officer from the Council's Asset Management Department acting as client's agent, an independent project quantity surveyor separately appointed by Luton Borough Council, and architects, structural engineers, mechanical engineers, electrical engineers and health and safety planning supervisor all in the employment of NPS Property Consultants, under a single appointment from Luton Borough Council to provide full design and contract administration services. The quantity surveyor was based in Northampton. All NPS consultants were based in Luton, with the exception of the structural engineers, who were based at the NPS Needham Market office.

At the initial development phase, the principal means of design exploration remained manual sketching, as this provided the quickest means of establishing the basic accommodation required and the spatial relationships between these main spaces. There were a large number of stakeholders with an interest in the development, and during the briefing process these were represented by a client design group of professional officers and managers from Luton Borough Council and Luton NHS Teaching Primary Care Trust. In addition a wider project development group was set up with members comprising local councillors, users of the existing day-care centre, social services care workers, representatives from local schools and nurseries, and interested local residents.

Having established the spaces and spatial inter-relationships required, outline design proposals were then developed in *Auto*CAD, as simple orthographic plan, section and elevation drawings. At this stage the architectural team adopted an element-based structure to the scheme, based on a set of forms and components that could be applied in a variety of arrangements. The CAD media allowed for flexibility in editing and amending designs. It was decided that a full 3D model would not be produced at this stage. The design was still very fluid and the ability to rapidly evolve variations of orthographic drawings was considered to be of greater value than a 3D model, as at this second design development stage drawings were mainly being exchanged between the architects, structural engineers, client's agent and professional officers and managers, all of whom had experience of the interpretation of orthographic drawings. However, as proposals became more defined a series of abstract 3D CAD development models were produced. A key strategy was to limit the number of different architectural elements that went to make up the scheme, in order to exploit the capacity of CAD systems to deal easily with repetition of elements, and to achieve efficiencies in the construction process. Examples of this abstract 3D modelling are illustrated in figs. 40, 41, 42 and 43:

Fig. 40: Chaul End Centre, 3D development model – structural elements.

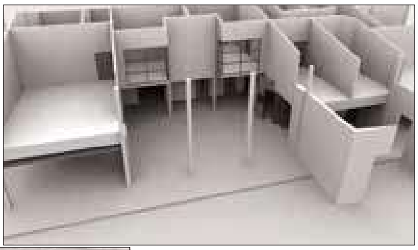


Fig. 41: Chaul End Centre, 3D development model – structural and spatial components.

Fig. 42: Chaul End Centre, 3D development model – external envelope, structural and spatial components.

Fig. 43: Chaul End Centre, 3D development model - external envelope, structural and spatial components.

The scheme went through a number of iterations over a three month detailed design development phase. Data were exchanged amongst members of the design team and with the client design group of professional officers and managers using simple email attachments. The NPS design team members and the client's agent, were able to access all drawings distributed electronically using AutoCAD, but files had to be converted to Adobe Acrobat PDF raster format for distribution to the client officers and managers. Other text-based design information was exchanged using the standard Microsoft text, spreadsheet and database formats that are ubiquitous in the general office computing market.

The project development group had been set up in response to the complex nature of the project and the wide range of potential user groups, in order to facilitate wider consultation and participation in design development, and to try and ensure the fitness for purpose of the final scheme. For the detailed design development phase, a full digital 3D model was made of the base scheme, using *Auto*CAD to produce the initial geometric model and 3D Studio to create a range of rendered internal and external perspectives (figs. 44 and 45), as well as digital animations. These were used to present the overall design concept to the development group. The immediacy offered by the digital 3D imagery, and the ability to demonstrate experientially through animations the qualities of the exterior forms and interior spaces to a diverse audience, many of whom were not familiar with traditional architectural drawing conventions, proved very valuable.

Fig. 44: Chaul End Centre - external perspective digital visualisation.

The design team were able to utilise the digital model to stimulate a debate about the most appropriate organisation of the building and its spaces and to help persuade the various stakeholders to invest both financially and psychologically in the project. A series of modifications were made to the design model over a number of meetings in order to reach a final agreed detailed design. The 3D

Fig. 45: Chaul End Centre - internal perspective digital visualisation.

digital design model also formed an important part of the planning application for the project, enabling the form and scale of the development and external material finishes to be accurately visualised. All the planning drawings and visualisations were digitally produced, but at the time of submission of the planning application, the local planning authority was not able to accept either the application or drawings in electronic format, and hard print copies had to be deposited. Subsequently the Luton planning authority has developed its systems to facilitate fully electronic applications, which can now be submitted through the Internet, via the national Planning Portal (2005).

During the development of production drawings and specifications, email exchange of digital drawings and data files between the architects and engineers formed an important medium for communication, given that the design team was geographically dispersed. Neither video conferencing nor electronic whiteboard technologies were available to the design team, but in most instances the combination of email and telephone was found to be a satisfactory method for design team communication.

Production drawings were limited to 2D format, based upon base plans, sections and elevations, which were then used as external reference drawings for the creation of the main general arrangement architectural, electrical, mechanical and structural drawings. General arrangement plans and sections were then in turn also used as external reference drawings for larger scale assembly details. A simplified 3D digital model was created at the production information stage, but only as an aid to developing shared understanding of the design concept and geometry amongst the design team members, and not as a construction information medium.
Traditional bills of quantities were produced as part of the tender documentation. The project quantity surveyor was not equipped with CAD and did not utilise any form of automated measurement

software. The measurement was therefore undertaken using purely traditional means from hard copy prints of drawings distributed by post. Email was used for the distribution of specifications and schedules to the project quantity surveyor and the answering of queries, but there was unfortunately no other significant utilisation of information technology to enhance the measurement process. This is perhaps indicative of some of the problems that can be encountered in trying to achieve integrated use of computing in an industrial context in which design and construction teams are formed and re-formed on a project-by-project basis, and where fee bidding is often the main criteria in the selection of both professional consultants and contracting companies.

The Luton Local Authority Building Control Department was keen to explore greater use of digital media in its plan inspection work, and was willing to accept all drawings in support of the building regulations full plans application as *Auto*CAD files submitted as email attachments. This was the first such application which the authority had dealt with in digital format. The only paper presented was the application form itself, which the local authority had not yet produced in electronic format. Subsequent to the successful electronic processing of this project, in common with a growing number of building control departments, they have now introduced an optional on-line submission system for all building regulations applications.

Traditional single stage selective tendering was used for the project, with a number of sub-contract packages tendered separately as named sub-contractor agreements, with the following specialist sub-contract packages tendered to three alternative sub-contractors in each case:

- Steelwork fabrication and erection
- Mechanical services installation
- Electrical services installation
- Lightning protection system
- Lift installation
- Commercial kitchen installation
- CCTV system.

Of the six general contractors asked to tender, four were able to accept tender drawings as *Auto*CAD files and all other tender documentation in electronic format, and for these contractors a CD ROM was prepared containing the full package of tender documentation, including drawings, specifications, bills of quantities and schedules. Some of the tendering companies for sub-contract packages were also able to accept tender documentation in electronic format, but again this was not universally the case, and hard copy drawings had to be provided for a number of the tendering sub-contractors.

After tender receipt and checking, the project was awarded to the lowest bidding main contractor, Borras Construction Ltd. of St Albans. The successful main contractor was equipped with basic CAD software, but did not have a culture of working with drawings in electronic format. This lack of an existing culture of digital working was a hindrance to fully exploiting the potential time and efficiency savings offered by extending the use of digitally-based material as the primary information source beyond the design team to the construction team. However, a number of the specialist named sub-contractors and main contractor's domestic sub-contractors were able and willing to utilise *Auto*CAD files distributed electronically, and for specific aspects of the project, including the steelwork, steel cladding, pre-cast concrete flooring, mechanical services, commercial kitchen, and external window, door and curtain walling packages, digital material formed the primary working medium for information exchange.

For the structural steelwork package, the fabricator was provided with digital drawings for pricing. However, there was no available translation software or standard between *Auto*CAD and the specialist fabrication detailing software used by the steelwork sub-contractor, and this meant that all design data had to be re-entered into the fabrication software. This is illustrative of a commonly encountered problem in transferring digital data down the construction industry supply chain, since many supply sectors employ specialist software packages with little or no effective data translation with the standard CAD systems commonly utilised by architects and other professional consultants.

The pre-cast concrete floor manufacturer, the roofing/cladding supplier/installer, mechanical services sub-contractor, and external glazing/curtain walling supplier/installer did all utilise AutoCAD as their standard tool for drawing production, and were provided with electronic versions of architect's and engineer's drawings for use as base drawings for the preparation of their fabrication drawings.

The main contractor was not able to offer the facility to receive drawings in digital format on site, even though an email connection was available, and required distribution of hard copies of drawings for quality assurance purposes. Overall there were therefore mixed experiences in terms of extending the use of digital media into the construction phase.

Figs. 46, 47, 48, 49, 50 and 51 illustrate various stages of the on-site construction sequence:

Fig. 46: Chaul End Centre – erection of steel frame.

Fig. 47: Chaul End Centre – erection of pre-cast floor units.

Fig. 48: Chaul End Centre – external brickwork construction.

Fig. 49: Chaul End Centre – installation of cladding, curtain walling and windows.

Fig. 50: Chaul End Centre – completed café/ IT area.

Fig. 51: Chaul End Centre – completed external works.

The case study project demonstrates both some of the opportunities for the use of digital technologies and application of a number of the concepts embedded in the digital design analogues within mainstream architectural practice, as well as some of the current practical limitations. The adoption of design methodologies that are compatible with digital design media is a natural progression in an increasingly digitised and networked professional environment. As illustrated by the case study project, the integrated 3D project model is not yet fully established as a working methodology, nor supported by fully evolved software solutions, and the majority of design development beyond conceptual design, as well as the preparation of production drawings, remains focussed on 2D design data.

The Internet is now widely used as a source for building product and design guidance data, and email exchange of drawings and other electronic documents amongst design and construction team members is now well established and unremarkable as a working method. However, more sophisticated methods of synchronous collaborative working, such as desktop video conferencing and electronic whiteboards, have not yet demonstrated sufficient proven benefits to gain broad acceptance, and the commercial practice sector remains reluctant to invest in such systems.

In general terms the integrated use of digital data becomes weaker as projects progress into the construction phase and the collaborating parties become more numerous and diverse, with increasingly varied attitudes and approaches to electronic working and a wider range of software products, with associated data translation issues. Coherent integration of digital design information becomes increasingly challenging as a project progresses.

There remain problems with inter-operability between different CAD systems and related software applications. In the case study project, the need for steelwork information to be re-inputted to the fabricator's production software was illustrative of this point. The adoption of standardised software solutions within a particular design and construction team remains critical to the success of electronic working. However, as in the case study project, it is not always possible to prioritise this in the commercial process of design and construction team selection and formation. Whilst many contracting organisations and specialist suppliers and installers are beginning to invest in the necessary software, the ability of digital design and collaboration techniques to penetrate into the construction industry supply and production chain within the medium-sized sector remains at an embryonic stage, and is constrained by economic, cultural and inter-operability issues.

In terms of the digital design studio analogue, the case study project demonstrates that an element-based approach can be implemented at the early stages of the design process, forming a base structure that can be enhanced and developed as the project progresses. However, whilst the case study project demonstrates that 3D digital modelling can be a powerful design communication medium during the design development process with clients and stakeholders, and in supporting funding and planning applications, most detailed design and construction development remains rooted in a 2D culture at present. Many design consultants and contractors remain to be persuaded that current software technologies can support a move to a 3D digital design environment that is cost effective and reliable.

The virtual design studio analogue envisages a scenario in which, by means of electronic communication technologies, geographical co-location will no longer be of key significance in design team formation. It also promotes the notion of extending the use of electronic communication of digitally based design data into the construction supply chain and onto the construction site. The case study project demonstrates that simple electronic communication technologies are now firmly embedded within the practice context, and that standard working practice is already beginning to exploit their potential for giving greater flexibility of collaborative working patterns, and enhancing the efficiency of the design and construction process. As with the pedagogic projects, in the practice context asynchronous communication was found to be adequate for most purposes. Where synchronous communication was needed, traditional telephone connections were often found to offer sufficient functionality, although as technologies such as video-conferencing and electronic whiteboards become more cost effective and ubiquitous in the general business environment there may be greater adoption of these techniques. In the academic projects adoption of common software solutions contributed significantly to ease of collaboration. The case study project illustrates that in a commercial environment, in which partnering arrangements are variable and often unique to specific projects, this can be more difficult to achieve. Where consultants and sub-contractors were equipped with the same CAD software, collaboration was easy to effect, but in some of the working relationships this was not the position, and this made it more difficult to achieve the objectives of digital tcollaboration. In the case of text based and spreadsheet data, the market dominance of Microsoft applications tends to ensure inter-operability, but this is not necessarily the case in relation to CAD software. Whilst intermediate publishing formats such as *Adobe* PDF can be of assistance in such circumstances, they do not offer the same functionality as working on a common software platform.

The case study project does not directly relate to the digital city analogue. Nevertheless there are aspects of the case study experience that can both inform and reflect upon the debate around which the digital city analogue is constructed. The case study project involved the participation of a large and diverse set of stakeholders, all of whom were consulted comprehensively throughout the design development process.

Extensive use was made of digital 3D models to assist in this consultation. The 3D modelling approach was found to be particularly valuable when debating design alternatives with stakeholders for whom involvement in a major architectural project was a unique experience, with which they had no prior familiarity. Digital animations and rendered imagery provided an accessible and easily interpreted design communication medium. In the case study project a series of 3D models and associated fixed path animations and still images were developed over a period of time as the scheme evolved. The use of an interactive, real-time 3D model within a web site environment, as proposed in the digital city analogue, would bring an additional level of immersion and accessibility to this process.
The opening up of the planning and building regulations systems to on-line submission of statutory applications in electronic formats can be interpreted as demonstrating a growing recognition by national and local government authorities of the importance of electronic communication technologies as an interface with both professionals and the general public.

The case study project indicates an industry in a state of transition. Amongst the professional consultants working on the case study project there was a widespread acceptance of the need to more effectively exploit the potential of CAD and electronic communication technologies to improve the quality and value of services to clients, and to increase the profitability of a sector that often operates on the basis of small margins.

However, some consultants were only in the early stages of changing their working methods. reflected in the experiences of the case study project. Those partners who were able to establish good working bonds were most able to utilise electronic communication technologies to best effect. As in the student projects, it was also found to be important to utilise the most The culture of electronic working appeared to be less established within the contracting and specialist supplier sectors, and it proved difficult to develop integrated digital approaches during the construction phase. However, this was not universally the case, and there were some very positive experiences of digital collaboration with specific sub-contractors and suppliers.

A key finding from the experimental pedagogic design projects using the virtual design studio analogue was the identification of the importance of the formation of strong social inter-relationships in achieving a successful distributed collaborative network. This was also appropriate communication techniques for any particular task, and in this regard the continuing utility and importance of telephone communications is noteworthy. Although some of the more sophisticated electronic communication technologies, such as video conferencing and electronic white boarding, have not yet been widely taken up in the architecture and construction sector, there has been an enthusiastic adoption of other innovations, such as fax, mobile telephones, which have proved invaluable for construction site-based workers, and the Internet, as both a data source and for email-based communication. This suggests that the industry has a pragmatic approach to technological change and is willing to use new devices and techniques as long as they are technically reliable and offer tangible benefits.

The global architectural village:
Globalisation has been a constant theme in the media in recent years, with recognition that economies are increasingly interdependent, and that goods, services and people will increasingly move and interact on a global basis.

Architecture is a profession based upon the creation and dissemination of design information, and thus, as in all other service industries, information technologies will inevitably be at the centre of the future development of the profession. Our experiments with the digital design studio analogue indicate that it is possible to approach the architectural design process with a digitally based approach from the earliest phases, and the virtual design studio projects show how this information can be exchanged and evolved using electronic communication technologies, irrespective of the geographical location Of the different design team members, and indeed across national boundaries. Whilst contruction projects themselves are place specific this does not imply that in future design teams cannot be widely distributed. The increasing convergence of Internet and telecommunication technologies which is occurring with rapidity will further enhance the opportunities for design collaboration beyond the confines of traditional regional and national political and economic structures.

At the same time as developments in the capabilities of digital design and communication tools there has been an expansion in cheap air travel, which is also bringing together architectural communities and resulting in greater movement of architects. Proximity is now as much related to air connections as physical geography, and large urban centres are becoming linked into large international transport and communication networks that force us to re-think the traditional basis of the market in architectural services. Truly we are now becoming a global architectural village.

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Recenzný posudok

Našej dobe už prestáva stačiť prívlastok informačná. Informácia je príliš všeobecný a neurčitý pojem na ostrejšiu charakteristiku. Už aj papieru sa hovorí „tradičný nosič informácií“. Oveľa viac nás charakterizuje prívlastok digitálny, v podstate súčasnú „informačnosť“ s digitálnosťou stotožňujeme. Všetko je na webe, čo nie je v informačnom systéme, neexistuje.
A. Dobson sa vo svojom texte nebojí každodennej jednoduchosti. Vo svete, v Európe i na Slovensku sa dejú podstatne komplexnejšie a závažnejšie veci, ako popisuje vo svojom texte, ale on podáva svoju interpretáciu konkrétneho stavu. Podľa dostupných ohlasov je nielen v našom prostredí interpretačne najďalej dizertácia M. Uhríka *Hranice digitálnych strojov architektúry* z roku 2005, ktorá ponúka inú kategorizáciu digitálnej tvorby ako A. Dobson, ale to je prirodzený prejav autorskej slobody. Zatiaľ čo v širšom kontexte je pod pojmom digitálna architektúra chápané generovanie konceptov, prípadne tvarov prostredníctvom počítača, tu máme počítač a iné elektronické médiá hodnotené ako vyspelé zobrazovacie a komunikačné nástroje. Prienik do konceptuálnosti je len naznačený v projekte digital city. Povestný (slovensko-britsko-rakúsky) vrabec, ktorého naozaj držíme v hrsti, analyzované medzinárodné projekty sa naozaj konali.
Konceptuálne štúdie G. Lynna a jeho súputnikov, či nasledovníkov tu nie sú spomenuté, čo možno vnímať celkom sympaticky, A. Dobson je zrejme dosť sebavedomý na to, aby nepotreboval odvolávky na „veľké povinné vzory“.

Prínosom do teórie digitálnej tvorivosti je nesporne diagram vzťahu troch „design analogues“. Na tomto mieste v podstate končia teoretické vstupy, v ďalšom je príspevok viac-menej pragmatický. Autor sa nerozpakuje zaradiť do výsledkov svojho výskumu štandardné, všedné výsledky, ako píše v úvode, mnohé základné myšlienky sa od 70. rokov nezmenili. Autor nás vedie CAD – abecedou od elementárnych po rozvinuté postupy a výsledky. Prezentované kompozície sú abstraktné možno vo vzťahu k (neprítomnej) funkcii, či obsahu, formálne, výrazovo sú celkom konkrétne. Je len drobnou otázkou hodnou diskusie, či modernistická tradícia odmietla symetriu, v kontexte príspevku to však nie je dôležité. Diskutovať samozrejme treba s tvrdením, že reštrikcie vnucované digitálnym navrhovaním pomáhajú pri vyjasňovaní tvorivých ideí, sú potom tieto kompozičné hry prínosom oproti voľným kresleným postupom? Alebo sú opodstatnené v prípade, že **chceme** postupovať digitálne a akceptujeme limity média, či nástroja. Ide potom o nácvik postupov s obmedzenou abecedou a kompozičným jazykom, voľné koncepty ostávajú bokom. Príspevok začínajúci vstupom do teórie, pokračujúci popisom návodu na použitie sa postupne mení na reportáž o spoločných projektoch škôl v Bratislave, Grazi, Lutone a Viedni. Prvoradý význam potom nadobúda kontext, v ktorom sa spoločné ateliérové projekty odohrávali, popísané prostriedky a postupy sú štandardné komunikačné metódy (FTP používame v rámci STU ako všedný spôsob komunikácie...) Pred desiatimi rokmi, kedy začínajú spomienky na popisované projekty, však všeličo bolo menej všedné a iste aj nové. Miestami by sa pri konkrétnej popisnosti žiadala vyššia miera zovšeobecnenia, je to základný parameter vedeckosti textu.

Pri projekte s témou bratislavského prístavu vyvodil A. Dobson 5 záverov, ktoré možno považovať za primerané zovšeobecnenia pre tento typ experimentálnych workshopov.

Možno paradoxne, ale prirodzene produktívne sa prihovára konzervatívnym tradicionalistom, keď do kontextu digitálnej tvorivosti zaraďuje aj sprostredkovanie – odkomunikovanie ručnej kresby pomocou elektronických médií – ručná kresba vstupuje do digitálneho sveta. Tak isto osobný kontakt medzi členmi tvorivého tímu považuje Dobson za dôležitý, elektronická virtualita vzťahov má podľa neho zrejme svoje hranice. Vzájomná ľudská prítomnosť akoby bola predpokladom úspechu projektu. Sociálny kontakt vyvažuje technologický chlad.

Metodika prípravy projektu s presahom do všeobecnej metodológie je hádam najviac rozvinutá pri type „The digital city“. Interaktívnosť vo virtuálnom prostredí je podmienená dobre pripraveným 3D modelom; 3D model naopak celkom samozrejme provokuje urobiť krok k interaktívnosti. Tu je Dobsonov príspevok najbližšie k „digitálnej tvorivosti“, objektívne aj z hľadiska subjektov zúčastnených na projekte.

V časti aplikácií v profesionálnej praxi sa snáď najviac stráca samotná digitálna tvorivosť, elektronické médiá a zariadenia sa zapájajú do tradične formalizovaného procesu. Samozrejme, že tu zohráva úlohu technologická aj mentálna výbava účastníkov postupu začínajúceho tvorbou a končiaceho realizáciou. Stačí jedno konzervatívne ohnivko a ostatné časti procesného reťazca sa musia prispôsobiť. Na druhej strane dobrou pomôckou sú aj digitálne výkresy konštrukcie umožňujúce výpočet ceny. Ak však nie je možné komunikovať medzi AutoCAD-om a softvérom pre tvorbu výrobných detailov konštrukcie, kedy bude reálne rozšírená plne počítačom riadená robotizovaná realizácia stavby? V tejto aplikačnej pragmatickej časti autor trocha zbytočne popisuje úlohu telefónov a faxov pri komunikácii, zrejme len v záujme komplexnosti svojej analýzy.

A. Dobson nám predostrel svoj pohľad na digitálnu tvorivosť v architektúre. Obsiahol škálu od užitočnosti 3D modelov pri konzultovaní variantov s klientom, až po interaktívne 3D modely pri projekte digital city. Samotná konceptuálna tvorba digitálnej architektúry ostala nepovšimnutá. Zaujímavá je záverečná poznámka o globálnej architektonickej dedine. Aj keď je stavba viazaná na konkrétne miesto, neznamená to, že tvorivý tím nemôže byť široko distribuovaný.

prof. Ing. arch. Robert Špaček, CSc.