IDENTIFYING DRIVERS FOR URBAN RENEWAL USING 3D LANDSCAPE MODELS

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ABSTRACT

The research described in this paper concerns a number of key issues which are of central importance to understanding public participation in the context of urban development and urban engineering. Proposals for the sustainable uplifting of many city centres rely on the identification of specific areas which will be of central importance to occupants, users and visitors to the city. It is thought to be essential that such areas are developed in such a way that better physical and other connections can be generated across the city centre.

This research is considering and modelling potential solutions to the issue of urban disconnection, and has undertaken to gather and report a detailed study of associated public perceptions, attitudes and values. The issue of disconnection within a city centre context requires that a complex range of attributes are considered, and that potential solutions including pedestrianisation initiatives, traffic management and addressing perceptions of safety be looked at in tandem.

The research used a combination of computer visualisation and cultural perception studies to gather data pertinent to better understanding the relationship between decision makers and end users of city centres. In order to ensure that any future intervention is both socially and economically sustainable, it is of utmost importance to gain a clear understanding of peoples' perceptions and understanding of the city centre as a social and physical landscape. The project computer models and web space were used to explore how information can be used to trigger ideas, challenge norms, and assist in reaching a consensus.

KEY WORDS

visualisation, urban development, public space, public decision-making, participation.

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INTRODUCTION AND AIMS

This paper reports on a research commission undertaken by The Robert Gordon University for Aberdeen City Council. The research emerged from a growing awareness that the process of urban design and redevelopment should make central use of end users, residents and other interested parties as a part of that process. The main aim of the research was to implement and test a method? whereby data concerning reaction to existing designs, and new ideas emanating from the population themselves, could be gathered in a robust manner and presented in such a way that it could be integrated within subsequent work at the design and construction stages.

Previous studies undertaken within the city have included consideration of the possible redesign or redevelopment of various vaulted areas within the city, which had originally been built to allow for the construction of level boulevards on a generally undulating topography. That work culminated, most recently, with publication of the 'Urban Realm' study[5], which included specific proposals for how the public spaces and public buildings within the city centre could be better used to help create a vibrant and modern environment. The intention with the research reported here was to use the design scenarios described in the urban realm study to prompt a further round of public consultation. The intention would be to determine the respects in which those design scenarios were understood and valued by potential users, and to generate ideas for specific site requirements, should construction work proceed.

The original *urban realm* studies took place against the backdrop of a city where the massive construction of major retail developments (including three indoor shopping malls in the city centre and over the historic core) and the construction of a dual carriageway through the centre had significantly altered the manner in which areas of historical and economic importance could be related to one another, and the extent to which the city centre could be regarded as accessible. Nevertheless, the urban realm study aimed to address a situation where the spaces between buildings, intended for public use, has arguably become lost in a time where funding had been directed towards the design and construction of retail and other buildings. Certainly, this situation is far from unusual, and a need for action has been argued for some time (for example, Gibbons & Oberholzer 1991).

The research reported in this paper was undertaken across a series of 'site specific' studies, followed by an overall consideration of the pedestrian connections between those areas and the main retail artery of Union Street. By way of illustration, the 'results' section of this paper describes some of the results and conclusions generated from a study of 'urban squares', which used the output from computer models within a preference study to identify those attributes which should be present within any further designs for the space under consideration.

The research has used public consultation methods coupled with detailed computer modelling techniques in an attempt to elicit information that can then be applied by the City Council in subsequent designs.

The work is important from a theoretical context in that it has afforded an opportunity to further test the appropriateness of using computer models within preference studies. Perhaps

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[5] Full details of the outcomes from that study can be found via
http://www.aberdeencity.gov.uk/acc/yourcouncil/departments/planning/urbanrealm.asp

more importantly, though, it has provided a live series of projects for which the results will be applied directly. It is anticipated, therefore, that a degree of post-project evaluation should follow such 'live' construction work.

The research carried a series of aims, as follows:

1. To develop a methodology using computer images to present urban design ideas appropriate across a range of sites.
2. To test the use of pre-consultation studies in the development of preference, perception and qualitative data collection.
3. To establish a clear method through which the results from each phase can be applied within post-research design work.

The first aim concerns the modelling of design ideas, to be applied within real sites and to be presented to respondents who will be familiar with the sites themselves. The process we undertook to achieve an appropriate level of geometrical accuracy, visual realism, and freedom to manipulate the models, is described later in this paper. The use of images to convey complex 'attribute sets' or design ideas within urban planning has been tested previously (Craig et al. 2005, Laing et al 2002), and there has been growing interest in the comparative use of real and simulated environments to identify preferences (Jorgensen et al. 2002, Rohrmann & Bishop 2002).

The second aim follows an established use of qualitative methodologies to inform the design of studies including conjoint analysis and preference studies. It is certainly true that many previous studies have established that the use of public surveys to determine the contents of 'main' design and/or preference studies can address a number of issues. Firstly, it is likely that by undertaking such work the research can then aim to address those issues which appear to be of greatest interest, or which would appear to carry the greatest capacity for uncertainty or debate within the respondent group. Previous studies have described a process whereby qualitative surveys or focus groups can be used to determine quite detailed attribute sets, which can then be used to determine the options provided within preference studies (for example, Davies and Laing 2002, Morrison et al. 1997). The pre-consultation stages had strong links with both the main preference studies and the visualisation elements of the project as a whole. The main studies themselves carried a number of expected outcomes:

- The studies increased general awareness of issues associated with the use and design of the spaces.
- There was an anticipated outcome (post research) of the direct enhancement of the design of those areas studied.
- There was an intention on the part of the funder to improve the strategic planning for different types of public open space.
- The issue of pedestrian disconnection has been recognised for some time. There has also been an awareness that the issue must be traced to factors which may be physical and economic, as well as being driven by historical or emotional associations with

particular spaces. The research aimed to identify what, if any, barriers to pedestrian flow exist within particular sites.

Work undertaken through the pre- and main- survey stages inevitably enhanced the collective understanding of issues to be addressed. Similarly the use of visualisation as part of the experimental work allowed the project to develop design scenarios for individual areas (or prompt discussion), and also to develop and test methodologies for the incorporation of images in otherwise text based experiments. The research also made use of internet based surveys to gather data, particularly at the pre-consultation stages[6].

The final aim concerns the assertion that those approaches used in this study together represent a process of public consultation and involvement in the design of urban spaces, which can then be applied within design studies. This follows established research studies by others (for example, Romice and Frey 2003, Sanoff 2000), which established methods whereby non-experts in design could effectively and meaningfully participate in urban design studies. The process undertaken within this research took the design consultation to a point where rich data sets could be taken to a further design stage in the expectation that the work resulting will reflect and better meet the needs of end users.

PROCESS

OVERVIEW

The research followed a clear process, whereby sites and case study areas were considered through a series of data collection, modelling and various consultation phases. The research undertook to ensure that a near-photorealistic model of each site be developed, through which design proposals could be presented, and a representative sample of end users and interested parties given the opportunity to present their own responses, preferences and ideas in relation to each site.

In addition to the analysis of each case study site, the research had a wider agenda, to consider the issue of pedestrian connection across the city centre, which required a parallel series of studies during the early research phases, culminating in a specific study considering key routes. Reference should be made to figure 1 for a diagrammatic representation of the overall research process.

SITE SELECTION

Following initial meetings with the client, it was established that key areas for consideration in relation to the subject of pedestrian connection within the city centre included an urban square, a large Victorian-era park in the city centre, and the city's 'historic core', centered on two medieval market spaces.

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[6] Online surveys can be accessed at http://rgusurvey.org.uk/aberdeen/
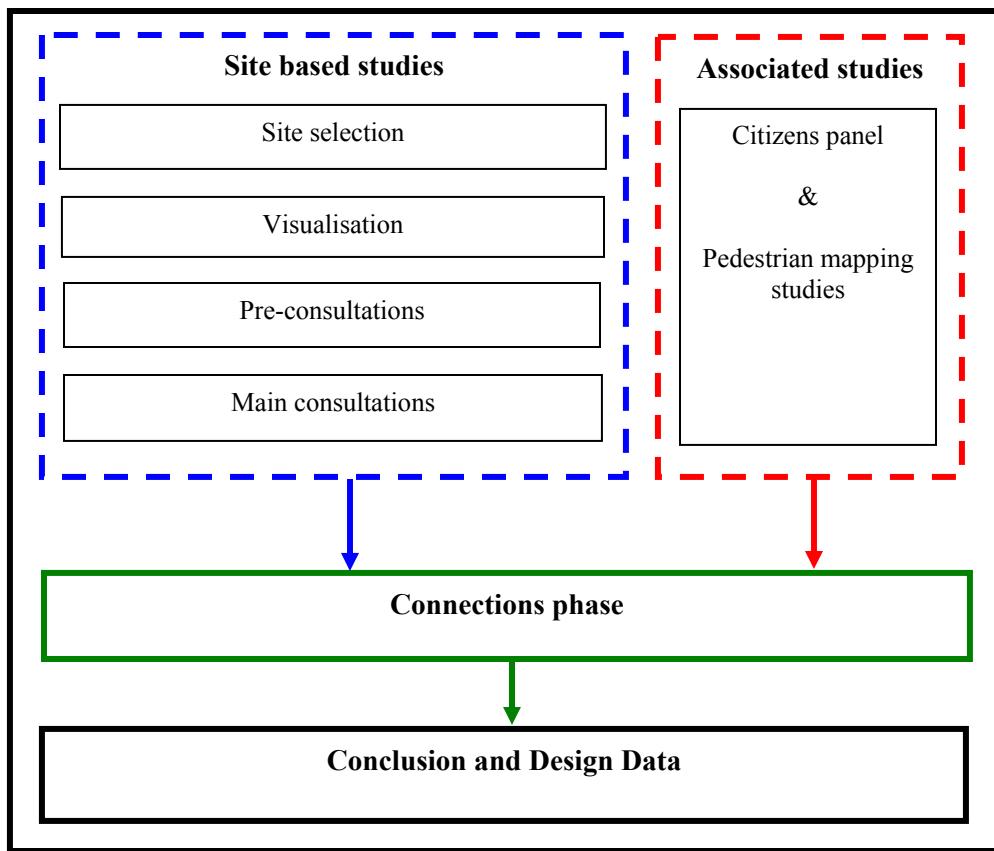
Figure 1: Research process

MODELLING

The computer visualisations constructed for the research took the form of complete and fully textured three-dimensional models of all sites within the city centre, as identified at the 'site selection' stage. Once complete, the models allowed each specific area to be inspected from any viewpoint, as well as enabling dynamic walkthroughs within the space.

Initially the identified areas were fully modelled in terms of their current arrangement. This then allowed any proposed alterations to the given sites to be added within the model and presented within a public participation phase. New features could be added or complete areas redesigned with minimal effect once the initial base model was complete. For example, it was possible to virtually remove vehicular traffic, or to introduce additional areas of green landscaping, to a level of realism which would have been difficult using photographs or photographic manipulation.

A complete photographic study of each site was completed, and used as reference within the modelling process and as presentation material in the main studies and research reports. Computer visualisation was utilised throughout all of the inter-related stages shown in figure 1, although the manner in which outputs were utilized varied depending on the issues to be addressed. That is, close-up images, vistas, site maps and walkthroughs were generated, to

satisfy the needs of the experimental design. For each site, every building has been recreated in digital form and fully textured using material gathered from real photographs of the actual buildings. Ordnance Survey data was used to ensure the greatest accuracy was achieved throughout the modelling process.

The research team had developed various computer models of parts of Aberdeen city centre over the past 10 years, and was be able to draw upon that experience for this project. The team had also recently been involved in creating urban based built environment visualisations through projects such as Streetscapes and urban park/green space visualisation through the EC funded Greenspace commission. In both of those research commissions, the visualisation was used extensively as a means to identify public perception of known areas of Aberdeen and to identify opinions on possible alterations[7].
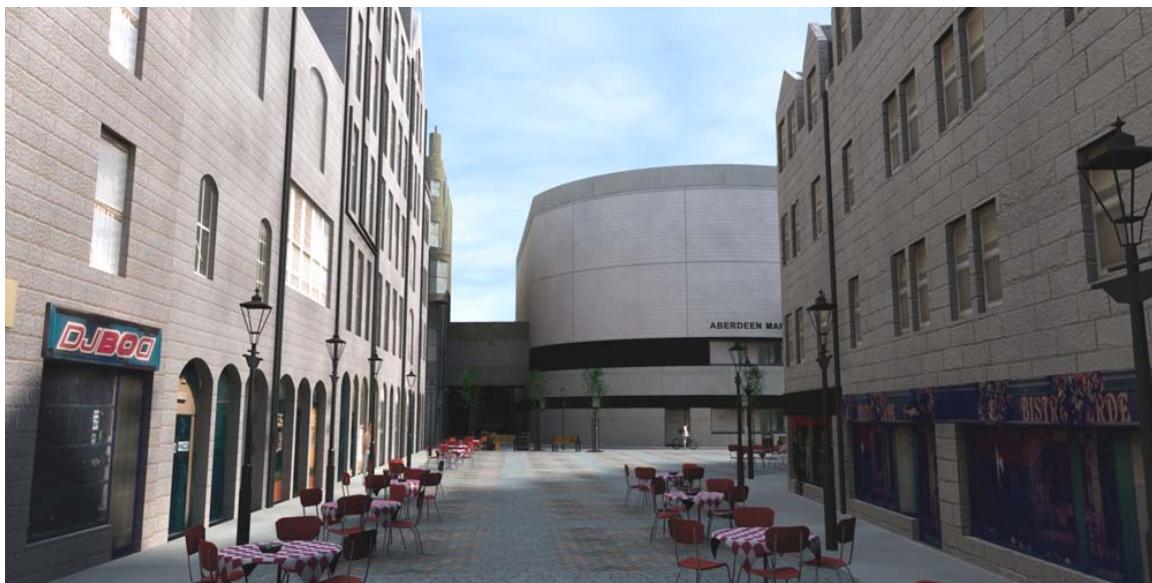
Figure 2: Computer model of a study area, showing the introduction of café seating

The production of three-dimensional computer models for each of the study sites was a key project deliverable and these are to be provided to the client as a tool to be developed as required.

APPLICATION

The computer visualisations completed were used to present specific design proposals to the public for the different areas under investigation. After computer visualisation of an existing space was complete, the three-dimensional model was modified to represent specific design 'scenarios' identified through earlier pre-surveys. Images generated for use in connection with the 'urban squares' study are shown in figure 3.

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[7] Further information on those studies can be accessed va http://www.rgu.ac.uk/sss/

Figure 3: Images used to represent possible scenarios for the site 'Golden Square'

Public responses to each design scenario were assessed through a combination of traditional public consultation methods and digital information presentation methods. The overall intention was to evaluate the public response to a series of presented change of use proposals, and to produce comprehensive feedback concerning the way in which each design proposal might enhance the existing environment and the extent to which symbolic connections and boundaries are apparent in each design proposal.

Wherever possible, the proposals and scenarios tested were drawn directly from real proposals for the areas under scrutiny. As there were several potential design solutions for each area, using the visualisations provided an ideal method for comparison for the different proposals, as only the attributes specified in the design will be changed in the model – everything else remained identical. This meant that there was complete control over the manner in which designs are presented, and an emphasis could be placed on ensuring that respondents were able to comment on the designs themselves, rather than the medium in which they are presented.

Public responses to each design proposal were assessed through a combination of traditional public consultation methods (e.g. public displays, questionnaires) and digital information presentation methods (e.g. 3D Walkthroughs, Internet based public consultations). The overall intention was to evaluate the public response to a series of presented design proposals, and to produce comprehensive feedback concerning the way in which each change of use proposal might enhance the existing environment and the extent to which symbolic connections and boundaries are apparent in each design proposal.

For each case study site or area, there was a public display and/or survey utilising presentation materials, where the public was given the opportunity to examine the dynamic 3D visualisations. This was achieved by presenting 3D walkthroughs of the design proposals, and allowing people to view the area from a variety of viewpoints. People were then asked to answer a series of open-ended questions about each proposal concerning, for example:

- the extent to which the design proposal is seen as an improvement to the existing environment;
- suggested changes to the design, and reasons for them;
- any potential conflicts of interest over space usage;
- implied connections to other areas.

After completion of the visualisation and survey stages, a further and final stage of the research sought to document the perceived connections between study areas, and the extent to which any apparent connectivity issues might be improved through design. The earlier case study areas were considered in relation to each other and consideration given to ways in which the proposed design solutions might enhance connectivity across the city.

RESULTS AND CONCLUSIONS

A general conclusion from the study must inevitably concern the activities undertaken at the modeling stages. This research was concerned almost exclusively with the consideration of

changes to public space between buildings which are already in place. However, the absence of models for over half of the sites required extensive site measurement activity, before any modeling or texturing work could take place. The increasing availability of larger scale 3D scanning equipment should assist in the more rapid compilation of geometric models in the future. The research team is currently exploring how such surveying equipment can be used to measure and record artifacts from the historic built environment, where the technology allows the research team to work remotely from the site with a reduced need for regular site visits. Thus, the reliance on a combination of media including ordnance survey data, historic maps and photography may reduce in the future.

Earlier stages of the research considered the topics of urban squares, the historic core and public gardens in the city centre. Each study aimed to attract responses from a wide range of potential users, and in this respect the studies were very successful. For example, the three pre- consultation studies received 133, 32 and 88 responses respectively (squares, historic core, gardens), with a further 32 respondents answering a separate study in the local press.

For the urban squares main study, each scenario aimed to reflect a changed use for the square, and each was presented (on posters and video) using a series of images taken from 3-dimensional computer models. That study, from which 270 responses were returned, concludes that there is strong public support for the removal of cars from the square in question. With this comes a perceived need to also introduce more greenspace with seating and café facilities. There was also strong support for retention of the existing architectural layout, including the circular central area and statue.

The change of use scenarios utilised in the study also reflected the results from questions posed to the Aberdeen citizen's panel, which provided data concerning wider issues of pedestrian flow and viable pedestrian routes through the city. What was particularly notable from many responses was the depth of feeling which respondents had for the areas under consideration, and the time respondents were willing to spend participating in the study. There would appear to be a clear appetite among the respondent group to be included in urban design processes, which will ultimately have a major effect on their living environments.

Whilst the level of interest in the research was encouraging, it is also worth noting perhaps that the methods and approaches described herein are geared towards satisfying the earlier stages of a longer process, which should ideally involve further design, consultation and implementation stages. In any case, it is clearly arguable that there is a need to ensure that the needs and preferences of end users can be incorporated within urban design decision making in a meaningful way. Certainly, it has been reported in the past (Chadwick 2002) that it can be difficult for the often emotionally driven data, however it is presented, to compete with the more objective concerns of large scale engineering, retail or road provision. The level and depth of responses received would tend to suggest that where mechanisms do not currently exist to incorporate such data, that work should be undertaken to develop an outlet for a deeper public involvement.

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