Abstract. This paper describes an urban design studio that explored digital methods of design thinking, expression, form finding and communication. It reports on the goals and outcomes of the studio and the educational approach is portrayed: the way urban design tools can make use of parametric design methods, and the process and outcomes of the studio. It discusses implications on design education as well as understanding and communicating of complex design tasks that are digitally responsive to a variety of parameters. The studio continues a series of investigations that explore parametric design methods in architectural design.

1. The Island

Urban Design Studios are an essential learning experience for architectural students. Their traditions and proceedings are well established. The studio is informed and supplemented by events, the city and the built environment, all of which contribute to the increase in participants’ knowledge. This in turn expands the learning environment and contributes to society in general. Hitherto there has been a gap between skills training and the application of knowledge within the cultural context of society (Batty and Longley, 1994). The Urban Islands Studio (Urban Islands, 2006) went beyond pure skills training and required both reflection and the creation of knowledge to feed back into the larger society.

This gap between expertise and the application of knowledge often becomes apparent in relation to urban design studios, where on one hand the underlying concepts of architectural design and philosophies of urban development are presented, and on the other hand, students have to be taught and trained in the skills of technical issues (Kvan, 2004). The integration of both within a single design studio often fails because the compound acquisition of skills prevents a deeper exploration of design and its theoretical aspects. Only long after the participants have learned and gained proficiency in technical skills are they able to employ their knowledge of design. Yet by then, the design problem may no longer consider these skills necessary because of the complexity of the interrelationships of urban design problems. The knowledge and the skills students have gained then quickly become inactive because the various learning foci of urban design problems have shifted to other aims.
The Urban Islands Studio addressed these issues by integrating the learning experience right from the beginning within a series of compact workshops, tutorials and lectures. This allowed the participants to draw from their own experiences as well as their expertise far into the project and beyond. Participants were inspired by their rich and informative experiences of the site. From the first day, they expanded the development and communication of their understanding of urban design issues using a variety of digital and parametric communication tools. This idea builds upon design studios held in the past that have allowed participants to explore design beyond its original definition and perceived limits (Schnabel, 2006). It continues a series of urban design studios that explores and addresses the evolving changes in cities using digital and parametric tools as mean of design creation.

2. The Tower Of Babel

The exploration of the relationship between human beings and the natural world and the subsequent implications for their interaction has deep roots in the social-cultural understanding of a society. A city is a direct reflection of its inhabitants, whereas design directly influences the living conditions of the people. In recent practice, cities have been designed and described by master plans that describe a picture-perfect, complete city in which change is not part of the picture. A few have tried different approaches. In the sixteenth century, Pieter Bruegel painted the Tower of Babel represented as a miniature city (Figure 1, left). A tower piercing the clouds depicts the entire problem of cities and city life. It is a depiction of a city crumbling and rebuilding at the same time. This city is constantly changing. Ca. four decades ago, Archigram came up with a similar idea. Reacting against the permanence of the house in their ‘Plug-in City’ (Figure 2, right), they proposed ever-changing units adaptable to different social and economic conditions (Karakiewicz, 2004A). Nevertheless, what has been practiced for centuries now is much closer to Le Corbusier’s idea of the city as a machine. Descriptions adaptable systems would be much closer to reality for informing the generation of desirable outcomes (Schön, 1985).

*Figure 1 Left: Pieter Bruegel (1525/30-1569) Tower of Babel Kunsthistorisches Museum, Wien – Right: Archigram’s Plug-In City 1962-1964, At Muzeum Zamościa*
A building, an urban situation or architecture in general can be expressed and specified in a variety of ways. Commonly, geometric properties are described with drawings. Thus, a building or a street can be explained, depicted and constructed. Alternatively, observed behaviours can be described, as found in performance specifications. It is also possible to describe properties in terms of relationships between entities as for instance, in a spreadsheet, while responsive materials change their properties in reaction to the conditions around them. Using such techniques, artists have created reactive sculptures and architects have made sentient spaces; that is, spaces that react to the occupant or other factors. Lights turn on if lux levels fall below a certain threshold; traffic flow is regulated according to need; walls move as users change location.

Using these ideas to formulate innovative design thinking in urban contexts, connections to a variety of data or atmospheres can be established that serve as a basis for generating urban forms and living environments. When designing urban space, it is usual to collect some data on the type of urban qualities desired. These are then, for example, translated into master plans, which are themselves specific spatial descriptions. One can also define performance requirements for urban places, linking the description of the urban space to historical, experiential, financial, social, environmental or other factors (Picon, 1997).

For its design of Federation Square in Melbourne, Australia (Figure 2, left), LAB Architecture Studio developed analogical building facades through the interactive application of sequential rules describing their visual characteristics both quantitatively and qualitatively (Davidson, 2006). Their more recent designs of Beijing’s urban master plans at ‘SOHO Shang Du’ appear to go even further (Figure 2, right). Instead of coming up with a master plan, LAB translated planning codes into a series of parametric design rules. As a result, the outcome both complies with and confounds the rigid regulations of traditional urban planning. Similar to the ‘Favela’ neighbourhoods in Sao Paulo, Brazil, students tried to respond to the influence of functionalism and economics by redesigning urban parameters (Vanderfeesten and de Vries, 2006). They derive their parameters from the social context of the neighbourhood and their relationship to the urban context in order to create a model that addresses the constant change as it is present within the Favela.
The Urban Islands Studio took this as its basis for the exploration of a distinctive site within and surrounded by Sydney’s urban context. Cockatoo Island is predestined for a parametric rethinking of its earlier development, which failed to anticipate changes that arose over the years, thereby excluding the island from the city.

As the basis of the investigation, the studio explored a distinctive abandoned land within the Sydney urban context. On this island, a variety of facilities and settings lie idle, awaiting redevelopment and integration into the urban context. Sydney’s pace of urbanisation, as well as its rate of development, has had a strong impact on both its sense of place and sense of community. Urban planning in general does not foresee the real changes that occur over the years of habitation. The Urban Islands Studio explored these issues, creating a new urban identity for the place and the city itself (Forrest, La Grange and Yip, 2002). In other words, what the studio is to the discourse of urban design is what the island is to the rest of the city.

4. Urban Parameters

The Urban Islands Studio was one of the design studios offered in the architectural programme at the University of Sydney. Forty-five students elected to join the urban design studio held in August 2006 and guided by international architects and assistants. It took place partly on various sites on Cockatoo Island within Sydney’s Inner Harbour and partly in the design studios and digital media labs of the university. Its aim was to establish an architectural discourse with the island, the harbour and the city, and their historical and cultural contexts, and to communicate to a broader audience visions for reintegrating the island within the city’s fabric by using a variety of digital and other media.

The studio presented design by basing it on parameters. In order to build up a philosophy around parametric dependencies and relationships, the participants used digital tools that allowed them to explore and express their designs. These tools allowed users to develop expertise and to engage creatively in parametric design. Parametric applications have inherited two crucial elements. These are that all entities start with a point in space and allow the study of urban conditions in a three-dimensional environment, rather than the commonly used two-dimensional or layering techniques, and that the underlying concept of parametric modelling is based on data, variables, and their relationship to other entities, which can then respond to variations of input data.

In their initial exploration, the participants collected data from the location. This discovery went beyond the traditional ‘site analysis’ and required students to relate their own interests in the project to data that arose from the ‘genius loci’ or its urban context. These parameters were informed by the site, and allowed a description of the place based on dependencies and the interconnected relationships between relevant information. The outcomes of these investigations led to both a very personal interpretation of the site as well as a rethinking of urban parameters as a whole. The studio successfully dismantled the boundaries between the theoretical and practical realms to the
extent that each crossed over to the other by focusing on multiple rather than single interactions.

In the next stage of the studio, the participants concentrated on understanding their design concepts and acquiring the skills of design communication, which allowed their concepts and theories to be interpreted and related to each other. These developments were tested at specific situations on Cockatoo Island and placed into its urban framework. The result was not only an academic discussion, but also the broad involvement of all stakeholders as well as the public.

The participants then developed their design creations and reflections into a comprehensive urban proposal. Using the data, their understanding and their recently acquired skills, the participants were able to establish and visualise their design in a variety of descriptive and multidimensional forms to create spatial expressions of their findings and explorations. The outcomes are strikingly powerful, because they describe form by creating both dependencies and parameters that define the urban spaces as well as the landscape. Normally, urban settings are the passive result of the description of the buildings around them (Karakiewicz, 2004B). This studio, however, described generators that created external spaces, which then defined the building forms, resulting in the subtraction of open space from the urban space.

The individual outcomes varied from large-scale installations, which responded to various light conditions across 24-hour cycles (Figure 3), to very small interventions at specific locations on the island (Figure 4). Participants carefully maintained most of the abandoned structures and buildings on the island and their interventions combined and redivided spaces and buildings. They re-established relationships with the surrounding water and neighbourhoods on the shorelines opposite the island, and allowed soft responses to hard places using digitally controlled media and installations. This stands in contrast to Sydney’s typical urban development, where relationships across the harbour, density, grown structures and function are erased, and new developments are isolated from their immediate surroundings (Toon and Falk, 2003).

Figure 3: Student’s installation: Digital generated and controlled lights, reflection & sound

The studio concluded with a public seminar that brought together the various aspects and results of all participants into one cluster design. After
two weeks of daily studio, the students merged their individual designs and dependencies of urban strategies, components and rules into a single large design concept and strategy. These highly complex representations, however, cannot be communicated using traditional urban planning methods or tools. The synthesis of the final seminar created layers of descriptions and dependencies that are complex and interrelated. This resulted in a rethinking of urban parameters, allowing a seamless communication with a larger audience. Urban planners, architects, stakeholders and the general public were invited to review and discuss the outcomes of the studio. The variety of innovative statements of urban habitation and the living environment enabled the participants to amplify the impact of their generated design proposals beyond the shores of the island and far into the city itself. The students were not limited to their own knowledge or level of skills in order to express their design. At the same time, the audience could engage in a complex discussion about urban planning and design. The proposals presented by the students allowed quick access to a variety of solutions as well as their synthesis within the overall context.

Figure 4: Student’s Work: Urban Islands collage using parametric modelling and CNC tools

The variety of individual design proposals, as well as the large multifaceted urban design cluster for Cockatoo Island, demonstrated a high level of thinking that ended in the generation of compound designs. Each participant in the seminar contributed to both the micro and macro scale in order to create and rethink urban strategies. This method allowed an innovative urban design to emerge.

5. Redesigning

The Urban Islands Studio addressed novel concepts in the creation of architectural urban design that can influence the recent development of architectural production. This partly experimental, partly realistic studio explored innovative methods of architectural expression, form finding and communication, and developed unconventional solutions. It coupled the in-depth studio-learning environment with a creative real-case scenario in order to close the gap between the studio environment and the application of knowledge. Hence, the studio relates to and reshapes urban design in general,
just as Cockatoo Island can relate to and reshape the city. Additionally, it explored novel processes for the integration of compound urban design issues. The rethinking of urban parameters allowed the participants to create an innovative urban design language based on social and cultural descriptions.

The studio continues a series of urban design studios that investigate parametric design creations and communication (Schnabel, 2006). One objective of the studio was to frame an intellectual research question linking to a variety of data to generate and integrate an urban form. A more interesting outcome derived from the ability to redefine and reframe the problem itself by stepping out from a preconception based on experience and exploring a set of unpredictable answers. These are higher levels of design problems. The framing of a problem at a higher level allows both a deeper investigation of the problem itself and a rethinking of the variables that contribute to a solution (Gao and Kvan, 2004). The establishment of meta-rules creates a precise problem-framing that allows the reference of one problem or parameter to another one. As with our design studio, the outcomes illustrate how nonlinear design processes and re-representations of an idea can lead to successful and responsive design expressions that differ from conventional approaches to urban planning.

Although the synthesis of all individual projects removed the students from individual ownership of their design, it also allowed them to reflect on their own as well as their colleagues’ designs as a whole cluster of contributions (Kvan, 2000). This outcome relates to earlier research by design studios based on the same principle, whereby the design environment is applied outside the bounds of its normal prescribed purpose, and innovative design methods are deployed through the interplay of design with exploration.

With the rethinking of urban design habitation, both culture and living experiences can act as generators of spatial dependencies and rules. The generated design can subsequently be linked to various ways of extracting or generating innovative urban forms and understandings (Figure 6). These descriptions can then be used directly in the communication and exploration of urban environments (Schnabel, Kvan, Kuan, and Li, 2004).

Figure 6: Redesigning urban parameters as abstract description by employing software scripts
The Urban Islands Studio addressed and expressed important aspects of the urban development process. It marked the beginning of architectural rethinking processes, and it is to be continued. A holistic discussion about design, city, function and development allows its significance to be rephrased not only within architectural education, but also in all other dialogues involving spatial representations. This follows the tradition of artists and designers, who have always pushed creativity towards new definitions of both artworks themselves and their cultural contexts.

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References