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Digital design and creativity: A reflection on curriculum change in landscape architecture education

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Abstract: *In comparison to the allied design disciplines of architecture and urban design, the creative potentials of digital media have been slow to influence landscape architecture. Many landscape architects consider digital media to lack the intuitive capability of more traditional means of design such as hand drawing. This paper argues for the creative potential of digital technologies in design pedagogy of landscape architecture. Drawing on the experience of the first year of the professional Master of Landscape Architecture program at the University of Melbourne, we outline a shift in design curriculum from planimetric design techniques to a focus on three- dimensional digital modelling including parametric design. We argue that immersing beginning design students within a three- dimensional understanding of space disrupts the linear problem-solving emphasis supported by conventional landscape architecture design techniques. We identify three avenues for creative exploration provoked by digital technologies –topographic form, creative unpredictability and a focus on experience and demonstrate how these moments encourage the beginning design student to develop a complex enquiry of program, form and experience.*

Keywords: creativity, landscape architecture, pedagogy

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Introduction

In 2008 the University of Melbourne began implementation of the Melbourne Model, its new vision for higher education in Australia. Six broad undergraduate university degrees were introduced and graduate schools created. This new structure revised the positioning of the previous undergraduate professional degrees such as architecture and landscape architecture where students completed a four or five-year undergraduate course. Under the new model, students may progress from an undergraduate generalist degree (with a major) to a professional Masters. Alternatively graduate entry is provided for students to pursue a professional qualification without prior experience in the discipline. Described as lateral entry, this pathway allows students with no design background to study landscape architecture in just three years. The adoption of a three year Masters of Landscape Architecture provided the opportunity to conceptualise its pedagogical foundation within an era of digital technology, with a particular focus on the ambitions of the first year of study. Two principles informed its development.

First, to adopt an accretive pedagogy that exposed students to the *complexity* of contemporary landscape architectural practice through a mixture of design, research, theory, history and exposure to the profession. This differs from 'foundational' knowledge that has been core to design education in architecture and landscape architecture. Design studios, considered the back bone of all design degrees, have generally been structured in a sequence of increasing complexity, beginning with design fundamentals and representational skills. Studios introduce more complex design issues as students advance through their degrees, and are supported by additional subjects focusing on theory, construction and history. This structure emphasizes a linear learning path with acquisition of the fundamental building blocks considered essential for more advanced learning.

An emphasis on complexity however acknowledges that a cohort of postgraduate students already has existing knowledge, skills and abilities that could be used and developed. This view profoundly influenced studio structure and reflects a constructivist theory of learning where students' backgrounds and knowledge are seen as the starting point on which to build; they are integral to not only engaging the students individually but also essential for students to learn, to construct meaning through confirmation or dissonance with the current state of their knowledge. As Pepin states, "All new knowledge must necessarily be constructed upon prior knowledge, either consolidating the latter, complexifying it, or deconstructing it "(1998,p.182). This departs from design curriculum that assumes students are 'empty vessels' in which to impart professional skills, with education positioned 'in between' the university and the 'external' profession (Crysler 1995, p. 211).

Second, an emphasis on digital technologies shaped the conceptualisation of design studios and technical subjects. We speculated that a shift away from planimetric techniques to embrace the potentials of digital technologies could provide a range of generative techniques for beginning design students. Importantly, it departed from framings of landscape architecture design, heavily influenced by landscape planning, that position design as a rationale 'problem solving' process, beginning with site analysis, conceptual drawing, presentation drawings and finishing with construction drawings. Within this model the two-dimensional plan is championed as the major design representation, considered to provide the basis for generating all other representations.

How the designer moves from an engagement with site (the existing) into creative and generative processes is hidden amongst a linear methodology of site analysis, conceptual design and design development. As Kathryn Moore states:

> Design is often characterised as a highly personal, mysterious act, almost like alchemy, adding weight to the dangerous idea that it is possible, even preferable, to hide behind the supposed objective neutrality implied by more 'scientific' technology-based, problem-solving approaches. (Moore 2010, p. 5)

Adopting a problem-solving approach to design does not by default inhibit creativity as demonstrated for instance by the discipline of industrial design which combines innovation and functionality in a creative process encompassing exploration, experimentation and discovery (Cross 2011). However we argue that in the case of landscape architecture it is the rigid *linearity* of the design process combined with a focus on problem -solving that restricts the level of experimentation and discovery within the creative process. Problem-solving within landscape architecture is weighted towards certainty and absolutes rather than experimentation and speculation (Seggern 2008). Further, review of publications on landscape architecture education offer minimal reflection and research on creativity and the use of digital technologies within the discipline (in contrast to allied disciplines such as architecture and industrial design).

We considered that the emergence of new digital technologies including the three-dimensional modelling programs such as Rhinoceros, parametric modelling through programs such as Maya and Grasshopper and new digital fabrication techniques of CNC milling, laser cutting and three-dimensional printing offer many potentials for reframing landscape architecture as a more creative design practice.

So how do we define design creativity within a new digital realm of landscape architecture? Lawson's discussion of 'fake' and 'real' creativity offers a useful starting point. Adopting Herman Hertzberger's definition of 'real' creativity which encompasses an engagement with the full complexities of design, Lawson (2002, p. 329) argues that architectural design within the digital realm has often fallen victim to the image making (fake creativity) at the expense of more complex design solutions. A review of recent publications in the field demonstrates that this development is equally evident within landscape architecture where the popularity of the Photoshop montage has led to a proliferation of hyper reality images which present an indicative design (see Amoroso 2012).

We position creativity as more than the creation of something new, instead also requiring an articulation of the value or contribution of this newness. As Gero (1996, p.2) argues "the introduction of 'something new' should lead to a result that is unexpected (as well as being valuable)." This understanding of creativity requires that we evaluate the results in relation to the normative concepts, ideas and practices applied in the respective discipline (Bruton & Radford 2012, p. 62). What we evaluate here is not only the product as the result of the design process. More interesting in this aspect is the study of the design process itself and the way the designer approaches and moves through a given task. It has been suggested that a creative design process is not based on linear rational decision-making associated with problem-solving strategies (Taura and Nagai 2010; Cross 2007; Seggern 2008). While it may rely on existing patterns, rules and concepts a creative design process challenges and restructures these information to generate new ideas. It is within this notion of creativity that we

can start to explore new possibilities for creative design practice that emerge from the use of digital technology.

There are however challenges in delivering this new mode of design education which emphasises creativity, complexity and the digital. The diversity of student backgrounds creates no common starting point for design teaching. Up to twenty percent of students had no experience with digital technologies or design, while ten percent had advanced design skills coming from graphic design, architecture or interior design. This disparity of abilities places considerable pressure on the teaching abilities of staff to manage the different pace that student's understand design concepts and digital programs. There was also no room in the curriculum to offer 'separate' digital focused subjects. Instead digital technologies were imbedded with design studios which were taught for ten hours a week. While this immersion presented considerable time constraints, we believe it to be central to the success of student's understanding the role of digital technologies as creative exploration as distinct from purely a representational tool.

The reminder of this paper discusses the observed outcomes of the implementation of this new design curriculum. It reflects on a five-year transition from an initial emphasis on hand drawing and problem solving to the most recent experience in 2012 which offered a more exploratory approach to design primarily through digital tools.

This new curriculum challenges the positioning of design studio teaching which establishes design tasks commensurate to representational ability and knowledge. For example a common design exercise for beginning landscape architecture students might ask for a design of a defined space such as a simple residential garden, together with a linear design process, with a clear design brief and prescribed compositional rules and representational outcomes. In contrast, our approach establishes a complex design agenda which positions creative exploration a major objective. Within this model, we seek not to prescribe outcomes, but instead offer the student multiple representational platforms to explore their own agendas within a range of conceptual and theoretical understandings. This revision shifts emphasis from teaching skills, knowledge and applications to instead acquiring these attributes as part of a bigger pedagogical agenda reflective of a Masters level.

As we will discuss, this approach still encompasses the necessarily disciplinary content, however this alternative model no longer separates the rationale and the practical from the creative and the artistic. Through a critical review of teaching practice, student outcomes and experiences, we identify three major conceptual shifts in the way these students understand and practice design –topographic form, creative unpredictability and a focus on experience.

Studio 1: Topography

Within the dominant model of landscape architecture education which is premised on degrees of 4-5 years, design studio would be taught separately from a site engineering studio; establishing a gap between design as a creative practice and engineering as making design work. Our new foundational year challenged this division between design and engineering by integrating the design studio and technical subject. This revision was far more strategic than simply using a technical subject to support a design studio (which is also common). Instead we proposed a more fundamental re-conceptualisation of topographic manipulation as a creative practice. This shaped the beginning student's first engagement with landscape architecture design. Rhinoceros,

physical and virtual modelling and Auto CAD provided the dominant modes of exploration.

As introduced earlier, plans have formed the dominant representational techniques in landscape architecture, offering the foundation to generate all other representations. Not only is the plan a highly abstracted mode of representation it also creates distance between the spatial configuration and experiential quality of the design. This is even more evident when it comes to the use of contours to represent three-dimensional landforms, which requires a "trained eye to visualize the shaping of the land" (Walker 2008, p. 9). Issues of site engineering are even further detached from the physical space, as slope manipulation and grading become mathematical problems.

This first introduction to design replaces the primacy of the plan and its representation of topography as abstracted contours with three-dimensional representation modes. Design exercises in both subjects were coordinated so that students simultaneously engage with the virtual and physical space in two and three dimensions at any one time. Together, they establish basic design and representation skills as well as a comprehensive understanding of a design project involving creative exploration, ideation, design development, site tectonics and grading.

The exercises were structured in two sequences. The first sequence focus on topographic exploration as an overlay of form and narrative using composite mapping and creative modelling studies. Engaging with representation and interpretation of cartographic material, the composite mapping shifts from plan representation into a physical contour model. Simultaneously, students explore generative processes of landform manipulation through a series of creative modelling studies in form of folding (paper) and moulding (clay). In the final study (digitising), the generative design techniques are translated into a digital model. Previously abstracted ideas and forms now materialise into concrete landscape features in the form of accurately sloped ramps, stairs, terraces and mounds, as shown in Figure 1.

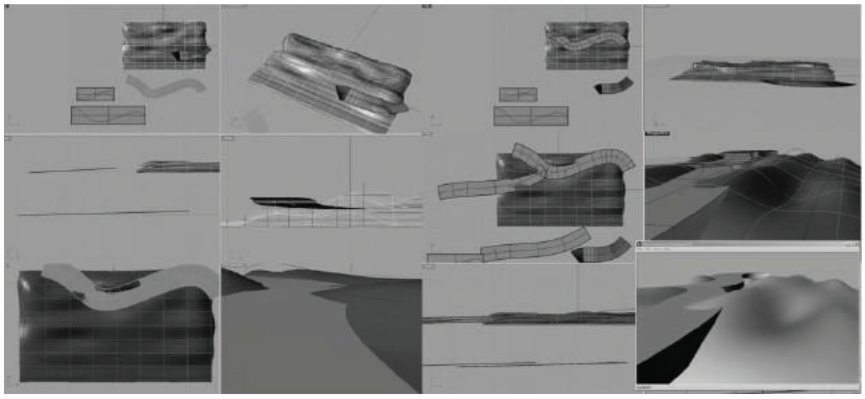


Figure 1. Translating form earlier explorations in clay and paper into digital models. Source: Author Frances Gaffney

The second sequence focuses on the exploration of experiential, functional, aesthetic and ecological aspects of landform manipulation. Developing a design proposal for a coastal park, students investigate program, material space, as well as

temporality and natural processes through the lens of topography. The engagement with dynamic systems (coastal processes), challenges students to adopt speculative design approaches with the possibility to explore topographic and programmatic scenarios for sea level rise. The tasks are organised to foster creative slope interpretation while developing a sense of scale throughout the design process. At this point, three-dimensional digital modelling technology is interlinked with CAD technology and representation of contour plans and contour models, as demonstrated in Figures 2 and 3.

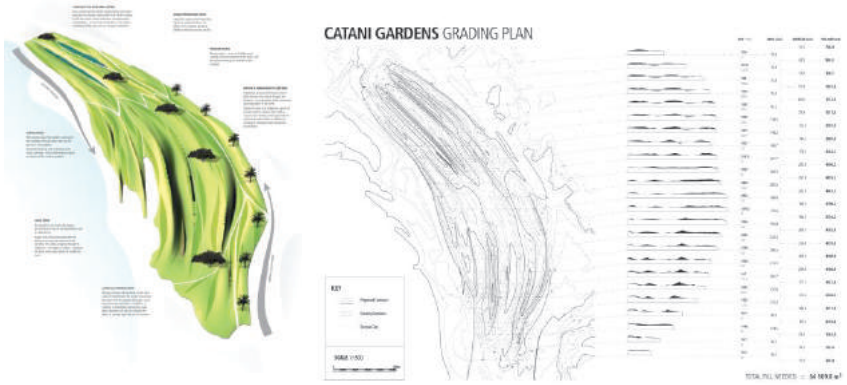


Figure 2. Working across multiple representations of space simultaneously –axonometric, two-dimensional contours and sections. Source: Author: Jonathon Chan.

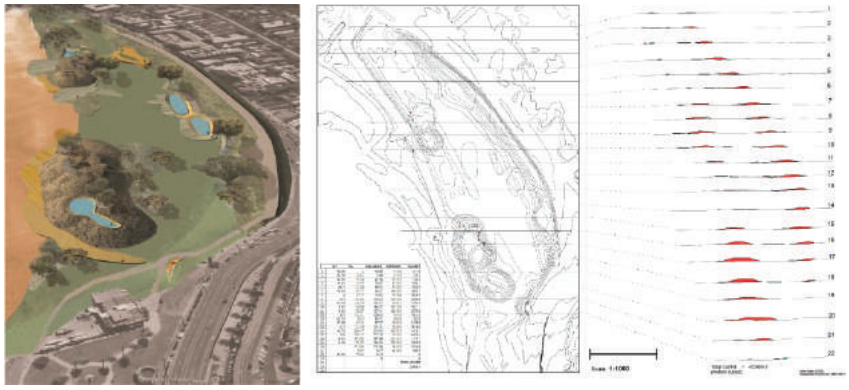


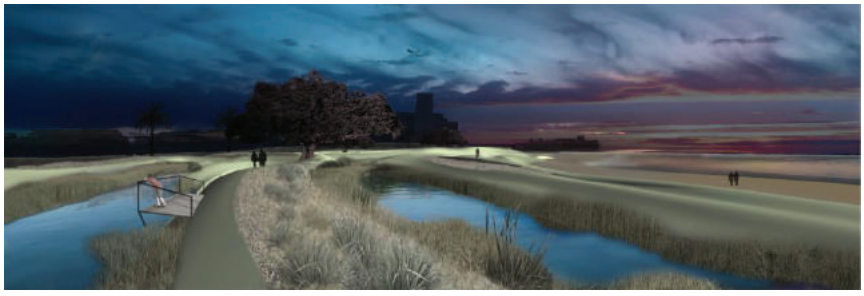
Figure 3. Working across multiple representations of space simultaneously –axonometric, two-dimensional contours and sections. Source: Author: Anna Durkin

While in conventional, plan oriented design processes the creative work has to be connected with the pragmatics of real life data through the use of slope calculations, digital technology now allows the designer to run the grading process concurrent to the design development. It is evident in the student works that the abstraction of contour lines and slope inclinations dissolves with the visualisation in three-dimensions. Working within the existing terrain model, students explore topographic manipulation

and grading considerations from an intuitive perspective while maintaining scale and spatial accuracy. It is not necessary to calculate the amount of stairs or the length of a ramp needed to negotiate a height difference. A 1:14 ramp is embedded into the existing terrain and embankments are automatically adjusted. The consequences of each action (insertion, landform manipulation) is immediately visible. In this way grading considerations are not just a means to adjust the proposed to the existing terrain but rather become conscious design considerations.

Importantly this first experience of design introduces a creative practice that constantly moves between different digital and physical representations, informed by multiple ways of testing and understanding space. It is through this production that students begin to understand the different roles of representations, images and sections. This differs from studios were representational conventions are often presented as the starting point.

An increase in resolution and complexity is also apparent, driven by the primacy of the three-dimensional models (digital and physical) which require an engagement with the entire topography. For example a high degree of spatial depth, material resolution and experience is evident in the final renders produced by the students to complement the technical drawings and axonometrics shown earlier. The quality of these images, shown in Figure 4, differs markedly from Photo shopped montages used so prevalently by design professionals and students. These montages are generated by nominating a place within a plan to 'imagine' how it might look within a view. Often elements are collaged into a site photo, as shown in Figure 5, presenting an impression of a three dimensional space and perspective assembled within a two dimensional realm.



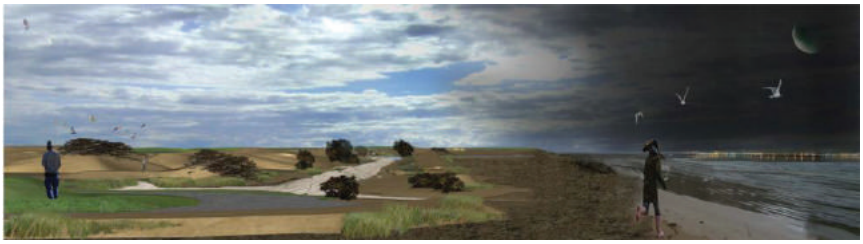


Figure 4. Images produced from Rhino three dimensional models. Source: Authors: Jonathon Chan, Frances Gaffney and Ruth Garry.

Figure 5. Photo shopped montage images produced within two-dimensional space. Source: Author: Chris Newman

The second studio of the foundational year introduces a further move away from plan driven design strategies through the introduction of parametric design, with a focus on experience.

Studio 2: Experience

This studio engages with form finding through defining and testing set parameters to inform an overall design proposition for a given site. Parametric design shifts emphasis from form to instead the identification of certain parameters or characteristics in which to guide design. While it can be argued that parameter-based decision-making can be found in every design process, there are specific possibilities digital technology offers to the design exploration and experimentation, particularly when dealing with complex systems (Salim et al 2011). As Oxman further argues "parametric design process is formational rather that compositional and formal. … In parametric design, the manipulation of associative geometrical relations of complex structural patterns can be further mapped to organizational and spatial concepts of the complexity of heterogeneous structures" (2008, p.109).

Parametric design processes are on the one hand highly structured processes when it comes to the selection of relevant parameters. On the other hand they also encompass a high level of uncertainty and complexity when considering the organizational nature and spatial outcomes. Oxman states:

> In parametric formation parameters of particular design are declared, not its shape; different configurations can be created assigning values to parameters. Parametric exploits associative geometry describing relationships between objects, establishing interdependencies and defining transformational behavior of these objects. (2008, p. 106).

The conception of the design process followed in this studio involves parametric considerations, where projects are explored through specific research questions focusing on procedural and performative aspects. The studio is structured into two phases. Phase one is an intense physical and bodily engagement with the project site through a series of on-site activities. Physical interventions, site writing, sketching, collecting, reading and mapping are tools through which student encounter tangible and intangible qualities of the site and its surrounding context. Figure 6 for example presents still images from a video exploring material qualities of the site. By the end of this phase students formulate their individual position brief, research question and response strategy for the site.

Figure 6. Exploring materiality and topography through physical intervention. Source: Author: Adrian Cook, Tim Luck and Jonathan Chan.

The bodily exploration of the site stands in stark contrast to the second phase of the studio where students entirely work in the digital realm. Here, the students' design positions are translated into a series of abstracted digital models that explore the spatial and systemic organization (topological variations) of their research question based on previous experiences and observations.

In the examples below the students explore how various three-dimensional circulation patterns can influence the pedestrian perception of the site and ultimately define a final design response for the site. The first project engages with a diverse range of visual interactions and explorations that would allow users the opportunity to respond to environmental conditions. Circulations will be achieved through the application of gradual landform elevations and paths, which will reveal a view or an installation. Sensory qualities, interactivity & performance of appearance are key parameters that drive this exploration.

Figure 7 shows a design that generated and tested fixed parameters, where only one parameter is changed at a time (fixed mode). Fixed mode operations are often applied when the designer aims to test specific experiential qualities such as view lines (revealing and hiding) or spatial experiences (enclosure and exposure) at a fixed location with in their site. For testing view lines, the vertical elevation remains unchanged while the horizontal parameter vary (e.g. moving of topographic location). Exploring enclosure and exposure on the other hand, requires that the horizontal parameter (location within the site) remains unchanged while the vertical parameter (elevation and landform) is manipulated, as demonstrated below.

Figure 7. Testing landforms from a fixed location within the site. Source: Author: Veronica Carassco

The second project investigates how the layers of topography, hydrology, and circulation can be interwoven to construct a pedestrian experience and to develop a relationship between the urban fabric and natural ecosystems. By adjusting the pedestrian baseline rhythm through change in elevation and change in materials the student aims to stitch these disparate layers together and "repair" the disjointed landscape. In this project the testing happens through variable modes. This means that the design is generated based on variable dimensions within a defined spatial form. The variable mode allows a strategic exploration of systemic relationships, processes and performative qualities of a specific aspect of the design (Figure 8). In this example, all parameters that define the various layers of circulation (rhythm, elevation, topography, material) are flexible so that each overlay creates a new circulation system. The various overlays of circulation systems are then applied to the site and subsequently inform the overall design response.

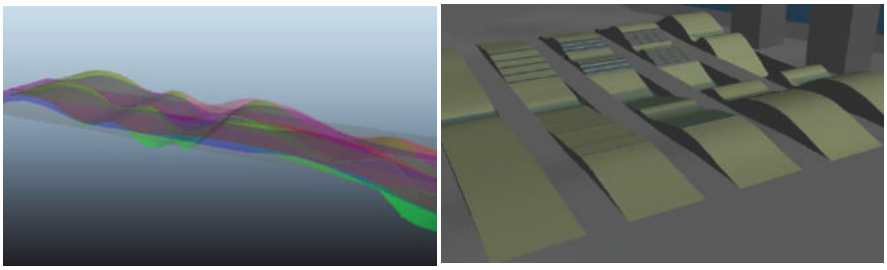


Figure 8. Testing vertical systems. Source: Author: Marc Rodriguez

Parametric driven design process breaks with the linearity of landscape architecture design processes. While the early explorations and interventions fulfil the objectives of site analysis they engage students in a very directive investigation of site, focussing on experiences and issues rather than all encompassing layering of (often redundant or insignificant) site information. By focussing on the generation of the design driving parameters the students start to engage only with relevant information and develop a depth and rigour of exploration that is difficult to achieve in beginning design students. Furthermore, despite the fact that these projects followed stringent parameters that were set very early in the design process there is a great deal of intuition and creative exploration involved. Guiding this process are open-ended observations of "what happens if…?" rather than outcome oriented statements such as "I want to achieve ….". Aspects of intuition, such as the condition of flow, play, experimentation, following gut feelings, and conscious awareness are imbedded in the design exploration and stand in opposition to logic and rational decision making.

Consequences for Design Creativity

The act of importing and transferring design ideas between the different digital platforms also introduces a new creative moment within the design process, offering what philosopher Andrew Benjamin (2012) describes as the 'presence of the unpredictable.' A contemporary engagement with digital technologies encompasses multiple processes, moving from the material to the immaterial and back, and between different digital platforms. These moments of transition are not seamless, and are at

times the source of frustration. However they also introduce elements of creative unpredictability into the design process, allowing the possibility to understand characteristics of space, form and program in different ways. At times 'a mistake' that might appear as a consequence of these transitional moments may offer a productive moment for moving forward.

According to Benjamin these unpredictable moments position digital technologies as a far more liberating design practice than that offered by other media such as drawing. This observation is supported by Lawson who argues that digital media is particularly empowering to people with limited design education allowing them to "express and explore ideas which their own drawing skills could not support" (2002, p. 176).

These arguments linking digital technologies and creativity are particularly challenging to the discipline of landscape architecture which has been slow to embrace the creative potentials of digital media. Instead many professionals and educators consider digital media to lack the intuitive capability of more traditional means of design such as hand drawing. This position is evident for example within Marc Treib's edited volume *Drawing/Thinking : confronting an electronic age* published in 2008.

Despite the use of 'electronic age' within the title, Trieb's collection of essays offers minimal discussion of digital media. Instead the essays present the merit of drawing rather than an enquiry into the value of drawing within an expanded technological context. Trieb argues that computer programs are bounded by limitations and suppress exploration. Those that have not been schooled in hand drawing are particularly vulnerable to these limitations. He states:

> Those that use the computer without understanding the practice and values of drawing by hand remain constrained by the default positions established by the programming team. The hand drawing, in contrast, comes with no default positions; we express what we want…In tandem, the hand and the computer offer astounding possibilities, but I still contend that the best computer-aided drawings are made by those who understand the systems of drawing manually. (2008, p. 15).

However as our studio experience demonstrates, new digital technologies (beyond Photo shop and CAD, which fundamentally stay within the two-dimensional realm) allow students to design directly within three-dimensional space, which we argue leads to an increased (rather than restricted) ability to comprehend and visualize complex spatial situations. The diversity of design proposals generated by the students clearly demonstrates that digital programs did not constrain outcomes.

Conclusion

While digital media has been accepted in landscape architecture within the realm of GIS, landscape visualization and landscape documentation, there is reluctance to embrace the potentials of digital technologies within creative practice. Our experience in shifting the design curriculum of a foundational year from planimetric design techniques to a focus on three- dimensional digital modelling however highlights the potentials for digital technologies and design creativity. This has proven especially valuable for the beginning design student allowing a direct engagement with three-dimensional space as opposed to modes of design education which emphasis the primacy of the two-dimensional plan.

In arguing for the new creative possibilities afforded by digital media, we do not proposing the abandonment of drawing and sketching, they still form an integral part of the design process. In fact many students employ sketching in their explorations almost as a bridge in instances where they feel stuck with their ability to handle the digital software. This occurs "naturally" even without formal instruction and suggests that the digital and analogue complement each other. However so far the real potential of the digital as tool for creative exploration, experimenting and testing has been largely overlooked in landscape architecture education and the profession. To many practitioners it remains a representational tool.

But as this paper has outlined, an engagement with digital technologies offers new avenues of design exploration which can elevate landscape architecture practice into a more dynamic field of creativity enquiry. Digital media can facilitate an increased engagement with complexity where the rationale and the practical are no longer separated from the creative and the artistic. To employ the potentials of the digital however will require a fundamental shift in landscape architecture design education and a critical engagement with how the discipline conceptualises design creativity.

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