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idea journal

interior technicity: unplugged and/or switched on

vol. 17, no. 01

2020

the journal of IDEA: the interior design + interior architecture educators' association

unspecified project: scenes of digital media practice in spatial design

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abstract

Working from a comparison between two teaching spaces used by the Spatial Design program at Auckland University of Technology (AUT), this article discusses the idea of 'technical teaching.' It describes how the authors have consciously sought to build a pedagogy around the teaching of digital media. Central to this pedagogy is the idea that learning to design is about producing a space of practice. This space is not merely the room in which practice occurs, but the space of possibility available to the designer. This space is not infinite or universal but relates specifically to a repertoire of actions (which links it in turn to the possibilities of the sites where it manifests). We offer an overview of four technical courses and describe the rationale for their structure and relationship to studio teaching. By counteracting predispositions toward completeness, finality, and linearity, these courses teach students how to prolong the design process, to stretch it out and keep it in motion. The computer lab and teaching studio are 'practised places' in de Certeau's terms, construction sites for an improvisational space of practice.[01]

cite as:
Douglas, Carl, Susan Hedges, Rafik Patel, and Nooroa Tapuni. 'Unspecified Project: Scenes of a Digital Media Practice in Spatial Design,' *idea journal* 17, no. 01 (2020): 131–148, http://doi.org/10.37113/ij.v17i01.385.

keywords:
spatial design pedagogy, digital media, repertoire, studio, lab

studio and lab

Figure 01 (left):
The studio during a Spatial Drawing class. Photo: Rafik Patel, 2020.

Figure 02 (above):
The computer lab. Photo: Susan Hedges, 2019.

We begin this article with two scenes. The first is a university teaching studio, and the second a computer lab. The studio, a generous space on the second floor with concrete underfoot and exposed overhead services, is one of the main teaching locations for the Spatial Design programme at Auckland University of Technology (Figure 01). The building (designed by Jasmax in 2004) is awkwardly angular. The plan is deep, so little light enters the space from the windows overlooking the street. Instead, it is lit by a grid of fluorescent tubes and air-conditioning ducts. The lab (Figure 02), a smaller room on the fourth floor of an adjacent building, is used for Spatial Design's digital media classes and shared with other programmes in the School of Art and Design. It's a more conventional shape, with generous windows on the north side, but once again is fluorescent-lit and air-conditioned. Swipe cards mediate access to both studios.

The studio and lab typify many of the office spaces of the city. They have generic floorplates, are atmospherically abstracted from exterior conditions, and are affectively neutral.

Studio and lab are, however, fitted out quite differently from one another, and support quite different pedagogies. The studio's furniture is mobile, intended to support a broader range of activities. Against two walls are a series of large flat tables, with two desktop computers at each end. These stay mainly in place (partly because the computers need to remain plugged into the wall) and define working groups of about six to eight people. Higher tables with tall stools are on wheels and moved for collaborative exercises or individual workspaces. During a typical studio session, these tables might be covered with paper printouts, large drawing sheets or rolls,

models in progress, laptops trailing charger cables, drinks and food, pencils, scale rulers, knives, paintbrushes, glue, small tools, and other paraphernalia. Lightweight fabrication (with cardboard or balsa wood, for example) can occur in the studio. For more substantial making (working with timber or plaster casting, for example), students move upstairs to workshops supervised by technical staff. Rolling screens migrate around the studio, and there are two banks of lockers for students to store their belongings. There are sinks at the back of the room, and a few (not enough) large shelves for storing materials and work in progress. There is a drop-down projection screen with and a large mobile TV screen for looking at digital files as a group. Students aren't allocated separate workspaces. Instead, the studio supports fluid movement between activities and groups.

In the lab, by contrast, the furniture is all bolted to the floor except for wheeled chairs. Rows of desktop computers are secured to banks of tables running across the classroom. At the front of the class is an instructor's computer that drives two large projection screens. From the instructor's seat, students are mostly invisible behind their large monitors. Light-excluding blinds are usually pulled down most of the way to make it easier to see projections. Students work individually behind identical computers. Food is not permitted, but there is space beside each computer for students to have a small sketchbook with them during class.

The very difference between the terms *studio* and *lab* says something important. While a studio is a place of study and creative production, a lab is a laboratory, referencing scientific norms and values. When we call rooms full of computers like these labs, we recall a time when computers were primarily scientific equipment. The room's configuration assumes the primary learning activity is for the individual students to replicate the operations of the instructor demonstrating at the front of the room. That is, it concretely embodies a one-to-many paradigm of learning. In comparison, the studio, while providing the opportunity for an instructor to address the entire group, orients the space around the fluidity of individual-driven or collaborative design practice. The lab presents itself as a site for technical teaching, while the studio facilitates creative practice.

The distinction isn't so clear elsewhere. The term 'lab' has become widely used with the rise of design research paradigms, marking a focus on experimentation with new technologies. MIT's Media Lab, founded in 1985 on the back of Nicholas Negroponte's Architecture Machine Group, has set the pattern for many similar research units (including the Spatial Information Architecture Laboratory at RMIT University and AUT's own Colab).[02] Theorists of design research Binder and Brandt identify the defining feature of such groups as the construction of a controlled environment, 'the setting where we let this "as-if" world live and be explored under the explicit condition that we have not yet decided if this world should be translated into a more permanent reality.'[03] The computer labs used by AUT's Spatial Design programme, however, are not associated with

this kind of research community. Instead, they are explicitly general-purpose venues that are mainly organised around technical equipment. There are pragmatic reasons for this, such as security and atmospheric control, but the prevalence of computers in other kinds of working environment suggest these factors are not as crucial as they once were. Instead, these spaces indicate the presence of an implicit design pedagogy. We will return to the idea of the lab as 'hypothetical space,' but for now, we use the term to distinguish conveniently between two styles of learning environment.

Our two scenes exemplify quite different ideas about learning. In what follows, we discuss 'technical teaching' and describe how we have sought to consciously build a pedagogy around the teaching of digital media as part of our Spatial Design programme. Central to this pedagogy is the idea that learning to design is about producing a space of practice. This space is not merely the room in which practice occurs, but the domain of possibility available to the designer. This space is defined by a 'repertoire of actions,' which links it, in turn, to the possibilities of the sites where it is manifest.[04] This repertoire is open-ended, incorporating both specification and the unspecified.

Practice is a now-ubiquitous but slippery term.[05] We understand practice to have value in itself rather than being purely a means an end. Accordingly, we emphasise the activity of making and doing rather than, exclusively, the things made and done. As Schön puts it, 'the practitioner approaches the practice problem as a unique case [...and] attends to the peculiarities of the situation at hand.'[06] Because design is inherently a situated exchange, competency as a designer relies on the ability to work reflectively and responsively. For this reason, practice involves long-term investment and development of the self. Practice is a lived process.

In de Certeau's famous formulation, 'space is a practiced place' — that is, practice is itself the production of space.[07] Design practice involves producing space for work (regardless of whether it is 'spatial design' or some other design specialty). It includes the literal venues where work takes place: the way workspaces are configured, the things that are gathered into them, and the way those things make action and reflection available. But the designer's workspace might also include networking and mobility. Grabner considers the studio 'as an instrument, as a state of mind, as a site of attention, but primarily as a practiced place.'[08] Art educators Jacob and Grabner divide their anthology on design studios into sections that explore the ways studios act as resources, as a setting for action, as a stage for performance, as a lived-in space, and as, simultaneously, space and non-space.

Significantly, Shreeve, who writes on art and design pedagogy, identifies studios as one of the 'signature pedagogies' of design.[09] They incline towards student-centred approaches, are focused on dialogue, and facilitate the development of communities of practice. Even where budgetary pressures squeeze out fixed individual studio spaces, many design education institutions still attempt

to provide some resourcing for studio-like learning. In the wake of the 2020 Covid-19 pandemic, a spotlight has been placed on virtual studios. Online communities of practice can sometimes fill (through either necessity or preference) some of the roles of a studio pedagogy, but in our view, cannot completely substitute for shared physical studios. Teaching studios simulate the kind of working environment students are likely to find themselves in once they graduate, but they are also scenes for the development of practice. As shared environments, they are also places of 'commoning… the psychological and social processes that people go through to create and maintain something in common.'[10]

What then, is the relevance of the lab? There are computers in the studio described at the outset of this article that are set up in such a way as to promote interplay between analogue and digital ways of working. Students typically bring personal laptops into the studio, and increasingly integrate digital work into the studio environment. Our question then is, how can we teach technical skills (for example, how to use software or employ drawing conventions) apart from the integrated and situated world of the studio?

We think this can happen by focusing on repertoire rather than normative competency. A repertoire is a collection of familiar procedures (that may be tacitly or explicitly held) enabling designers to make sense of a new situation.[11] According to Schön, 'It is our capacity to see unfamiliar situations as familiar ones, and to do in the former as we have done in the latter, that enables us to bring our past experience to bear on the unique case.'[12] Faced with a new situation, we reach into our toolbox of possible actions and select from what we have available. This doesn't mean, however, that designers simply force the new to fit the template of the old. On the contrary, Schön suggests, 'Because he [sic] is able to see these as elements of his repertoire, he is able to make sense of their uniqueness and need not reduce them to instances of standard categories.'[13] Nor does repertoire relate to general principles or rules:

> a unique case may be generalised to other cases, not by giving rise to general principles, but by contributing to the practitioner's repertoire of exemplary themes from which, in the subsequent cases of his practice, he may compose new variations.[14]

Repertoire points to the improvisational and open-ended nature of designing.

This repertoire is sometimes described to students as a toolkit (although we strive to avoid using excessively instrumental language, with its gendered and cultural freight). A repertoire is a collection of familiar actions to draw on at short notice, in a similar manner to a musician or dancer improvising. With access to a varied repertoire, students become more able to approach new design scenarios. Studio courses focus on guiding students through a coherent, end-to-end design process, respecting the context-dependent character of design and the emergent nature of processes and techniques. Our technical courses, however, focus on repertoire*:* that

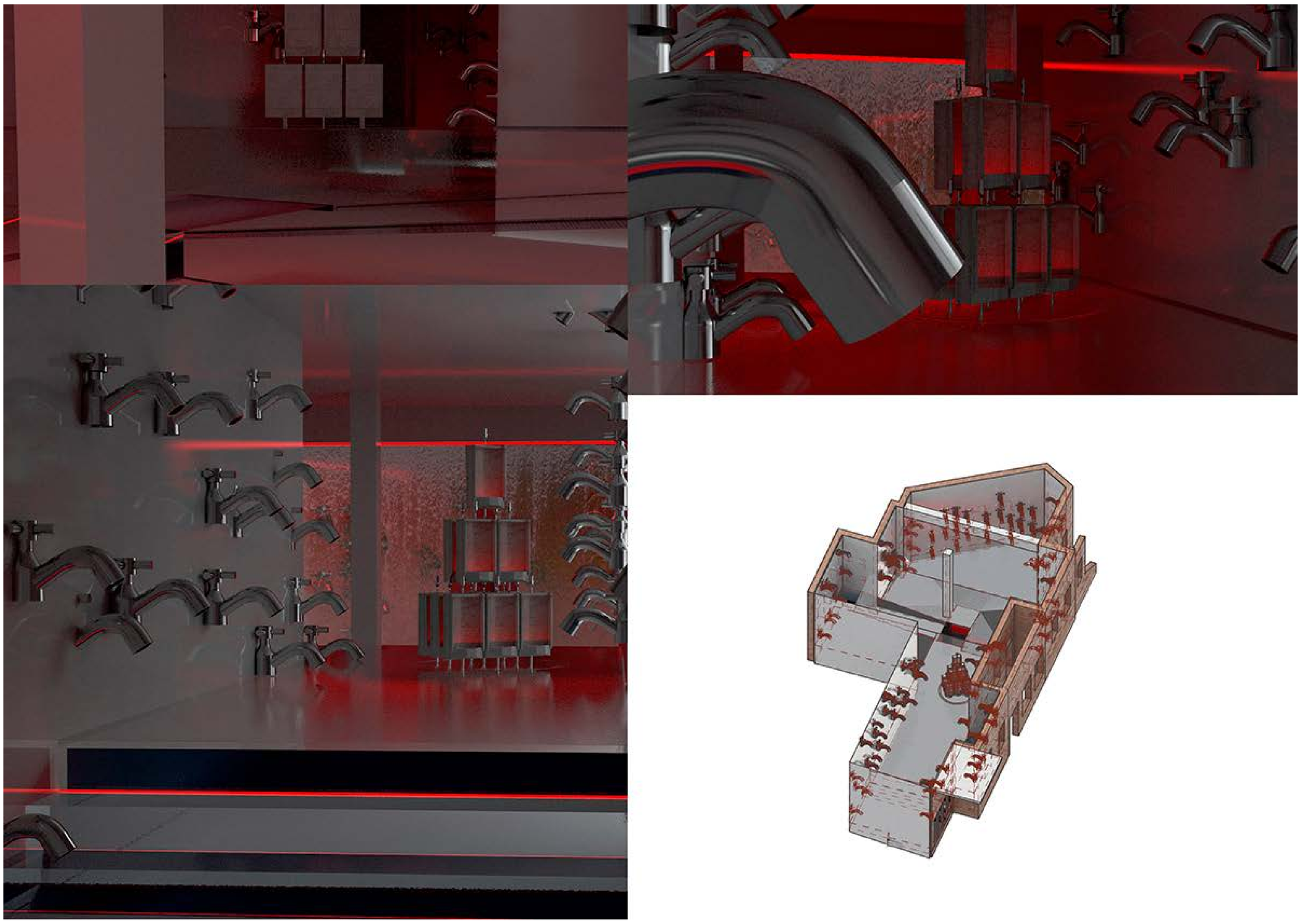
is, on reusable practices that can be drawn on at short notice and are adaptable for new situations. Accordingly, the courses seek to instigate experimental or playful approaches to software, instances of which we give below. We have come to understand media techniques as a means to mobilise a project, to develop forward movement, and to respond transformatively to a situation by improvising with the tools to hand.

The lab, for us, offers a site apart from the studio, where we can focus on helping students develop a digital repertoire.[15] That is, we aim to help students assemble a personalised collection of possibilities for action. Our digital media teaching faces in two directions. It speaks to conventions of representation and instruction, but it also exploits media techniques to defamiliarise and disrupt those conventions.

We explicitly steer away from teaching 'correct' or standardised use of software and have no interest in trying to teach software comprehensively. Some software resists this approach. Autodesk's Revit BIM software, for example, claims to provide a single unified workflow for architecture: from initial site studies to bulk-and-location designations, to formal concept design, structural analysis, detail design, environmental performance simulation, and the production of documentation and visualisations.[16] While this model of practice may match professional procurement processes for buildings, it does not resemble anything like the ways that designers actually work in our experience. The movement of design doesn't look like the smooth lines or cycles sometimes drawn in descriptions of design process; it proceeds in fits and starts, a scruffy contraption limping and clanking along through improvisation and approximation.

We do instruct on process. In a typical session, one of us will demonstrate how to do something with the software, telling students where they will find various tools, and how to use them, warning of pitfalls, and guiding them towards predictable results. We studiously maintain the open-endedness of these processes. Rather than demonstrating competency, (that is, fidelity to the intended functioning of the software and consistent knowledge of its capabilities) we ask students to improvise with a smaller set of processes. We don't specify the end outcome as the solution to a design problem; instead, we ask students to demonstrate what is creatively possible using particular workflows, beginning from a specific point.

As they progress through these courses, students encounter the tension between specification and non-specification in design, and the various shadings, nuances, and kinds of specification. While digital tools typically embed a deep concern for precision, we show students how there is such a thing as too much precision. We intend to lead them to a more profound sense of how design projects forward and what it might mean to formulate a project. In the following sections, we describe the sequence of four technical courses in terms of the designer's developing repertoire and their emerging space of practice.



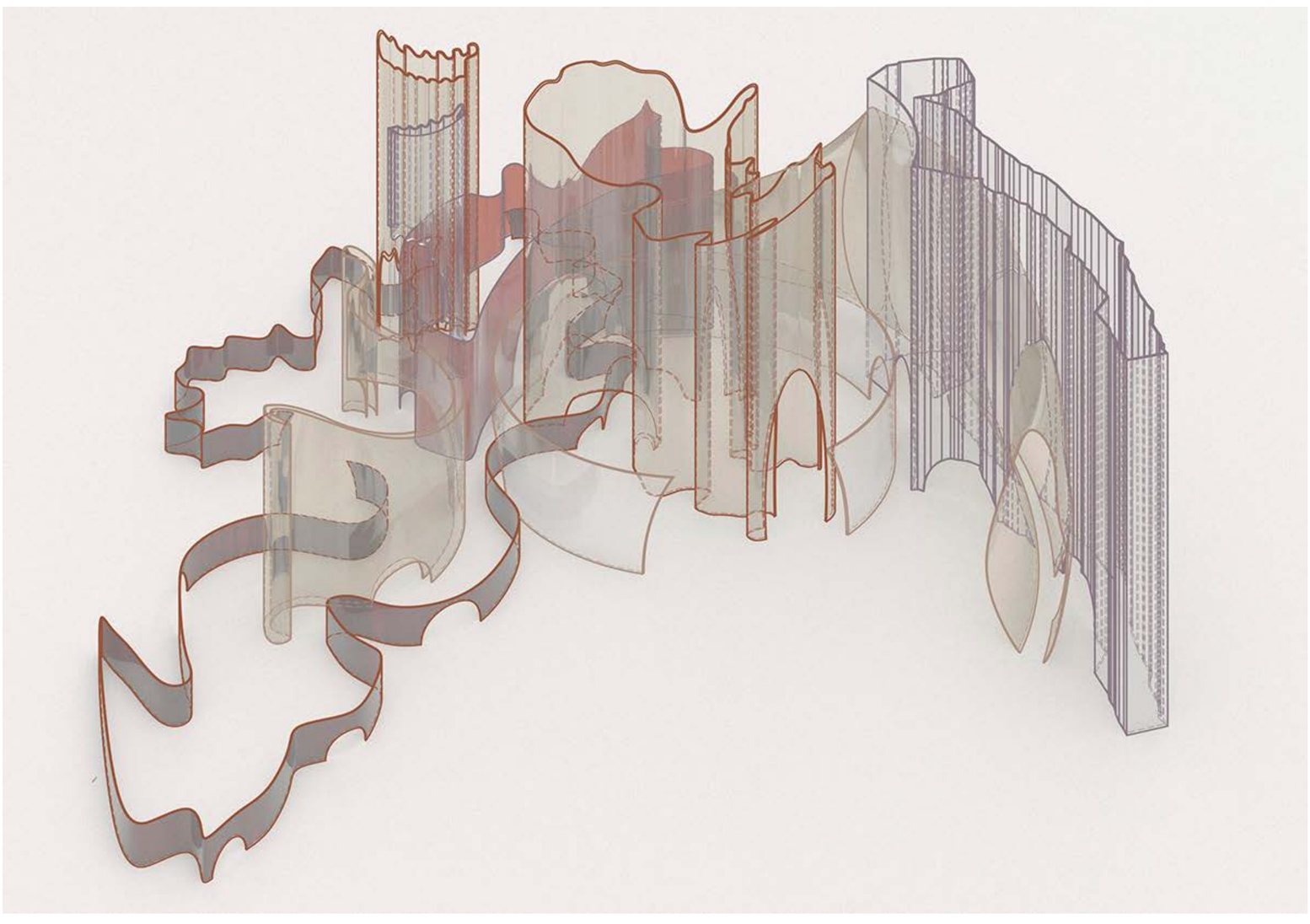


Figure 03:
Scene produced in Digital Techniques I by Zara Lane, 2018.

Figure 04:
Scene produced in Digital Techniques I by Yumeng Sun, 2018.

digital techniques I: scenography

In their first semester of study, students take Digital Techniques I, in which we introduce them to digital processes. The first challenge to teaching this paper is unhinging the preconceived notion that, to use digital tools for spatial design practice, students must become technical whizzes able to drive high-level software with mathematical precision. This intimidating preconception can be further complicated and reinforced by the physical orientation of the computer lab. Rows of identical machines reinforce the assumption of uniform expectations. The space is gridded with a rigid physicality that restricts movement, play and collaboration. Students can't shift the furniture to form working groups or clear it away to pace out the shape of a room they're modelling.

The processes taught underpin a series of outcomes folded around a creative brief. This approach is similar to our studio classes. Practically, the brief calls on students to deliver an art installation in a 3D environment, drawing inspiration from a film scene. Students provide this work as a sequence of images, an axonometric drawing, and an augmented reality experience. The goal is for students to understand the intrinsic relationship between the formal possibilities of space, its atmospheric conditions, and a narrative that spoke to these conditions conveyed through a considered sequence of images.

As in studio, the first half of the course takes students through a series of exercises and contextual presentations. These allow them to acquire basic digital making processes and connect to their expanding understanding of the field of spatial design. Students learn modelling techniques that allow them to navigate, build, and play in three dimensions. The outcome of these initial exercises is the construction of images of a meaningful object, taking students back from three- to two-dimensions.

Students unpack the formal qualities of a single cinematic frame, chosen from one of several suggested film scenes. An analysis of light, colour, composition, and apparent volume helps them see how the frame's two-dimensional image constructs space and atmosphere in terms of a narrative. They then make a series of self-directed decisions on how to integrate this experimentation and analysis into a design (Figures 03 and 04). Some recreate objects from images, some focus on colour, and others draw from the conceptual ideas read from the narrative of the film. Some try to reproduce the atmosphere of the frame, drawing on light and colour, activating the rendering power of the software. Crucially, students set the aims of this production in response to their own interests and experiences of working with the software.

The course purposely weaves between different modes of space creating, particularly installation and set design for film. It cycles between two and three dimensions, circling or jutting back rather than proceeding inexorably from beginning to end. This cycling opens imaginary thinking in the student and helps them navigate digital logic and resist the assumptions preconfigured into the physical environment of the computer lab and the software.

Figure 05:
Drawing from a sequence produced in Spatial Drawing by Andrew Lin, 2017.

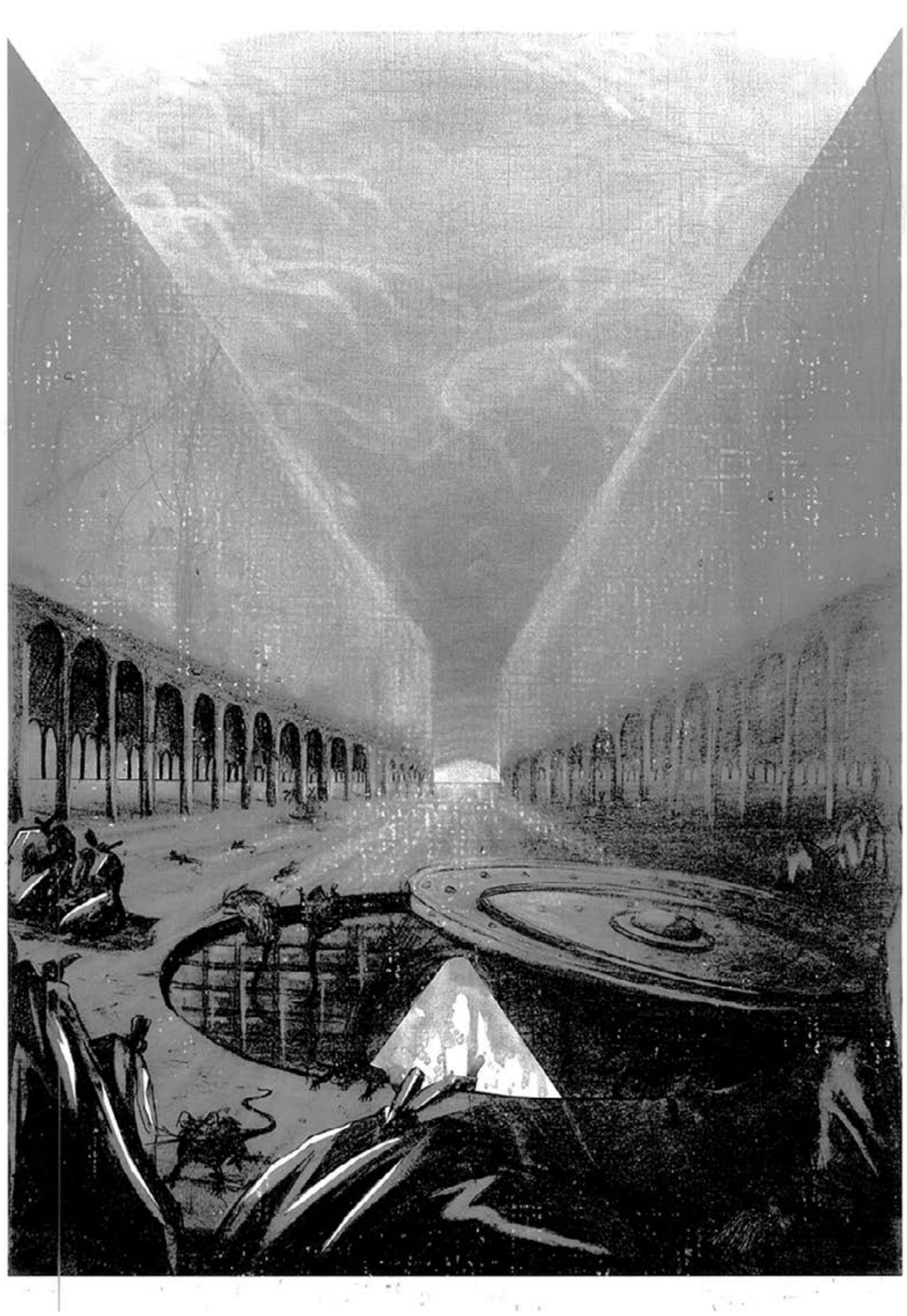


Figure 06:
Drawing from a sequence produced in Spatial Drawing by Daniel Eaton, 2019.

spatial drawing: invisible cities

The counterpart to Digital Techniques I focuses exclusively on hand drawing. Spatial Drawing exploits tensions between drawing conventions and atmospheric exploration. The students again produce an image sequence, a kind of visual narrative. We provide them with Jorge Luis Borges's 'Library of Babel,' and selections from Italo Calvino's *Invisible Cities* (1997), and ask them to draw a journey through one of these fictional spaces.[17]

They need to maintain careful fidelity to the descriptions of their selected text at the same time as they navigate the non-specificity of a fictional scenario. In addition, we ask them to work within conventions of perspectival and orthographic drawing.

Students sometimes find the uncertainty of this situation challenging. They do not seem to experience openness as purely positive freedom but as a lack of direction.

Drawing becomes a way to move forward in the presence of a deficiency or uncertainty. A direction isn't provided from the outset but emerges through practice.

A sheet of paper can be an uncertain blank site. Its empty surface is the ground on which narration is possible. Lines, scratches, and textures are applied onto the surface and imagined spaces start to manifest. The students make marks in graphite, ink, and watercolour. Lectures and workshops are themed around line, field, temporal sequence, figurative exaggeration, sectioning, breaking the frame, shadow, and colour. Working through this abstract programme of activities, students test ideas and techniques.

They work in sketchbooks, but ultimately produce a series of layered A3 drawings. As confidence grows, a repertoire of skills forms. The sketchbook is mobile, it travels, becoming an appendage of the body, and then becomes a place for remembrance, a place to recollect, and a place to extend from into larger detailed drawings. 'In the idea of drawing, the word itself can also designate an essential suspension of an achieved reality,' writes Jean-Luc Nancy.[18] The sketchbook becomes a virtual space or an achieved reality in which students can relocate themselves. It is a landscape of imagery forms, made up of the fantasy of the text, the students' fantasies, and also their realities.

The original stories by Borges and Calvino become sites for new spaces, reconstructed as drawn narratives. Nancy writes, 'what gives pleasure is a relation (an opening, an alteration).'[19] The trepidation and uncertainty faced by students as they develop a drawing practice leads towards the pleasurable discovery of new imagined scenes opening in front of them.

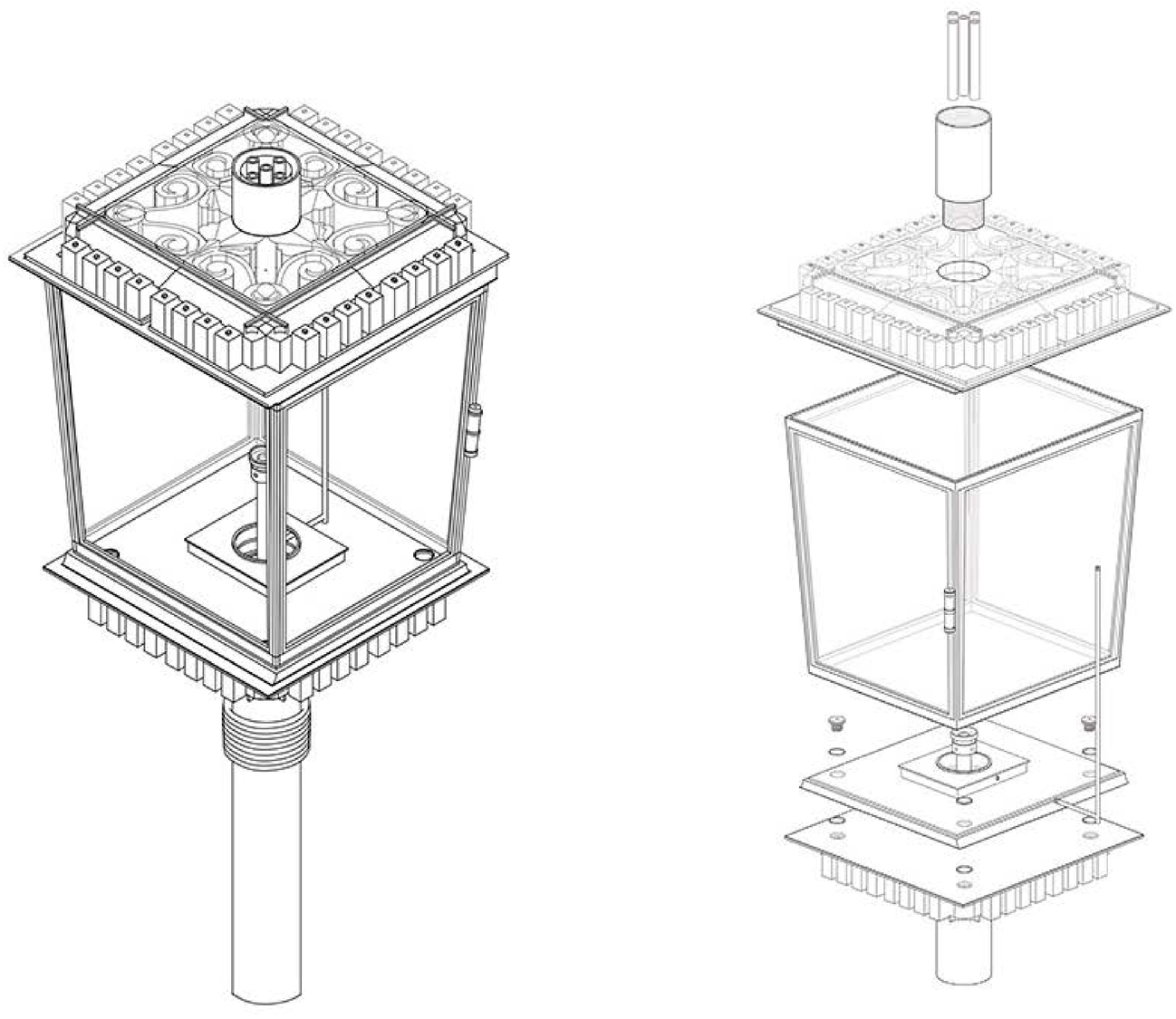


Figure 07:
Construction diagram made in Digital Techniques II by Chris Bentley, 2018.

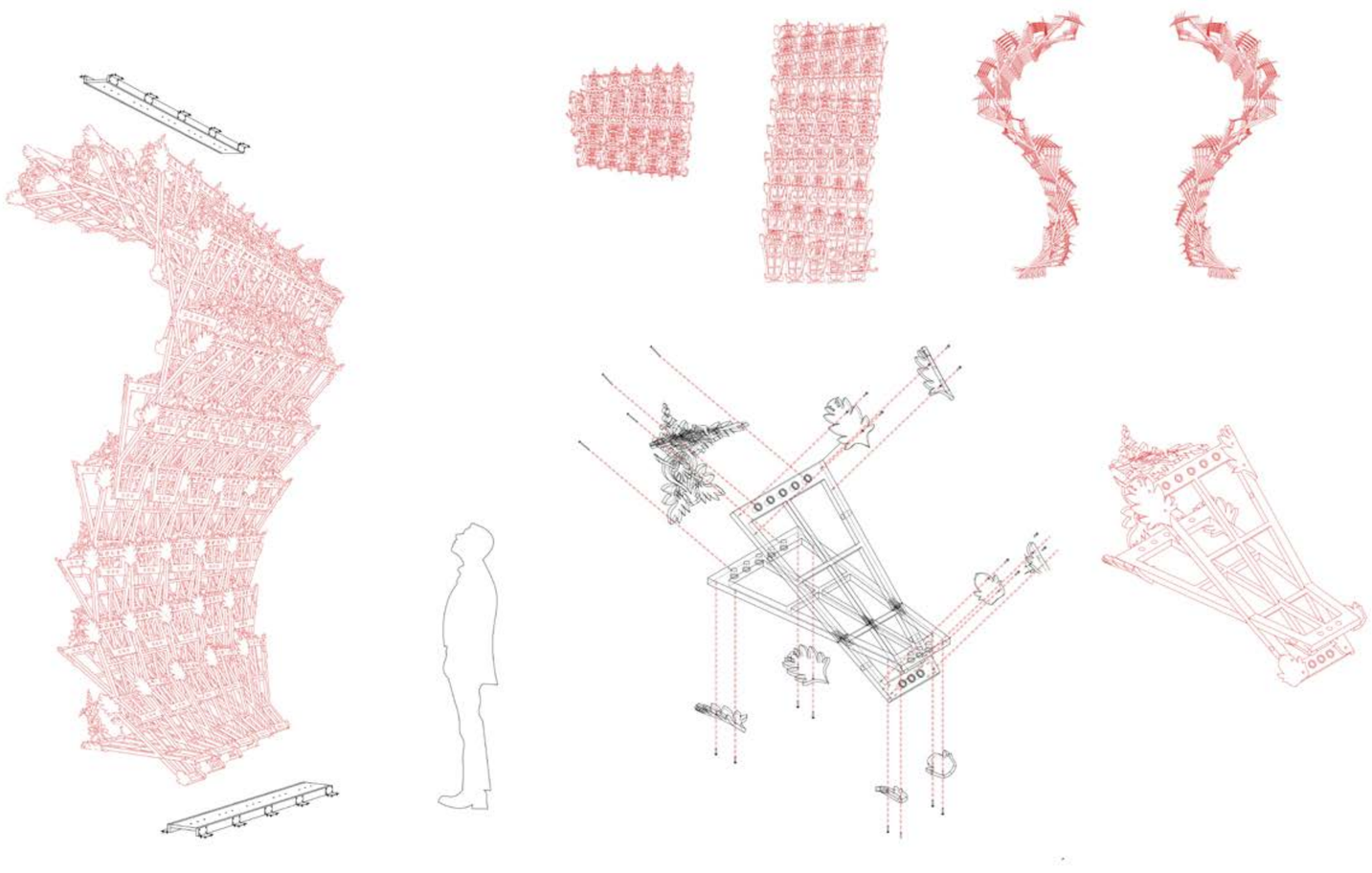


Figure 08:
Construction diagram made in Digital Techniques II by Yejin Park, 2018.

digital techniques ii: instructional constructions

In Digital Techniques II, digital media are a means to construct, communicate, and instruct. Instructional drawing links elements in response to physical constraints, composing components, actions, locations, and relationships. Design, construction, manufacture, and assembly can be seen as technical methods whose correctness lie in the functioning of the object rather than its abstract logic.[20]

Many instructional drawings play with scale in the relationships between parts and whole, forming a layered or sequentially organised non-hierarchical kit of parts. Similarly, a standardised set of prefabricated members and connections whose components are ready to use without adaptation implies an assembly or fitting together without alteration. Drawings for these types of constructions stress the connections between components, a standardised set of joints and members, enabling the drawing's viewer or user to build a narrative or picture.[21]

Instructional drawings may first offer a description of the various parts of which they are composed. These basic modules enter into relationships governed by their size and possibilities for attachment. Models or drawings allow for a unified vision of each separate part of a construction, showing how each relates with an immediacy that may be beyond written description.

Diagrams and illustrations can give visibility to broader constructional gestures as an organised assemblage. The problem with instructional drawings consists not so much in describing what is to appear in space, but

in diagramming its operation. By describing a sequence of acts to be carried out, a set of instructional drawings operate like a machine that materialises a construction before the viewer's eyes. Notation adds necessary information but also coordinates and connects. The drawing becomes like an abridged text, made up of lines that indicate, but do not separate or conjugate. Together, they create a series of superimpositions that may perplex anyone unfamiliar with what is being described.

In Digital Techniques II, students visit a particular site, for example, the derelict St. James Theatre in Auckland's Queen Street, a Category 1 Building under the Historic Places Trust, and erstwhile focus of Auckland's social life. It is one of the best-preserved vaudeville theatres in the country and was closely associated with the early motion picture industry in New Zealand. While the theatre once had a tower over the Queens Street entrance which could be seen from the waterfront, the building now has no landmark presence. Instead, its significance resides in the virtually intact interior.

The main auditorium has three tiers of seating plus boxes, elaborate lighting, ornate plasterwork decoration supported by wooden frameworks, marble staircases, and terrazzo flooring. During its peak, the theatre was lit with thousands of coloured globes concealed behind plaster and lead lights. Currently, the theatre is under restoration, part of a larger commercial development. As the building has been slowly dismantled and reinforced under earthquake regulations, remnants of Auckland's early colonising histories have been revealed. Beneath the theatre floor lies a cobbled street leading to an early butcher's shop with vats for rendering fat. Beneath this lies the undergrounded Waihorotiu stream, audible in heavy rain.

Students respond to this setting by making a series of digital constructions, culminating in the production of measured instructional drawings for new interior elements (Figures 07 and 08). These deliberately approximate the kind of specification that designers might be expected to produce professionally. They show how a single element of an interior can be broken down into parts for manufacture and assembly and fixing. They typically involve devising or selecting a supporting structure. For example, a student might specify a steel frame using information from manufacturers' catalogues. In doing this, students visit the websites of local suppliers (steel merchants, hardware stores, or more specialist enterprises), and record these visits as notes on the drawings. Some students mirror the compressed technical language often found in professional fabrication drawing sets, while others devise informal or descriptive styles.

Through their experiences in Digital Techniques II, students learn to use drawings not only to express, but also to instruct. Instructional drawings reveal not just factual information about the thing to be built but express processes of making. They instigate a dialogue between the builder and the imagination of the designer. Instructional drawings demand measurement and accuracy but also alternate between the representable

Figure 09:
Scene produced in Digital Techniques III by Audry Yu, 2020.

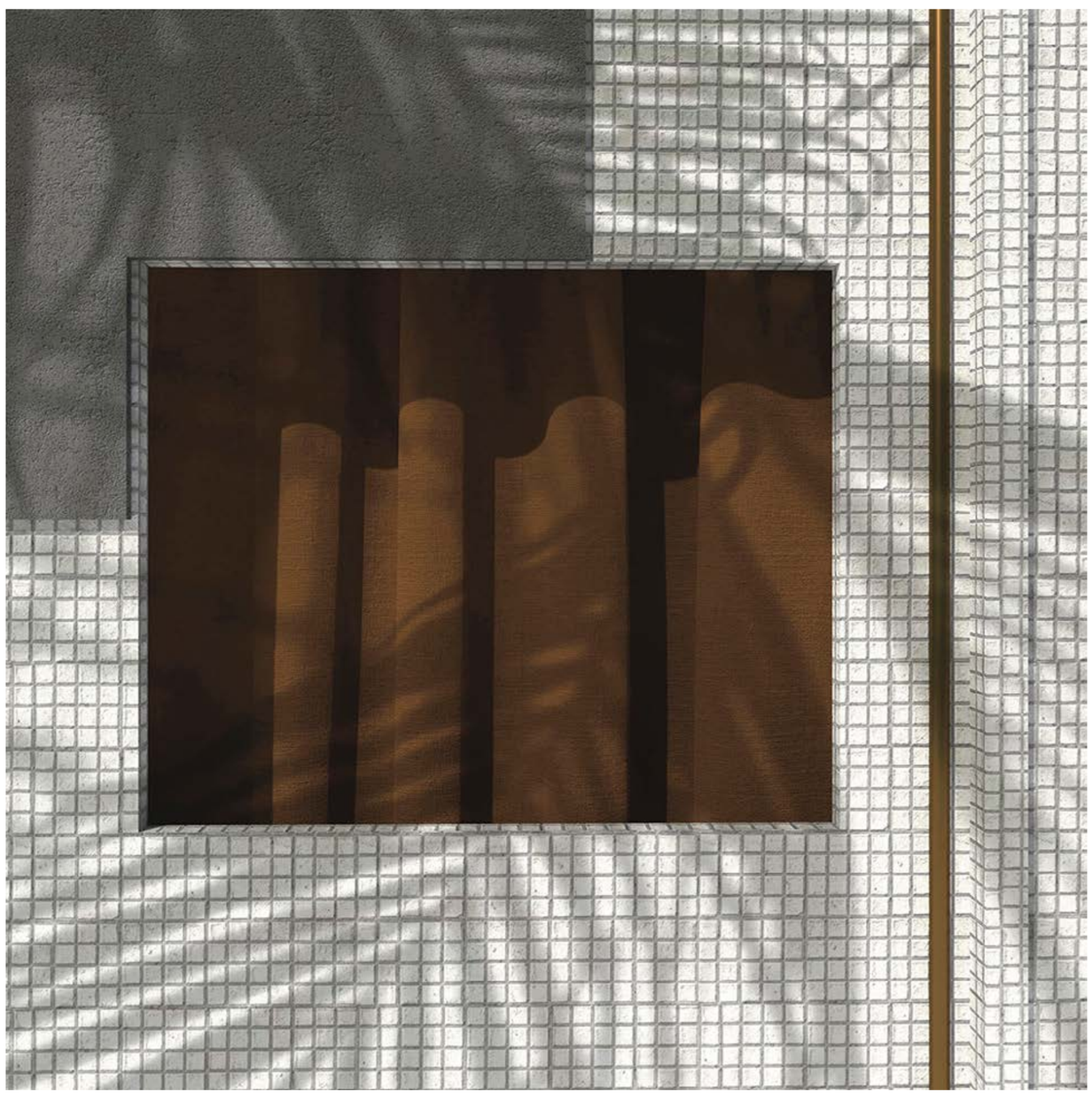


Figure 10:
Scene produced in Digital Techniques III by Hannah Rayneau, 2018.

and the non-representable. Diagrammatic techniques of contraction, miniaturisation, conversion, and suppression densify the meaning of the drawing, doing more with less.

digital techniques III: wintergardens

In the final course in this sequence, Digital Techniques III, we return to the question of the space of practice. That is, we ask where and how we work as designers. The previous three papers help students understand what studio and design practice are by prompting them to reflect on their tools and techniques.

In Digital Techniques III, students confront the limits of control and precision. To do this, we introduce students to a range of software workflows defined in terms of variables and constraints. We balance the ideal of precise specification against ideas of tolerance, approximation, and imperfection. What stops a designer from specifying perfectly? What impedes the designer's aim for control? How can leaving some things unspecified become productive or unproductive for design?

In previous courses and parallel studios, students have learned to specify what they want as exactly as possible and how it should be done. In Digital Techniques III, we confront situations where intentions cannot be expressed exactly, where the outcome doesn't depend solely on the designer's plan, but a muddle of contingent and unpredictable factors.[22] The scene for this assignment is the Auckland Domain Winter Gardens, which they visit in person to note materials, weathering, and irregularities in construction.

We develop a more nuanced approach to material design using the node-based material editor built into the open-source digital modelling software, Blender.[23] We show students how to construct complex materials with irregular surfaces, using image maps and procedural effects. This process requires them to understand how surfaces will interact with light and viewing angles. To simulate stains, smudges, and irregularities convincingly, students consider the surface's use, and how materials age or weather. A plastered surface might chip or flake at the corners, a timber benchtop might be scratched or scored by the objects that sit on it, and a copper surface develops a characteristic patina.

We experiment with producing complex, variable surfaces using standardised elements. A parametric screen is designed using standard steel profiles so students can study the effect of changes to the underlying variables. Unlike approaches to parametric design that emphasise abstract form, we adopt material constraints as crucial parameters. As part of this exercise, we also visualise the processes required of the fabricator and discuss the pertinent tolerances.

We also exploit Blender's cloth physics simulation to play with flexible materials like textiles. Students can see how heavier fabrics (like denim or leather) hang differently to lighter ones (like silk or nylon mesh), and can vary the fabric's optical properties, density, and weave. Students can easily change material parameters without having to source actual material samples. So even while

experimenting with simulated materials is not a substitute for working with tangible materials, we consider that students are developing valuable understanding about them.[24]

Circling back to their first semester in the Spatial Design programme, we ask students once again to produce a narrative spatial sequence (Figures 09 and 10). This process can be thought of as analogous to the storyboarding of a scene in production design, designing how spaces might change during an event, or planning consecutive spatial arrangements. These sequences prompt students to think of how time, change, and difference are aspects of spatial design.

spaces of practice

Design is a situated practice. That is, the practice of designing can't meaningfully be separated from the specific contexts through which it unfolds. Ranulph Glanville, using the language of cybernetics, describes design as occurring through the 'circularity of conversation.'[25] In Glanville's model, the designer instigates feedback loops by externalizing design ideas and then reading them back. Accordingly, the external context refracts and potentially redirects the process. As Schön put it, the designer 'shapes the situation in accordance with his [sic] initial appreciation of it, the situation "talks back," and he responds to the situation's back-talk.'[26] A circuit like this takes place in the everyday design act of sketching: ideas are transformed by being delineated and reviewed. Further, when someone else comments, redraws or reflects an idea, that person too becomes part of the feedback loop.

Our studio is a space of situated practice. A particular project is manifested in the studio as a distinctive field of constraints and possibilities, and in response, students draw on their repertoire of possible actions. Projects develop in response to specific conditions refracted into studio (perhaps a site, a client brief, or a conceptual provocation). The proposals ultimately formulated result from the construal of both problem and solution simultaneously.[27]

'Designing,' suggested Cross, 'appears to be an 'appositional' search for a matching problem-solution pair, rather than a propositional argument from problem to solution.'[28] The conversational cycle passes outside the studio, conceptualizing situations external to it.

Our labs, by contrast, are spaces of un-situated or dislocated practice. Removed from the field of constraints and possibilities construed by a project, practice takes on a different character. Through a series of exercises, students build their repertoire of open-ended actions and experiment with sequencing these actions into a design process. Tasks are specified loosely, and mostly in terms of process and format.

We do not mean that situations and contexts are not relevant in the lab, or that the students' work is placeless. We explicitly build each paper around a series of scenes: a film set, a gallery, a fictional narrative, a derelict heritage building, and a public garden. But unlike the studio, these are provisional scenes. We noted above Binder and Brandt's description of

the lab as a controlled environment, an 'as-if world' or 'hypothetical space.'[29] By displacing design practice into speculative spaces, we invite students to enter into dialogues with their tools and techniques.

To learn technically, we suggest, could be thought of as a means to rehearse and customise a repertoire capable of maintaining the circularity of design conversations. Students learn to take an apparent endpoint (a frame of a film, a published text), and open it up again as the starting point for new design ideas. They often enter the course with a predisposition towards completeness and finality, and a desire to arrive at the complete and final as efficiently as possible. Counteracting this predisposition, we teach them how to prolong the design process, to keep it in motion, to move both forwards and backwards.

Through these courses, we explicitly work against the idea of a linear progression from the provisional, vague, and non-specific to the final, technical, and precisely specified. Instead, we teach a repertoire of techniques that enable students to move in any direction. Patching together procedures drawn from their repertoire, students become adept at working in open-ended ways. Architect Mike Davis has written of the importance of abstraction and delay for designing: 'Abstraction was a means of delay, creating space in time and of resisting the "real" so that the design proposition could develop, rather than be thrust forward and bound prematurely at any one point.'[30] Design, claims Davis, may require resisting finality, eluding completeness, and moving backwards. We aspire to teach students to keep the design conversation open, in the manner that a musician might improvise to keep a piece of music going while retaining the possibility of drawing it to a (provisional) close at any point.

A repertoire opens up a space of practice, 'an event-based and ongoing, improvisory state of productivity.'[31] This space of practice pertains to specific rooms, sites, and workshops to the extent that these venues constrain, permit, or invite various kinds of action as practised places, but can also be understood as the field of possible outcomes oriented by a repertoire. Technical teaching and its physical settings provide a means to rehearse this repertoire. To this end, spaces like the computer lab (so long as it is possible to neutralise its implicit ideal of replication and normative practice) can be used advantageously.

acknowledgements

We would like to acknowledge the interdisciplinary team of the School of Art and Design at AUT University for constant prompts to see our teaching in new light, and to the students who have taught us so much. Thanks also to the reviewers and editor who raised important questions about our work.

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Dr Carl Douglas is Programme Leader for Spatial Design at AUT University's School of Art and Design. His research and teaching focuses on public places (particularly informal, amateur, ad-hoc, and illicit spacemaking), procedural design techniques (particularly cartography, drawing, and scripting), and the links between them. He draws a lot and tweets rarely @agfa8x.

Dr Susan Hedges is Deputy Head of School at AUT University's School of Art and Design. Her research and publication interests embrace an interest for architectural drawing, interior architecture, notation, dance, film, and critical theory regarding drawing and visual culture. These seemingly divergent fields are connected by an interest in the relationship that exists between the body condition, surface, pattern, architectural notation and visual images.

Rafik Patel is a lecturer in Spatial Design at AUT University's School of Art and Design. His research examines how architecture and public spaces are politically charged. The main focus is on the Muslim diaspora in New Zealand. His creative practice uses drawing as a method to examine Islamic poetry and philosophy.

Dr Nooroa Tapuni is a lecturer in Spatial Design at AUT University's School of Art and Design. An interdisciplinary artist, Nooroa seeks to derive a correlation between seemingly disparate knowledge sets to unfold power relations. Their PhD research posited an indigenous understanding of interconnection as a cybernetic system through interactive digital art practice. It did so as a way to explore the extent that digital material can be the interface for intuitive understanding and indigenous knowledge. The researcher is currently exploring the ambiguity of communication through the process of code-switching.

notes

01 Michel de Certeau, *The Practice of Everyday Life* (Berkeley: University of California Press, 1984), 117.

02 Stewart Brand, *The Media Lab: Inventing the Future at MIT* (New York, NY: Viking, 1987), 1-5. Laboratories derive from the sciences. On scientific labs as spaces of practice see Bruno Latour, *Science in Action* (Cambridge, MA: Harvard University Press, 1987), 63-100.

03 Thomas Binder and Eva Brandt, 'The Design: Lab as Platform in Participatory Design Research,' *CoDesign* 4, no. 2 (June 2008): 115–29, 19, https://doi.org/10.1080/15710880802117113.

04 We derive our use of the term 'repertoire' from Donald Schön *The Reflective Practitioner: How Professionals Think in Action* (Abingdon, Oxon, UK: Routledge, 1994), 140. See also note 11 below for its use in sociology.

05 Schön, *The Reflective Practitioner*, 129.

06 Boon and Levine usefully explore the term in an art context: Marcus Boon, and Gabriel Levine, eds., *Practice, Whitechapel: Documents of Contemporary Art* (Cambridge, MA: The MIT Press, 2018). The opposition between theory and practice can easily be overstated. As Althusser writes, through practice, 'everyone is a theorist' because theorising is itself a practice, and practices implicitly embed theories (cited in Boone, Marcus, and Levine, *Practi*ce, 5).

07 de Certeau, *The Practice of Everyday Life*, 117.

08 Mary Jane Jacob and Michelle Grabner, *The Studio Reader: On the Space of Artists* (Chicago, USA: University of Chicago Press, 2010), 5.

09 Alison Shreeve, 'Signature Pedagogies in Design,' In *Design Pedagogy*, ed. M Tovey (London, UK: Routledge, 2015,) 83–94, 83.

10 Olivia Hamilton, 'Commoning Interior Design Pedagogy,' *Interiors* 9, no. 2 (May 4, 2018): 122–39, 123, https://doi.org/10.1080/20419112.2019.1565678.

11 A suggestive use of the term 'repertoire' is found in sociology; for example, in studies of revolution and political contention, such as in Charles Tilley, *The Contentious French* (New York, NY: Harvard University Press, 1986), 4. Tilley uses the term to indicate the way political action tends to follow performative scripts or patterns.

12 Schön, *The Reflective Practitioner,* 140.

13 Schön, *The Reflective Practitioner,* 140.

14 Schön, *The Reflective Practitioner,* 140.

15 Although the distinction between digital and analogue methods has broken down, we continue to use 'digital' as a convenient term, signalling to students that most of the work in these courses is done using computers. Some prefer the term 'post-digital' (for example Fred Deakin and Charlotte Webb, *Discovering the Post-Digital Art School* (London, UK: University of the Arts, London, 2016). http://ualresearchonline.arts.ac.uk/10295/ p.9). However, this still seems to encode the basic distinction.

16 See Autodesk's marketing website for Revit: https://www.autodesk.com/products/revit/overview.

17 Jorge Luis Borges, *Collected Fictions* (London: Penguin Books, 1999), 112-118; Italo Calvino, *Invisible Cities* (London, UK: Vintage, 1997).

18 Jean-Luc Nancy, *The Pleasure in Drawing* (New York, NY: Fordham University Press, 2013), 2.

19 Nancy, *The Pleasure in Drawing*, 68. Tom F. Peters, 'Technological Thought Is Design's Operative Method,' *Perspecta* 31, Reading Structures (2000): 118–129, 119.

20 Tom F. Peters, 'Technological Thought Is Design's Operative Method,' *Perspecta* 31, Reading Structures (2000): 118–129, 119.

21 Susan Hedges, 'On Frascari's Notion of Construal,' PhD diss., (University of Auckland School of Architecture and Planning, 2012), 1, http://hdl.handle.net/2292/19484.

22 Carl Douglas, 'Accident + Emergency. Risky Intervals in the Design Studio,' In *Inhabiting Risk. Proceedings of the 3rd Conference of the Interior Design / Interior Architecture Educators Association*, eds Christine McCarthy and Gill Matthewson, (Wellington: WelTec, Victoria University, and Massey University, 2007), 44–51, 44.

23 Available from https://blender.org.

24 David Scheer has lamented the way simulation has come to replace drawing. We are more optimistic about the relationship. See Scheer, *The Death of Drawing. Architecture in the Age of Simulation* (New York, NY: Routledge, 2014), 1-17.

25 Ranulph Glanville, 'Try Again. Fail Again. Fail Better: The Cybernetics in Design and the Design in Cybernetics,' *Kybernetes* 36, no. 9/10 (2007): 1173–1206, 1186, https://doi.org/10.1108/03684920710827238.

26 Schön, *The Reflective Practitioner*, 79.

27 On construal, see Marco Frascari, who uses the term to mean the process of meaning-making, particularly as it relates to the operation of drawing as an analogue of construction. Marco Frascari, *Eleven Exercises in the Art of Architectural Drawing. Slow Food for the Architect's Imagination* (London, UK: Routledge, 2011), 38; and for critical discussion, see Hedges, 'On Frascari's Notion of Construal, 31-56.

28 Nigel Cross, *Designerly Ways of Knowing* (London, UK: Springer-Verlag, 2006), 91.

29 Binder and Brandt, *The Design: Lab*, 119.

30 Mike Davies, 'Maintaining the Abstract. Critical Facility in Post-Digital Drawing Practice,' *Interstices* 11 (2010): 82–91, 85.

31 Andrea Philips, in Boon and Levine, *Practice*, 72.