Design Leaps:
Divergent thinking techniques across media for architectural design

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Declaration

This is to certify that the work contained within has been composed by me and is entirely my own work. No part of this thesis has been submitted for any other degree or professional qualification, unless where cited.

Acknowledgements

Firstly, I would like to thank my supervisory team for the support they have given me over the last seven years. In particular, I would like to thank my Director of Studies of five years Professor Rachel Sara and Dr Colin Booth, who replaced her in the final two years. Both have helped guide me through the complexities of the PhD research process. I would also like to thank my second supervisor Jonathan Mosley, who has been of great support in this research and, who first introduced me to using divergent and filmic techniques within my design process, back in 2007, during my Bachelor of Architecture degree.

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Abstract

This thesis examines the moments of divergence that occur across media in the early stages of the architectural design process. The term 'divergent thinking', coined by Joy Paul Guilford (1967) as a key component of creativity, describes the flexibility and elaboration entailed in an individual's ability to come up with new ideas. Research across architectural design and cognitive science has previously identified the importance of the balance between divergent and convergent thinking, for creativity within the architectural design process (Lawson, 2006). However, preceding studies have consistently sought to model, and thus converge the very nature of divergence as a form of behaviour. This thesis, instead, shifts focus on the media and techniques that enable the architectural designer to think divergently. In this context, the research is particularly concerned with the creative exchanges between digital and analogue media and the opportunities for design that these create.

The research responds to concerns that recent trends within the development of architectural software have shifted the design process away from conceptual thinking, towards processes of simulation. The thesis stipulates that, traditionally, divergence is enabled in the process of architectural design through an iterative process of production, which is articulated in the transition across media, such as drawing and modelling, in their various degrees of resolution. As this iterative switching between media and environments is increasingly short-cut or bypassed within environments of simulation, this thesis examines the possible exchanges between analogue architectural media and the digital context, in order to reveal how architectural divergence can emerge within an expanded field of media.

In the context of this thesis, the exploration of divergent thinking has been carried by combining a design research methodology with visual ethnography. A series of key projects explore and develop methods for the introduction of divergent prompts into the architectural design process, drawing techniques from architecture, as well as literature and the visual arts. The implementation of the prompts across design-based projects, draws from the pedagogical context of the design studio to address a wider field of architectural creative practice. Applications examined include student projects, workshops, architectural competitions and engagements with artist and community groups, as sites for the critical analysis and further development of divergent techniques and their respective media contexts. Film, drawing, photography, and their exchanges play a critical part in observing and understanding these divergent moments. The clash between the connotative qualities of abstraction found in architectural drawing and the denotative nature of the digital image, becomes central to this examination of architectural media through the creative practice of divergent strategies.

The use, iteration and study of explicit divergent techniques, contributes to the definition of the 'design leap' as a response to, and expansion of, the cognitive science term of the 'leap' (Wallas, 1926), to describe the moments that actively diverge the designer's perspective of the process through the media. Defining distinct kinds of 'design leaps', the thesis proposes a renewed understanding of subtle divergent processes that already exist within architectural design tradition, as well as a more explicit understanding of the architectural habitus. Further, it reveals the diachronic quality of architecture to adapt to, as well as infuse with divergence, new tools and techniques, through the spatial-representational lens of its pre-existing tools.

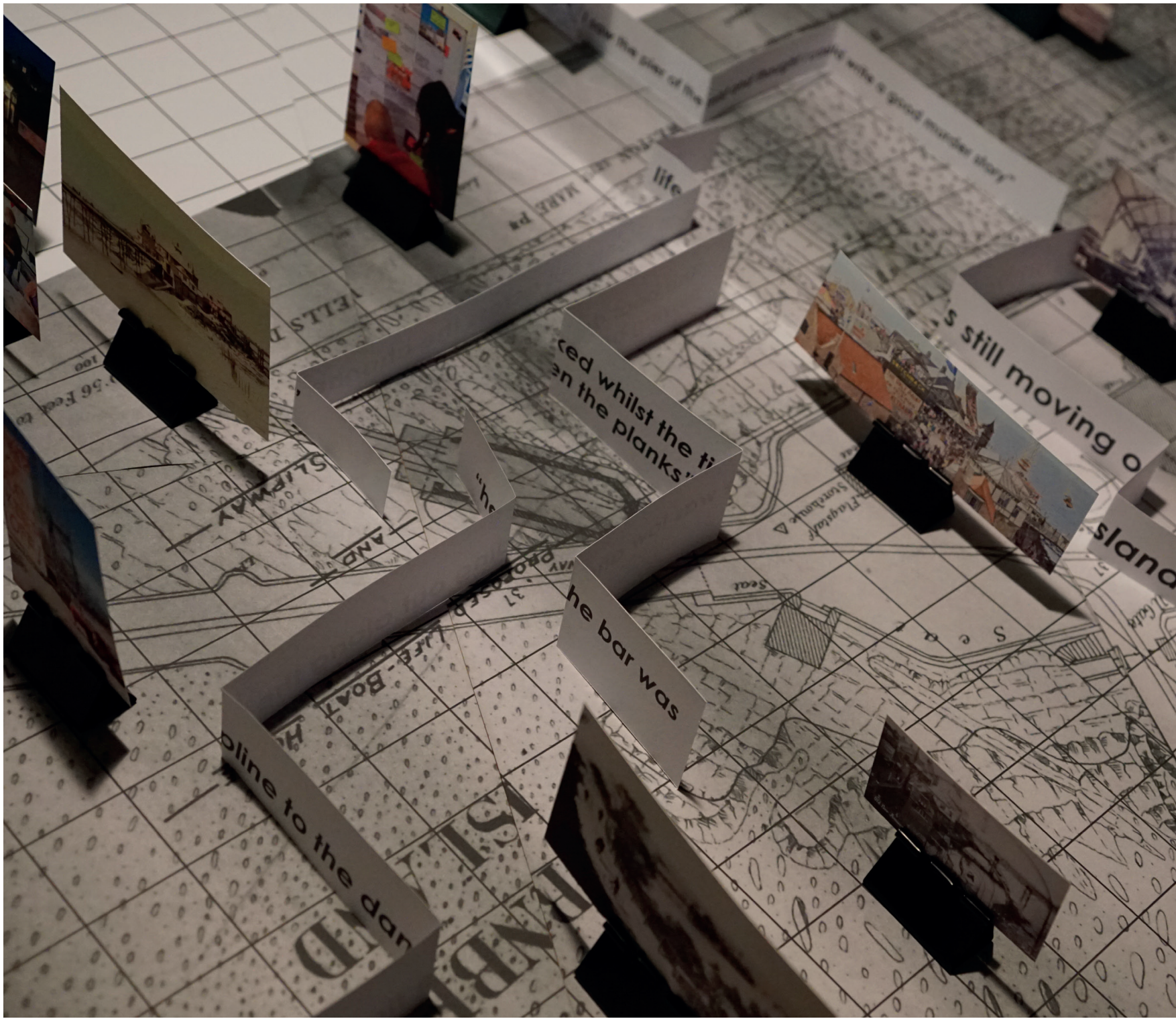


Fig. 1: 'A dance floor and a zip line', close up of three-dimensional paper composition (2018). A mixed-media map exploring an iteration of William Burroughs & Brion Gysin's Fold-in technique, driving an enquiry into the value of text-based divergent architectural thinking.

Contents

1 | Introduction

1.1 | Moving towards convergence

This thesis proposes an examination of divergent thinking within the architectural design process. The intention is not to systematize and model the creative process of design but, rather, to understand how it emerges beyond the designer's authority, between and across the media that designers use. The research, in this sense, is concerned with architecture as a creative discipline and not with its explicit professional context. However, it is acknowledged that the creative practice of architecture is affected by wider professional issues, applications and frameworks, which inform also the educational context of architectural pedagogy. In this direction, the research seeks to address the tendencies of convergence that although originating in a professional, regulatory context, have, over the past twenty-five years, through the cycle of market demand – higher education – discipline, led into an increasingly convergent understanding of architecture as discipline and creative practice (Deutsch, 2017). The rapid advancement of digital technologies of representation, simulation and collaboration, have enabled and accelerated these tendency to converge, by putting pressure on the mode of operation and even expediency of core architectural practices such as drawing (Carpo, 2013a).Towards addressing these phenomena, the thesis revisits and interrogates traditional and emergent media environments for architectural design, foregrounding divergence as an inherent and required condition of architectural creativity.

This research, thus, in part responds to a trend that emerged in the late noughties, driven by the rapid implementation of digital media, into architectural thinking and making. At the start of this thesis, in 2014 this question was of particular importance as the UK government was looking to implement radical changes in the way that architectural designers worked with media, in terms of not only communicating but also delivering architectural design (Cabinet Office, 2011, p. 5). More specifically, it was mandated that by April 2016, all projects containing funding by central government would be required to be delivered through the use of Building Information Modelling (BIM) software (Cabinet Office, 2011, p. 14). Although BIM is not the focus of this research, its mode of operation and wide implementation is representative of the shifts, within architectural practice and its tools of mediation, that prompted this research, and to which this thesis seeks to respond. BIM assumes that design can be carried out as a simulative process, whereby designers and construction professionals collaborate across a single online digital model (NBS 2016). The simulation can then be used to monitor and check a project during construction and provide a legacy for those who might intervene or redevelop the project in the future (RIBA, 2013). BIM as a process, therefore, would appear to have many benefits, including more accurately estimating construction and operational cost, as well as reducing material waste. These characteristics importantly align with the Government's ongoing agenda – more explicitly articulated through the Latham (1994) and Egan (1998) reports – to reduce the amount of carbon dioxide used within the construction industry (Motawa and Carter, 2013.). BIM, however, also presupposes that the designer carries out what can be described as a convergent process of thinking, where the primary task becomes to sift, arrange, and add information to a component-based model of the project. In a wider perspective of the practice and profession, it is well known that the software that underpins BIM's validity in simulation and the modelling operations that this culture promotes, have existed long before it. Namely, these can be identified in platforms such as ArchiCAD (first introduced in 1987) or Revit (2000), which have introduced and established parametric component-based approaches to architectural modelling (Fig. 2). This pursuit of the architectural project as a perfect single platform of simulation constitutes a dramatic shift from the existing practice of design, where a designer works iteratively and intuitively between different representational media to progress and develop the design process.

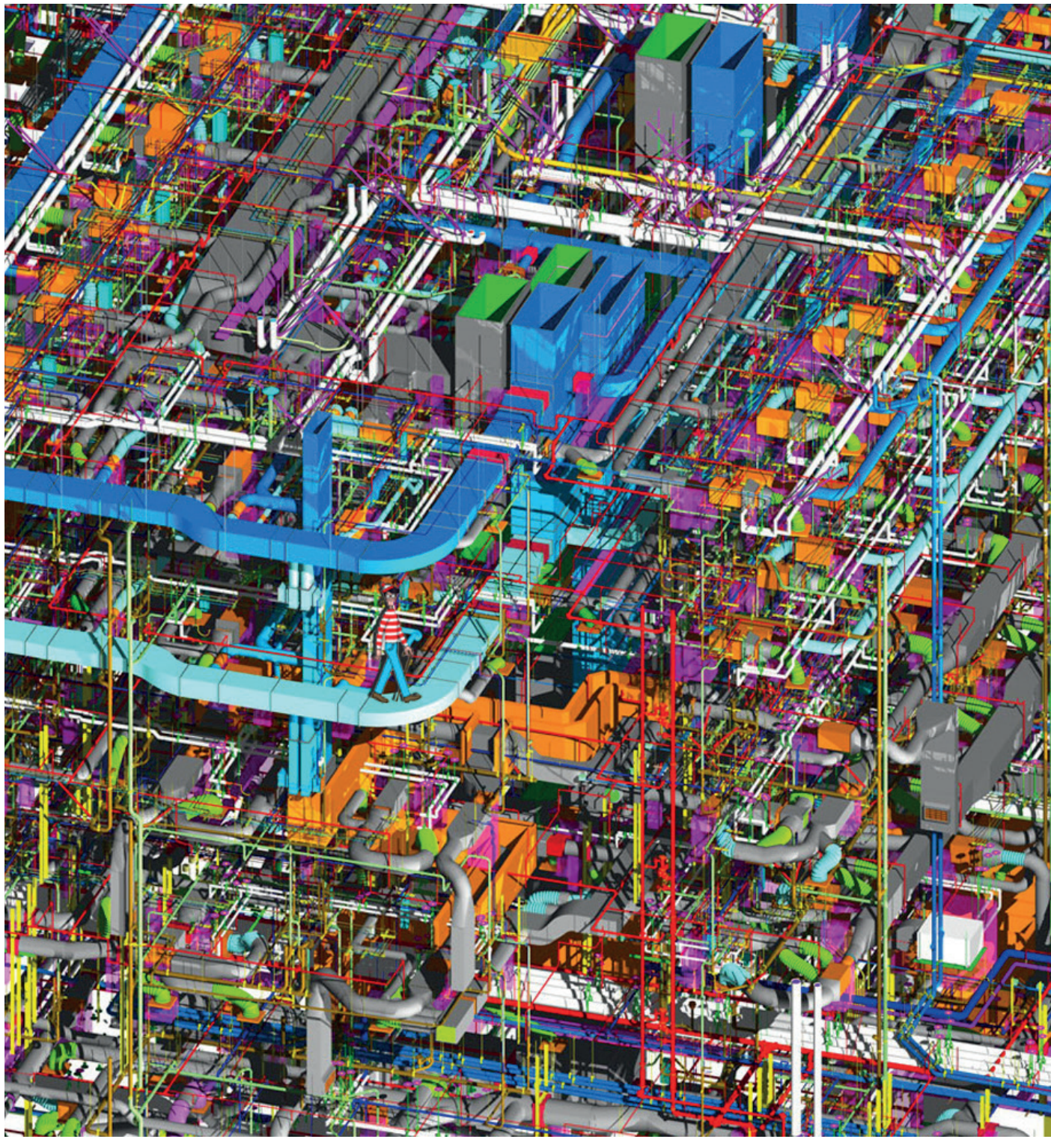


Fig. 2: Isometric projection from a BIM model showing the complexity of the HVAC systems (heating, ventilation and air conditioning) (Silicon GCC, 2018).

On top of this wide endorsement of BIM by the public sector, which was also reflected in the RIBA Plan of Works (2013), the private sector has also been seeking to capitalise on the adoption of BIM for the development of projects, equally intrigued by the promise of time and cost certainty. The conflict entailed within this trend is illustrated in a description of events provided to me by a colleague, who at the time was part of a team developing the UK headquarters for Google. On reviewing the initial proposals as uninteresting the client asked the architect and his team with dismay: *'Why is this scheme so different from your usual portfolio of work?'*, to which the designers replied that they had struggled to work creatively using the current generation of BIM software. At this point, Google allegedly sent the design team back to the drawing board telling them to do *'what they did best'*, essentially prompting them to bypass BIM to return to their known design habits.

The observation that BIM may be reducing the potential for creativity within the design process raised for me not the question of how BIM software might become more creative, but instead of the architectural design process itself and of the ways that this process responds to such attempts of systemization, which commonly go hand in hand with intentions of optimisation. Drawing from the experience of previously introduced technologies and particularly software that have become implemented into architectural production – such as Computer Aided Design (CAD), three-dimensional digital modelling, digital rendering or parametricism – it is easy to discern the expectation that BIM software will too eventually become more user-friendly and that eventually designers will no doubt learn how to work not only with but also around it. Already this is indeed happening to a degree, with the emergence of applications such as OPEN BIM (Borrmann *et al*., 2018), which pursues the open-source appropriation of BIM software by its users, with the primary goal to make BIM more accessible to diverse software platforms but also flexible.

This thesis does not position itself in opposition to either digitisation or the wider potential of BIM and the efficiencies these profess to offers through simulative collaboration. Instead, here BIM acts as a paradigm for an epoch of convergence within architectural practice that has been defined by a gap, or arguably a lack of gaps, between the designer and the design process where creativity can occur. As mentioned before, this is something that arguably has been growing with the gradual systemization and digitisation of the design process but until recently has remained bridgeable through the creative skill of the designer. Current gaps and issues will undoubtedly be solved by software evolutions and a more holistic approach to what media can be integrated into the future of BIM platforms, as is already seen through the implementation of responses such as Open BIM. However, the over-reliance of professional and governmental trends and directives on BIM, highlight an issue with our existing knowledge of the design process and the lack of understanding surrounding the value of thinking divergently whilst designing. Similar issues have also manifested within current literature on how we move forward, which illustrate how such market-driven practices, strongly related to regulation and efficiency rather than creativity and cultural value, offered back into academic discourse. Randy Deutsch's (2017, p. 15) recent edited volume *Convergence: The Redesign of Design*, whilst acknowledging such issues for both practice and education does not tackle the issue of the importance of divergence within design process thinking. On the other hand, Richard Garber (2014, p.29) examines the creative potential of BIM in allowing the architect to be more involved within the crafting of buildings, suggesting that since the inception of the profession in the 15th century the practice of the architect has distanced itself from craft. Citing examples of architects such as SHoP (Garber 2014, p.44) and Morphosis (Garber 2014, p.70) innovatively using component-based software, such as Revit and ArchiCAD alongside their existing process to enrich their practice. It is, however, questionable how such examples actually represent the culture

of BIM, as in both cases the additional software is used in tandem to existing processes and not simply within a single software environment. With more specific focus to the impact of this shifting landscape on the education of architects, architectural educators such as Peggy Deamer and Philip G. Bernstein (2011) propose that, ultimately, there remains a general lack of understanding surrounding the impact of such processes on the architectural design process, as applied in both practice and education. The most definitive manifestation of this lack can be seen in the ways that such technologies have begun to shift architectural education towards the definitive training of architectural skills and away from the more critical and creative processes of design thinking.

In responding to this lack of knowledge, which is at once a misunderstanding of digital technologies and of design itself, this thesis does not attempt to analyse or lay bare the process of architectural design, thus mirroring what technologies such as BIM seem to attempt. Instead, recognising this convergence as an issue pertaining to the overpowering media monopoly of BIM technologies as a removal of media from the process of design, the research returns to architecture's representational field to interrogate and examine its value and resilience. Towards this, it focuses specifically on the moments of divergence that emanate between and across the media involved in the architectural design process, hence reflecting in part on the reductive qualities of attempts to converge and systematize it but primarily framing and illustrating the role of mediation and representation as critical sites of creative divergence for architectural design.

In engaging with media, the thesis traces and proposes divergent design practices that connect the analogue representational traditions of architectural media with the digital screen-based context, which has become associated with a culture of utilitarian optimisation through systemization. The key issue that the thesis addresses in underlining the value of divergence within architectural design, against the simulative context of recent digitisation practice, is the plurality of media and the importance of negotiating and refining ideas through a wider landscape of media and mediations. If the professional culture that BIM represents enables a participation that disseminates the architectural project across a variety of professionals, from design to construction, divergence responds to the beginnings of the project within architectural design practice, and the dissemination of creative thinking across a field of representation. What this research is therefore interested in, triggered by both a justifiable critique of emerging software for the creative industry, as well as the faith in creativity itself, is exactly this ability of the designer to work *around* things. The thesis is, thus, concerned with understanding not the possible threats or obstacles posed for creativity in the possibility of a 'digital turn' (Carpo, 2013b p. 8), but rather to understand and make more explicit how creativity might be capable of navigating such media turns, be them digital or analogue.

Previous studies of architectural creativity, such as those produced by architects Bryan Lawson (2006) and Nigel Cross (2006), have placed focus on the pursuit of demystifying and understanding the design process. Whilst these studies attempt to escape the simplistic understanding of creativity as a modellable phenomenon – as first set out by Graham Wallas (1926) with his four-stage model of creativity (Fig. 3) – their explorations of how designers think and design, still attempt to offer a convergent systematized understanding of creativity that I would like to argue clashes with the nature of architectural design. Thus, this research approaches the idea of the model with caution, starting instead with an examination and pursuit of the elements of divergence rather than systematic convergence within architectural thinking, as allowing and enabling of the endurance and flexibility of creative processes and their ability to adopt and adapt to new tools and techniques. This premise then defines two key axes in the development of this research: on one hand the designer as

an individual and on the other hand the media of representation, are considered in the context of this thesis as equally contributing factors of destabilisation and, therefore, of proliferation and creativity in the design process.

As a starting point, the thesis positions itself in architectural practice through the pedagogical context of the architectural design studio as a space that replicates and reflects the processes of architectural practice, therefore offering the opportunity to study how designers acquire the ability to work divergently through associations with architectural media and their visual cultures. This pedagogical context is examined here not with the intention of explicitly offering pedagogical formulas and solutions, but rather as context that is definitive for the development and consolidation of architecture's specific scope and culture of practice, to a degree freed from the entrepreneurial scope that more professional and regulatory contexts might entail. Identifying such frameworks, whereby 'real-world' issues pertain more explicitly to utilitarian, commercially profitable applications of design, as directly related with the wider culture of design convergence, this project draws attention to architectural design as mode of cultural production rather than a clearly defined professional and commercial practice.

Wallas' creativity model + 1

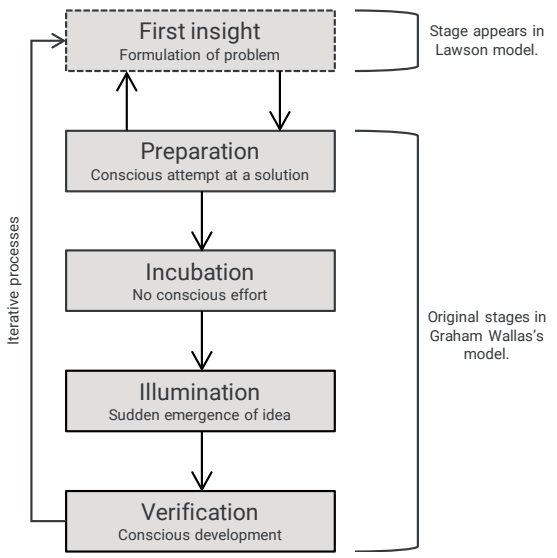


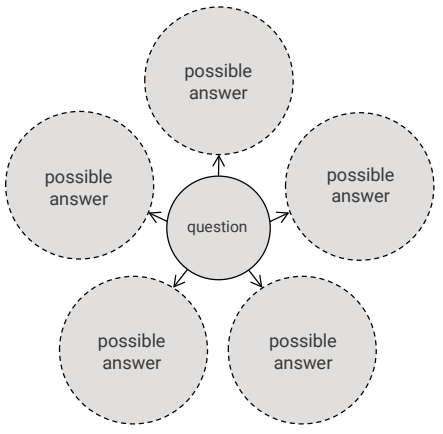
Fig. 3: Stages of creativity according to Graham Wallas (1926), with additional 'First insight' stage according to Bryan Lawson (2006).

1.2 | Diverging and leaping

1.2.1 | The thinking leap

Core to this examination of divergent thinking within the architectural design process is the relationship and importance of divergence to creativity. The investigation of creativity here does not stem from a need to understand how to produce a creative output but, instead, from the intention to glimpse and follow creative moments within the design process. Defined by American psychologist Joy Paul Guilford (1967), 'divergent thinking' emerges as the key moment within creative processes, in which a designer starts to think and generate multiple ideas beyond their initial starting point. Divergent thinking describes a free-flowing thinking process, where the thinker can diverge from a linear process into one that has multiple potential outcomes (Fig. 4). In contrast to this, Guilford (1967) also defines 'convergent thinking' as a linear process where the thinker employs deductive reasoning to converge on an idea through a sequence of logical steps (Fig. 4). According to educational psychologist Arthur Cropley (2006, p. 391), a further characteristic of thinking convergently is its ability to limit ambiguity and to allow a designer to find the best answer for a problem. This is because thinking convergently sees the designer working with and manipulating existing knowledge through the use of standard procedures in a process where they sift and deduce the final solution (Cropley 2006, p. 391). Whilst Cropley (2006, p. 402) argues the importance of convergent thinking in the production of ideas, he acknowledges that central to a creative process is the ability to combine both convergent and divergent modes of thinking. Cropley discusses (2006, p. 402) terms including chance, luck, novelty and intuition, under the umbrella of divergence, concluding that whilst these are important in the emergence of creative ideas, convergence is equally important in allowing ideas to be tested, reconstructed and narrowed down. With a more specifically architectural scope, Lawson (2006, p. 153) proposes that design is not simply a combination of divergent and convergent thinking but, instead, the balance between the two modes of thinking that is necessary in order for creativity to flourish within the design process.

Divergent thinking



Convergent thinking

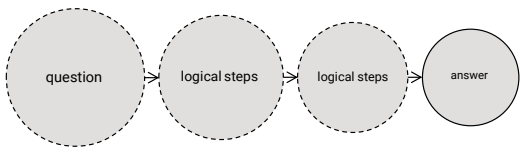


Fig. 4: Divergent and convergent thinking.

This thesis proposes that examining moments of divergence reveals what I would like to define as the 'design leap'; a point at which a designer breaks away from an otherwise convergent process by actively looking for new possibilities through a process of shifting between conditions of representation. The leap as a cognitive phenomenon can already be traced within the very first attempt to model creativity, carried out by Graham Wallas in 1926, where the term is used to describe a similar occurrence within his four-stage model as 'illumination'. Illumination, often colloquially referred to as the lightbulb moment (Cross, 2006, p.65), sees the designer undergo a sudden rush where they perceive either a glimpse or an entire creative response to a problem (Wallas, 1926, p.38). Respectively 'sudden illumination' (Cross, 2006, p.65) can be interpreted as a moment where the designer is either triggered to leap and introduce something new or, through reflection, perceives a new field of study for the design process to engage with. Within Wallas' notion of illumination, the triggering of this event is not clearly defined or scrutinised. The design leap, as defined in the context of this research, situates Wallas' concept in the architectural design process and, in doing so, examines the importance of media in such critical moments of creativity. The conditions and cultures of signification and representation that media create are in this context revealed neither as ends nor as beginnings of the design process, but as movements across and between stages of resolution.

Although a term widely referred to in the literature on creative thinking, over the last fifteen years the term 'leap' has remained undeveloped and come into criticism for the way that it oversimplifies and underplays moments of creativity. Rather than seeing the leap as a singular lightbulb moment, Cross (2006, p. 78) proposes it as a bridging process where a designer draws associations from one point in a design process to another, thus forming a connection between existing and emerging ideas. In this perspective, the leap develops from a singular moment to a chain of events. Cross (2006) goes on to suggest that the leap builds a bridge between problem and solution, which when crossed allows the designer to recognize a successful connection between the two fields, which, in turn, triggers the moment of illumination (Cross, 2006, p. 78). Further studies of the leap from beyond architecture in the field of artificial intelligence have also attempted to breakdown and systematize different types of leaps, such as John Gero's (2000) model of creativity, which defines five subcategories of the phenomenon: combination, mutation, analogy, design from first principles and emergence. These categories have found their way into design through the later work of Cross (2006 p.70) who has attempted to discuss them in relation to design-based problems. Working with teams of designers through recording their verbal discourse in order to identify moments of leaps, Cross appropriates and illustrates Gero's categorisations of leaps within an architectural context of practice. Whilst these categories help expand the study of the leap through a set of definable and recognizable processes, they still approach the leap as a fixed modellable phenomenon, which attempts to converge and systemise something that is, at its core, divergent and therefore fleeting. It is important, however, to underline that the architectural design leap, as defined and explored within the context of this thesis, is not limited by its origin within the discourse of cognitive science. Specifically, the thesis seeks to expand the understanding of the design leap, in bridging design thinking and an architectural design theory by shifting the focus from the designer as the sole context of the leap or the design process, to include and consider the role that the media involved in the process of architectural design play in the occurrence and development of such moments. The question that the aforementioned studies fail to address, is where does this leap take place, or rather, and to put it in architectural terms, what are the operative sites or loci of these leaps?

Start, initial sketch of house

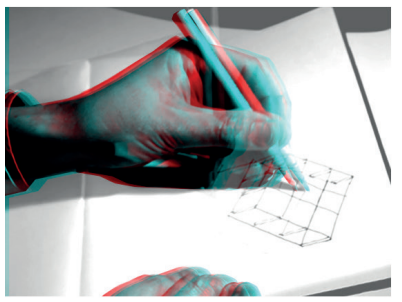
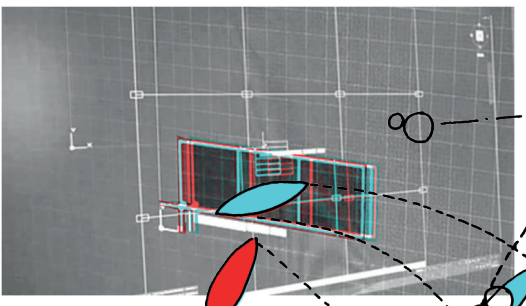


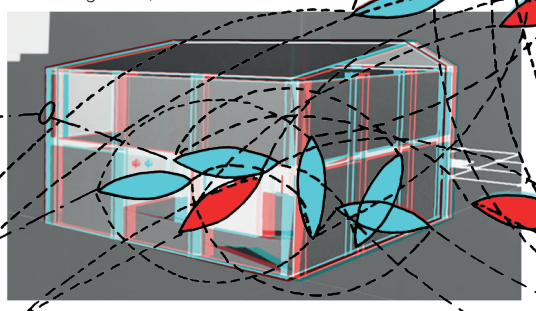
Fig. 5: 'The Architect's brain', Poster from the *Research Practice Seminar* at Bower Ashton, UWE Bristol (2016). Anaglyph 3D image illustrating the recursive exchange between divergent and convergent thinking.

Recursive

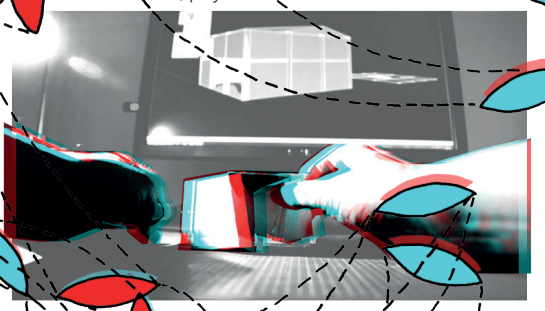
Drawing up in CAD



Modelling in 3D, reach creative block

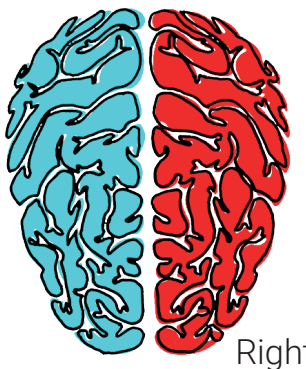


Switch media, physical model



Insertion of physical model into digital

Architect's brain



Left logic

Convergent

Right creative

Divergent

1.2.2 | Media crossroads

In order to clarify this conjunction of media, it is helpful to consider the emergence of similar concepts within architectural research, which, importantly, suggest a perspective of not only external observation but also of participation within the discipline and its practice. In the book *Architectures of Chance*, architect and educator Yeoryia Manolopoulou (2013) investigated similar to the design leap conditions, whereby moments of creative agency are attributed to acts of 'chance'. This aspect of chance has similarities to what is defined here as divergence, in that it enables the designer to see new paths and possibilities through accidents that occur during the design process. However, in Manolopoulou's terms, these chanceful events emerge, as Aikaterini Antonopoulou (2014) clarifies, due to the 'tensions' in place between the designer and the existing context of their process. Manolopoulou studies these 'fleeting moments' and how they enable the design process to unfold and develop, through her own creative practice, as well as within the works of architects such as Lina Bo Bardi, among others, to propose her own approaches, as well as a wider review of design techniques that introduce chance in architectural design. Although Manolopoulou's (2013) framing of chance aligns with the understanding of divergence in this thesis in the way that it seeks creative openness, a key difference between the two concepts lies in the way that the intentionality and control come to play in or are surrendered from the method and scope of the process. Manolopolou (2013) calls for a pro-active acceptance of indeterminacy and questioning [of] the degree of control demanded from and exercised by most architects. On the other hand, the effects of divergence discussed here, to a degree, pursue rather than relinquish a form of control. Although potentially fleeting in subtlety and temporality, the design leap is not chanceful in its creative instrumentality but conditioned by the way that the media involved and their derivative cultures produce meaning. It is, therefore, the specific openings and alignments to architectural norms and habits of productivity that media create that is the focus of the design leap as defined here, rather than the aleatory effects that may occasionally emerge from encounters with media. As this thesis proposes, the cognitive habits and conventions that emerge in the architectural appropriation of media allow the designer a degree of control of the process exactly by means of the emerging divergence; through creative responses such as the transposition of conventions across media and acts of interpretation that might be tacit and divergent, yet not chanceful. Of course, Manolopoulou does not always rely on the spontaneous occurrence of chance. As does this research, she also pursues paths that evoke and interrogate it through her own design practice. Manolopoulou's response to the aleatory within architectural design, incorporates aspects of both divergence and convergence towards defining expanded perceptions of context and design performance rather than established media cultures, which set out specific forms of divergence. The focus on media placed here, contributes to and allows an interrogation of the media and the ways they have and will define architecture's transition from paper to screen, and from a long-standing representational field of action to a digital-visual context of practice.

Defining the leap as a divergent design action, places focus not on the fabrication but rather on the capturing of these fleeting effects, which are engendered in design as an intentional and, therefore, creative act of controlling material. This is carried out by either setting out new or interrogating specific techniques for prompting and instigating design leaps, as a way of clarifying this definition and understanding the process of leaping within architectural design in its wider complexity. This involves not only the designer as modelled personage – as design thinking studies tend to suggest – but rather the ensemble of the designer as a diverse range of behaviours in interaction with a currently shifting *milieu* of media. The chanceful therefore does become important to the development of this research in a methodological capacity; whereby the tools and techniques

employed see chance enter a design-led research process through elements of randomness expressed in the process of prompting the designer towards divergence from normative procedures and behaviours. However, it is the study of divergence as manifesting through the conscious alteration of the design process that is the focus of this research and the specific ways in which media cultures become engendered into architectural design thinking.

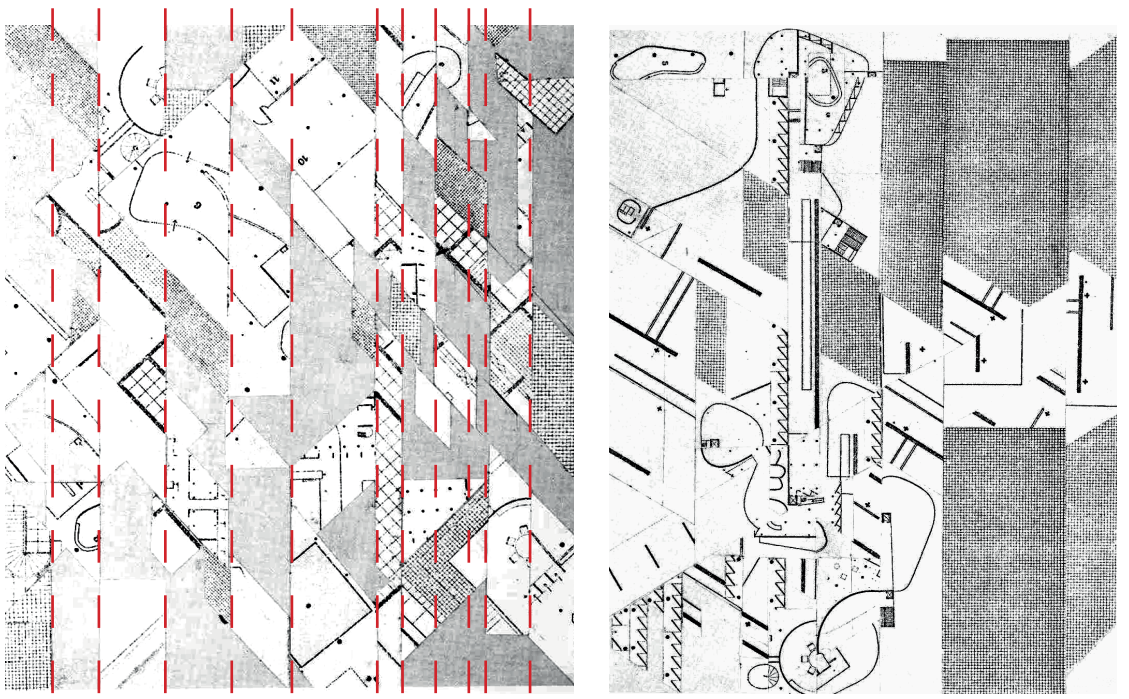
This is a discussion that puts focus on the role of media upon design creativity that becomes now more pressing in the context of architecture's pursuit to digest its response to the digital context, which often disarms this divergence in the pursuit of optimisation. However, it is also a discussion that is not completely new, if one looks back at the complex history of the relationship between technological advancements and artistic creativity. The challenge of mechanical reproduction (Benjamin, 2008), the moving image, cinematic or televised, all have had their mark upon artistic and creative production that each time had to actively position itself towards the media not only as material and technological but also as cultural contexts of perception and signification. In this, artistic production has often proved itself to be more agile than architecture, which is inevitably bound to its functionalist and, less so, commercial roles. For instance, one can observe the drastically distinct in articulation responses that art and architecture proposed to modernist thought and its technological counterpart: the former (in all its various movements and manifestations) defined by the radical exploration of visual perception through abstraction, the latter defined by the rationalism of functionality as a creative force (Banou, 2016b). As a result, the exploration of such divergent techniques can be observed to have been prominent in artistic production long before it consciously made its appearance in architectural discourse, as a response to post-structuralist ideas that emerged in the latter half of the twentieth century. The divergent lenses offered by the Dada techniques of collage and the deconstruction of vision of Cubist painting, in the visual arts; the double reading of images in the surrealist works of Salvador Dalì (1930); William Burroughs' technique of cutting up text (1950s-1960s) or Stephane Mallarme's spatial explorations of text in literature (1897), all respond to the deconstruction of vision and meaning that, even if not yet concurrently articulated in philosophical and theoretical discourse at the time, emanated from the fragmentation of subjectivity that modernist technological advancements laid bare.

Examples of creative practice such as those described above, illustrate the necessity and creative potential of divergence through organised but open-ended processes. In every one of those practices it was the specificity of the medium: painting, image, or text, that set out a specific cultural context of representation and appropriation of meaning and establishes the rules of engagement with the material. It is not accidental then, that in the field of architectural practice, and pedagogy, similar practices have always been pursued by means of the representational field of architectural drawing. The wider 'deconstructivist' (Johnson and Wigley, 1988) context of drawing as a means of excavating and enriching composition and context demonstrated by architects such as Daniel Libeskind and Peter Eisenman, is indicative of such practical media explorations of divergence in architecture. However, it is important to track and consider how their origins and situation in relation to another techno-representational shift, as expressed in the pedagogical fermentations demonstrated through the briefs and work of students under the directorship of American architect, artist and educator John Hejduk, which resonate with architecture's current friction – or conformity – with digitisation.

Hejduk, who worked at The Cooper Union (New York, USA) from 1964 until 2000, and as Dean between 1975 and 2000, used the architectural design studio as a space to explore the shifting context of American architecture through two exhibitions of Cooper Union students work held at the

Museum of Modern Art in New York (MoMA): the first entitled *Education of an Architect: A Point of View* (1971-72), showed student work from 1964-1971 and the second *Education of an Architect: The Irwin S. Chanin School of Architecture* (1988), showing work from 1972-1985. The two exhibitions, remarkably placed student work at the forefront of artistic and cultural discourse by displaying it for the first time at such a seminal institution, framing architectural education and pedagogy as an incubator and indicator of cutting-edge architectural discourse and practice. According to Deamer (2012), these two exhibitions did more than simply showcase the work of students. Through an exhibition of abstract drawings and minimal text, which at the time contrasted how architecture was commonly represented, the exhibition sought to propose a response to North American architecture, which was at the time torn between, on one hand, pursuing a critique of modernism through a resurgence of neo-plasticism and, in particular, the work of Le Corbusier and, on the other, pursuing the establishment of a North American vernacular as indicated in the work of Robert Venturi (1966) and Vincent Scully (1992). North American architecture seemed to be struggling to position itself in relation to the critique of modernism, which in Europe had begun through the work of practices such as: Archigram, Superstudio and Coop Himmelblau in the 1960s.

Daniel Libeskind, who was then a student at The Cooper Union, contributed to the exhibition with Collage Rebus (1971) (Figs. 6-8) as included in the first exhibition: a collage working across drawings perceived interchangeably as images and as drawing and typed text, before seemingly leaping from a two-dimensional plan (Libeskind, 1971, p. 281-284) into a three-dimensional isometric (Libeskind, 1971, p. 285). The text that accompanies the drawing starts by critiquing the status of practice and, in particular, the inadequacies of representational media – namely drawing – for their inability to respond formally, programmatically or technically to the complexities arising from the



Figs. 6-7: 'Rebus'. (Left) Collaged drawing showing the process of the initial cuts of an original drawing, highlighted in red. (Right) The emerging formation of a plan in a consequent re-drawing (Daniel Libeskind, 1971).

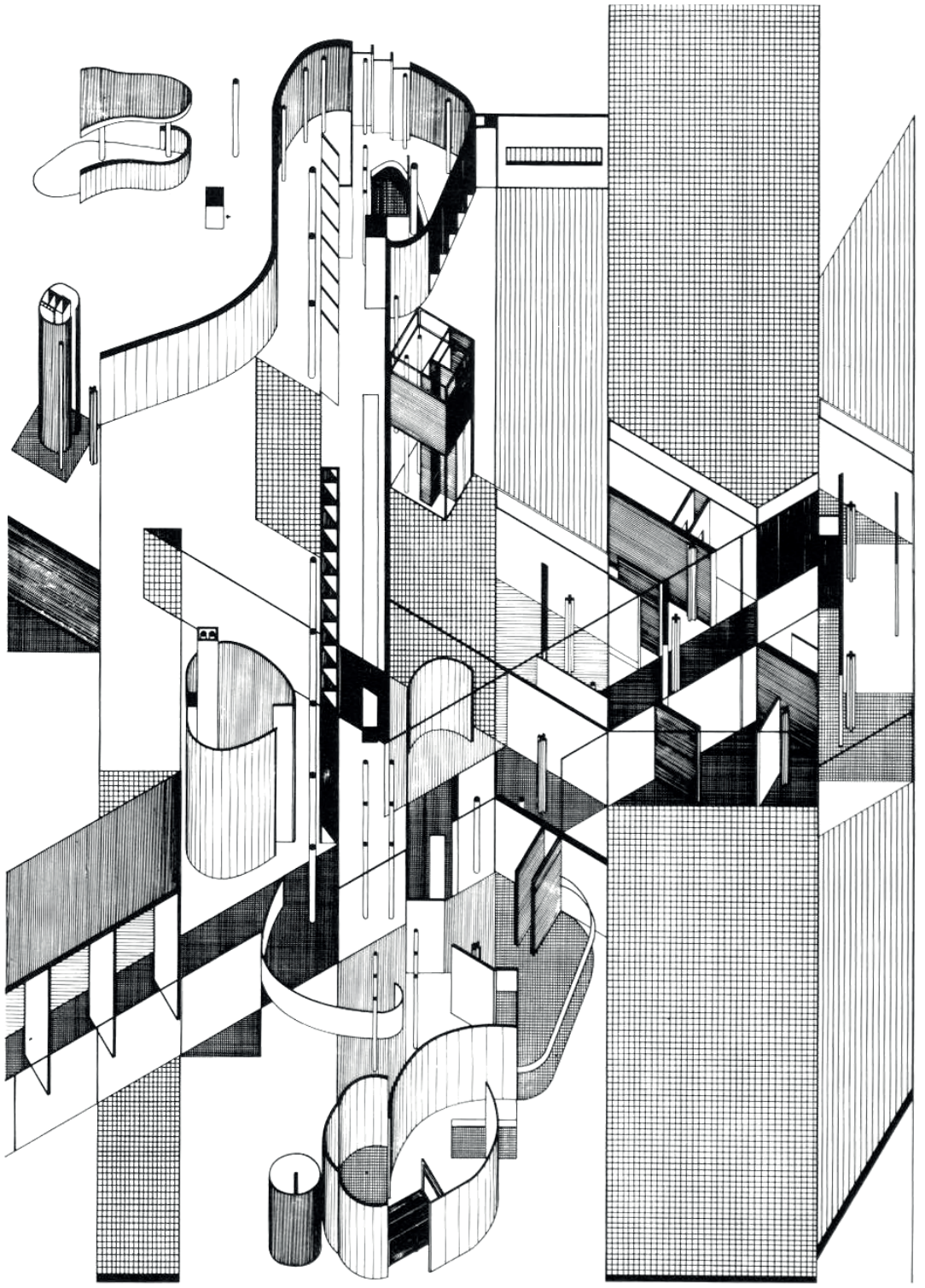


Fig. 8: ‘Rebus’, final drawing in a sequence of collages and re-drawings (Daniel Libeskind, 1971).

increasing 'technification' (Libeskind, 1971, p.280) of architecture. Libeskind (1970, p. 280) proposed that drawing alone could achieve the relevance of film, total theatre, technology, psychology and sociology and that working across media can not only *'penetrate beyond the surface appearance of meaning and form'* but also reveal new methods and techniques that present a new grammar and with it a *'radically different way of perceiving, thinking and ultimately acting'* (Libeskind, 1971 p. 280). What Libeskind (1971 p.280) identified and Deamer (2012) contextualised, is that at the time architectural practice in North America had become consumed with a formal debate on the future of architecture that was resulting in a form of 'media poverty' that required raising the importance of representational techniques not simply as an end in itself but also as a means of communicating and developing a creative practice towards a building. What emerges from the briefs of Hejduk and other staff of the Cooper Union and work of students as curated through the exhibition is both a *'… new language architecture as a narrative of seduction and desire'* (Deamer, 2012 p.137), which although at first appears as foreign to the wider profession, it retrospectively reveals itself as a fulcrum for creative talent and the emergence of practices, such as Studio Libeskind and Diller Scofidio + Renfro, among others.

The 'media poverty' that triggered Hejduk's response, owed to the exhaustion of architectural drawing by modernist rationalism, has clear similarities with the current situation that architecture is faced with through the wide implementation of BIM. In this case the poverty can be identified in the convergence and systemization of the practice through single media software platforms that rely on systemization and simulation and, thus, co-opt the culture by means of the industry from a position of cost and time efficiency through collaboration. A year before writing on the seeming crossroads of architectural praxis in North America during the 1960s-1980s (Deamer, 2012), Deamer also wrote on the challenges that the introduction of BIM has created for architectural academia, as a form of media that has shifted architectural education further towards digital software skills training, due to industry demand and its reflection on student satisfaction through the pressure of the job market (Deamer, 2011). Deamer (2011, p.3) concludes that for BIM to be meaningfully implemented into the pedagogical design studio its applications needs to be expanded beyond its practical notion of a tool for efficiencies towards an exploration of the unknown embracing one of academia's core roles of challenging the wider field of architectural practice. In the current context of digitisation, architecture is once again at a crossroads, dealing with an infiltration of its creative discipline from the pressures of the construction industry from the developers of CAD software, which although predating BIM, they have found in it the Trojan Horse for their final domination. This convergent overpowering of media marks a return to rationalism through the digital, that echoes the calculative response of modernism to drawing as a means of rationalist geometricization, which the capabilities of the digital have, in a sense, revived (Capo, 2013, p. 159). Inevitably, this situation calls for a re-evaluation of architecture's media tactics towards maintaining its creative core.

1.3 | Iteration, iteration, iteration

1.3.1| Architectural media environments

Moving beyond the model as a way of defining architectural creativity, this thesis examines how design as a process of thinking is informed and shaped by the media and techniques that the designer introduces, analogue and digital. Here, the term 'analogue media' includes forms of hand-drawing such as diagramming, sketching, tracing and orthographic drafting as well as physical model-making. The term 'digital media' is used to refer to computer software interfaces, which operate between the designer and the computer's physical hardware and enable the production of drawings or images, either through coordinate-based vector lines (as in CAD) or through pixel-based raster matrices (as in Adobe Photoshop).

The range of analogue and digital media available to the designer and the ways this allows them to switch between media and inform their thinking depending on the task they are performing, is highlighted by architect and educator Andrew Pressman. He points out that the media enable the designer a freedom to express themselves through effects, such as slowing down the design process in order to focus on an element further (Pressman, 2012, p. 101). This range of scales and speeds provided by architectural media enables a fluency to the design process and becomes key to the designer's ability to explore ideas (Pressman, 2012; Banks, 2014). Although the process by which designers work with different tools is by no means rigid, it often begins with the production of concept sketches and concept models. The lack of rigidity or sequence in how these tools are used is described by architect and software developer Jarad Banks as their strength. Banks (2014) goes on to explain how the lack of rigidity afforded by architectural media offers designers a playful and impure environment ripe with the opportunity for accidental discovery. What becomes apparent from examining research into architectural media, is how the media offer structured ways of gathering and organising material, whilst also providing a space for creative thinking to emerge between and across them (Pressman, 2012; Banks, 2014). However, previous studies, which acknowledge and recognize the creative benefit of a multimedia approach, focus on the role of representational media as specific, formal or material conditions rather than wider modes of subjective interpretation. This thesis will glimpse, celebrate and interrogate these fleeting moments of creativity by engaging directly with tools and techniques derived from a wider discourse of divergence, indeterminacy and chance from architecture and beyond. This examination of architectural creativity will take place through a series of design exercises that iterate techniques of design, as well as divergence. These are either directly carried out or prompted by me. This series of tests that examine and outline divergent leaps across media, rely on the idea of iteration, which is key in the development of any design process. Iteration entails a dimension of productive repetition; of a persistence on carrying out an act a number of times in order to further distil the outcome through a re-articulation of a situation. This involves both the designer, as a reflective practitioner (Schön, 1982), and the media, as a field of representation. Later in the chapter, this will be expanded towards understanding the architectural habitus, which incorporates patterns of design thinking, conventions and media. The recognition of this *milieu* will reveal the complex intertwining of practice and its means of mediation as unmodellable. Similarly, and by extent, the element of repetition entailed within the design process is not procedural but pluralistic and productive and, therefore, resists standardisation or modelling. Rather, as Gilles Deleuze (1994, p. 2) suggests, this is a form of repetition that constitutes a moment of transgression, which through re-iteration puts into question not only the media but also

the conventions and syntax that these entail. It is in this dimension, which is concerned with the way that media take part in the production of meaning, that the research engages with post-structuralist theory as a way of framing design practice, as opposed to cognitive science studies that place their focus on the designer as an actor of predictable behaviour. Contrary to this approach, this research is concerned with the modes of subjectivity that media set out and the tacit responses to media that architectural design thinking enables.

1.3.2 | The architectural studio: From pedagogy to practice

This research finds itself situated largely within the pedagogical context of the architectural design studio to examine how creative design processes are shaped by the media and technologies that designers introduce. This, however, is not to say that the research is limited to pedagogical applications and observations. Firstly, as discussed, the pedagogical design studio models itself on architectural practice, where students develop their design processes through iterative design cycles. Secondly, students are in effect the incoming generation of designers and the context and habits through which they acquire knowledge of design processes inevitably inform practice. This is especially important when the study considers the impact of emerging digital media, such as BIM, on these processes. Thirdly, research into the architectural design process has previously looked at students, with particular focus on how design is acquired as a skill through education, in order to offer insights on the wider field of design. An example of this can be seen in the way Lawson (2006, p. 41) contrasted the cognitive styles of architecture and psychology students examining their differing approaches to design-based challenges. The study, which asked students to solve problems that had been formulated without a technical bias towards either profession, found that architecture students consistently looked to achieve the best end result, whilst the psychology students looked to understand the underlying rules (Lawson, 2006, p. 41). Lawson (2006, p. 41) attributes this difference in the approach of the architecture students to how they have been educated. In this instance, the architecture students could be seen to be attempting to creatively bridge or leap over the problem rather than systematically and exhaustively work through it. In a further study of how architecture students learn, Cross (2006, p. 47) contrasted the design ability of novice designers with more experienced designers drawing out issues such as design fixation being more prevalent within the novice designer.

Here, the study of divergent creative design processes does not set out to differentiate or understand the differing skill levels of designers and other professions or designers at different points within their carriers. Instead, the various design-based projects explored within the context of this thesis bring together a range of architectural designers from students to experienced practitioners (including the researcher) working individually or collectively on a number or design-based projects, in order to examine moments of divergence occurring across media in the early stages of the architectural design process. Whilst studying specifically how different designers might act divergently faced with similar design situations would be interesting in itself, it is more important to study the role of divergence within the design process and the ways it manifests across and between media. This is because the digitisation of architectural practice (professional or not) and technologies such as BIM, have in the last decade proposed and gradually imposed the simulation, systemization and ‘grammatization’ (Stiegler, 2010) of the architectural design process. However, it is also important due to the way that previous studies, such as Lawson (2016) and Cross (2016) have isolated the designer’s creative process from their media environments and the wider frameworks that these entail.

It is important to the development of the argument, to understand and define the architectural design studio as a key space within architectural education, where students develop and expand their design process through practicing design and discussing the outcomes with tutors and peers, thus consolidating and establishing ways of thinking and interacting with both peers and material that are carried across to and inform architectural practice. This process of practice and discussion occurs repeatedly in the studio through formal events such as tutorials and reviews, and also through more spontaneous conversations. What the studio sets up is an environment where students can iteratively test design ideas and develop their design process (Hardy and Teymur, 1996). This continual development and reviewing of design work as a mode of teaching students illustrates the close entanglement of pedagogy and practice in architecture and has its roots in the 19th century and the master-apprentice model, whereby novice designers would learn about the design process not through explicitly defined teaching set ups, but whilst working under a more experienced designer (Salama, 2016 p. 78; Stevens, 2017). However, a key difference between the architectural apprenticeship model and the pedagogical design studio is that whilst an apprentice would work on actual projects, a design studio student primarily works on speculative projects, briefed to maximise the learning opportunity for the student. The advantage of this approach is that it can be tailored by the tutor in complexity to meet the learning needs of a specific cohort of students.

The design studio has also proven to be a useful context for studying how students learn through iteratively practicing design with much of this research emanating from the work of Donald Schön (1991) and the concept of the 'reflective practitioner'. Schön recognised the design studio as something novel within professional studies that other fields, such as medicine, law, and engineering, could learn from (Schön, 1991, p. 312). Schön recognised how this type of pedagogical approach provided a very different type of learning experience for a student than simply reflecting on somebody else's experience from a textbook, coining the terms 'reflection in action' and 'reflection on action' (Schön, 1991). 'Reflection in action' refers to the process of a student thinking about and understanding what they are doing whilst designing. 'Reflection on action', on the other hand, refers to a student retrospectively contemplating their design decisions, which might critically occur during a tutorial or review with a tutor but also, importantly, mirrors how architects operate iteratively in wider practice.

Whilst the design studio has improved the consistency and repeatability of teaching design processes to students, the legacy of the architectural apprentice has resulted in hierarchical issues between students and tutors. These issues have led to criticisms of the design studio with particular regards to how negative dynamics can occur within the design tutorial (Webster, 2015, p. 68) and also within the review process (Doidge, Sara, Parnell, 2000, p. 82). Specific issues concerning design thinking include tutors pushing their own design ideas onto a student rather than helping them to think through their own ideas resulting in creative blocks due to disjunction in thinking. Similarly, the misconception of students believing they should follow the tutors' words verbatim in producing design work and not deviating into their own line of thinking can also limit the creative potential of the student. Both of these issues are relevant to this study of creative divergent thinking because they suggest that the design studio might be a context of limited design creativity. This is because the concept of 'reflective practice' puts emphasis on the design process thinking as emerging primarily from discussions between the tutor and student. This is something that architectural educator Helena Webster (2015, p. 66) highlights as a principal issue with Schön's idea of 'reflective practice', proposing instead that students are influenced by a much wider sphere of ideas. If Lawson (2016) and Cross (2016) then seem to place too much emphasis on the student subject as an individual agent within their design process, what Webster argues is that 'reflective practice' frames

the studio as a convergent space where design propositions are formed in a closed loop between the student and the tutor and through processes that converge towards design treated as problem solving. Whilst reflective practice provides a useful starting point for examining how designers think, Schön himself did not primarily set out to posit the concept as a means to critique the pedagogical design studio. Instead, Schön (1982) clearly uses the concept as a means to address the shortcomings within how design processes are taught in other design practices and their professional contexts. The issue, which is in part highlighted by Webster (2015) but not fully drawn out, is that whilst the concept of 'reflective practice' is useful, it has some deficiencies in terms of explaining how design processes are accumulated within the design studio. Ironically quoting Ronald Barnett's (1992) claim that *'we're all reflective practitioners now'* (Webster, 2015, p. 64), Webster's position is less concerned with the principles of 'reflection in' and 'on action' and more with how reflection, since Schön's popularisation of the term, has become an over-appropriated concept within architectural pedagogy. This dislocation of the concept from its original field of study has resulted in an oversimplified understanding of how designers develop their thinking skills within the architectural design studio.

This thesis questions the idea that design processes and, in particular, creative design processes comprise a tangible set of skills that can be transferred from an expert designer to a novice designer. Instead, the thesis takes Mark Dorrian and Adrian Hawker's (2003) position that, beyond the setting of the brief, the role of the design tutor is primarily participatory and operating through processes of experience, guesswork and anticipation that are not dissimilar to those that a student might adopt (Dorrian and Hawker, 2003, p. 183). Expanding on this further and looking, in particular, at Dennis Fox's (1983) paper on 'Personal theories of teaching', which seeks to conceptualise a series of established teaching theories beyond the specificities of architectural education. Fox (1983) draws out four different types of teaching theories: the first two, 'transfer theory' and 'shaping theory', he considers to be 'simple theories', which place emphasis on the delivery of the syllabus through textbooks and then getting the students to recall facts. These theories refer to prevalent teaching approaches within education in general, higher education and the teaching of architectural education outside of the design studio. Fox (1983, p. 159) proposes that these approaches can lead to 'surface learning', where students simply learn information in order to regurgitate it later. Within the design studio this can present an issue, when students take their experience of modules beyond the design studio and start to overly rely on their tutor to prescribe and ratify their design processes. Inevitably this can lead to a negative process of 'reflective practice' as proposed by Webster (2015, p. 66), whereby the discourse of design is a process of convergence between the student and tutor. The second two types of theories that Fox (1983) discusses, 'traveling theory' and 'growing theory' are considered to be 'developed' theories where the emphasis is on the activities and contributions of the student. In this case, the emphasis is placed on 'experiential learning' rather than teaching strategies.

This thesis proposes that it is a hybrid between 'teaching as travelling' and 'teaching as growing' that most aptly describes the prevalent approaches to architectural design education. The idea of 'teaching as travelling' involves the discovery of a pre-existing landscape of knowledge. Here, the tutor acts as a tour guide enabling the traveller / student *'…to see in perspective features previously only experienced out of context'* (Fox, p. 156). In this sense we can see the architectural tutor offering a divergent perspective or reading of the student's work, to provide critical advice on how to develop it further. 'Teaching as growing' sees the tutor as the gardener and the students as the ground. According to this analogy, as plants will grow without intervention from the gardener but what the gardener brings is the skills to act as a catalyst for bringing out the best from the available ground

that is possible (Fox, p. 157), the tutor will not define but support and nurture the student designer's growth. Like the gardener, the design tutor is not working towards a defined end but instead continually surveying, adapting and seeding the ground to get the best out of it.

Whilst there are key differences between the analogies of 'teaching as travelling' and 'teaching as growing' (Fox, 1983), in the context of the design studio it is the combination of both that form the relationship between the student and tutor and enables the emergence and unfolding of the design process. The travelling concept provides the discovery of a pre-existing and, therefore, predefined landscape of knowledge, while the growing concept offers a further flexibility to propose that the field appears to be dynamic and undetermined. This theorisation of the design studio brings into question the degree to which design-based knowledge can be considered as fixed, finite and therefore transferable, instead hinting towards a constructivist approach to the design process. Constructivism suggests that the learner constructs meaning through experience, influenced by the '*…interaction of prior knowledge and new events*' (Arends, 1998). While travelling reflects the divergent qualities of design as a field of knowledge, the growing analogy reveals its developmental qualities, which entail the development of design processes not as finite procedures but as dynamically constructed and embodied behaviours. Within the architectural studio, the student is not called to learn and imitate a previously established practice; rather, they develop and consolidate their own practice, within a wider, dynamic field.

1.3.3 | An architectural habitus

Shifting perspective away from pedagogical analogies of how designers acquire an understanding of design processes and focusing instead on the dynamics of constructed and embodied behaviours it is useful to look at French sociologist Pierre Bourdieu's (1977) concept of the 'habitus', which will allow for the outline of a wider context that incorporates and thus allows us to understand the intertwining and exchanges of pre-existing contexts of knowledge with emerging attitudes and behaviours. Webster (2015, p. 69), who was discussed earlier as advocating a move away from Schön's (1982) concept of 'reflective practice', also arrives at Bourdieu's habitus as a means of replacing generic ideas of design process inheritance with a continual development of an individual's habitus through experience. Bourdieu first adopted the concept of habitus after translating Erwin Panofsky's (1957) 'Gothic Architecture and scholasticism' from French to English, in 1967. Panofsky used the term to describe the 'habits of the mind' specifically in conjunction with seeking hidden 'analogies of logical organisation' between scholastic thought and the construction of Gothic architecture, with scholasticism, coincidently, concerning itself with a convergent systemization and formulisation of knowledge of the world. As linguist and anthropologist William F. Hanks (2005) later identified, through this process of translation Bourdieu (1967) appropriates the term, shifting away from a notion of habitus as merely pertaining to 'habits of the mind' and towards the idea of an embodied habitus, which may incorporate more material manifestations. Comparing Panofsky's discourse to Bourdieu's, we see terms such as 'mental habitus' move to 'embodied habituality', 'mental schema shift to 'embodied schema', the notion of the habitus as 'achieved via training' compared to a habitus 'achieved via reproduction' and, most importantly, the expansion of the concept from pertaining to 'philosophy and architecture' to encompassing the exchanges between 'actor[s] and fields' (Hanks, 2005, p. 71). What Hanks (2005, p. 71), and later Truc (2011), note about these shifts is that they open up the habitus to a wider embodied field embracing the habitus as not merely an 'actor' but an 'agent'. This embodied manifestation of the habitus, shifting from 'desire' (in Panofsky) to 'posture' and 'inclination' (in Bourdieu) becomes problematic due to the new anthropocentric nature it acquires through its expansion beyond Panofsky's original field of

scholastic processes within architectural design/architecture (Hanks, 2005, p. 71). In this research, we will see Bourdieu's understanding of the habitus refocused on the field of architectural design to enable a more specific investigation of the architectural designer's habitus by speculating a distribution of agency. As such, an *architectural habitus* can be considered as manifesting not solely within the designer but within a wider field of social subjectivity, tools, media and conventions that become involved in the design process.

Theorist Carlos Belvedere (2013, p.1095) summarises that across Bourdieu's work no singular fixed definition of the habitus emerges. Instead, he proposes Bourdieu offers three definitions that each time pertain to the specific scope and context of his work. These definitions revolve around the concepts of capacity, dispositions, and schemes. The understanding of the habitus as 'capacity' refers to an infinite field made up of 'engendering products, perceptions, expressions actions and thoughts' (Bourdieu, 1990, p. 55). The understanding of the habitus as a set of 'dispositions' relates to an enduring and transferable set of principles that generate, organise perceptions, practices and representations (Bourdieu, 1990, p. 53). The final understanding of the habitus as a constellation of 'schemes' relates to a subjective but not necessarily individual mapping of perceptions, conceptions and actions. What we can see emerging across the three definitions is the possibility of a wider collective of individuals form a precondition and appreciation for the navigation of a practice (Bourdieu, 1977). Belvedere (2013) goes on to propose that whilst there are clear overlaps between the three definitions there is also a semantic conflict that prevents the drawing out of a definitive definition. As he points out, there is an obvious conflict between capacity and disposition as attributes of the same subject area, with capacity engendering 'action' whilst disposition proposing an 'inclination' (Belvedere, 2013, p. 1096). However, a rerouting of the habitus within the context of architectural praxis, not through the perspective of scholastic thinking, as in Panofsky's original use of the term, but through the spectrum of contemporary architectural practice as a space of iterative exploration – extending from the pedagogical context of the design studio into the wider architectural practice – can illustrate how these three attributes are not conflicting but complimentary.

In defining an architectural habitus, it is useful to start by considering schemes as constellations of existing and emerging design permutations that provide a network of options for a designer to navigate through practice. However, as Bourdieu (2013) suggests, schemes alone cannot be defined for practice because they do not represent a static position and, therefore, involve a degree of 'uncertainty', 'opaqueness' and 'fuzziness' (Bourdieu, 1990, p. 12). Rather than drawing analogies with the fixed patterns of stars in the night sky, the notion of a constellation allows us to interrogate architectural design as a dynamic and continually diverging and converging formation, more akin to the murmurations of starlings before dusk. Within this dynamic field, it is the dispositions that serve to organise and establish principles and techniques for diverging and converging across schemes. In the process of architectural design, we find it is the techniques of composition and representation that reveal insight into this constellation of schemes and navigate between and across them. An example of this is the technique of tracing, which requires the designer to shift their disposition to a process of searching for new configurations of their schemes and gradually pull these ideas together to draw them out on the surface of the media. Tracing is examined in further detail within the body of this thesis as one of three techniques of diverging within and across the architectural design process (Chapter 5: Pixelate, p. 94). The use of such dispositions does not necessarily reveal the schemes in a sharp panoptic light but, instead, enables glimpses of varying 'uncertainty', 'opaqueness' and 'fuzziness'. It is precisely these qualities, which Bourdieu (2013) first highlights within the schemes of the habitus that also pervade the techniques of architectural design and

allow for divergence to creep into a process where the designer is not simply procedurally moving through a constellation of pre-existing schemes, but conceptually bridging, leaping and reconfiguring them as new juxtapositions appear. This proposes that the composition of the schemes and their relative positions are not simply not fixed but reciprocally responding to one another in a process of orchestration through techniques of disposition.

The orchestration of schemes through techniques is where we see the capacity component of the habitus first enter. Capacity, in this first instance, refers to the ability of a designer to respond to the schemes through techniques of dispositions, which are transitioned from the designer into architectural media. Whilst the capacity varies between individuals it can itself be developed and honed through practice. The place of this initial honing is the pedagogical design studio, where important stages of formulating schemes, developing techniques but also developing a capacity to output this through media occurs. This capacity of the designer is what enables an iterative dialogue between architectural media and other designers to occur. It can be glimpsed in notions of 'skill' and 'cunning', which, as described by Dalì in relation to painting (1930, p. 116), enable the formation of 'double images' within the designer's mind, and the emergence of objects of multiple figurations. Similarly, Mark Dorian and Adrian Hawker (2002, p. 6), in the context of their practice Metis, discuss a not dissimilar set of attributes in 'guile', 'cunning', and 'trickery' as instrumental for operating within the *milieu* of design. Here, the *milieu* seen as an embodied extension of the designer's context offers an opportunity to expand the capacity beyond the designer's mind into architectural media and representation. The capacity of the media in this sense is concerned with enabling the designer to compose, transfer and transcribe the designer's reading of schemes and dispositions towards an architectural form. Critical to a media's capacity to translate a continually diverging and converging field of thought is the dexterity with which these processes of translation are carried out by the designer.

1.3.4 | Architectural drawing and the pursuit of grammatization

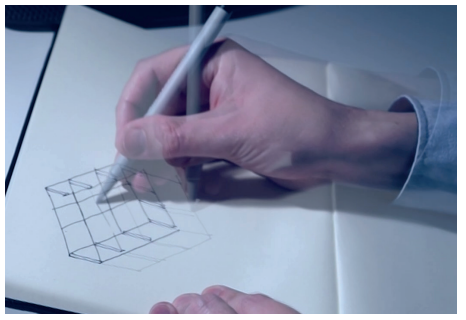
It is the dexterity of these processes between the designer and the media that enables divergence within design. Temporarily shifting perspective from the capacity of the habitus to encompass the media to the examination of how the media respond to the habits of the designer, it useful to introduce French Philosopher Bernard Stiegler's (2010) concept of 'grammatization'. Stiegler's concept offers a means to understand the development of design-based media through incremental shifts in their structures as they transferred from their analogue origins in hand-drawn representations into new digital platforms. Within architectural media this phenomenon first appeared in the 1990s when analogue drawing techniques were grammatically ported into the emerging graphic user interface of CAD software platforms, such as AutoCAD. In the case of AutoCAD, and other CAD packages of the time, this initial grammatization offered the designer an additional medium, which grammatized many existing drawing conventions and techniques including the use of line-weights, hatches, and means to set out complex shapes, such as curves, making them transposable into a digital context. What AutoCAD did not impose, however, was that the designer would have to work solely within it as a media platform. Since then, the grammar of the architectural design process has continued to evolve as the digital capacity of computers has increased. As mentioned earlier, the most recent trend within the development of architectural software has been through the influence of BIM-based software with an agenda not simply to consider how the designer interfaces with the media through the grammatization of techniques and conventions but to optimise and systematize the design process itself. What Stiegler's (2010) grammatization offers here is not an alternative means to fully displace the design process

within the digital context by means of systemization but a means to further explore the embodied relationship between the media and the designer. Whereas the habitus has offered insight into the relationship between the designer and the media, grammatization offers insight into the syntactical aspect of that relationship. This thesis posits that new media platforms, such as BIM, have altered this grammatical relationship between the designer and architectural media distorting their original meaning and, thus, dislocating elements from the designer's habitual capacity. In turn, this distortion towards a more convergent systematized approach to design has affected the designer's ability to respond divergently and creatively within the design process.

Spanning across architecture's analogue tradition and recent digital past, drawing has historically persisted as the predominate medium of the architectural designer. This long-standing relationship has inevitably left its mark in the definition of the architectural habitus and its role in enabling creative divergence. In part, this reveals why it has been so difficult for software developers to transfer analogue drawing techniques through processes of digital systematization and grammatization. This also reveals the post-structuralist underpinnings of the thesis through a focus on representational practices within architectural design processes. This is expressed in the ways that the design-led component of the thesis interrogates and engages with the production of meaning that enables design creativity, by putting to practice divergent techniques from within and beyond the architectural representation toolkit. This is carried out across various forms of architectural representational media, including drawing, while considering other representational and visual cultures that have informed the architectural field over the last hundred or so years. Photography, film, and the wider culture of the image set out a common visual ground, from which to approach the digital screen, while text offers linguistic paradigms of structuring meaning, such as syntax, grammar and convention, from which to challenge and assess the degrees of convergence and divergence that enable the design process.

The centrality of drawing in the spectrum of architectural media and its archetypal implications for the definition of the complex relationship between the architectural habitus and digital grammatization is aptly illustrated in architectural theorist Marco Frascari's work. Frascari (2011, p. 36) puts forward that architectural drawing provides a 'thinking space' or in his words 'a locus for thought' where the process of architectural design can take place. This space of drawing, Frascari proposes, allows for a balance between order and disorder which, in the context of this thesis, we can relate to the balance between convergent and divergent thinking. Frascari (2011) goes on to relate this flexibility to the science of cosmography, which historically has concerned itself with the mapping and understanding of forms within the heavens and the earth, whereby, unlike geography and astronomy's detailed interrogations, the appreciation of the field is focused on the wider appreciation of features and their relationships. Whilst this analogy is useful in explaining how drawing is capable of capturing the initial formations of habitual schemes, it does not necessarily convey how drawing itself covers a vast array of techniques that are capable of varying its focal range from the panoptic cosmographic view of schemes into a focused astronomical examination of individual schemes.

In the early stages of the design process, where I would like to posit drawing techniques engage with a wider cosmographic level of the habitus and utilise a greater degree of divergence, we find designers working with not only one but multiple techniques, including sketching, note taking and diagramming. Manolopoulou (2005, p. 517) identifies these specific techniques as helping to form an intersection between imagination and critical thinking. According to Manolopoulou, the seemingly unformed nature of these drawing techniques is critical in trapping *'... a dense residue of*



Introduce new media

This test sees the switching of media when a block is reached.

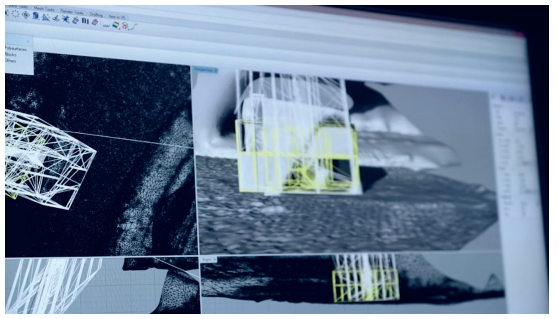
In this instance it is performed on a housing project. The project starts by drawing a grid along with some orthographic views in a sketchbook before switching to a CAD environment to draw the plan up.

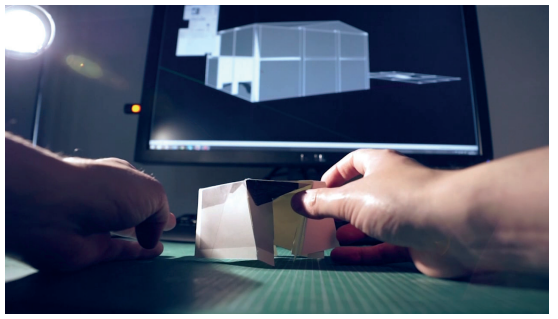
This then moves onto a 3D environment where the plans are modelled.

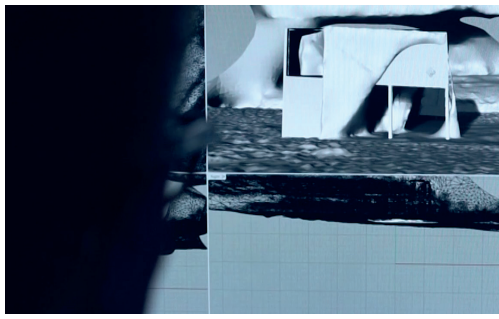
The block occurs when we start to examine the elevations and it becomes unclear what to do at this point.

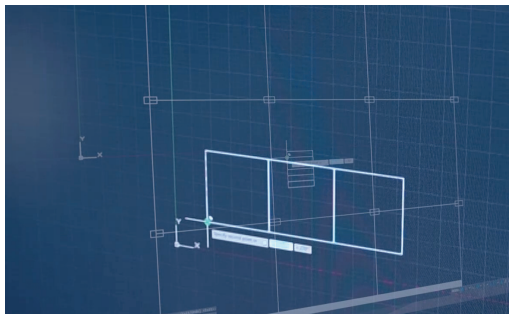
The media is introduced. In this case a physical model of the envelope is created. It is scored and folded to examine new possible openings within the envelope.

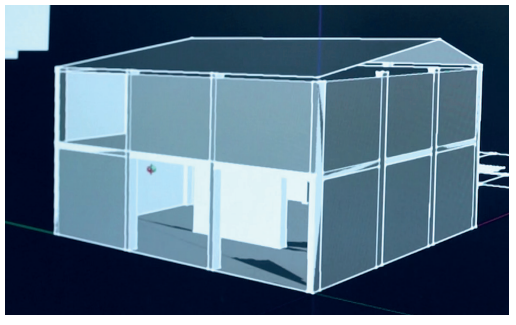
This is then scanned with an iPad using 123D catch which allows photographs to be made into a 3D model a process known as photogrammetry.











The process involves uploading the pictures to a server it then comes back as a model.

The model is exported to the 3D modelling program Rhino where the mesh is examined before the introduction of the original model.

The second model is scaled to match the 123D catch model and aligned.

The combination of the two models suggest new possibilities for the elevation treatment.

Fig. 9: ‘Introduce new media’, stills from film [3:02 - 6:25]: for the ‘Leap!’ exhibition at the *Design Research Symposium*, UWE Bristol (2015). The film explores ideas of purposefully switching between media to iteratively develop an idea, when promoted to by throwing a dice. Sequence from the divergent action ‘Introduce new media’, first developed within the Leap dice game. See page 27.

intentions and meanings', which would be difficult to express through more refined modes of drawing (Manolopoulou, 2005, p. 517). Moving beyond the initial stages of the design process, sees drawing grow from a set of seemingly simple and unformed techniques into a vast array of projections, conventions and drawing media, whereby even the drawing tool informs the designers position within their thinking space. This is not to say that in the later stages the designer will not return to sketching or diagramming to work through or over an idea but that, instead, drawing has the capacity to respond to the designer's habitus at different points within the iterative cycles of testing and developing ideas. Expanding on Manolopoulou's (2005) notion of drawing's ability to capture and trap ideas, Frascari's (2011) concept of the 'transitus', offers a further example of how ideas might become captured through drawing. The transitus refers specifically to how the act of tracing, not with the intention of copying but in order to actively hunt for ideas, sees the designer literally draw ideas through the fibres of tracing paper from underlying sheets into new drawings. During this process, ideas fluctuate between a fixed and an unfixed state, where the designer glimpses different permutations through the opaqueness of the trace. In this sense, the effect of the transitus can be seen as a form divergence where new possibilities emerge as the designer must repeatedly make choices on what to draw through and carry across into the new iteration afforded by the medium.

Expanding on the notion of the transfer of ideas across the designer's habitus and into the medium of drawing, the means by which drawings provides a space for the translation of ideas towards architecture have been discussed at length by architect and educator Robin Evans (1997). Evans (1997, p. 154) stresses that the processes of translation from drawings to building are not communicated simply through lines and forms into built architecture but through an activity of exploration where things get broken and lost on the way. In this, Evans suggests, the space – the 'gap' that drawing leaves between the designer and architecture, creates a necessary field of critical disbelief that is essential for the process of design to occur (Evans, 1997, p. 154). Similarly, Frascari (2011, p. 40) argues that architectural drawings are not only about representations of buildings but also about the creation of a space of perspicuous interpretations that exist to the designer. What Evans (1997) and Frascari's (2011) theorizations of drawing illustrate, is that the close exchange that takes place between architectural drawing and the designer's architectural habitus – as this emerges at the crossroad of both collective and individual practices, cannot be replicated in a process of simulation, such as that introduced by BIM-based software modelling, where the aim is to construct an architectural simulacrum instead of a representational 'thinking space' (Frascari, 2011). Rather, design is grounded in a process of creative divergent translations and transfigurations across architectural drawing techniques and other media towards the projection of an architectural form.

Whilst digital software platforms have improved dramatically over the years, what still seems misunderstood is that it is not possible to separate drawing processes from the architectural habitus and, hence, to fully translate them into digital tools. This is particularly evident when these processes attempt to alter the grammar of drawing with the intent of streamlining by reducing design as a whole into a process of problem solving. An example of this can be seen be seen within the BIM Platform Revit, where sketch diagramming the form of a building has been digitised into a process known as 'conceptual massing'. This function allows the designer to extrude shapes as volumes in order to explore massing options on a site. Whilst this process sounds similar to its physical counterpart of early-stage massing sketches and models, there is something very definitive in the act of extruding volumes as opposed to sketching them slowly, whereby lines do not always denote something as solid as a form. In short, processes such as this do not simulate either modelling or sketching as creative processes; they produce simulacra of artefacts, that *look like* but do not *do* what models and sketches do for the design process. A common, if slightly clunky, workaround is to

temporarily step out of the digital and print out a Revit view and trace over it. Whilst this may allow for the designer's architectural habitus to reconnect with the digital, it is strange that when returning to the simulative environment the physical trace is lost and, hence, whilst ideas may have transferred from the analogue trace to the digital model, the creative thinking process remains outside of the simulation. This process of physically tracing to bridge ideas within a digital model also takes time and, in many cases, designers under pressure do not have time to step out of the digital and take time to fully consider their design process.

The issue here is that in a shift towards fully digital platforms of design it has not been appreciated that whilst we have an understanding of an architectural habitus through concepts such as schemes, capacity and techniques these are but conceptual lenses into a set of processes that are inextricably tangled together within the designer's mind as a form of tacit knowledge. Tacit knowledge, by its very definition, is not easily written down or transferred, and by extent, grammatized or simulated. According to architectural historian and theorist Paul Emmons, in the case of architecture, this tacit knowledge can only be glimpsed through the manifestations of architectural drawing (Emmons, 2014). So, whilst architectural media is an extension of the architectural habitus, it is not possible through the tracks left within the media to understand its full complexity in order to systematize the processes that underpin it. With this view, this research does not attempt to demystify the architectural design process to the ends of being able to reconstruct it through further systemization. Instead, it aims to shed light on those elements of the process that precisely resist and refute such a systemization, which reveal the importance of thinking divergently across both digital and analogue forms of architectural media. In fact, this thesis seeks to demonstrate that such moments are not only impossible to reduce and simulate within a digitisation but rather manage to contaminate such digital environments by appropriating media and inheriting an architectural habitus to them.

1.3.5 | Architectural media and the production of meaning

The discourse around architectural drawings that has flourished, particularly since the early 1980s, through the work of historians such as Evans (1997), Pérez-Gómez and Pelletier (1998) and Frascari (1988); and later on through the work of Emmons (2014), Allen (1999) and Dorrian (2005), has allowed for a more nuanced perspective of the 'intangible' (Allen, 1999) 'tacit' (Emmons, 2014) and even 'cunning' (Dorrian and Hawker, 2003) qualities that architectural representation introduces into the design process. In the context of this thesis, this discourse becomes critical in interrogating and underlining the impact of not only drawing, but also other forms of mediation and their corresponding media environments upon the design process, which find their way into architectural design through practices directly related to or inherited from drawing, as means of both systemization and divergence. In particular, Evans' (1997) critical interrogation of drawings through the scheme of translation becomes central in the chapter on pixelation (Chapter 4, p. 97-100), where we see images translated into drawings through divergent processes. This is then expanded further in the chapter on tracing (Chapter 5, p. 119-120), through Frascari's (2007) notion of the transitus of ideas through the translucent fibres of tracing paper into an understanding of how ideas both diverge and converge as they start to manifest on the surface of the media.

Theorisations of drawing such as those provided by Frascari (2007) and Emmons (2014), become useful in revealing the experiential qualities of drawing practice and, thus, provide a phenomenological perspective of drawing practice. However, this thesis is more concerned with the semiotic function of architectural representation as articulated across a wider set of schemes, shifting focus from the designer towards a wider *milieu* of representation that encompasses the

media, the systemizations of meaning that these entail, as well as the processes of grammatization that these undergo through the context of the digital. As explained, this digital context of architectural media has expanded greatly since the 1990s to the point that the theorisation of architectural representation and its media requires a shift of focus beyond the designer's cognitive experience which has been central to both the cognitive science responses to creative thinking and the phenomenological discourse surrounding drawing. Hence, instead, this thesis pursues a post-structuralist framing of representation through the linguistic paradigm of the production of meaning. Jacques Derrida's (1997, p. 20) proposition that meaning, as reflected in the relationship between the signified and the signifier is not stable, suggests that structural systems such as grammar and syntax, do not guarantee convergence but, instead, a landscape within which the divergence of meaning occurs. Further to this, Gilles Deleuze's (1994, p. 24) notions of 'difference and repetition', which can be related to the terms divergence and iteration, enable an unfolding of ideas within a 'creative' and 'dynamic space', entangled with systems and media of representation as productive (and therefore) rather than utilitarian translative fields. This space sees difference enabling an emergence and transference of ideas from the designer through the media into a representational field where its manifestation operates to settle, juxtapose, disturb or replace existing schemes. Rather than cycles of difference and repetition or, in Schön's terms, reflection *on* and *in* action, this thesis proposes the understanding of the progression of design as an act of creative thinking that is fulfilled through the iteration and reiteration of ideas across media.

This shift of focus from the designer to the media, also becomes evident in texts such as Dorrian's (2005) essay 'The Cartographic Turns of Architecture', whereby, by closely examining the cartographic design practices of Peter Eisenman and Daniel Libeskind, expressed primarily in drawing but also modelling, Dorrian provides a post-structuralist framing of architectural design that relies on the inherent quality of systems of representation, such as orthographic drawing, to diverge. In this, Dorrian summarises by defining a cartographic response to architecture that is fulfilled and achieved by means of drawing and involves the increasing use of mapping techniques, not as analytical tools for understanding the characteristics of a site but instead as part of a generative and productivist drawing syntax for the production of architectural meaning and, hence, the motivation of the design process. What Dorrian's cartographic framing of drawing reveals is that, whilst the conventions of architectural drawing practice enable a degree of corroboration and stability of ideas, drawings still have the potential to present the designer with moments of promise and surprise. Here, Dorrian (2005, p. 3) is not simply referring to sketches and diagrams as previously discussed through Manolopoulou (2005), but to what we might consider as a more rigorous practice of orthographic projection.

The very meaning of orthography itself, is telling of the systematic nature of architectural drawing and how it provides a 'correct' (*ortho-* from Greek, meaning 'right') representation (*-graphic* from Greek *graphe*, meaning 'writing') of an architectural space or design proposal, by means of right angles into parallel projections, such as plans, sections and elevations. In this 'right' recoding of the subject of the representation, each partial view of a projection seemingly progressively informs and stabilises the other (the plan informs the section and the elevation or interchangeably). In this sense, the process of designing by means of producing orthographic drawings would seem at first to indicate a process of convergence, whereby a design becomes increasingly solid and stable with the progressive consolidation of each new projection. Yet, whilst to a degree such drawings enable a solidity and convergence of the design process, the plurality, abstraction and fragmentation that this breaking up into projections provides, allows room for moments of 'alienation' and 'deterritorialisation' (Dorrian and Hawker, 2003, p. 187; Dorrian, 2005, p. 3), or in Evan's (1997) terms

of ‘gaps’ to occur between the designer and the media. For Dorrian, this emerges more productively (and paradoxically) when the codes and conventions of drawing practice become ‘unhinged’ (Dorrian, 2005, p. 3) from their content (the signified) or context. This is something that architectural drawings are able to do and sustain, exactly due to their systematic ‘rightness’ and the precision and measurability that this provides as anchors of meaning. The discussion of drawings seemingly providing a convergence, whilst still enabling divergence, is discussed further within the forthcoming chapter on Tracing, exemplified by the paradigm of the commonplace in architecture act of *tracing* and its related practice. There, ideas of projection shift beyond the orientation of the drawing towards the drawing out of form. This unhinging and diversion, as Dorrian (2005, p. 3) proposes, is not a fault or shortcoming of the media or its codes, but rather it an inherent trait of the way that representational media such as drawing affect the selective visibility of the designer, allowing certain information to be seen clearly whilst supressing other parts (Evans, 1997; Dorrian, 2005). This is also elaborated in Dorrian’s work with Adrian Hawker (2003, p. 187), who put forward that drawing’s ability to surprise the designer is not dwindled by the mastery of drawing as a converging technique but rather enabling the designer to divergently interpret and translate the representational field through means of ‘cunning’.

This quality of drawing as a medium of both stability and instability, provides a solid but creative representational ground for architectural design, which, despite Evans’ (1997) nuancing of the act of architectural translation, can bridge the conceptual stages of the design process with the prescriptive stages that lead to the construction of architecture. This thesis will argue that architectural drawing’s underlying syntax itself, enables varying degrees of certainty and uncertainty, precision and interpretation. However, it will more importantly explore how, through this inherent quality of divergence by means of abstraction, drawing poses itself as a hinge for the introduction of techniques and media from beyond architecture that not only enable divergence but also allow for the expansion of architecture’s media landscape into the digital context. The expansion of architectural media beyond architectural drawing brings into play an examination of meaning within images, as a means to discuss how designers can expand their constellation of design schemes across media. In turn, this expansion of the designer’s schemes across a new field of media and techniques is what enables the interrogation of a diverse range of moments of divergence, convergence and in the creative leaps. In particular, Roland Barthes’ (1977 p. 32) concepts of denotation and connotation play an important role in discussing the connection between the designer, the media and the schemes of the design process. Within the research, the introduction of a series of divergent techniques see the initial media contexts become unhinged from the design process and losing much of their denotative design-based syntax. Following this, the thesis will examine and illustrate how the designer works with the techniques within new deterritorialised connotative contexts to establish connections back to the syntax of the design process, where emerging new schemes have the potential to inform, bridge or replace existing schemes within the design processes, causing what this thesis defines as the design leap. The techniques introduced to instigate these leaps are discussed in the next section but, in principle, aim to shift and unhinge meaning and open up the designer to a broader set of possibilities associated with connotation, towards a more grounded denotative meaning that can be connected back to the syntactical discourse of the architectural habitus.

1.4 | The leaps

Expanding the idea of the leap as a movement that sees the designer change their position within the design process and produce new material, the thesis unfolds through a series of three chapters, each examining with a particular technique of divergent thinking, thus defining a specific kind of design leap. The prevalence of these three specific leaps as defining recognizable modes of leaping emerged from analysing the wider body of design research undertaken. There the leaps were quickly identified as the predominate techniques for instigating divergence, among a range of techniques applied and tested in a series of design projects. Divergence here, has been embraced not only through the techniques employed within the design process but also within the methods used to undertake the research. As such, the development of the research has taken on a divergent and iterative quality where the inquiry has pursued and altered course as new material has been uncovered. This has seen existing divergent techniques, from beyond architecture, iteratively developed to work beyond their original use, specifically here within the architectural design process. The wider body of design research, which fed into this thesis can be found on the accompanying www.designleap.org website (see link below). Fig 11, on spread 38-39, shows a chronology of the projects undertaken and the divergent techniques employed. The overlay of dotted boxes denoting their relationship to the three leap chapters.

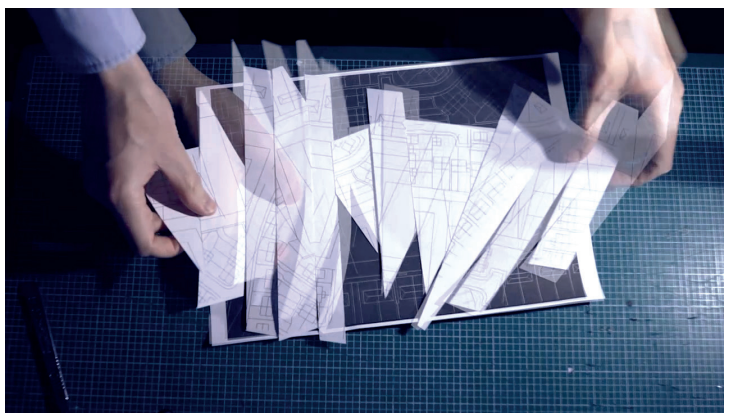
Rather than presenting the design research in a chronological sequence of events, the leap chapters analyse and reflect on the projects by situating them within a context of literature and design practice. In doing so, each leap chapter frames and defines a specific media context, ranging from filmic and literary modes of cultural production to digital culture and drawing. The techniques discussed, developed and expanded across the three chapters can be themselves understood as 'design thresholds'. The concept of threshold here, does not refer to the architectural spatial equivalences of an element that bridges the gap between two spaces. Neither does it refer to the pedagogical learning threshold, which sees the acquisition of knowledge as something that transforms an individual's understanding of something to the point that it cannot be unlearned (Meyer and Land, 2003). Instead here, the threshold draws from Foucault's definition that sees it as the discursive transformation of ideas and the emergence or disappearance of a given discourse (Foucault, 2013).

The first leap chapter (Chapter 3: Cut-up) is framed around the cut-up technique, which originated within the Dadaism art movement but popularised by William Burrough and Bryon Gysin (Burroughs and Gysin, 1978). Here, the cut-up is introduced as a divergent technique from beyond architecture, which involves cutting up strips of a pre-existing text and then randomly rearranging them to create a new text. There are two critical differences in terms of how the cut-up was introduced by the Dadaists and the ways it is used in this research. Firstly, drawn from literature, the cut-up introduces narrative in the form of written word into the design process leading to the emergence of image and drawings from text. Secondly, the cut-up provides a film-derived methodological approach in the analysis of the emerging leaps. The text-based narratives of the cut-up, which naturally provoke spatiotemporal transitions, draw parallels with filmic montage techniques. This is due to the way that filmic montage, a technique that itself is based on the cut, provides a way to understand the tension between the spatial and the temporal aspects of the design process.

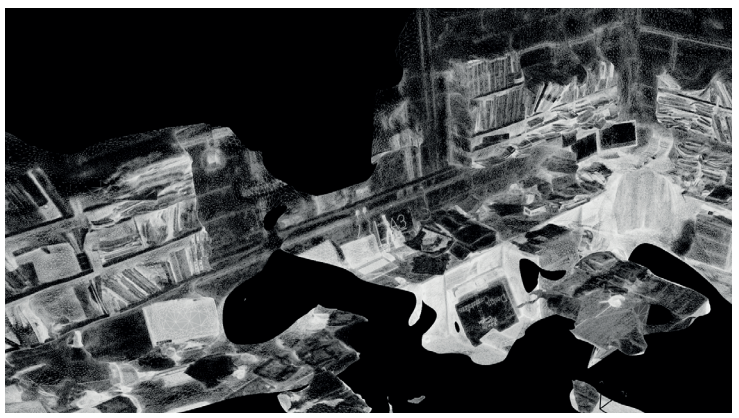
The second leap chapter (Chapter 4: Pixelate) discusses how the process of pixelation can lead to divergent thinking and the emergence of new ideas, through a series of divergent interventions

Link to designleap website.

| Leap one: Cut-up



| Leap two: Pixelate



| Leap three: Trace

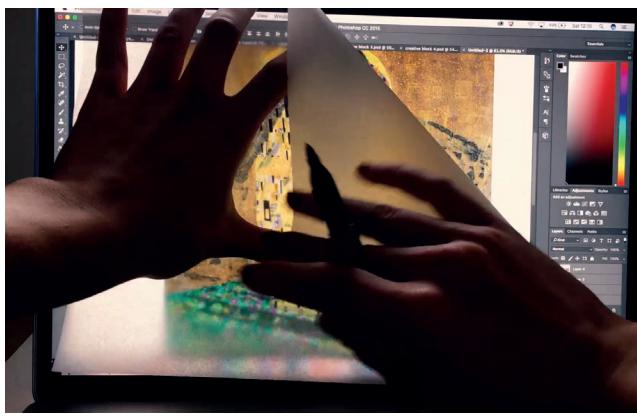


Fig. 10: Images from the three leap chapters: Cut-up, Pixelate and Trace.

within design projects. Pixelation here refers to the effect of individual pixels within a digital image becoming visible to the eye as a grid of squares. Pixelation is proposed as a technique that can be applied to architectural drawings in order to transform them to the point that they are temporarily removed from their original content while, importantly, still carrying the structure of their original form. The 'original form' of the drawing/image here refers to the information put down by a designer when constructing the drawing, including line work, use of conventions and the embodied thinking process. Within this chapter the iterative process studied takes place after the pixelation of an image and is structured as a series of thresholds between the designer and the image. At that stage, the image becomes a threshold between the initial drawing, the emerging drawing and the structures that each one is derived from. The concept of the threshold here takes Foucault's (2013) definition of a discursive transformation of ideas and involves a both physical and cognitive separation between the designer and the media through the act of pixelation. Within this definition the physical refers to the way in which drawings are broken down and blurred by the pixelation process. The cognitive separation refers to the way in which the original meaning behind the drawing is removed by the pixelation process. This threshold and the emergence of new drawn concepts that it enables is the focus of this chapter. The examination of the pixelation action through these projects has resulted in the structuring of the chapter into three distinct dimensions of translate, transform and transcribe.

The final leap chapter (Chapter 5: Trace) examines techniques of tracing digital media from the screen onto tracing paper as a process that accumulates divergent ideas and draws them through into the realm of the architectural drawing. Tracing in this chapter moves beyond the familiar technique of tracing over another drawing or even between the two sides of a drawing to a hybrid form of tracing. Here, the tracing takes place against the vertical digital screen and acts as an expanded interface between digital software, the drawing as a consolidated terrain of architectural representation, and the designer. This exploration of trace takes place across three projects each exploring the emergence of the drawn from digital media and through the sub-sections of tracking, plotting and projecting. Within this, the investigation focuses specifically on how tracing as a form of architectural drawing is capable of not only capturing divergent ideas from digital media, but bringing them into a recognisable drawing syntax. Here, the importance of being able to transfer divergent ideas back into drawing is critical because drawings remain fundamental to the architectural design process, as the productive space where ideas emerge and transform, rather than simply 'translate' into buildings (Evans, 1997, p. 165).

Before unravelling the distinct leaps, the following chapter sets out the methodological framework of the research situating it between design research and visual ethnography. What these methods offer in this context is a process of critical reflection on how divergent thinking alters the architectural design process. Within this research, visual media pose as the tools of both methodological components. On one hand, drawings, images and digital models become the means used to set out, test and investigate divergent thinking at the threshold between media, through particular design situations. On the other, film, photography and drawing also become the means of immersive observation and reflection that allows the drawing out of a wider critical landscape of architectural divergence.

The layout of this thesis document has been designed to convey the moments of divergence that have been found within the various projects, and the exchange between the screen and paper contexts that these respond to. When unfolded, the widescreen viewing ratio of 2:1 (18:9) of the spread is able to frame sequential shots of screen-based media: from the films produced to record

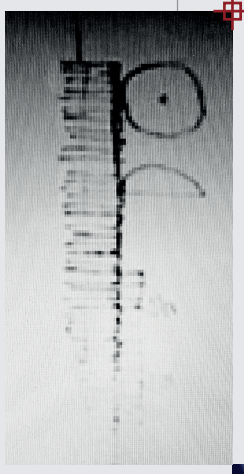
and reflect on the projects presented, to specific screen-based representations. The single page provides a square field that corresponds to the orthographic cartesian field of architectural drawing conventions, holding drawings and references to the analogue worlds of architectural tradition. Whilst the physical copy of the PhD contains everything needed to understand this divergent discourse you may wish to refer to the PDF copy, which contain clickable online hyperlinks to the original films and material being discussed. It is recommended that the films are watched on a laptop or computer monitor with sound. Alternatively, QR codes (Quick Response matrix barcodes) are provided next to the filmic stills and can be scanned with a QR application or (on Apple iOS devices) by scanning with the camera.

(Following spread) Fig. 11: 'Divergent moments'. Map of key divergent projects carried out within this research, set out to show how they sit in relation to each other chronologically across the research and within each of the leap chapters. See links to films and page numbers for more details on each project.

Divergent moments

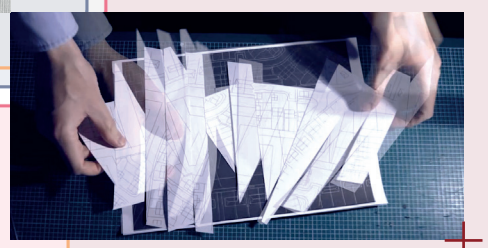
The Divergent Deck
page. 54

Yeats 2015 competition
Collective pixelation
page. 100



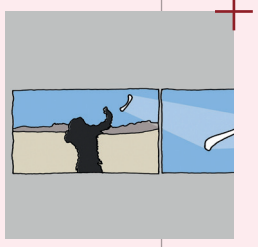
BARCH Filmic exploration
Spitalfields International Film School

Trace



UWE Design Research Symposium
page. 82

Divergent Deck test:
'Hatch with colours from a painting you like'
page. 126

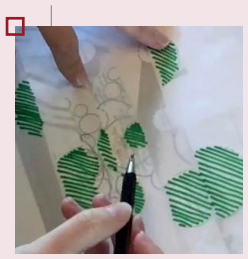


MA Architecture
Filmic Space

Cut-up

Divergent thinking workshop
Cut-up
page. 52

Divergent Deck test:
'Print, cut into strips and randomly rearrange' page. 80



2005-2007
earlier research: divergent and filmic techniques

2009-2011
earlier research: filmic transitions and their parallels in urban space

2014
Start of PhD

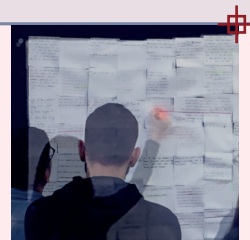
2015

2016

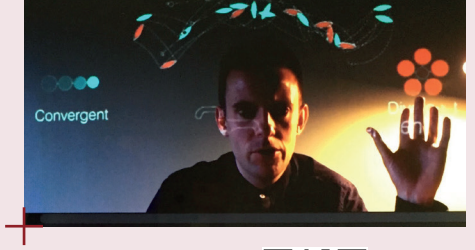
2017

Pixelate

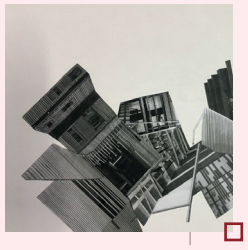
Brutal Object
page. 110



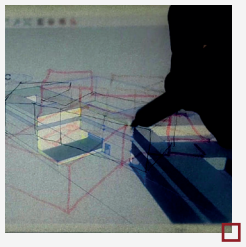
Divergent thinking workshop
Fold-in
page. 87



Divergent Toolkit film
page. 50



Oscillating between connotation and denotation
page. 78

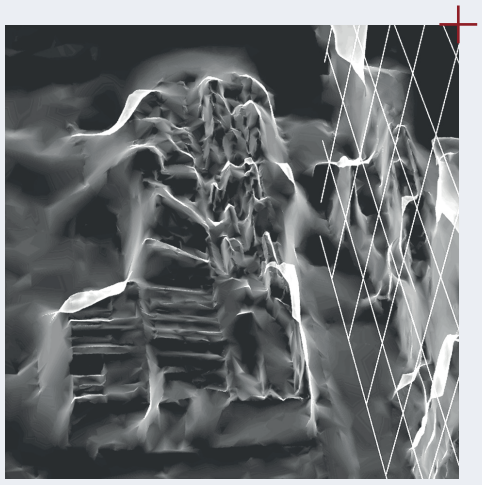


Divergent Deck test:
'Trace and then rotate from an off centre spot'
page. 121

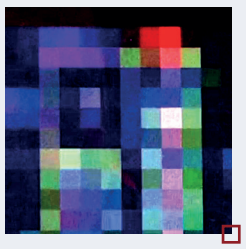
A dance floor and a zip line
page. 85

Pixelation tool
Glassworks symposium
page. 106

Divergent Deck test:
'Trace over the screen scan and reinsert'
page. 132



A Chaotic topography
page. 113



Divergent Deck test:
'Take a snapshot and pixelate it'
page. 99

2018

2019

2020

Key:

Projects by myself

Collective projects

Projects by others

2 | Tools, techniques and methods

This chapter will present and discuss the research approach of the thesis, setting out an understanding of the two key methodological approaches it employs: design research and visual ethnography. In the context of this thesis, these two approaches are combined towards developing a critical reflection on the ways that divergent thinking can inform and alter the architectural design process. This methodology chapter, firstly, contextualizes design research and visual ethnography as distinct methodological tools within creative practice. Secondly, it focuses their application and consideration in relation to design pedagogy and epistemology, by examining, unpacking and expanding existing divergent techniques to respond to specific architectural situations. This is framed by a chronological examination of a series of key projects, that were developed as tools for introducing divergent prompts into the architectural design process. Moving on from design to reflection, the strategies used for capturing, editing and reviewing the various design processes are outlined. Finally, the chapter introduces the three emerging techniques that define key divergent leaps in architectural design.

Reflecting on design thinking and making, the research draws from a wider field of creative thinking, that extends beyond architectural design processes, into composition techniques from the literary and pictorial arts to film. To begin with, the design research proceeds through the iterative development of a series of divergent tools, which provide frameworks for collecting, retrieving and and recontextualizing representational operations into an architectural context and are discussed in this chapter. These 'divergent tools' that mark the earlier stages of the research, respond to the initial objective of the research to pursue the development of a divergent tool as its key output. However, the perspectives that these open up through their diverse applications contribute towards developing a wider understanding of how divergence, as a phenomenon, occurs between and across media and the specific conditions of interpretation and ideation that these create.

The iterative process of re-designing and adapting the techniques involved allows the research to focus further, gradually building a greater understanding of divergent thinking at the thresholds between media. In the chapters that follow, divergent thinking is consequently examined through the introduction of these divergent techniques into design projects. These applications set up moments of reflection, analysis, categorisation, reduction and, consequently, of expansive exploration and experimentation. These moments, which occur as part of the iterative nature of the design process itself, set out an interplay between divergent and convergent thinking. The iterative nature of design, provides here both a field and a method for the investigation of divergent thinking through a recursive process of design-diverge-iterate, which is equally reflected on the design of its methodological divergent tools and the applications.

The investigation of these design applications is recorded using a visual ethnographic approach that articulates a similar inter-play of convergence and divergence, as ideas are explored through design before being reviewed and refined through the analysis of footage captured whilst designing. The process entails filming and photographing designers interacting with media and testing divergent tools, found or specifically designed for the purposes of the thesis. This footage is then edited to highlight the moments of divergence. These moments and the understandings of divergence they depict, are further analysed within the thesis through a series of three chapters that examine in depth each one of the key creative leaps identified. The analysis draws from architectural theory and, in particular, a post-structuralist approach to the production of meaning within image and language, in and across media, within the core tradition of architectural representation and beyond.

2.1 | The design (in) research

The key focus of this thesis is the design process. Within the design process, divergent thinking is investigated through the observation of divergent leaps across media in the architectural design process; the leaps here being moments of observed divergence, which are triggered by the use of divergent techniques. In this context, this research entails design projects carried out by the researcher and other participants. At the same time, however, it also employs design as a method for identifying and testing divergent techniques through the creative use of media and the design of thinking tools. Design research is not here considered as a definitive singular research methodology but, instead, as a divergent way of approaching both the subject matter and the method of a thesis *in* and *through* design. This research develops its own definition of design research by building on Christopher Frayling's (1993) definition for design research in the wider field of art and design. Frayling sets out three methodological approaches which can be considered under the umbrella of design research. These categories are 'research into art and design', 'research for art and design' and 'research through art and design' (Frayling, 1993, p. 5). Within this research the methodological approach spans all three of Frayling's categories. 'Research into art and design' here is concerned with the examination of the historical and theoretical positions of existing divergent techniques. The techniques and processes here are drawn from and develop upon the work of, Salvador Dalí, Brian Eno & Peter Schmidt, William Burroughs & Brion Gysin to name but a few. This material is unpacked and examined at the start of each of the three leap chapters. 'Research through art and design' is made manifest through the emergence of conceptual tools that theorise and open up wider perspectives of design thinking and making. 'Research through art and design' is made manifest in the emergence of conceptual tools that organise, theorise and open up wider perspectives of design thinking and making. Lastly, 'research for art and design' sees the divergent techniques iteratively developed and, in some cases, manifest within a series of artefacts. These artefacts, ranging range from drawings to objects and models that respond to the specific design situations, concern the final products of individual design projects that become the subject of analysis.

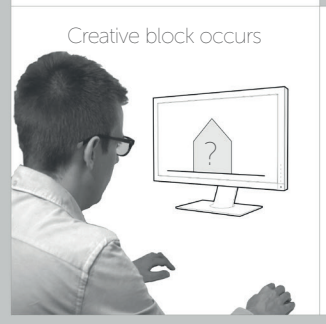
Whilst these artefacts have helped consolidate and demonstrate an understanding of divergent thinking through the distinct instances they describe, it is 'Research through art and design', which defines the main methodological approach of this thesis, as well as its key contribution. Here, the techniques of divergence that are employed and applied in the above projects are brought together into a series of tools for divergent intervention within the design process. As tools they provide explicit moments of divergence that, when inserted within the design process, can be tracked and recorded through film and photography enabling a greater understanding of divergent thinking to be formed. Early on in the process of this research, these tools were originally intended as a key objective of this thesis, with the scope of providing a methodological toolkit for design that would maintain divergence. The development of this thesis, however, through the analysis of focus groups (p. 23) demonstrated the limitations of such a universal tooling approach to design which on consolidating divergent thinking became itself convergent. Instead, through the expanding findings of the research generated by iteratively testing the toolkit on design projects the thesis shifted its focus from developing a readymade toolkit for architectural designers towards prompting and examining divergent leaps as they occur across and between media.

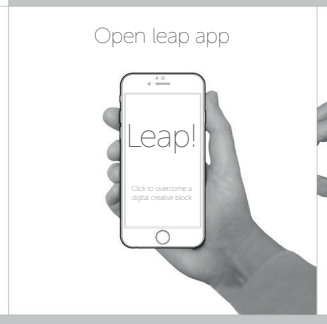
2.1.1 | The divergent app and dice

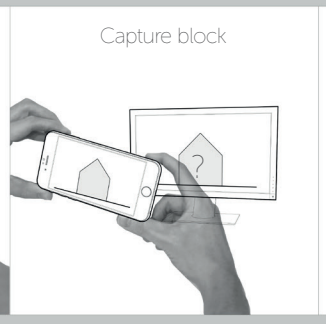
The development of a divergent tool started with a proposal for a phone application entitled 'Leap' that could digitally manipulate an architectural drawing or image by capturing it through the phone's built-in camera and then performing one of the following random actions on the image: *pixelate, zoom in, cut-up, rotate* and *colour adjust* (Fig. 12). The choice of the five actions at this early stage in the research came firstly from recognising within my own practice divergent techniques that I have accumulated and adopted over time and then considering how these might manifest within a digital app. An example of this is William Burrough's and Brion Gysin's *Cut-up* technique, which is discussed in length in the Chapter 3 (Cut-up: p. 66). Within the app the image would be sliced into sections and then digitally rearranged. *Pixelate* here started from the position that I often squint at a drawing to obscure its detail and attempt to reveal what is most prominent. This action when considered within the context of making the phone app translated into the pixelation of the drawing. The digital translation of squinting to pixelation now seems tenuous due to the fact pixelation treats the entire drawing with an equal grid of pixels, whereas squinting reduces the periphery and draws attention to the foveal (central field of vision). Despite this the divergent moment of translating squinting into pixelation led eventually to it becoming an important technique in understanding how divergence occurs when drawings are transformed, through obscuring, into images and back again. *Zoom in* and *rotate* were inspired by the work of Peter Eisenman (1986) as epitomised within *Moving arrows eros and other errors* where he uses both rotation and scaling to draw between geometries of different media. Within my own practice I had used zooming and rotating techniques to switch between media. Rotation and scaling techniques also manifest frequently within Chapter 5 (Trace) where they become useful techniques in tracing field conditions between different media layers (Eisenman, 1999). The final app technique *colour adjust* again concerned obscuring and revealing. However, this time by adjusting the colours of lines and geometry within a drawing new forms might emerge. This technique emerged from my own observation that within CAD packages the graphic user interface colour codes the lines not based on how they will be represented in a physical printed form but on a component-based layering system. Here, doors might be assigned a different colour line to windows and walls. This in turn leads to certain colours gaining more prominence when displayed against the black background of the user interface. Capturing the screen and transforming the colours through the leap app was intended to shift this prominence and offer a different perspective of the drawing to the designer.

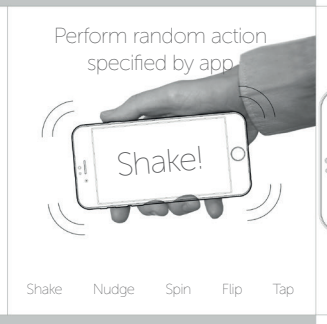
(Opposite page) Fig. 12: 'Leap', mobile app proposal diagram (2015).

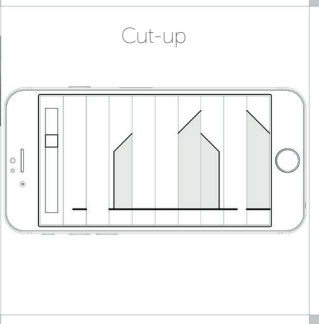
Leap!

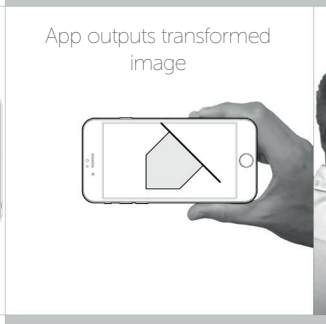












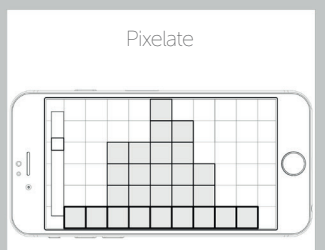
Pixelate
The captured image is pixelated and reduced to a grid of squares which can be adjusted in scale with the slide bar to add or reduce detail.

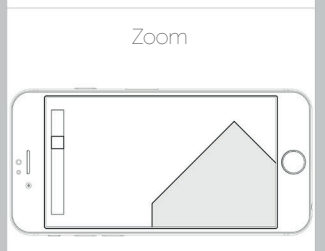
Zoom in
The captured image is magnified and focused at random on part of it. The magnification can be tweaked with the slide to re frame the image further.

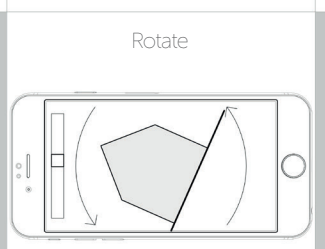
Cut-up
The image is sliced either vertically or horizontally into strips and then re ordered at random. The slide can alter the parallel lap between slices.

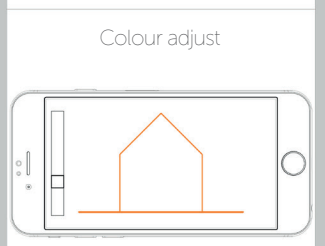
Rotate
The image is rotated from its original captured orientation and then can be tweaked using the slide.

Colour adjust
The image colours are transformed shifting the hierarchy of black and white lines in the process. The slide allows tweaking of the altered colours.







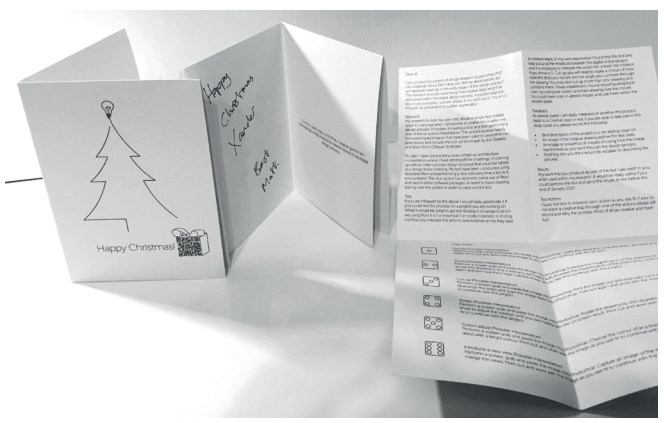


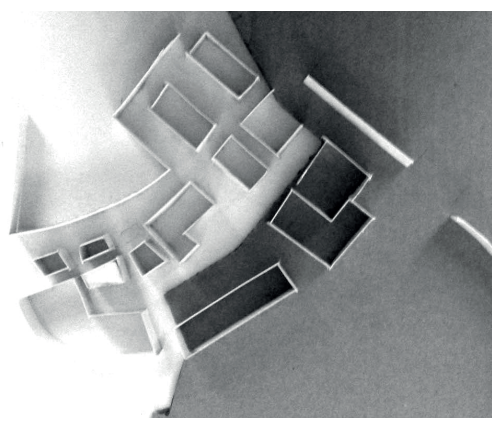
The app proposal and its actions were also heavily inspired by the work of Chicago based architectural practice Norman Kelley (2013), who had run a drawing workshop with the intent of getting designers to manipulate drawings through a series of analogue and parametric techniques, which misappropriated drawing conventions (Kelley, 2015). The techniques included the Droste effect, false shadow projections, incorrect line weights and reversible figurations. What most interested me about Norman Kelley's Eyecon (2015) workshop was how, through simple image manipulation, it became possible to play with the ways a drawing might be viewed and then reinterpreted (Fig. 13, for example). Architect and Academic, Jaffer Kolb writes on how these reinterpretations of the original media offer a map of misreading, where the geography explored provides something simultaneously known but also perpetually new (Kolb, 2015, p. 9). Whilst the Eyecon drawings provided alternative design outcomes to well-known building precedents, presented as final exhibition pieces, they remained speculative with regards to how their divergent potential might be re-introduced into the design process and alter its course. Kolb's observation that elements of the original drawing remained within the transformed drawing alluded to the possibility that a designer might be able to make a leap between a drawing and an ongoing design process (Kolb, 2015). Kolb speculates that the drawings might, through acts of substitution and translation, start to displace the design process and introduce *'…an epistemological Trojan horse'* (Kolb, 2015, p. 9). Within the proposed leap app this Trojan horse moment was anticipated to occur at the point when the designer would start to work between the transformed image and the existing design process. Here, it was anticipated that by drawing between the existing and transformed material new design thinking would emerge. The potential that these techniques held in transforming an image to the point that it could offer multiple divergent readings aligned with the intentions of the app to employ digital manipulation of existing images and drawings as an external means of introducing divergence into the design process.

Fig. 13: Images from the Eyecon workshop by Norman Kelley (2015). 'Wrong lineweights' and 'Villa Savoye Redrawn' (Owen Duross, 2015).

The leap phone app was not developed into a piece of software because it became apparent that it was not essential to the divergent process to have a digital interface in order to perform the actions. Instead, an initial manual testing of the app was carried out through the formulation of a Leap dice game, which saw designers manually perform the actions through the use of a dice. The dice provided the element of randomness while the numbers on the dice were each correlated to a divergent action. The designers were then free to apply the action assigned by the dice within the media of their preference. This analogue iteration of the app, revealed a further degree of complexity as divergence was not only achieved through the ways that created images were reintroduced into the design process but also in the ways that designers would customise the technique for their particular processes. It became apparent that whilst leaving the selection of the technique to chance its application and integration within the design process became an important part of the divergent thinking process. This understanding of divergent thinking expanded the area of investigation beyond the insertion of the technique to include the processes on either side. As such, it emerged that the best way for myself and other designers to capture this expanded processes was to record it with digital film. Here, filming not only became a way of capturing the process in its entirety but also a way to review and reflect back on the moments of divergence in order to hone the actions and also gain a greater understanding of divergent thinking. Whilst the strategies behind capturing the design process are discussed in full in the second part of this chapter (p. 59) it should be noted that in terms of design research the films played a vital role in both iteratively developing the actions and uncovering new aspects of divergence.

In addition to the five actions proposed within the leap app (*pixelate, zoom, cut-up, rotate and colour adjust*) the dice incorporated the additional action *introduce new media*. This new prompt, which at first was added simply because of the dice having six sides instead of five, came from an early observation within the research that actively introducing media from one platform into another often led to unexpected moments. Examples of this included the emergence of new forms when vector-based CAD drawings were introduced into photo editing software where they became vectored and open to new forms of photographic manipulation. The technique was also influenced by the earlier observation that on inserting the divergent technique the designer would manipulate it in order for it to work with their existing process. In this sense *introduce new media* provided a flexibility of interpretation whereby the designer could also decide how to use the term within their individual process.





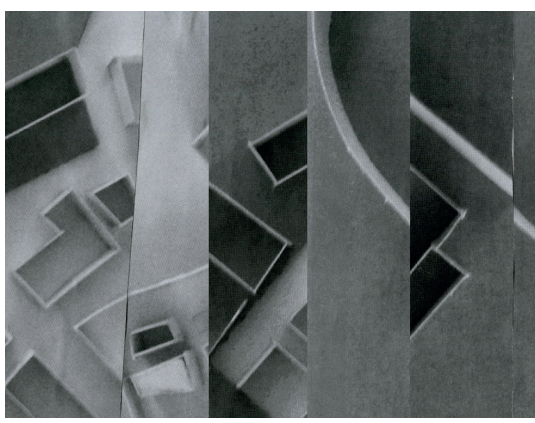


Fig. 14: 'Divergent Christmas Card' (2014). A development of the Leap dice game to include basic actions on how to interpret and record the divergence emerging from the actions, sent out to students and professionals as a prompt to participate in the research.

2.1.2 | Testing and reflecting

The testing of the Leap dice game started in 2014 with a pilot study, carried at the University of the West of England, which was followed by an invitation to students I was teaching to test it on their studio projects before testing on a live architectural competition. The findings from these were then brought together for review within an exhibition as part of the University of the West of England's annual Design Research symposium (2015).

The initial pilot study saw all of the actions tested by myself on a RIBA competition entitled Re-imagine Ageing (RIBA, 2012). This brief sought to re-think retirement living for the elderly with an emphasis on providing a mutually supportive community. The thinking behind engaging with a competition brief was that it allowed me to quickly test the divergent actions and then compare the output proposal with the completed entries. The comparison allowed me to see that the actions had not overtaken and derailed the design process. Instead, they had aided it through the production of a proposal that showed signs of architectural merit and originality in its response to a specific programme and function of the competition brief (Fig. 15). The project is discussed further within Chapter 4 (Pixelate: p.97). Whilst not going beyond the initial concept stage, the design outputs produced using the divergent actions gave me confidence that I could now test the actions with other designers on an architectural competition.

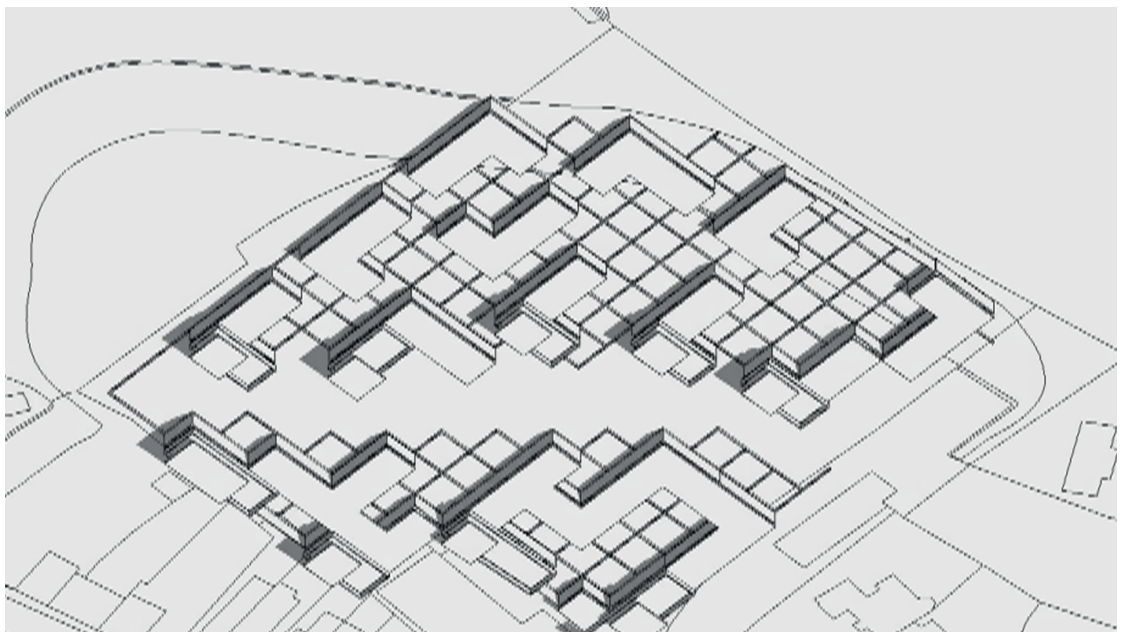


Fig. 15: 'Re-imagine Ageing'. (RIBA, 2012) still from film, showing the performance of divergent actions for an RIBA architectural competition (2012). Image created after importing a Revit model into InDesign and accidently turning it upside down. The rotation caused the voids and solids to appear to have been switched creating an alternative option where the building became a sinuous mix of living and landscape.

Following my individual testing of the dice actions, I decided to offer the architectural designers I was teaching the opportunity to test the actions on their studio projects. With Christmas approaching I packaged this iteration of the dice game as a divergent Christmas Card (Fig 14 p. 45), which when unfolded provided them with instructions on how to use the actions. Whilst verbally I asked the designers involved to capture their findings using digital video or photographic stills, this was not written down within the instructions. The result here was that the end films were in some cases unedited and poorly framed, requiring me to watch large amounts of footage in order to understand what was going on. This led to later iterations of the leap test instructions carefully specifying how to frame, capture and edit the footage (Fig 23 p. 57). This later decision to ask the designer to edit and narrate the footage not only limited the quantity of footage I was required to review but also allowed the designer to reflect on what was emerging. These narrated reflections by the designers did not always align with my reading of the footage and consequently sometimes I questioned the emerging divergence within the projects. An example of this can be seen within the Chapter 4 (Pixelate: pp. 99-100), where on writing my version of the narrative I returned to discuss this alternative finding with the designer.

On the completion of the test by the student designers, I decided to enter an architectural competition for the development of an intervention to celebrate the work of W.B. Yeats. Specific details on the output of the competition and the use of the divergent action can be found within the Chapter 4 (Pixelate: p. 100). Here, however, it is worth reflecting upon the introduction of additional designers to the design process beyond myself and their use of the divergent actions. Here, we see a number of logistical hurdles that needed to be crossed. This included finding designers who were willing to provide their time to produce an architectural competition and secondly willing to test the actions when creatively blocked.

Here, I decided to form a competition team by inviting students from the across the architecture department to take part within the research. This decision followed Nigel Cross's (2006) observation that the majority of design process studies have used students due to their accessibility. However Cross (2006) warns that within this strategy there are limitations to using students as they are often novice designers who think differently to expert designers. Within the competition I carefully paired the students with more experienced designers creating a similar structure to an architectural practice, where teams of designers often have very different skill levels (Pressman, 2014). Whilst this research did not examine how students think differently from more experienced designers my observation across the research, in terms of divergent thinking, students were often better at thinking divergently that their more experienced counterparts. Here, they were more capable of detaching themselves from standard conventions and practice in order to perform the divergent action. This observation led to a wider practice within the research regarding the involvement of students, where in later projects they would undertake the divergent actions individually.

Working with students and other designers also presented numerous ethical considerations including the capturing, recording, analysis, storage, anonymisation (where necessary) and reproduction of the material. In order to ensure that the research considered the ethical impact on the individuals involved and maintained its integrity as a piece of academic research an ethics application was made for scrutiny by the university's ethics committee. This application included a step-by-step analysis of how the research would engage participants, along with a series of information and consent forms for the various project types undertaken. All designers were required to read and sign this form before participating in the research. Participants also had thirty days

following each project to ask for their contribution to be removed or amended, if necessary. The ethics of using video containing designers working within the design process is expanded further later in this chapter (p. 60).

For the competition test I decided to iterate the dice game by adding a second dice action, which could propose ways of translating the first dice action, in order to address further creative blocks and uncertainty. Here, the second dice gave the designer a spatial component which prompted an orthographic projection of plan, section, elevation or three-dimensional view. The additional action was designed to offer a degree of convergence back towards a form of drawing, however, at the same time it demonstrated the multiple possible outcomes of the process. Offering a moment of convergence into an architectural language, after divergence, served to balance the thinking within the design process as proposed necessary by Brian Lawson (2006). Within the competition this process proved useful in translating a section that had been pixelated by the first dice action into a plan, as proposed by the second dice action (p. 103). As the analysis of the project showed - which is presented within the corresponding leap chapter - instead of a moment of convergence, where the idea came back to drawing, this second action proved to have in fact increased the divergence and questioned the drawing projection itself.

(Above) Fig. 16: Competition team working on the Yeats competition (2015).
(Opposite page) Fig. 17: Leap dice game iteration with second dice action, used during the Yeats competition (2015).

Action dice roles:

1	Pixelate
2	Zoom in
3	Cut-up
4	Rotate
5	Colour adjust
6	Introduce new media

Interpretation dice

	roles:
1	Plan
2	Section
3	Elevation
4	3D

spective

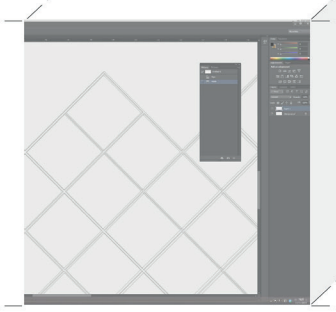
Block

point at which you are unable to progress design

block encountered

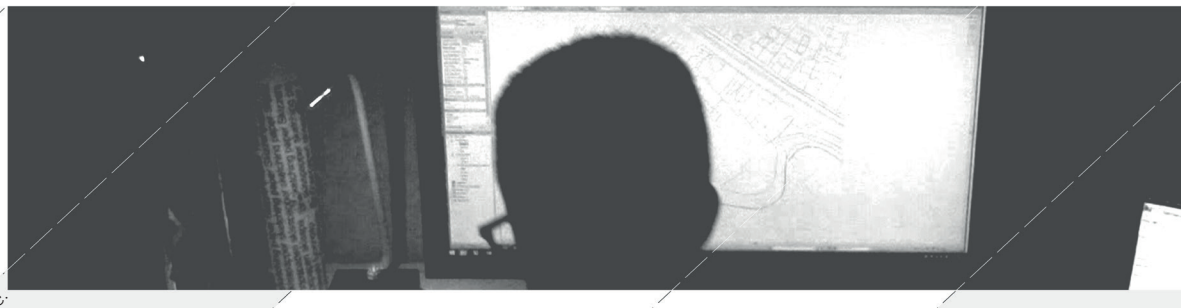
step 1: action dice role: pixelate

alternative view around block
if not develop further using the interpretation dice.



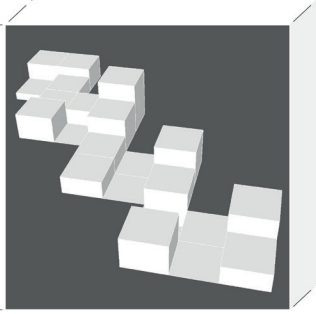
step 2: drawing after pixelation

step 3: interpret dice role if still stuck



continue design process

alternative view around block
if not restart process and re role action dice



step 4: drawing after interpretation dice

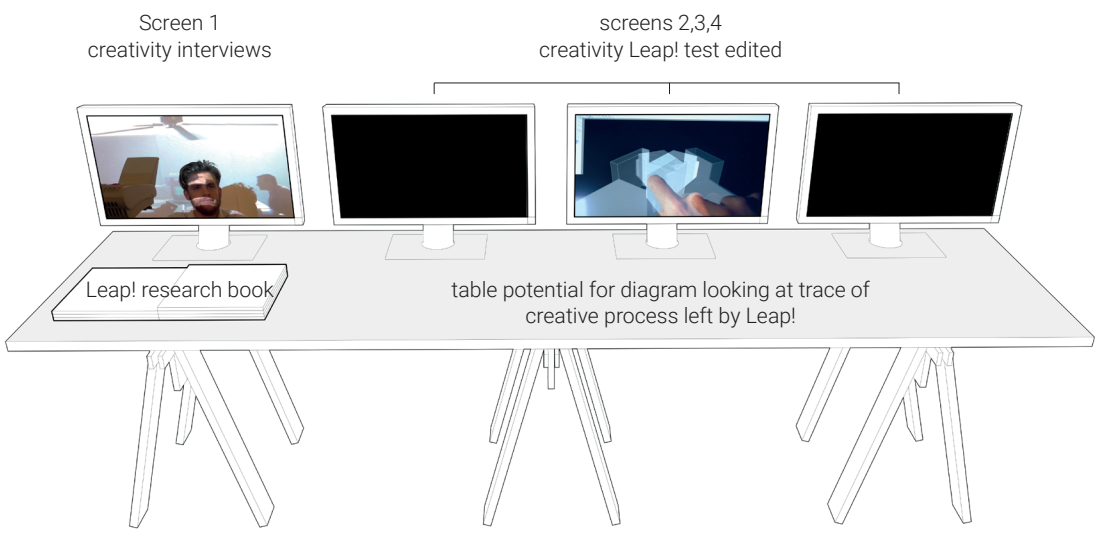
Following the testing of the dice actions the material was carefully analysed by myself and brought together within an exhibition for the 2015 edition of the University of the West of England's annual design research symposium (UWE Bristol, 2015) (Fig.18). Here, a decision was made not to show the captured footage of the projects undertaken, as this was very long and difficult to read visually, but instead for me to analyse the footage and then carefully make a series of new films, which demonstrated the potential of these actions to an exhibition audience. It is important to note that at this point within the research the focus was still on the development of a divergent tool. As such the exhibition films were focused on showing clearly the potential of each divergent action in order that I could gain a further understanding of how they might be developed and systematized. A further key aspect of these films was that whilst they were made specifically for the exhibition the processes explored were not rehearsed. Instead, beforehand the design scenarios for each film were established and then captured through a multi camera setup (p. 58). The collected footage was then edited carefully considering the emergence of moments of divergence.

Within the exhibition this was played across three screens where for most of the time two of the screens remained blank, whilst the third played the edited footage. At important moments within the process the footage would spread out across all of the screens indicating to the viewer that something was about to happen. At moments of divergence the footage would leap from one screen to another. To accompany the edited footage, I recorded a narrative that explained to onlookers the processes being undertaken and what myself as a designer perceived as emerging from it. Finally, a fourth screen was added to the exhibition, showing footage of the designers answering questions regarding their understanding of divergent thinking and its role within the design process. This footage was orientated towards gaining a common understanding of divergence that could influence the direction of a tool's development.

Whilst making the exhibition films proved extremely useful in gaining a further understanding of each actions' immediate application, it also highlighted further that the divergence triggered by the insertion of each action was in fact far more intriguing. What the films clearly demonstrate, is how divergence emerges from the designer working between the action and the temporally unfolding design process: divergence expands from an idea that emanates from the action, to an idea as part of a wider chain of techniques, brought together with the designer's tacit knowledge, across media and containing both moments of divergent and convergent thinking.

In addition to this, film offered a tool for capturing and reviewing the design process as well as a means for disseminating it to a wider audience, and often these two incentives motivated each other. A further example of using film in this way was the production of a short film made for the AHRC Research Film Awards 2017. Whilst, like the symposium, this film also focused on the idea that the output of the research might be a toolkit, it also served as a useful platform for discussing my research and moving it forward. The process by which it was captured and edited saw the screen-based media discussed in the film, be projected across my face, whilst I narrated the story of the research. This layering of the media literally across the designer's presence, allowed for a reflection that highlighted the interplay between the designer and their tools and initiated the moving of the discussion beyond the toolkit.

Link to 'Divergent Toolkit film' made for the AHRC Research in Film Awards (2017). This film was created as an accessible way to share innovative new design research with a diverse audience. It documents the development of a toolkit to enhance creativity within the early stages of the architectural design process. The toolkit responds to an emerging situation in professional practice, in which the design process has become increasingly trapped in the world of the digital.



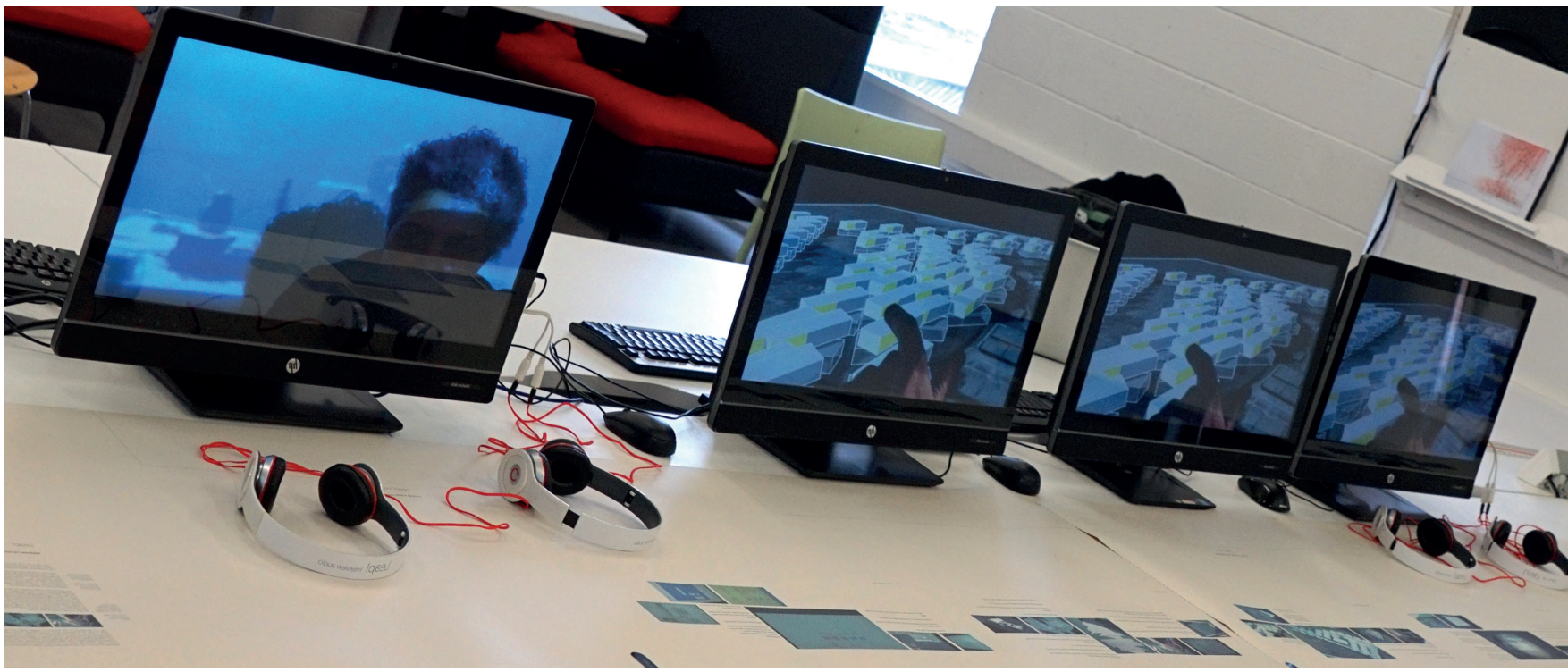


Fig. 18: 'Leap!', multiscreen display for the *Design Research Symposium*, UWE Bristol (2015). From left to right: screen 1 playing extracts from interviews with participants on their understanding of divergent thinking, screens 2 to 4 playing loops of the divergent actions, which jump between the screens.

2.1.3 | From action to technique

Film was useful in revealing divergence as an exchange between the designer and the media, not only through symbolic projections such as the one described above, but most importantly due to its ability to represent aspects of the process that are otherwise tacit and therefore difficult to communicate. To further understand this it is useful to consider architectural theorist Paul Emmons' (2014) discussion of tacit knowledge, that is, of the knowledge that a designer has accumulates and internalises through the repetitive practice of design. Emmons, whose research focuses on the imaginative role of diagrams and technical drawing in architectural design, describes tacit knowledge as something nearly impossible for the designer to communicate and explain. Emmons further proposes that tacit knowledge is manifest most clearly through the practice of drawing where it can be seen in the habitus of the designer. Habitus differentiates itself from habits which are acts of fixed, repetitive, unthinking and instead are concerned with processes that continually adapt themselves within a *'network of dispositions'* which are concerned with approaching design in a certain way (Emmons, 2014). Emmons explains that a designer who has mastered their habitus is able to draw *'… whilst not focusing on executing techniques but rather on making the design itself'* (Emmons, 2014, p. 537).

Within the review of the divergent actions, the tacit nature of the designer's skill became more evident as it was possible to see how the designer's habitus had been contaminated by the divergent actions. The films show how the actions actively promoted the designer to be divergent by disturbing, unsettling and contaminating their habitus. What was also found with regards to this divergent disturbance was that, for it to be productive, it should not compete with and overtake the habitus, thus leaving the designer unable to return the new thinking to the design process. What emerged as most critical then, in terms of the direction and methodological approach of this research, was the conclusion that the primary outcome of this research should not be the design of the divergent actions themselves as stand-alone, pre-determined prompts. Instead, what is more useful to the understanding of creative thinking within processes of architectural design, is the examination and outlining of the ways in which actions of divergence are fused with the designer's habitus. These ways then concern techniques that overcome actions, and which are equally outwards, moving away from the conventions of the designer's habitus, and inwards, bringing things back into the realm of architectural thinking and making. Therefore, a decision was made not to converge further the set of divergent actions, but instead to expand their range and multiply them. This was achieved by projecting or re-siting the previously defined actions into more specific and therefore diverse contexts of architectural production: from representational media and techniques to design operations. The intention of this expansion was to explore the divergence emanating from their investigation.

2.1.4 | The cut-up workshops

Outside of the individual testing of the actions, divergent workshops were held as part of a series of Master of Architecture studios. The workshops focused on a tried and tested adaptation of William Burroughs and Brion Gysin's Cut-up technique, which I myself had been introduced to by architect and educator Robin Wilson (Burroughs and Gysin 1978). This version of the cut-up technique begins with the generation of designer-based narratives, which are then cut up line by line before being randomly recomposed. The divergence within this technique emerges at the point when the designer

reads the recomposed text, which, from its fragmented state, has the potential to animate new narratives within the designer's mind. A full discussion on the emergence of divergence from the cut-up technique can be found within Chapter 3 (Cut-up).

Within the workshops what was found to be most useful for the student designers was how the technique freed them from their existing thinking and allowed them to consider the design process from an alternative perspective (Fig. 19). In particular, what the process seemed to offer was a way for the students to formulate the spaces needed for the project, their scale, materiality, atmosphere and sequence.

In designing the workshops what became critical with regards to its structure was how it was inserted into the designers' process. It quickly became apparent that it was most useful when positioned at the point where they were considering the programme of their projects. Here, the technique's ability to question the sequence and the spatial types proved useful in helping them formulate a proposal. The workshop also worked particularly well when paired with studios that used film-based media, where the fragmenting of narratives drew equivalences with filmic montage techniques. Also, the technique worked well when paired with spatial model making exercises, which used speed modelling techniques to rapidly build the new narrative sequences which emerged. An iteration of the technique developed by myself saw designers switch from cutting text to cutting into images they had produced. This approach was used most effectively within a workshop I ran with Dr Sophia Banou entitled Atmospheres. Here, students cut up copies of collages they had made for key spaces within their project and as with the text-based cut-ups recomposed them. From these cut-up images we asked the students to physically model a space that saw the spatial, material and atmospheric qualities of collaging transfer into a three-dimensional form. The workshops and emerging techniques will be discussed within Chapter 3 (Cut-up).

Fig. 19: Divergent Thinking Workshop, UWE Bristol (2016). Masters of Architecture students use an iteration of the cut-up technique to develop their design studio projects by cutting up and rearranging narrated sequences of their proposals.

2.1.5 | The Divergent Deck

In considering how to expand the range of divergent actions that had previously been established through the divergent app and dice, an investigation of Brian Eno & Peter Schmidt's Oblique Strategies, (subtitled: Over One Hundred Worthwhile Dilemmas)' (1975) was undertaken. Oblique Strategies comprise a deck of cards containing short prompts, which are designed to be used at random when a designer is faced with a creative block. According to Christopher Scoates (2013), from an early age Eno recognised that *'…mistakes and random errors could be productive if approached with the right mindset'* (Scoates and Eno, 2019, p. 910). Here, Eno started to note down and record such events as a growing list of divergent ideas which would prove useful in escaping a creative *'cul-de-sac'* (Scoates and Eno, 2019, p. 901). Eno was also influenced by John Cage's (1951) reading of the *I Ching*, a Chinese text also known as 'the book of changes' (10th - 4th century BC), within his 1951 composition *Music of Changes*. Here Eno was inspired by how Cage used the *I Ching* as a technique for chance operations within the composition of the piece (Jensen, 2009). Parallel to Eno's exploration Schmidt had been developing a set of sixty-four drawings based on readings of the *I Ching*. Eno and Schmidt who met in Ipswich art school in the late 1960s were fascinated by the similarities of each other's working practices.

Whilst the cards emerged from Eno's and Schmidt's separate working strategy Eno remarked in a radio interview in 1980 how similar many of their approaches were (Cass, 2018). This is also particularly evident within the first prompt to enter the Divergent Deck: *Honour thy error as a hidden intention.* This card, which emanated from Eno's notes, had a striking resemblance to Schmidt's notes which had *Was it really a mistake?*. *Honour thy error as a hidden intention* in particular seems to embrace the wider ethos of the deck and the ideas of chance and random events leading to moments of creativity. In an interview with BBC Click (2017), Eno discusses with presenter Spencer Kelly, how whilst the cards had been derived from a synthesis of notes from past creative moments when applied to a creative problem, they proved themselves useful in helping overcome a block. Eno notes how they were particularly useful in the production of Roxy music, where, when alone and facing the pressure of a deadline, pulling a card at random would provide a sounding board that helped him both reflect upon what he was doing and offered suggestions how to look differently at the problem.

Eno also used the cards with David Bowie, whilst producing *Sense of Doubt* from the album *Heroes* (1977) (Scoates and Eno, 2019, p. 933). Bowie, who was not unfamiliar to the use of divergent techniques is also referenced within this research for his use of the cut-up technique to generate song lyrics for *Diamond Dogs* (1974). Here, Bowie and Eno used Oblique Strategies to individually work on the lyrics of the song (Fig. 20). Eno got the card which said *Try to make everything as similar as possible,* whilst Bowie got *Emphasize differences* (Scoates and Eno, 2019, p. 933). The contrast in the cards meant that the two were constantly moving apart in approaches to the lyrics. On publication, in 1975, there were 110 Oblique Strategies. Over time the deck was iterated with cards being added, removed and modified up until Schmidt's untimely death in 1980.

What became apparent from studying the oblique strategies was not so much the element of randomness the cards generated, but rather how the cards offered the opportunity to reflect upon the design process in a new way. They offered a new field but also, at the same time, a datum for comparison and evaluation of pre-existing ideas that might have been rendered stagnant and

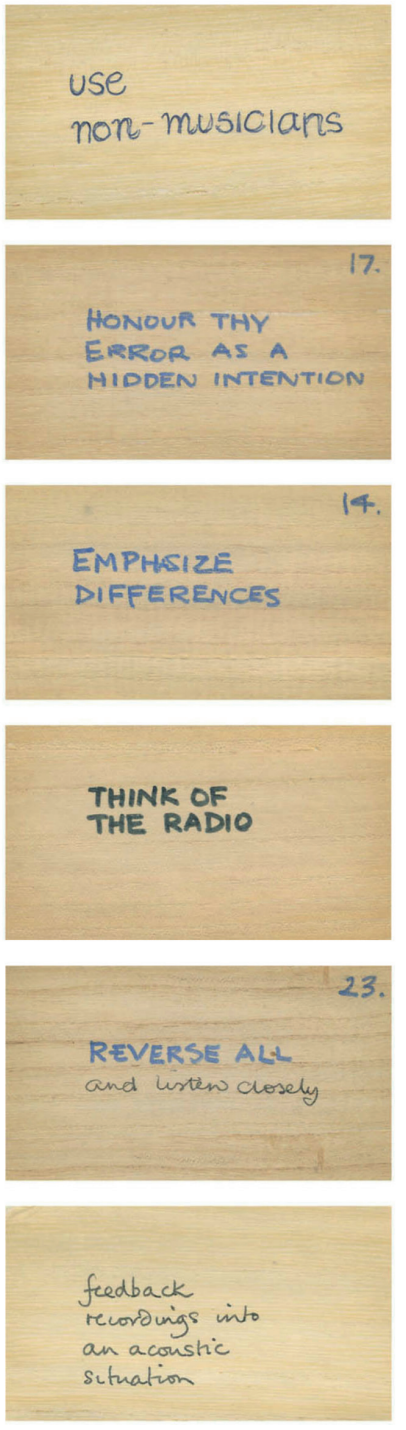


Fig. 20: 'Oblique Strategies', Brian Eno and Peter Schmidt (1974).

exhausted, thus allowing reflection from a different perspective. This reflective process shows parallels with Donald Schön's (1982) idea of *reflect-in-action* where a designer, on making a move automatically generates an effect within the design process which they must reaffirm, modify or reframe in order to continue the process. However, within Oblique Strategies the opportunity for reflection comes from beyond the designer's immediate design context and as such is capable of drawing in a much wider range of divergent possibilities that are not immediately obvious to the designer.

Whilst Oblique Strategies was intended for a wider application than its original use within the music industry it became apparent to me that many of the cards were too specific or perhaps too divergent for use within the architectural design process. Examples of such cards included: *(Organic) machinery, Feedback recordings into an acoustic situation, Imagine the music as a moving chain or caterpillar*. This was no doubt, in part, down to the fact that the cards had emerged from the specific unpicking and examination of the habitus of Eno and Schmidt. With this in mind, I started to consider how I might expand my actions and incorporate more of my own tacit knowledge into a set of divergent prompts. A internet survey revealed that I was not the first to attempt this as an idea and, in fact, architectural writer Guy Horton (Horton 2013) had written a short blog on what an Oblique Strategies for Architects might look like, which included suggestions for fifty-one possible prompts.

Looking at Horton's list it became obvious that there were a number of overlaps with the divergent dice actions such as the *pixelate* it and *zoom out* prompts. Furthermore, the prompt *print and draw over by hand* was reminiscent of the tracing process that had emerged as a technique for translating the dice actions between media. Looking at Oblique Strategies and Horton's prompts also revealed certain patterns in the language used. For instance, the verbs abandon, change, consider, define and consult occur repeatedly within Oblique Strategies, whilst in Horton's prompts the verbs draw, make and build constitute the verbs with the most occurrences. This led me to understand that, to develop the Divergent Deck as an inclusive but also relevant to architectural designers tool, alongside expanding the range of actions and bringing in some that were derived from my own architectural habitus, I should also consider carefully the verbs that form the actions within the prompts.

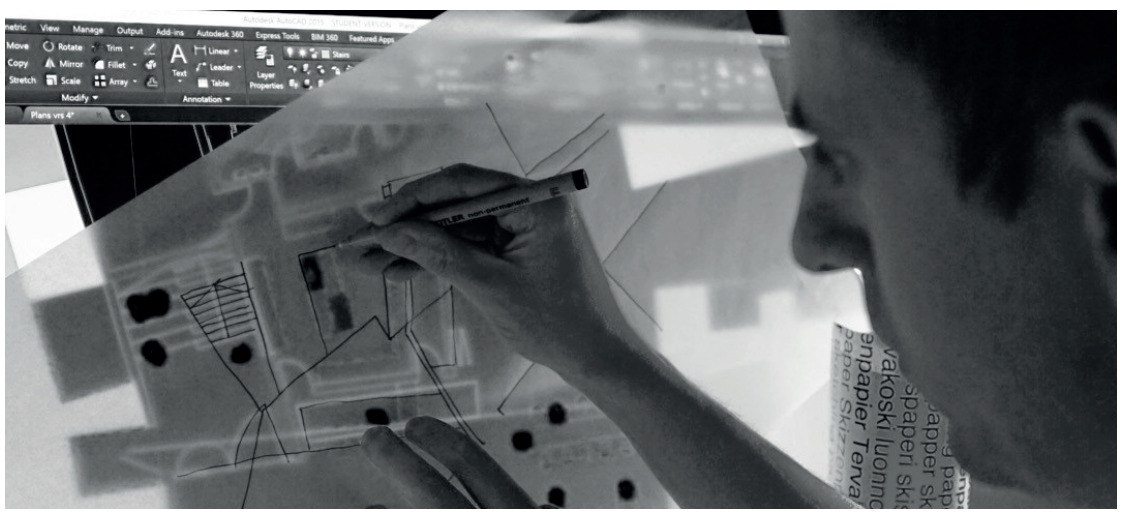
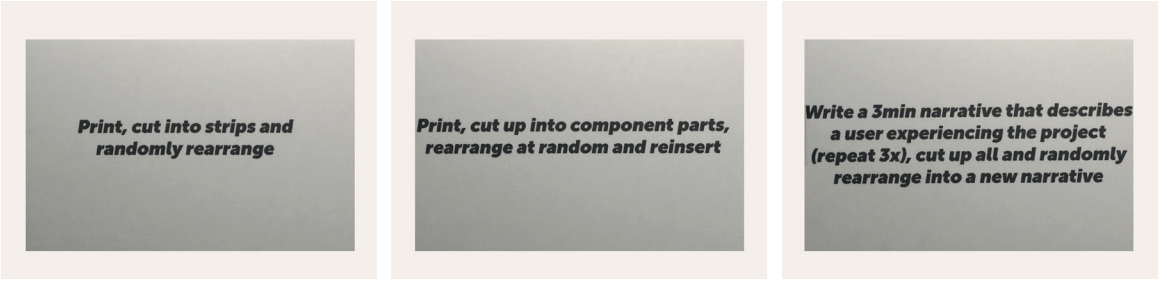


Fig. 21: 'Tracing over digital screen', still from film for the 'Leap!' exhibition, *Design Research Symposium* at UWE Bristol (2015).

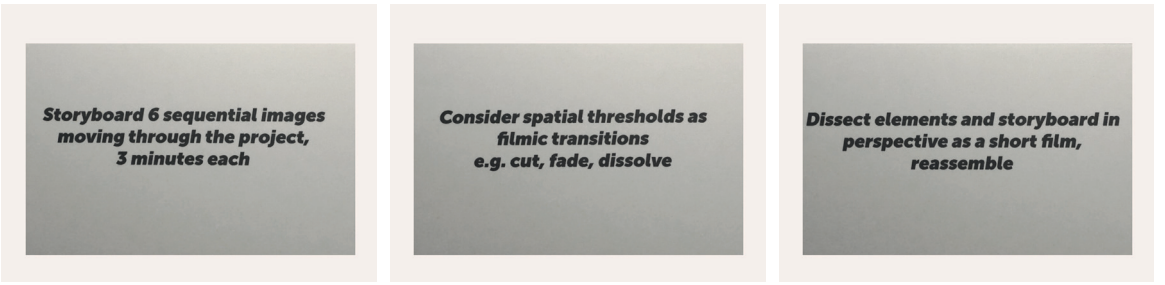
This included common actions from within the architectural design process, such as draw, trace, model, diagram and also actions that propose a potential movement between media, such as export, print, scan, switch. The latter emerged as part of the inital observation that current trends in architectural software, namely BIM, are eliminating the opportunity for divergence between media by proposing that designers work in a single media environment. Here, the prompts sought to get the designer to move across and between digital and analogue media.

As for Eno and Schmidt, key to the development of my divergent prompts was an intuitive process of reflecting on my own habitus processes that led to creative moments. This included the creation of individual prompts such as *Hatch with colours from a painting you like,* which was derived from my use of colours within existing artwork to inform the colour composition of drawings. Here, I would often use the block colour paintings of Julian Opie (2003) as a colour palette within photoshop to develop conceptual drawings and diagrams.

Two aspects of my habitus stand out within the divergent prompts and span multiple cards. The first of these comes from my use of an iterated version of William Burrough's and Brion Gysin's cut-up technique (Burroughs and Gysin, 1978). Here, the technique sees the production, cutting up and then reassembly of designer generated narratives to reveal new hidden meaning about the design process.

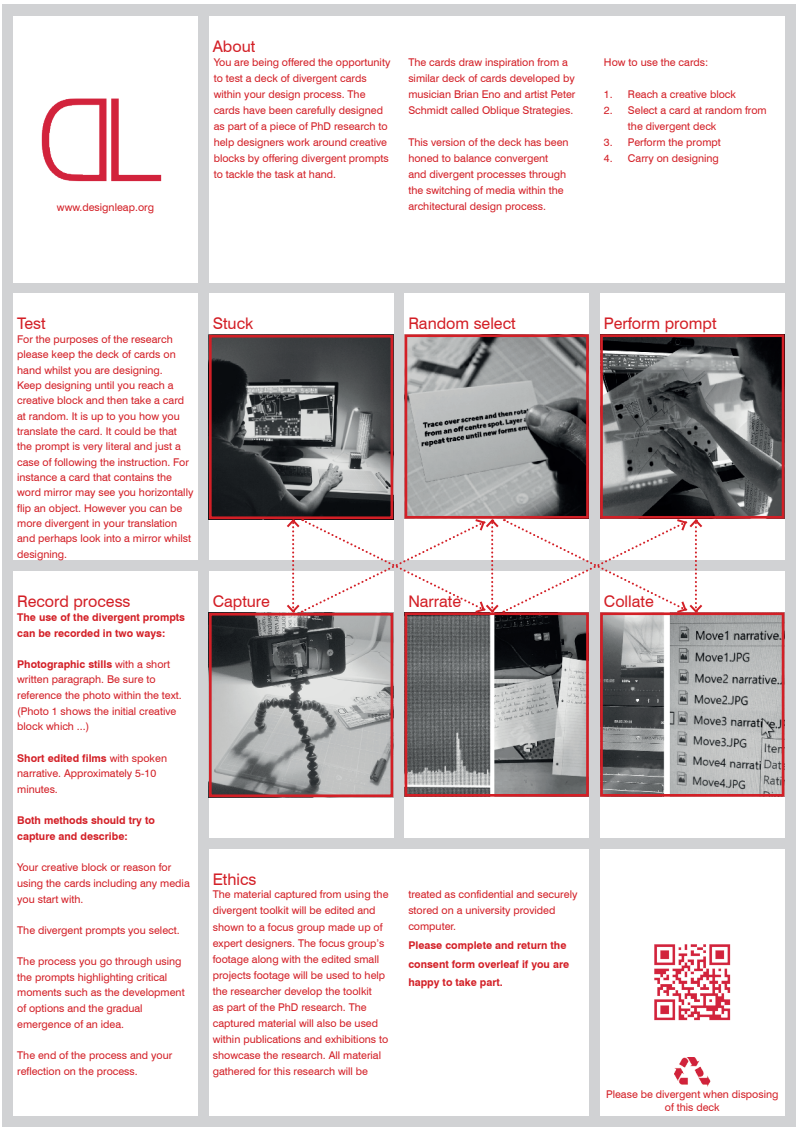


The second aspect of my habitus that is clearly evident within multiple prompts is the use of filmic transition techniques particularly with regards to the consideration of spatial sequences and how users might transition between them (J cuts p. 70, match-cuts p. 76 and jump cuts p. 82). In fact filmic transition techniques have become so influential within my habitus that they also manifest beyond the prompts in the structuring and analysis of the leaps within Chapter 3 (Cut-up).



Figs. 22a & 22b: Cards from the Divergent Deck showing the emergence of the cut-up technique and filmic techniques from my pre-existing habitus.

The intuitive compilation of divergent prompts, drawing both upon the original dice actions and my own habitus, resulted in the production of a deck of fifty divergent card prompts. These cards were issued to designers with a set of instructions, which developed those that had been included in the Leap dice game (Fig, 23). These expanded the scope particularly with regards to testing the prompts and also capturing the emerging processes. For testing, emphasis was put on the designer considering how the prompt could be interpreted. As an example, whilst a card containing the word *mirror* may be understood as the horizontal flipping of an object (an operation common in drawing and image editing software), it could as well be understood as the less conventional act of looking at the material through a mirror whilst designing. The aim was that the ability to divergently interpret the prompt would further help its integration with the existing processes and increase the chances of divergent moments emerging.



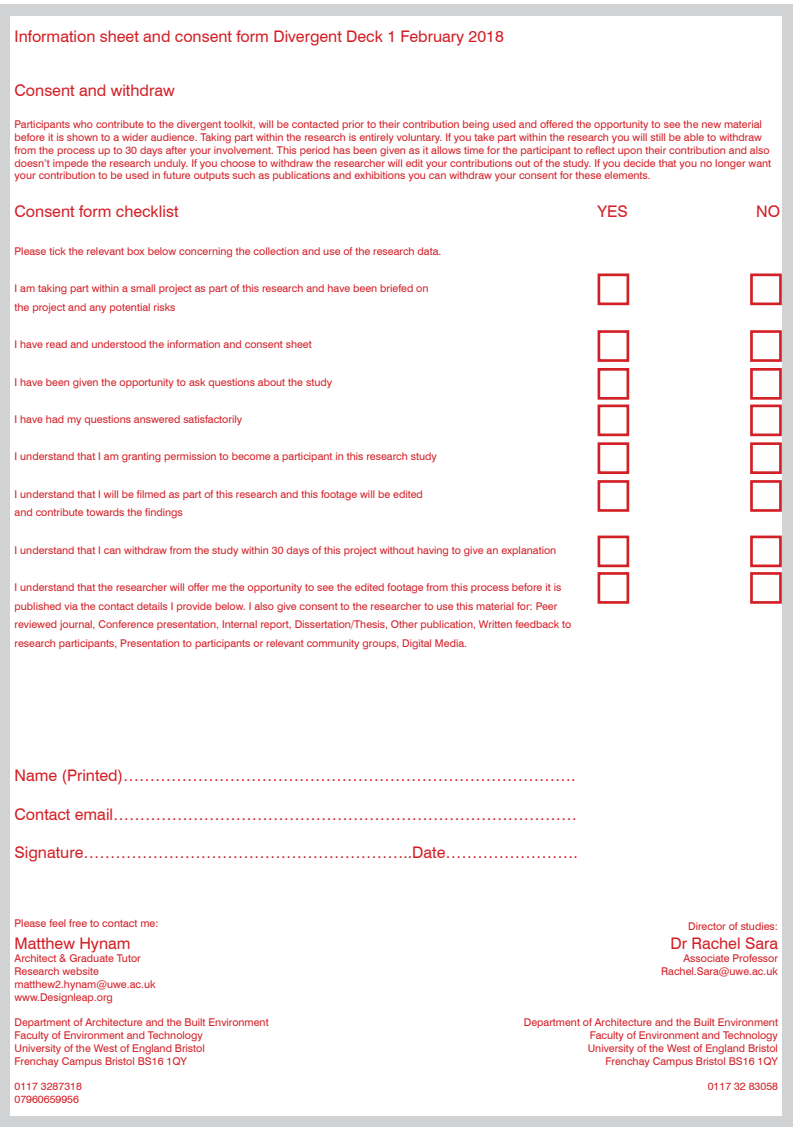


Fig. 23: Instruction form and ethics form for the Divergent Deck.

Link to Ethics Application and its corresponding letter of approval.

2.2 | The designer (as) visual researcher

While testing the prompts the designers' contribution was critical for the development of this research, in terms of capturing this process in a way that would be capable of offering valid material for further analysis and assessment. Towards this, was important to devise clear methods that could be carried out easily by the designers, in the privacy of their own space and with the minimum possible disturbance of their thinking process. The following section, firstly offers an overview of the use of visual ethnography, as a useful methodological approach for the examination of such embedded modes of observation through visual material, before delving into the more specific tool of film within the research, and the nuances of this medium in terms of capturing, ethical provisions and implications, editing and reviewing. The section concludes with an explanation of how the material within the films was discussed further with the designers through a focus group.

2.2.1 | Visual ethnography

In the context of recording the introduction of the divergent actions into the design projects, visual ethnography methods were examined for their potential to develop and analyse visual material, such as photographs or film, as part of the research (Pink, 2007). Visual ethnography builds upon ethnographic methods, where the researcher places themselves within the field of research in order to study people and cultural phenomena, by using photography, film, and at times drawing, to carry out the investigation (Schwimmer, 2014) (Pink, 2007). However, unlike other visual methods, this approach does not work with existing material; instead it is concerned with the researcher developing the visual material as part of the research. This means that the visual material created by the designers as part of the design process is not there simply to illustrate some aspects of the research project, but instead is used actively within the research process (Rose, 2012, p. 298). In the context of this research case, the approach to visual ethnography is concerned specifically with film and photography's ability to capture and observe the habits and habitus of the designer whilst working within the design process. Of particular importance was the consideration of whether the designer, through reviewing and editing the footage of the design process, may unconsciously present a bias towards the events that unfolded. Whilst this could not be fully mitigated, the approach set out within the instructions given out with the Divergent Deck and other tests attempted to reinforce an approach that would limit this. This included getting the designer to continuously capture the process and not attempt to live-edit the footage by stopping and starting the camera whilst designing. Editing live might have seen the designer miss critical moments of divergence of which they, at the time, were unaware. Similarly, the ability to reflect on the process and edit afterwards was seen as a way to consciously consider what needed to come across in the film. During the editing phase the designer was also asked to record an audio narrative describing their process. As well as helping the designer critique and consider what they actually found out from undertaking the process, the narrative also helped me later discern what was happening in terms of the evolution of the design process and the moments of divergence within the film. Characteristic of this double layer of analysis, between the designer and myself, which to a degree was able to counter the designer's bias, is the example of one of the pixelate films (pp. 99-100), in which I found myself disagreeing with what the designer had considered they had learnt from the process.

2.2.2 | Capturing

Within the research two options were, thus, given to the designers: first, capturing through titled photographic stills with an accompanying narrative text or, secondly, a short-edited digital video, approximately three to four minutes in length with a spoken narrative. The choice to offer photographic stills as an option was in order to accommodate for designer's who may not have felt comfortable capturing their process through attempting to frame and edit a film. The key benefit of digital video was that it offered both 'temporal' and 'reflective' qualities. Other key technical features that made digital video the ideal platform for capturing the design process were: the high image and audio quality and affordability of both camera and media (Pink, 2007). Modern video cameras also come close to the capturing definition of a still camera and, as such, allow the viewer to see a high level of detail within the frame. Within the study this was important, as many of the moves within the digital design process are extremely subtle and could be as simple as a cursor dragging an object across a computer screen, which might go unnoticed if using a stills camera or standard definition video camera. Fortunately, we have reached a point in time where most modern smart phones are capable of capturing video at 4K, which translates in pixels as two thousand five hundred and sixty pixels by one thousand four hundred and forty pixels, which gives a high level of detail that can be examined and enlarged without becoming pixelated to the eye.

A further key aspect of the capturing process was the careful positioning of the camera and the framing of the design process. Here, participants were given a small smartphone tripod, which could be easily positioned within the vicinity of the action in order to carefully frame the interaction between the user and the process. Participants within the research were also encouraged to take control of the camera to reframe their view of the process as it unfolded. This handing over of the camera has been coined spontaneous video by Sarah Pink and provides a useful means for participants to capture their perspective of the process (Pink, 2007). Within the design process it proved useful in understanding how designers positioned themselves in relation to the media from forward facing screen-based processes to downward looking desk based processes (p. 124).

Fig. 24: Image of mini tripods given out to participants with the Divergent Deck.

2.2.3 | Visual ethics

The video process also required careful consideration in terms of ethics. It was important that participants understood how the material they were capturing would be used and later represented, as well as to protect any personal data. Within each test this was carried out through providing the designers with both an information sheet and ethics checklist (Fig. 23). The ethics approach followed the procedure previously applied to the Leap dice game tests and, because of similar testing, editing and reviewing processes, it was covered by the earlier research ethics application. Despite the approval of this earlier procedure, further development of the video editing process led to the decision to anonymise the designers within the writing up of the leap chapters which follow this methodology. Referring to the participants as designers enabled me to talk more candidly about the processes, which emerged and prevented anyone from feeling negatively affected through the discussion of the unfolding design process.

2.2.4 | Editing

The video editing process was controlled by the various designers and conducted through digital video editing packages, such as Adobe Premiere. In some situations, I helped the various designers with the editing process and suggested editing techniques for conveying their ideas. This process allowed for each video to be edited into short montages that show the divergent prompts in action and how they were altering the grammar of the design process. Audio was added to the film afterwards as a reflective process in the form of a narrative track explaining what is happening within the frames. This process allowed the various designers to watch the edits and then simultaneously record a digital sound file using a digital microphone. The benefit of being able to reflectively watch and record a narrative was that it allowed the designer to focus in on specifics occurring within the frame. Gillian Rose suggests narrating montage sequences is key to the audience being able to interpret the intended information (Rose, 2012).

2.2.5 | Reviewing

Of the fourteen tests of the prompts conducted by designers all chose the route of producing short films which be viewed on the following YouTube site (see link below). It was evident from this outcome, and from the analysis of the films, that this form of recording allowed for the smoother unravelling of the process, not requiring the interruption of the thinking. This form of recording was also extremely effective in enabling the analysis, as through the filmic medium it provided me with an immersive perspective of what the designer was doing, what decisions they were making and why. The instructions given (Fig. 23) stated clearly that within the film the designers were allowed and encouraged to post-edit the captured footage. The intention behind this was that the designers where able to reflect on and asses the process themselves, while highlighting what they identified as the moment of divergence and nuancing the ways they understood it. There were, therefore, two levels of analysis and reflection taking place: one from the designer's own perspective and one from my own as the director of the research.

Link to YouTube playlist: 'Divergent Deck' short films.

2.2.6 | Focus group

Following the testing of the Divergent Deck, a focus group was carried out with five of the testers to examine how the Divergent Deck might be iterated further. Although this was still at a moment in the development of the research where the Divergent Deck was still considered as holding the possibility of a toolkit, and therefore as an output rather than a process of examination, it is important to note that the conclusions drawn from this focus group highlighted the futility of attempting to systematize, and thus converge divergence in such a way. The focus group involved a screening of the films of the designers present in the group and a discussion of their reflections on their tests. To facilitate this discussion and be able to draw more specific feedback on the value of the individual prompts, I organised them into a taxonomy. The starting point for organising the prompts was originally the result of an intuitive act of listing divergent techniques, similar to that followed by Eno and Schmidt's. As such, the process attempted to avoid the 'bias' of any systematic thinking and organised the prompts reflectively. The taxonomy (following spread 62-63) that emerged served to create an understanding of the types of processes that were emerging and, with regards to the focus group, discussed in conjunction with the films. The categories devised, which were not mutually exclusive, were as follows:

1. 'Outside' processes
These cards have a series of suggestions for process actions that draw from outside of architecture and also include subcategories from film and the Dadaism art movement.

2. Tempo-altering processes
Affecting the rhythm of the design process and promoting the switching between media.

3. Architectural processes
Processes that are used currently within architecture often to review and question the direction of an approach and have a direct emphasis on spatial representation.

4. Physical processes
Processes that are normally carried out by hand outside of the computer.

5. Digital processes
Processes that occur within digital devices including computers and smart phones.

6. Uncategorised process
Processes that do not fall into the above categories. Some of which have been inspired by Brian Eno and Peter Schmidt's Oblique strategies.

Whilst the test films did not cover all fifty of the Divergent Deck cards, they provided a wide enough visual field to allow for a wider charting of the divergent techniques that emerged from the dice, the workshop and the deck.

(Following spread) Fig. 25: Taxonomy of cards, showing an early categorization of the cards into different process types.

Outside processes	Think like an engineer express the structure in a diagram	Hatch with colours from a painting you like	Scan in a random object	Insert a void with an object from another medium	Attach a rogue element from a foreign medium outside of architecture	Introduce an object from a different medium
Tempo altering processes	Repeat the process in a different medium	Slow down and work up an area in detail	Alter your rhythm switch to a faster medium	Break up the rhythm by inserting something from a different plane	Be messy, frantic & noisy e.g. Charcoal stick + DnB	
Tempo altering architectural processes	Switch between mediums every 10 minutes for 1 hour e.g. sketch, CAD, physical model, diagram, orthographic, detail, digital model					
Architectural processes	Print, pin up and look at from distance	Perform a scale test by inserting a repetitive element from another medium e.g. Google Earth	Parti diagram your current position	Draw the shadow	Print out and erase the circulation	Add more detail to the context
Architectural physical processes	Speed model with paper for 30 minutes					
Physical processes	Mirror the image using a physical medium	Switch to a more physical medium	Model the inside as outside and outside as inside			
Physical processes / Digital processes				Explode components draw as elements	Export multiple views, layer with 10% opacity, print, trace a new form and reinsert	Rotate the view to a non-orthographic projection, wireframe, print and trace

| Oblique strategies inspired |

Uncategorised processes	Look at the weakest part of the design and amplify it	Remove the element you think works	Take a snapshot and pixelate it	Reframe your work and consider a new boundary	Reframe asymmetrically

Print, cut into strips and randomly rearrange	Print, cut up into component parts, rearrange at random and reinsert	Storyboard 6 sequential images moving through the project, 3 minutes each	Consider spatial thresholds as filmic transitions e.g. cut, fade, dissolve	Dissect elements and storyboard in perspective as a short film, reassemble	Write a 3min narrative that describes a user experiencing the project (repeat 3x), cut up all and randomly rearrange into a new narrative
| Dadaist processes		| Filmic processes			
Steal an idea from someone else's project	Consider a new section and sketch freehand with a fat pen	Trace over the screen scan and reinsert	Trace over screen and then rotate from an off centre spot. Layer and repeat trace until new forms emerge		
	| Sketching				
Architectural digital processes	Reverse the line weights and print out	Change the parameters	Zoom, change scale + or –	Alter your rhythm switch to a faster medium	
Digital processes	Export a screenshot and invert the image	Blast the brightness and contrast and work with what is left	Take a snapshot and pixelate it	Fade and draw only the edges	Export a screenshot and blur the image

Taxonomy of cards

link to Divergent Deck films

2.3 | Conclusions

This chapter has unpacked the methodological tools and approaches that this research employs towards the examination of divergent thinking across media in architectural design. Starting with the introduction of the key methodological approaches of design research and visual ethnography, the chapter examined chronologically a series of key projects concerned with introducing divergent prompts into the architectural design process, such as the Leap dice game and Divergent Deck. These projects, act as methodological tools that propose provisional categorizations of possible divergent prompts, within either operations or media familiar to the architect. At the same time, however, the development that they outline as a sequence of iterations, also outlines and defines the research's move away from the creation of a toolkit and towards an expanded understanding of moments of divergence between and across media. The research then progresses through the application of prompts either directly derived from these tools or more intentionally selected, into a series of projects carried out by myself or other designers. Following this, the development of the key methodological strategies focused on capturing divergence in the context of recording and reflecting on these projects. This was discussed specifically with regards to the use of film. Film was used here, not only for its ability to capture temporal moments within design but also for the way that, similarly to design, it proceeds through switching between modes of diverging and converging through processes of capturing and editing.

The analysis of the projects that had accumulated and the categorization of divergent processes that they revealed, began to highlight the affinities and disjunctions between the various projects and the ways that moments of divergence became embedded into their creative outcomes. The reflection upon the projects made evident the inadequacy of any categorization of the divergent techniques by means of instructed actions. On one hand, it revealed the breadth of responses that each prompt evoked, shifting focus from the prompt to the execution. On the other hand, it highlighted, on behalf of the designers, preferences and therefore convergences to specific techniques that demonstrated closer affinities to the normative means and media that architectural practice employs.

The following chapters, therefore, focus on a series of three techniques: Cut-up, Pixelation and Tracing, which were identified through the described iteration of the prompts and the analysis of the projects, as key creative leaps. These were not simply leaps within the design process, leading to a creative resolution by means of divergence: they also defined leaps between external prompts and normative architectural outputs that consistently occur across representational media and their contexts. The leap chapters, therefore, examine each one of the three overarching techniques for their ability to diverge and open up the design process while establishing meaningful connections to the concerns and language of architectural design. To this end, the leap chapters draw from the close analysis of particular projects in order to contextualize the operations that they describe into the wider theoretical context of architectural thinking, tracing the connections between architectural representation and other contexts of representation and proposing a new glossary of techniques for the architectural designer. Further to this, the detailed investigation of the leaps deepens the understanding of the interplay of divergent and convergent thinking within the design process.

Fig. 26: Photo from the Divergent Deck focus group.

Leap One

3 | Cut-up: Towards a new order

'All writing is in fact cut-ups. A collage of words read heard overhead. What else? Use of scissors renders the process explicit and subject to extension and variation'.

Burroughs and Gysin (1978) p. 17

In this chapter, the understanding of cut-up develops and expands on the divergent techniques of fragmenting and reassembling found beyond architecture, originating within the Dadaist art movement of the 1920s and popularised by William Burrough and Bryon Gysin (Burroughs and Gysin, 1978). In its original form, cut-up operates with text as its primary subject matter, taking advantage of the sequential but modular structure of language as an assembly of discrete, pre-existing components. It involves the cutting up of strips of a pre-existing text and then randomly rearranging them to create a new text. For the purposes of this thesis, cut-up poses a divergent leap that provokes a degree of randomness within the architectural design process. However, this randomness is countered and controlled by the designer's ability to derive new concepts and ideas. The critical difference between the cut-up as introduced by the Dadaists and the way it is used within this thesis as a technique for generating divergent leaps, lies in the framing of the design process as a narrative itself, which can embrace both text and image. In this chapter, the methodological tool for analysing the creative leaps formed by the spatiotemporal transitions that cutting and re-ordering media creates is found in filmic montage. This is due to the ways that montage, a technique that is itself is based on the cut, provides a way to understand the tension between the spatial and the temporal aspects of both the architectural design process and its desired outputs. Montage offers here a means to cut through and reflect on a series of projects that engage with different iterations of the cut-up technique. These projects demonstrate, in their contextualisation, that the narrative embedded within the thinking of the design process can manifest within and be motivated by visual material. At the same time, these projects reveal how divergence affects the temporality of the design process, which is revealed as depending on a non-linear sequence of events.

In my own experience of architectural design, I first encountered the cut-up technique as a method for developing a creative narrative-led approach to design (Hynam, 2007). The technique was introduced to me by, then visiting tutor, Dr Robin Wilson during my Batchelor's in Architecture at the University of the West of England. The technique provided me with a means to explore a project by randomly combining speculative perspectives of potential users. Wilson had developed an architectural adaptation of the technique at The Bartlett, UCL, as part of an experimental writing workshop aimed at destabilising existing narrative structures. Wilson's approach to cut-up differed from Burrough's in that instead of using pre-existing text the designer produced three short narratives specifically for the task and project in question, driven by experiential speculations about the project. For each narrative a short scenario setting out a situation between the building and the user was established, such as *describe your project from the perspective of someone coming to view it on the opening day*. The narratives were then cut-up into single-line strips and turned face down

before being randomly rearranged. On turning over the strips the resulting narrative, whilst needing some grammatical correction, gave new insight into the project promoting the designer to think differently about the potential spaces and their sequencing within the project. In the ten years plus since completing my Batchelor's degree I have introduced the technique into several architectural projects that I have worked on, in moments of creative blocks; particularly as a means to explore a project's programme and its spatial articulation when the design team had become stuck. Whilst the design process is naturally full of more or less implicit tools and techniques that can help overcoming creative blocks, such as drawing and geometric conventions, cut-up presents itself as an explicit response to such moments, sitting beyond architecture. In its explicitness it reveals the occurrence of other divergent techniques, which are so inherent within architectural thinking that they might go unnoticed. Even though the leaps that follow beyond this chapter are not as self-evidently divergent, it is the precedent provided by cut-up that allows us to recognize and understand these processes in the context of divergent thinking.

The projects referred to in this chapter will demonstrate cut-up operations that acquire an expanded form of the technique, which moves beyond text-based narratives to include images and, through them, spaces. This will be framed by montage theory as a methodology of exploring temporal thresholds within the design process. As a result, the process of cut-up will be seen as concerning a re-sequencing of text and images to incur not only conceptual but also temporal shifts, through which the designer can glimpse at alternative outcomes.

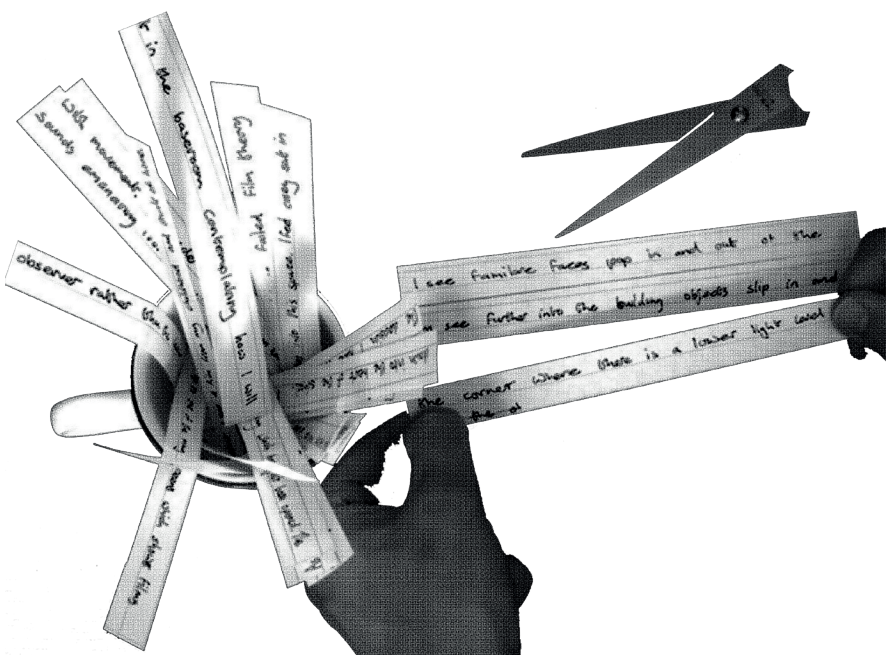


Fig. 27: 'International Film Institute', Bachelor of Architecture final year project at UWE Bristol (Matthew Hynam, 2007). (Left) Cut-up narrative from Robin Wilson's cut-up workshop. (Right) Image render of the final proposal, which used a central wall (illustrated in red) as cinematic structuring device for moving between spaces, drawing on the re-sequenced cut-up narratives.

3.1 | Cut, paste, reorder: From text to filmic narrative

William Burroughs, a writer, and painter Brion Gysin, who popularised the cut-up, were seminal figures of the Beat Generation in the 1950s; a movement that, at its core, rejected standard narrative values (Serrano, 2015). In an interview with Conrad Knickerbocker (1965), when asked about what the cut-up offered in comparison to standard forms of narrative, Burroughs responded that *'(a)ny narrative passage, say, of poetic images is subject to any number of variations, all of which may be interesting and valid in their own right'* (Burroughs and Gysin, 1978), highlighting the importance of plurality and variation afforded to the process by the relations between (verbal) images as individual instances. Writing in 1963, Leroi Jones described how the cut-up essentially provided the 'Beats' with a method of collaging with words in a way that had equivalences with techniques developed by the Cubists almost 50 years earlier (Randle, 2001). Considering the similarities between cut-up and montage, it is useful to examine them in comparison, in order to further understand cut-up's modes of operation. Collage, in French meaning 'a pasting', has its origin in the Old French verb *coller*, meaning 'to glue' (Simpson, 1989) and suggesting the act of composing and reassembling disparate components. Relying primarily on visual, rather than verbal elements, collage was over the course of the twentieth century developed and appropriated by a number of European avant-garde movements, including Dadaism and Surrealism. Whilst the Dadaists employed collage to bring together a wider range of media including text, it was the Surrealists that expanded the interpretative possibilities of collage into assemblages that balanced visual cohesion with a sense of dreaming. For the Surrealists collage offered a technique within a wider set or processes that allowed the systemization of randomness and, through this, the emergence of new visual material. Dali describes these processes as hallucinatory and generating of a paranoid-critical activity, which through the skill and cunning of the designer is able to provide a 'double image', whereby objects of multiple figuration are born (Dali, 1930, p. 115-119). As creative compositional processes, both collage and cut-up increase the opportunity for such double images to appear by the very nature of fragmenting images and then gradually reassembling them into a new whole. During this process, the repositioning and juxtaposition between elements see the viewer not only attempting to fit the pieces together but also locating them within a wider composition.

3.2 | The Emergence of narrative: From text to filmic space

A key characteristic of the cut-up, which is not an implicit attribute of collage is narrative. In transposing the cut-up into architecture, the introduction of architectural elements articulated in the description of spaces and their experiences, inevitably sees a new narrative enter the frame: that of the design process. This narrative, whilst not written down as text, is bound up between the media being collaged, which carry themselves narratives of past design moves, a syntax of architectural conventions, and the consciousness of the designer. The comparison between text and drawn narratives is examined by Dr Sophia Banou who proposes that in architectural design drawing works as a text for '*…representing and instrumentalizing the very textuality of real space*' (Banou, 2016c p. 214 b). Considered in this way, drawings constitute visual articulations of spatial concepts that uncover latent realities through continuous iteration of a process of reading and writing carried out by the designer. Drawing's textual ability to naturally allow new readings to enter the process suggests an exchange between divergent and convergent thinking that could be increased by the act of cutting and re-sequencing not only written but also drawn narratives, increasing further the opportunity for divergence to enter the design process and for new unseen narratives to be glimpsed and developed into a design.

Within cut-up, it is the ability to re-sequence time and matter that creates opportunities for divergence. This operation of resequencing and (re)arranging material is also what makes cut-up techniques useful to the processes of architectural design. The ever-present narratives within architectural design suggest that it, too, cannot escape temporality. In this sense, similarities can be drawn between cut-up has filmic montage, where to quote film maker Jean-Luc Godard, stories do have *'a beginning middle and end but not necessarily in that order'* (Corliss, 1981). Leroi Jones also points out parallels between architecture and film, in the way that individual frames can contain unpredictable elements and the ways the process of editing re-sequences time, presenting the opportunity for serendipitous juxtapositions of narrative (Randel, 2001). The conventions and syntax of re-sequencing that filmic montage has established can, therefore, offer a framework for understanding and further scrutinizing the ways in which cut-up may operate within architectural design, offering an anchoring of assembling and re-sequencing fragments to space and time. The connection between all four: collage, narrative, montage and architecture, is elaborated in Juhani Pallasmaa's foreward to *Collage and Architecture* (2014). Here, Pallasmaa suggests that collage has strong links to filmic montage in the way it is able to evoke *'…new narratives, dialogues, juxtapositions and temporal durations…'* (Shields, 2014, p. ix). He goes on to suggest that a key reason for its usefulness to architects is that its fragmented nature aligns with the partial glimpses of ideas that appear within the designer's mind: *'(s)hifting from one percept and thought to the next, from actuality to dream, association to deduction, and from recollection to imagination'* (Shields, 2014, p. ix).

William Burroughs (1966) had also experimented with using the cut-up technique within film. In perhaps his most well-known piece 'Cut-ups', Burrough's worked with Anthony Balch to create a film that cut together fragments of pre-existing footage. These fragments included shots of Gysin's dream machine, a rotating cylinder with holes, through which light shines out creating a stroboscopic effect, shots of Burroughs and Gysin walking varies city streets, top down shots of writing and painting. The fast cutting pace of the film leads to a hypnotic quality enhanced by the audio fragments, which cut between greeting phrases of *'yes'*, *'hello'*, *'good'*, *'thank you'*, and questions such as *'how does it seem now?'*. At one level the film provides a non-sequitur narrative but at another, it leaves the viewer trying to interpret the relationships between the individual narratives being portrayed. What is perhaps most interesting in this variation of cut-up, is again how as a technique it leaves an explicit mark on the media, whereby the actual cut becomes as important as the frames on either side of it.

This relationship between Burrough's cut-up technique and the filmic frame is explored by John Beck and Mark Dorrian, who suggest that the cut-up provides a 'temporal threshold' (Beck and Dorrian, 2020, p. 97) aiming to *'… destabilize the present through the release of futurity within it'* (Beck and Dorrian, 2020, p. 110). In this, they suggest Burroughs embraces the fracturing of narrative *'… as an escape from the domination of chronological determinations…'* (Beck and Dorrian, 2020, p. 110), which is capable of breaking away from the anticipated ending and revealing new narratives (Beck and Dorrian, 2020, p. 97). It is important to note here, how Beck and Dorrian refer to the specific filmic montage technique of the 'jump cut' as a particular way of controlling temporality (Beck and Dorrian, 2020, p. 110). The jump cut is only one of the many syntactical formations for transitioning from one shot into another. Yet, what the wider understanding of the filmic cut offers, as not simply a means of divergence but in particular of doing so by manipulating temporality, is a borrowed framework through which to develop a syntax of divergent leaps within architectural design processes. Uncovering this emerging syntax by applying it, the chapter will discuss the various cut-up projects carried out within this research by way of three types of design leaps as cuts. These architectural cuts take place as much across as within media.

3.3 | J Cuts: From narrative to architecture

The first test of the cut-up technique in the context of this research took place within a final year Master of Architecture studio at the University of the West of England in the form of a workshop (Fig. 28). The idea behind the workshop was that it would offer the students the opportunity to develop divergent ideas for their projects and offer me the opportunity to examine in more detail, how the cut-up can enter the architectural design process. In total, thirty-two students engaged with the workshop developing further their initial design work for a community building, which they had been tasked with designing for the industrial quarter of Bristol, known as St Philip Marsh. Up until this point the students had been working on the early stages of the design process with some having only developed their programmes, whilst others had already started to produce early spatial adjacency diagrams. The shift from brief to programme, to spatial adjacency and towards early concept plans is common in the design process and designers often go back and forth between these stages before developing more detailed drawings.

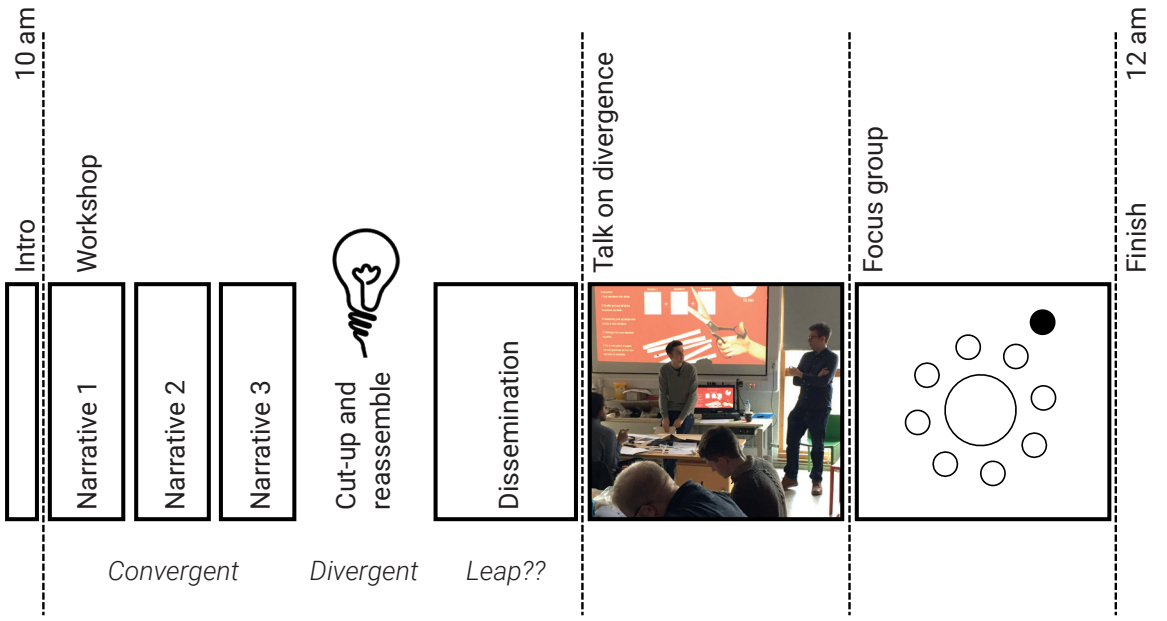


Fig. 28: Diagram illustrating the structure of the Divergent Thinking Workshop held at UWE Bristol and involving Master of Architecture students (2016).

Robin Wilson's cut-up workshop, in which I had taken part as a student, introduced the cut-up as a pedagogical tool for producing a range of divergent outputs. For myself and many of my colleagues at the time, it became clear that the technique was indeed useful for prompting and uncovering new ideas. In the context of exploring divergent processes within design thinking, my workshop focused on explicitly examining how the cut-up, a divergent but originally text-based narrative, can infiltrate and inform the design process. To do this I developed an approach which examined how the cut-up and the design process could be considered as forming two parallel streams of narrative. As the cut-up is introduced to the design process the two streams of narrative start to interweave and coalesce until they become one in the designer's mind.

In order to understand this further, it is useful to consider the similarities between this observed process of intertwining media and the filmic transition technique known as the J cut. 'J' and 'L' cuts are techniques for montaging filmic shots together that fall into the wider category of split editing. Split editing sees the parallel sets of information of audio and video, running on celluloid strips and transferred into the visual language for digital film editing, split apart and put back together with differing audio and video. The characteristic letters J and L, here refer literally to the shape formed by the edited junction between two sections of film, corresponding to sound and image as distinct streams. In particular, a J cut transition allows the video of the current scene to be accompanied by the sound of the following scene (Fig. 29). On the contrary, the L cut transition sees the opposite effect, allowing the sound of the current scene to be accompanied by the video of the following scene. Within film this type of editing has been used since the 1920s, commonly to communicate events happening off camera in the next shot and, thus, aiding the flow of the film (Paul, 2016).

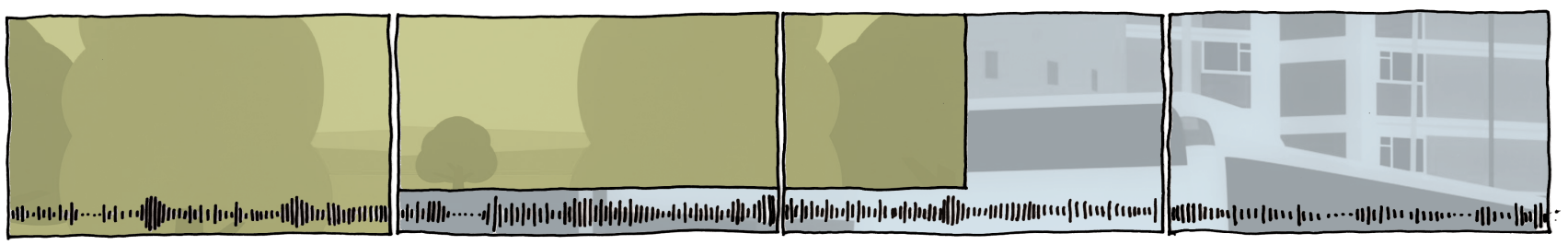


Fig. 29: Example of a J cut from 'Filmic Space', MA Architecture thesis at UWE Bristol (Matthew Hynam, 2011).

In order to promote opportunities for such a J cut to occur within the cut-up process, an additional stage was added to the start of the workshop. Here, students were asked to write down a series of nine key architectural words: three relating to spaces, three relating to atmospheres and three relating to materials. The students were then asked to draw on the nine words when creating their initial narratives in response to the three set scenarios. By infiltrating the narratives with key architectural words, generated by the student, it was hoped that these would re-emerge when reading cut-up narratives and increase the opportunities for a merging with the design process thinking. Following the generation of the key words, the students spent the next fifteen minutes writing three short narratives responding to the following scenarios:

1. Write a short paragraph about your new studio project from the perspective of someone coming to view it on the opening day. Describe a space inside the project.

2. Write a short paragraph about your new studio project from the perspective of a tourist who has chanced upon it. At this point it has been open for 10 years. Describe the approach.

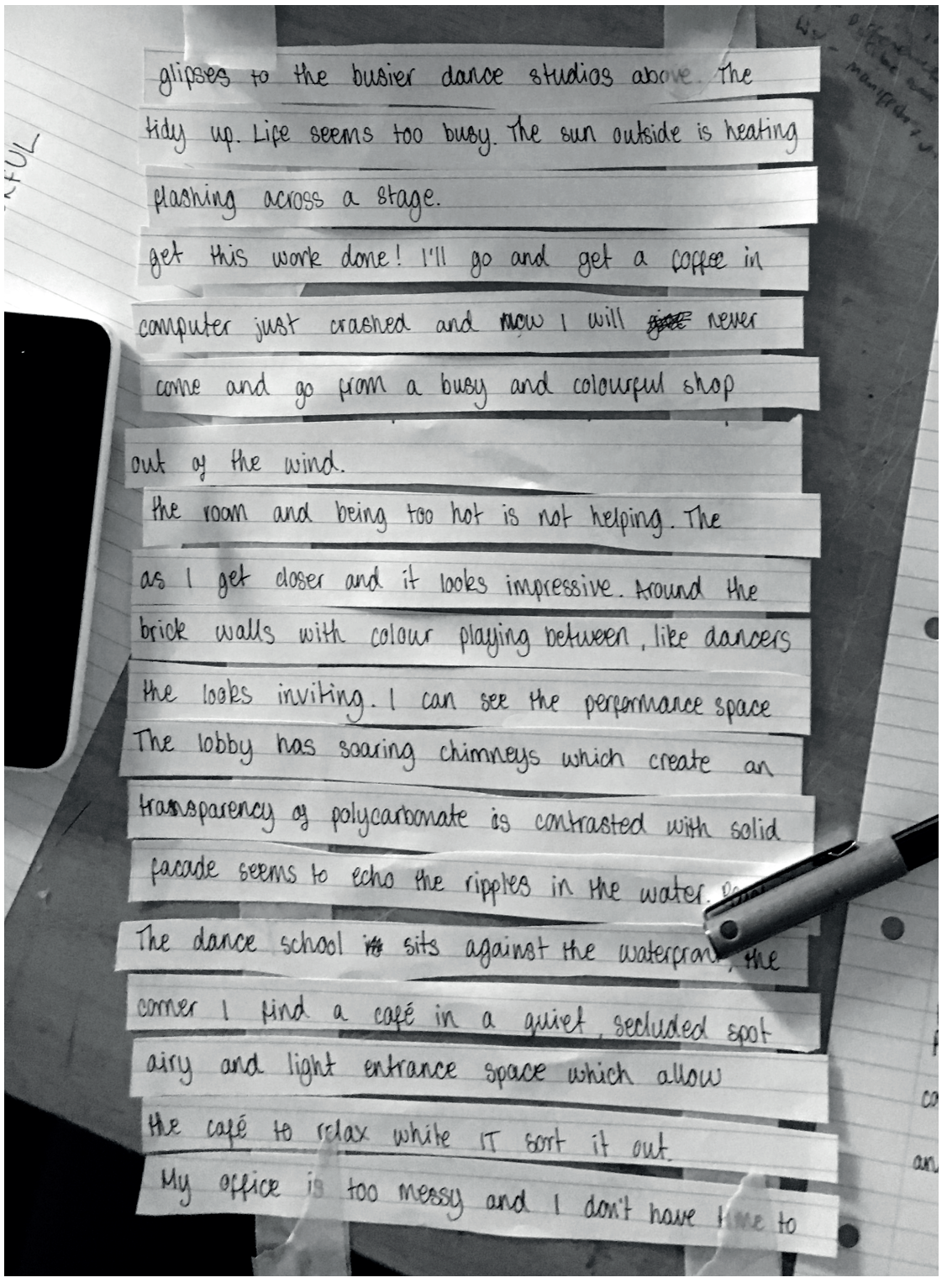
3. Write a short paragraph about your new studio project from the perspective of a user who is wrestling with a problem. Describe their workplace.

The workshop was recorded through photographs and notes, which provided the basis for the following analysis. Following the workshop, eight of the students involved took part in a filmed focus group, which offered further insight on how cutting and reassembling the narratives allowed new, relevant ideas to enter and attach themselves to the design process.

[Glimpses of the dance studios]

The first cut-up project to be discussed from the workshop is Glimpses of the dance studios (Fig. 30). Examining the cut-up it becomes apparent within the grammatical editing process how the student shifts the flow of the three narratives towards something that was more spatial and architectural and, in so doing, forms a series of J cuts between the narratives and their design process. An example of this can be seen in how Narrative 3, which was primarily about a computer crash, suddenly becomes part of describing a journey from a desk space, through a colourful shop and a light entrance space into a secluded café. Here, the narrative of the computer crash, which at first seems to describe a disappointing situation to discuss in the design of a building, suddenly helps form a spatial sequence (montage) that through a series of interpretations and a few grammatical adjustments sees new design-based ideas emerge.

Narrative 1, line 3
Narrative 3, line 2
Narrative 1, line 6
Narrative 3, line 5
Narrative 3, line 4
Narrative 2, line 3
Narrative 2, line 7
Narrative 2, line 5
Narrative 1, line 5
Narrative 2, line 4
Narrative 1, line 1
Narrative 1, line 4
Narrative 2, line 2
Narrative 2, line 1
Narrative 2, line 6
Narrative 1, line 2
Narrative 3, line 6
Narrative 3, line 1



Key words:

Material: Brick, Polycarbonate, Copper
Space: Lobby, Shop, Studio
Atmosphere: Airy, Busy, Colourful

Narrative 1

The lobby has soaring chimneys, which create an airy and light entrance space, which allow glimpses to the busier dance studios above. The transparency of polycarbonate as contrasted with solid brick walls with colour playing between, like dancers flashing across a stage.

Narrative 2

The dance school sits against the waterfront, the facade seems to echo the ripples of the water. People come and go from a busy and colourful shop this looks inviting. I can see the performance space as I get closer and it looks impressive, around the Corner I find a café in a quite, secluded spot out of the wind.

Narrative 3

My office is too messy and I don't have time to tidy up. Life seems too busy the sun outside is heating the room and being too hot is not helping. The computer just crashed and now I will never get this work done! I'll go and get a coffee in the café to relax, while IT sort it out.

Cut-up with corrections

Glimpses ~~to~~ of the busier dance studios above. The I can't wait to get this work done! I'll go and get a coffee ~~in now~~ while my computer just crashed and now I will ~~never~~ see ~~P~~people come and go from a busy and colourful shop out of the wind. T~~t~~he room ~~and~~ being ~~too~~ hot is ~~not~~ helping~~.~~ ~~The~~ and as I get closer and it looks impressive ~~around~~ with the brick walls ~~with~~ and colour playing between, like dancers~~.~~ t~~T~~his looks inviting~~:~~! I can see the performance space. The lobby has soaring chimneys which create ~~an~~ a transparency of polycarbonate ~~as~~ contrast~~ed~~ing with the solid facade seems to echo the ripples of the water~~.~~ which The dance school sits against on the waterfront~~;~~. t~~T~~he ~~C~~corner I find a café in a quite, secluded spot airy and light entrance space which allow the ~~café~~ me to relax while IT sort it out. ~~My office is too messy and I don't have time t~~

Fig. 30: 'Glimpses of the dance studios', photo of participant's cut-up from the Divergent Thinking Workshop (2015).

[Etching dance patterns]

Etching dance patterns (Fig. 31) sees significantly more editing take place between the cut-up text and the final grammatically corrected version. Here, the student takes the initiative to alter words, in places shifting to homonyms, misreading and then jumping across syntax to find new ideas within the text: 'Temporary' is shifted to 'temporality', 'glare' somehow becomes 'glimpsed' and negative words, such as 'difficult', are omitted. Here, the J cuts happen on the fly, as the student plays with and explores how the architecture might emerge through the text.

Returning back to the first example, Glimpses of the dance studios, it is interesting to observe how the additional stage of writing down the nine key architectural words impacts on the final cut-up. In terms of their initial distribution within the three narratives, only five key words are actually used. Four of these appear in Narrative 1, with the fifth word appearing in Narrative 2. Despite this, when the text is cut-up these can be found distributed relatively evenly throughout the new text, playing an important role in linking the new narrative back the design process. These 'architectural' words add to the strong spatial qualities within the cut-up evoking ideas, such as *'polycarbonate chimneys, which echo with ripples of the waterfront'*. Similarly, within a further example from a third cut-up, A dance studio in the Shadows, the material and the ephemeral come together to suggest spatial qualities of *'…shadows cast within the foyer, strong and create the need to jump and fall into a mirror'*. Interestingly, here the student discussed how this image made them want to play with angled mirrors and coloured light in order to get light refracting off of the canal water in a way that would give the dancers the sense of floating in the air.

In exploring the subtle syntactical shifts within the cut-up further it is useful to introduce Roland Barthes' examination of denotative and connotative meaning within text and images (Barthes, 1977). In the essay *The Rhetoric of the Image,* Barthes discusses the meaning carried by text as denotation, being obvious and common-sense, contrasted with the meaning carried by images, which acquire socio-cultural and 'personal' meanings through connotation. The connotation behind images, he goes on to suggests, allows for divergent readings of the same image (Barthes, 1977 p. 46). Considering Burroughs's interest in the cut-up's ability to produce new 'images' out of text through a process of interpretative variation, (Burroughs and Gysin, 1978, p. 5), we can deduce the cut-up's reduced reliance on the grammar that underpins English, which highlights distances the outcome from the denotative qualities of verbal language. This reduction provides the opportunity for connotative meaning to enter the process, allowing the reader to see mental images beyond those denoted by the text. Burroughs goes on to suggest that this freedom means the cut-up has similarities to an ideographic writing system, where the graphic symbol becomes open to interpretation and can, in this sense, be considered already cut-up (Burroughs and Gysin, 1978, p. 6).

Within the architectural design process as outlined in the context of the workshop, the fragmentation of text evokes a disruption in the denotative and a gradual shift towards the connotative function of the text, as the designer starts to see new images emerge. This does not mean the cut-up text loses all of its denotative meaning but that, in its fragmented state, connotative meaning enters its reading. As the designer reads the cut-up text the connotative possibilities allow for the merging of the two streams: the architectural design process, which preceded the workshop, and the introduced narrative, through a J cut formation that relies on the sliding between text and image; through the sliding between denotation and connotation. The balance between denotative and

Narrative 1, line 1
Narrative 2, line 8
Narrative 3, line 1
Narrative 2, line 6
Narrative 2, line 3
Narrative 1, line 2
Narrative 1, line 5
Narrative 2, line 7
Narrative 3, line 4
Narrative 3, line 3
Narrative 2, line 5
Narrative 3, line 5
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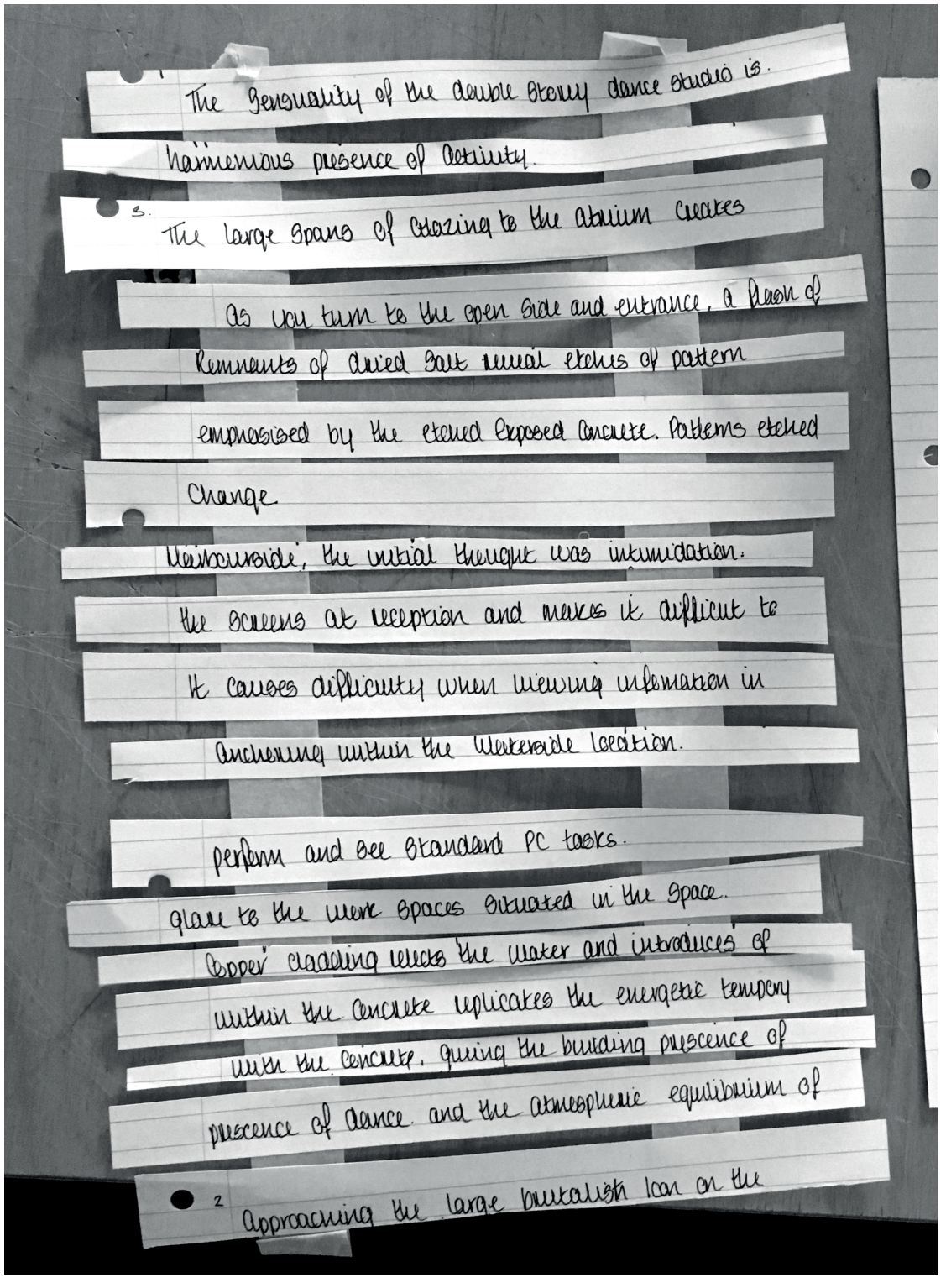
Narrative 2, line 9
Narrative 1, line 4
Narrative 1, line 6



Key words:

Material: Concrete form work pattern etch, Glazing large, Metal cladding (copper)
Space: Atrium, Double storey room, Treatment room
Atmosphere: Calming, Energetic, Sensual

Narrative 1

The sensuality of the double storey dance studio is emphasised by the etched exposed concrete. Patterns etched
within the concrete replicates the energetic temporary presence of dance and the atmosphere equilibrium of change.

Narrative 2

Approaching the large brutalist icon on the harbourside, the initial thought was intimidation. Remnants of dried salt reveal etches of pattern within the concrete. Giving the building presence of anchoring within the waterside location.
As you turn to the open side and entrance. A flash of copper cladding reflects the water and introduces a harmonious presence of activity.

Narrative 3

The large spans of glazing to the atrium creates glare to the work spaces situated in the space it causes difficulty when viewing information in the screens at reception and makes it difficult to perform and see standard PC tasks.

Cut-up with corrections

The sensuality of the double storey dance studio is a place of harmonious presence ~~of~~ and activity. The large spans of glazing to the atrium ~~creates~~ open ~~A~~as you turn towards the ~~open~~ side ~~and~~ entrance. ~~A flash of r~~Remnants of dried salt flash and reveal etches of patterns emphasised by the ~~etched~~ exposed concrete. These ~~P~~patterns etch~~ed~~ the changes~~.~~ to the harbourside, with the initial thought ~~was~~ of intimidation. ~~t~~The screens at reception ~~and makes it difficult to~~ frame ~~it causes difficulty when~~ viewing information ~~in~~ and anchor~~ing~~ it within the waterside location. See ~~p~~Performers and ~~see~~ standard PC tasks. ~~Glare~~ glimpsed ~~to the work~~ through spaces situated in the ~~space~~ copper cladding. ~~r~~Reflect~~s~~ing the water and introduce~~s~~ing a ~~within the~~ concrete ~~replicates the~~ energetic ~~tempora~~rylity presence of dance ~~and the~~ with an atmosphere of equilibrium ~~of~~ as you ~~A~~approach~~ing~~ the~~is~~ large brutalist icon~~. on the~~

Fig. 31: ‘Etching dance patterns’, photo of participant’s cut-up from Divergent Thinking Workshop (2015).

connotative meaning that the cut-up provides is something that Barthes also sees in drawing, due to its coded nature and abstract qualities (Barthes, 1977, p. 42-43). It is important to note that Barthes discusses drawing in the wider sense, beyond architecture, and therefore the codes he refers to do not explicitly concern orthographic drawing but rather how material is transposed from reality into a drawing, say using rules of perspective, how drawing necessitates the division between the significant and insignificant and, finally, how drawing requires an apprenticeship, which suggests its conventional nature (Barthes, 1977, p. 42-43). Marco Frascari expands on the importance of this exchange between descriptive denotation and the abstraction of connotation in architectural drawing, stating that whilst architecture exists in the world of the visible, drawing as a tool enables the intangible to be made tangible and the invisible to be made visible (Frascari, 1988, p. 14). The architectural drawing in its many forms, from the early stage concept sketch to the construction drawing can be seen as something that offers the design process varying degrees of denotative and connotative meaning. Here, the cut-up can be seen as something that is akin to concept sketching or diagramming. However, what makes it different from drawing is the way that cutting becomes an explicit form of divergence. This is articulated by means of cuts rather than lines, in a shift towards connotative meaning, which takes place through an architectural J cut, whereby a verbal sequence can be transformed into architectural images.

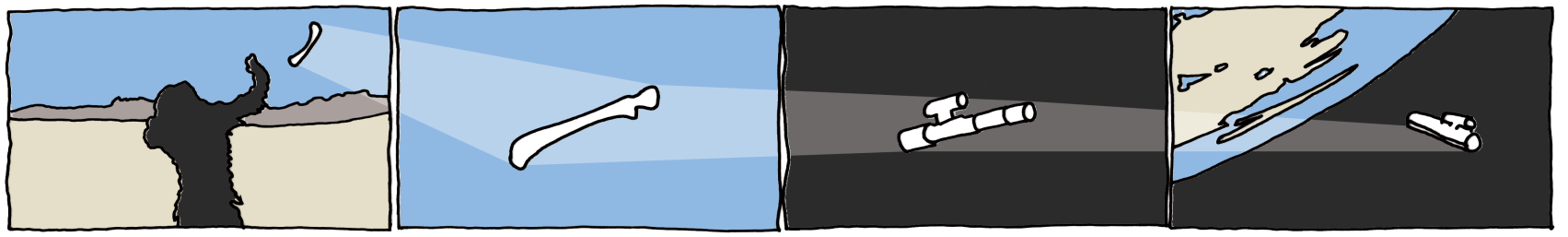
3.4 | Architectural match-cuts: The strip and the figure

Moving beyond the cutting up of text, the research started to explore whether a similar temporal process would transfer in the cutting-up of drawn architectural media. As previously discussed architectural media, particularly drawing with its use of conventions, can provide a designer with a means to read space in an abstracted form that presents certain similarities to text; in the coding of convention, as well as in the interpretative qualities of its reading. Drawing, however, differs from text in that its syntax and varying forms, from sketches to detailed plans, enable the designer to experience varying degrees of denotation and connotation across the design process. In the research, the various tests performed used a wide range of architectural media, from collages to concept sketches and digital CAD drawings. This enabled a wider exploration of how the initial levels of denotative and connotative meaning within drawings affected the designer's ability to read the cut-up. Of interest was whether in each test the denotative meaning could be disrupted to the point that the extracted connotative meaning was still of use to the designer within their process.

In the essay 'The Electronic Revolution', Burroughs draws parallels between text cut-ups and images (Burroughs and Weissner, 1971). He explores how words might be viewed as images in sequence, going on to suggest that these sequences might become altered by rogue words or images that act like viruses within a biological organism, capable of altering the *'cell structure'* of their host causing mutation (Burroughs and Weissner, 1971, p. 6). Burroughs further posits that words have not previously been viewed as viruses because they have *'…achieved a state of stable symbiosis with the host'* (Burroughs and Weissner, 1971, p. 5). What Burroughs' biological analogy offers is the possibility of understanding a process of signification that is enabled by representational media, be it words or image, as one of contamination. In this process, a seemingly stable, convergent system of meaning is contaminated with divergence. In the context of cutting up images the idea of the sequential steps of the design process being altered by means of divergent techniques through the reworking of media, offers the opportunity to reflect further on how an image can acquire a similar syntactical purpose to a word. Burroughs himself highlights the similarity between film and word as

being found in the unravelling of meaning through sequential ‘images’: words follow one another in the unravelling of speech as frames follow one another in film.

The match-cut is a particular type of filmic transition that enables the transition between two shots by graphically matching elements of the first scene with elements of the second scene. A now classic example of a match-cut can be found in Stanley Kubrick’s opening shots for *2001 A Space Odyssey*, where a bone is thrown by an ape and its graphical outline is matched with a satellite orbiting the earth (Fig. 32). Beyond the denotative graphical match-cut there is a further connotative match-cut occurring, as the transition from the bone to the satellite represents the advent zenith of tools.



scene 1

scene 2

Fig. 32: Example of a match-cut, drawn over stills from Stanley Kubrick’s film *2001: A Space Odyssey* (1968). From ‘Filmic Space’, MA Architecture thesis, UWE Bristol (Matthew Hynam, 2011).

[Oscillating between connotation and denotation]

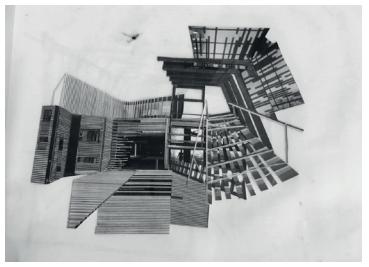
In the architectural cut-up, the match-cut can be located at the point where the designer is able to connect elements within the cut-up to the design process. As with the filmic technique these elements can be both denotative (graphical) and connotative (metaphorical). The first project discussed here was produced by a Masters of Architecture student who developed a series of architectural collages as part of a workshop at the University of the West of England, run by Dr Sophia Banou and I in February 2018. The workshop, which aimed to help students develop and detail spatial atmospheric ideas for their projects, used a selection of the divergent cards based on the cut-up technique to help the participants produce collages as visual cut-ups, instead of text using image-based media they had already produced or collected. These media included initial original drawings and photographic copies of spatial precedents, which we asked them to collect beforehand based on the atmospheric, material and other spatial qualities they wanted their projects to achieve. This Master's project for a film institute set out to respond to the three landscapes that surrounded the site in Bristol: The Feeder canal, a raised flyover road and the train tracks leading towards Temple Meads Railway Station. Prior to the workshop the student had decided to focus on the different speeds of the surrounding contexts examining how in the context of the film institute the varying temporal qualities of the surrounding sites might be reflected within the design of his project's facade. For the first hour of the workshop he focused on developing a standard collage from the media already collected. This resulted in a composite image made from a series of precedents with timber facade elements which could be read literally as an entrance perspective.

The second part of the workshop required the use of the divergent cards on the collage. After experimenting with several of them the student found the card prompting *Dissect elements and storyboard in perspective as a short film, reassemble* as the most useful. In order to undertake the prompt, a process of analysing the initial collage against the building programme was undertaken. As key parts of the user's journey were drawn out as a series of spaces, the match-cut process can be identified where forms within the existing collage are matched connotatively to the building programme. Following this, the collage was carefully cut by dissecting into distinct elements. At this point the cutting process itself moves from the connotative to the denotative with the emphasis on cutting out visible forms within the surface of the collage rather than linear strips, in a conscious attempt to reveal new forms. The cut-out pieces were then set out on the table before re-positioning. Consideration was taken to understand how one form flowed into the next with each piece being offered up and tested by rotating and overlapping with another until a match was found. The match here has again moved back to the connotative in becoming concerned with the relationship between the collage and its the programmatic spaces of the design.

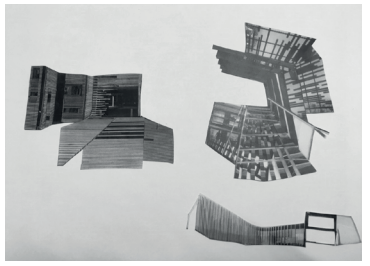
The final form of the collage (Fig. 33 opposite) was a linear composition reading from left to right as an abstracted storyboard of a user's journey around the building. The abstraction here allows for further divergence to creep into the reading of the collage as the eye follows a number of paths across the surface with further match-cutting occurring where floors, walls and ceilings switch in order for the spatial sequence to be interpreted. The student's comment following the workshop was that *'the process enabled a very unique way to visualise and work on intangible and qualitative elements of the building that would prove difficult to manifest in orthographic or more literal forms of drawing'*. What is interesting within this example of an architectural match-cut, is the way the process lends itself to interpretation by the user. The application of the cut-up on a film-inspired design project no doubt helped with this, especially regarding the initial temporal ideas surrounding

the facades. However, during the cut-up process the project quickly moved beyond this initial idea and proved itself useful as a divergent technique for oscillating between connotative and denotative meaning. Returning to Burroughs' ideas of the cut-up as a virus we see that when viewed as an architectural match-cut, the visual cut-up is capable of providing a divergent contamination of an otherwise stable design process. After cutting, it comes down to the designer's skill to read the image both denotatively and connotatively in-order to sequentially match and unravel the meaning until it connects back to the design process.

Initial collage



Photocopied processed collage



Collage after storyboard separation

Final collage

Fig. 33: Photographic collage sequence showing the divergent manipulation of the initial collage using the Divergent Deck. Produced by a Masters of Architecture student as part of the Atmospheres design studio workshop, run by Sophia Banou and Matthew Hynam. (2018)

[Drawing from Fragments]

The second project to be discussed in conjunction with the architectural match-cut was undertaken by an undergraduate architecture student during the development of their final year design studio project at the University of the West of England. The project for a dementia care facility in a disused quarry in Salisbury used a number of the Divergent Deck cards to explore possibilities in the early stages of the design process. The particular divergent prompt discussed here; *Print, cut into strips and randomly rearrange* was performed at a point when the designer wanted to shift away from an early iteration of the building plan that had taken on an overly linear approach to setting out the spaces. The issue with this layout was that it did not create a core centre for the proposal that would allow the dementia patients to gather and feel at home. The plan had come about as a result of trying to translate a spatial adjacency drawing, which showed the flow of uses around the building, directly into a plan. A short film of the process was made as part of the Divergent Deck series and a link can be can found in Fig. 34.

The approach to the performing of the cut-up technique differed significantly from the Master's student discussed previously. While in the previous project the designer had carefully cut-out forms within his collage, driven by the figural interpretation of the cut-up, here, the student returned to more 'traditional' cut-up approaches, cutting her spatial adjacency drawing into uniform parallel strips, akin to that of the text-based cut-ups of Burroughs. When we consider the drawing in its syntactical form as something that has an equivalence with text it is important to first consider how a drawing is read. In both cases, the text and the drawing, the cut does not take into consideration the content of the material being cut. However, whilst the majority of western text forms are read from left to

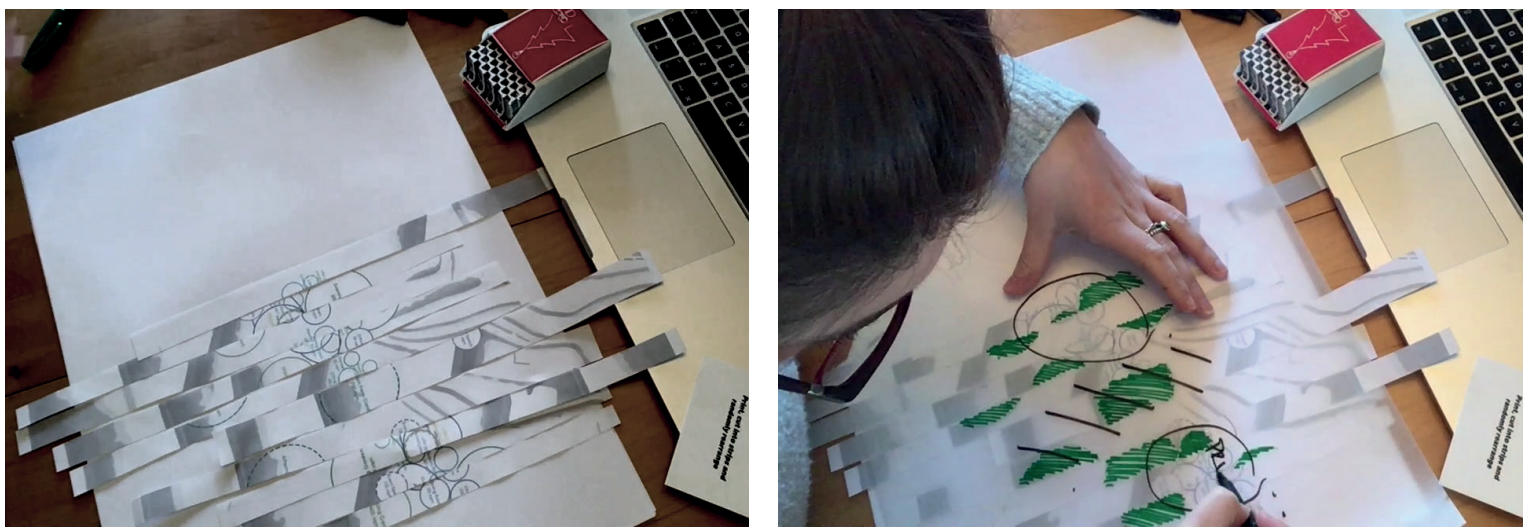


Fig. 34: 'Print, cut into strips and randomly rearrange', filmic stills from the Divergent Deck film. (Left) Image showing cut-up forms. (Right) Image showing process of tracing over forms (2017).

right, this is not the case with a drawing. Drawings are not read sequentially but instead read as a graphical field. If in Burroughs' technique the parallel strips of the cut coincide with the linear form of the verbal text, the drawing's field condition calls for a panoptic reading, which is further disrupted by the linear, sequential cutting of the divergent prompt. The cutting of the drawing into strips, therefore, caused a far higher level of disruption to the syntax than with a text-based cut-up. To cause a similar level of disruption to a text-based syntax would require the cuts to fragment words rather than just the sentences.

Moving beyond the cutting of the drawing it is critical to examine how it is then read in its fragmented state. In the use of the cut-up, she performs the operation twice cutting the same drawing vertically and then again horizontally. Following this, both iterations of the cut-up are traced over. Here, the process involves drawing out onto the trace significant lines and hatching other areas. In this example of the architectural match-cut, the process of matching material back to the design process occurs in the additional stage of tracing after the cut-up has been performed. In the Master's student approach the architectural match-cut started whilst cutting the collage. What is of note here, is how the student treated the cut-up like an image rather than a drawing that is loaded with orthographic syntax. What we can see here is that, along with the fragmentation of the syntax, there is a shift from drawing to image. With this shift there is a loss of the denotative meaning and an increase in the connotative meaning as the designer attempts to interpret it within the wider context of the design process.

Within this process the act of tracing becomes critical to understanding the connotative meaning and the ability to match forms and ideas back to the design process. The qualities of tracing, as an architectural technique for exploring divergent media is explored in later chapters; however, what is important here, is its ability to filter and capture the divergent thinking occurring between the cut-up and the existing design process, ultimately enabling an architectural match-cut to occur.

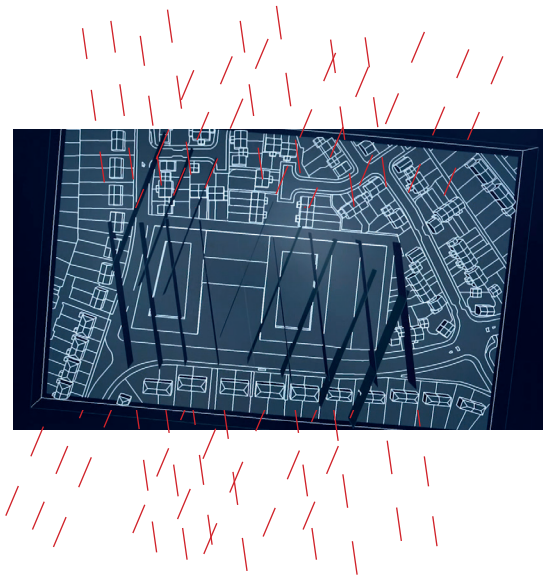
The matches formed on the surface of the trace between the cut-up and the design process echo what Dali describes as a double image, discussed earlier in this chapter. A well-known example of this is Dali's painting 'The Hallucinogenic Toreador' (1968-1970), which combines symbolism and optical illusions to convey his wife's dislike of bullfighting. Staring at the painting the viewer is drawn into images within images, including a pool of blood from a dying bulls head, which doubles as water and a beach landscape on which a figure is afloat on a raft. Within the architectural match-cut the double image has a temporal quality and can, therefore, be seen as the threshold between past and future elements of the design process. This threshold occurs before the tracing process starts and, as with Dali's double image, it is seen in the eye of the designer before '*…the slightest figuration or anatomical modification*' through tracing. Rather, as Dali continues, it *'is at the same time the representation of another absolutely different object, itself also devoid of any kind of deformation or abnormality betraying some arrangement'* (Dali, 1930, p. 116). The transition across this threshold is carried out as the designer starts to modify the image through what Dali (1930, p. 116) equates to as their *'skill and cunning'*, creating something new by pulling across forms that resonate with the wider design process, at which point the architectural match-cut is complete.

3.5 | Architectural jump-cuts: the cut as architectural figure

[Bristol Community Centre]

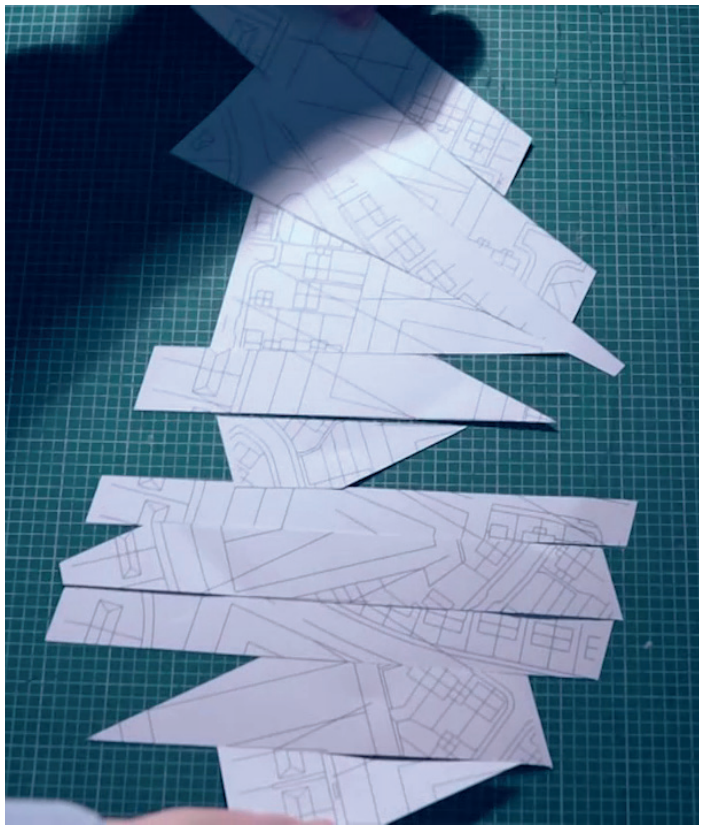
The third and final example of the match-cut was performed by myself, whilst looking for alternative layouts for a community centre in Bristol. Here, the initial layout plan, which was drawn out over a digital OS (Ordinance Survey) drawing in CAD, was found to be unsatisfactory in the way that it sat within the existing site context. This was because the surrounding context consisted of two storey terrace and semi-detached houses, which were much smaller in scale than the proposed community centre. In a different approach to the cut-ups performed in the previous projects, grid lines were placed over the site in CAD as a guide for cutting the drawing (Fig. 35). Grids are conventionally used in architecture to understand the size and functionality of spaces and how far structure might span. Architectural grids are explored in greater detail in Chapter 4 (Pixelate: p. 97); however, here the grid is used in a non-conventional manner, in order to understand the scale and grain of the wider context rather than as a means to start setting out the proposal on the site. The resulting grid is made up of two different sets of parallel lines, which run diagonally across the drawing from top to bottom crossing each other at points. The predetermination of the cut-lines reduced the possibility for the designer to follow shapes and forms within the original drawing, whilst cutting, as was the case in the first match-cut discussed. The cut lines here also provided a more structured approach than cutting the drawing into strips as was the case with the second match-cut example. What the gridded cut lines represented was an additional layer of syntax that connected the cuts to an idea of scale for the new proposal. The intention was that when the cut-up was re-assembled, these cut lines along with the fragmented drawing would help with clarifying the scale of the new proposal. In this way, the grid became of the mediating layer of an architectural match-cut, helping with the transitions into a new proposal.

1. Grid lines.



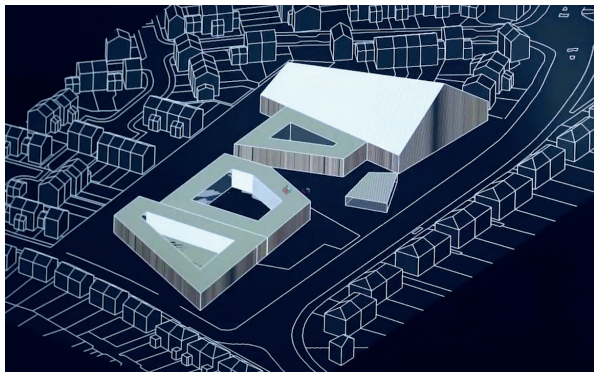
Following the cut-up the pieces were placed face down on a desk and then randomly re-assembled. The resulting composition was then scanned back into the CAD computer package where it was carefully placed under the OS drawing as a digital layer. Care was taken here to make sure that the scale of the cut-up matched the scale of the digital OS. The aim was to not distort the scale of the cut-up and allow the fragments to provide a useful reference between the context and the site. Within this process the architectural match-cut was performed by placing a piece of tracing paper over the computer screen. Following this, a process of carefully tracing through elements that appeared to be useful was undertaken. The act of tracing within architecture is discussed further in the later chapters for its ability to enable divergent techniques; however, it is important to consider how, in this case, the tracing paper in front of the screen created an opaque layer that obscured some of the information that could be seen. From this, it was interesting to see how the shapes traced through were not just made up of the context and initial proposal lines. Instead, through the obscuring process, the cuts lines that emerged from the underlying grid structure, had suddenly gained prominence, being traced as part of the drawn material. Here, the syntax of the scaled grid, used to help cut the initial drawing and aid the matching of forms, had through the subtle opacity of the tracing paper, contaminated the design process beyond its initial function. The cut shifted from an explicit technique for fragmenting and randomising the drawn content on either side of it, to becoming part of the new emerging material.

2. Cut-up of plan.



3. Reassembly of plan.

4. Insertion of sketched form using both the lines of the drawing and the grid lines.



5. Final proposal extruded from cut-up

Fig. 35: Cut-up design process for the Bristol Community Centre. Filmic stills from the 'Cut-up' exhibition film for 'Leap!', at the *Design Research Symposium*, UWE Bristol (2015)

To consider further the importance of the cut highlighted within the Bristol Community Centre project, it is useful to return to filmic syntax and, in particular, to a technique for transitioning between scenes that makes the cut itself more explicit. This transition technique, known as the jump-cut, has already been referred to at the start of the chapter through Beck and Dorrian (2020, p. 110), with regards to its ability to control temporality. Unlike the J cut and the match-cut, the jump-cut breaks with the rules of continuity editing and makes the viewer conscious of the cut itself. A jump-cut sees successive shots of the same subject varying slightly in camera position causing the transition to appear as a visual jump. This deliberate breakdown in the continuity of the filmic process is often used to convey emotions or instability. In order to prevent accidental jump-cuts, directors employ the 30 degree rule, which suggests that two successive shots should vary in angle by no more than 30 degrees, '*...because such a shift does not draw attention to itself and is logically motivated within the narrative*' (Hayward, 2005, p. 416). Jump-cuts are often caused by the director deliberately removing frames from a sequence where the camera is moving, or action is occurring. Jean Luc Godard famously used the jump-cut to great effect in the film Breathless (1960). An example of this within the film takes place when as one of the main characters, Patricia, leaves the New York Herald Tribune to meet up with Tolmatchoff, she jumps from the left middle ground of the frame where she is looking to cross the road to the centre foreground of the frame. There she pirouettes in front of a car with Tolmatchoff at the wheel (Fig. 36). This specific example of the jump-cut breaks the cutting rule known as 'eye trace', as defined by Walter Murch, which indicates that the viewer's eye should be able to easily track and anticipate the movement of objects between scenes (Murch, 2001). Murch suggests disrupting the viewer's 'eye trace' risks making them *'disorientated and annoyed without knowing why'* (Ondaatje and Murch, 2002, p. 41). Within this example Godard skillfully frames a car passing through the shot in the same direction as Patricia, helping the viewers eyes to reconnect with Patricia following the jump.

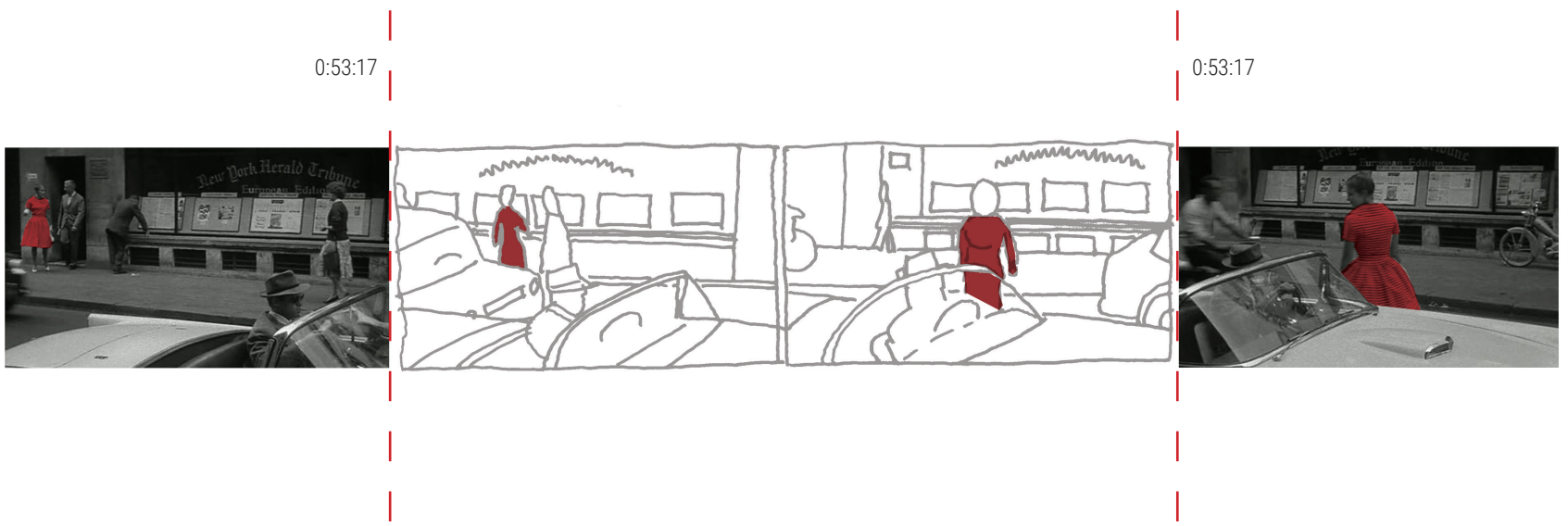


Fig. 36: Jump-cut, drawn from stills from Jean-Luc Godard's *Breathless* (1960). Demonstrating missing footage through sketching and the disrupted (cut) movement of Patricia's figure in red.

Examining further the role of the cut within the cut-up technique for architecture, it is possible to start drawing equivalencies with the jump-cut. Like the filmic jump-cut, the cut of the plan in the Bristol Community Centre project provides a temporal break, that combines a continuity of viewpoint with a discontinuity of duration (Davidson, 1997). In effect, the cut occupies the missing frames preventing the designer from seeing the panoptic view of the drawing whilst temporarily detaching them from the design process. At this point, the designer is unable to trace denotative or connotative meaning within the cut-up and therefore needs to actively look for alternative possibilities. In this instance, placing the tracing paper over the computer screen allows the designer to start a process of looking for new forms within the cut-up. As in the filmic example of Breathless, the car passing through the frame in a similar direction to Patricia aids the eye trace and her reattachment following the jump, In the cut-up the momentum connecting to the next scene is initiated by the designer's knowledge of the existing design development. This momentum is carried forward by the skill of the designer, who is required to simultaneously consider the existing whilst tracing through the new. Here, the jump cut sees new connotative meaning emerge as shapes are prescribed potential roles within the designer's mind. Continuous working on the trace sees elements of denotative drawing syntax appear such as walls between inside and outside spaces. The process completes at the point when a new panoptic drawing field emerges. It is important then to note how the jump-cut, in both film and architecture, relies on leaving a trace on the eye: in the film, it creates a visual jolt, whilst in the architectural equivalent it emerges within the final drawing field. In the latter, its explicit nature is such that it contaminates and intertwines with the fragmented syntax passing through the trace indistinguishably, unless consciously recorded, into the new drawing.

[A dance floor and a zip line]

So far the exploration of divergent thinking through the cut-up has made explicit techniques that are often hidden yet familiar to the architectural design process. These latent techniques are, however, through the cut-up framed in new ways by drawing analogies between these divergent moments and filmic transitions. Whilst we have already seen in the Bristol Community Centre project evidence that the identified cuts are not mutually exclusive and can operate together, we have yet to see how these might work in sequence as a wider temporal divergent composition. The final project for this chapter sees the introduction of a further iteration of the cut-up developed by William Burroughs and Brion Gysin, known as the 'fold-in' and used extensively within their poem 'Minutes to Go' (Burroughs and Gysin, 1978, p. 22) illustrated in Fig. 37. Instead of physically cutting the medium, the fold-in sees two different narratives folded down the centre perpendicularly to the text and then placed together. The result is a new narrative where the reader is required to visually jump between the narratives every time their eyes cross the centre of the page. Whilst the technique fragments the line of text by breaking it in half, some continuity is retained by the fact that the reader returns to the same narrative every half line. If we were to compare this to a filmic transition we might see the fold-in as a 'parallel cross cut', where the director keeps cutting between two sets of parallel action. Burroughs specifically compared the technique to a filmic flashback, enabling a writer to move backwards and forwards between different text (Burroughs and Gysin, 1978, p. 51). However, due to the undirected randomness of how the folds meet, it makes more sense to consider the folds not as a cross-cut or flashback but again as a jump-cut, where crossing the narratives them sees the reader jolted, exposed to the technique and attempting to transition multiple narrative streams.

A key advantage of the fold-in technique over the cut-up is that it allows the designer to simultaneously work with both images and text. This can be seen in ‘Minutes to Go’ (Burroughs and Gysin, 1978, p. 22). There, the folds are made explicit and transformed into a grid by tracing over them with a calligraphy pen. Within this grid sit combinations of images and texts that enable the reader to scan across a fold and between media. Burroughs describes the importance of the grid in both its latent and explicit calligraphic form as something that helps the human mind plot movement across the fold, acting as a cellular scaffold for controlling visual material and, by extent, controlling meaning (Burroughs and Gysin, 1978, p. 26). In this sense, the grid has some similarities to the grids used in the cut-up of the Community Centre project, which also helped control and mediate between the cut and the drawing’s syntax.

Fig. 37: ‘Minutes to Go’, fold-in collage (William Burroughs and Brion Gysin, 1978).

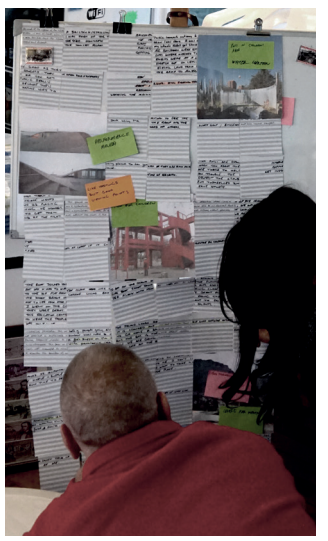
[Memories of Birnbeck]

The iteration of the fold-in technique tested in the following project drew from an earlier workshop for the design of a pocket park in Southmead, Bristol (Fig. 38). The Birnbeck Pier project built upon this earlier workshop to produce an additional mapping component. The workshop, which was aimed at developing a strategy for how Birnbeck Pier and Island, a dilapidated Victorian pleasure pier in North Somerset, might be redeveloped for the 21st century, brought together designers and members of the Birnbeck Trust, who are charged with overseeing the restoration of the pier. The pier has lain in ruin since the early 1990s and it is still currently at a critical point where it needs to be restored or left to the mercy of the 14-metre tidal range of the Bristol Channel, which visits twice a day. The pier and island have generated significant historical and cultural memories over the last 150 years, such as the singing of Welsh mining families who would journey to it on paddle steamers, every Sunday during the prohibition of alcohol (1881-1961). During its heyday, the island amassed a large range of Victorian attractions including an airship chairoplane, a helter-skelter, a hurry scurry, a switchback railway and a water splash. Many of the current trustees have strong memories of what it was like to experience the pier and island. These memories have come to generate a number of ideas of how the attraction might be redeveloped. However, these memories have not been able to create a coherent strategy for how the attraction might be redeveloped in the 21st century. Previous attempts to develop a strategy have seen an international RIBA competition, held in 2007, which resulted in some useful ideas but mostly a series of unrealistic propositions (Fairs, 2007). A series of complex issues with ownership of the island and raising funds has subsequently left the attraction to decay for another decade.

Fig. 38: Fold-in test from a workshop for a pocket park in Southmead Bristol (2016). (Left) Image showing the assembly of individual narratives into a grid. Right image: showing the mining of the assembled images.

In 2017, I ran a year-long Master of Architecture studio that invited students to develop plans for a contemporary film institute on the island, alongside a secondary programmatic use that they would establish and develop with the trustees (Hynam, 2017). Alongside the film institute the studio produced proposals for the reintroduction of an RNLI lifeboat station, a steam punk theme park, a cathartic retreat and a new jetty for Bristol Channel ferries. The ambition of the studio was to generate a greater understanding of the site and its potential future use. The results were mixed with some students really engaging with the geographical and social complexity and others simply skirting around it and producing similarly unrealistic propositions to the earlier architectural competition. During this time the trustees continued to fixate on their own individual ambitions and remained unable to produce a coherent vision for the future. This was not surprising due to the sheer complexity of the project.

The purpose of the fold-in workshop was to bring together the trustees' ideas and, through a process of writing narratives and performing the fold-in process, to develop a collective understanding of the project. Taking place on site, within the pier master's pavilion overlooking the pier, the workshop began with a review of visual material amassed over the years, including the studio projects on the redevelopment of the pier. This material was presented in a printed format as a series of squares, which could be worked into the fold-in narrative grid. Following a long discussion, the workshop moved on to getting the trustees to produce new narratives, drawing on both their memories and future ambitions. Having the trustees generate the divergent material differed significantly from previous workshops, where this had been performed by the designers. Of interest here was whether this would alter the nature of the fold (cut) and whether it would consequently be possible for a designer to make sense of the transitions between the various trustees' narratives. Burroughs' own experience of testing the fold-in saw him conclude it by crossing the folds between two different narratives, which, thus, became inextricably mixed, challenging authorship in wonderfully articulated question: *'So, who owns words?'* (Burroughs and Gysin 1978, p. 48). This possibility that new ideas might emerge as one narrative transitioned into another and that the ideas generated would not be solely attributable to one trustee further supported the potential of the process leading to a unified vision.



Text mined from the fold-in by the trustees of Birnbeck Trust

from over the coffee I see the causeway

something is still moving on the island

the contemporary intervention rises up over steepholm

the last facade peers

the joy of solidity whilst the backwind whistles through the timber shuttering

the original reveals how the islands architecture starts to open further

the life boat shoots out across the channel

I saw the pier of the mist and thought I could write a good murder story

the architecture and sea view meet up like mirrors

the boat docked whilst the tide was low and the bar was thriving between the planks

Link to Master of Architecture studio film exploring the proposals made by students for a contemporary film institute on Birnbeck Island (2017).

Fig. 39: Trustees of Birnbeck Trust participating in the fold-in workshop.

The narrative writing began by giving each trustee a squared piece of lined paper with a vertical mark down the middle. We then asked the trustees to take five minutes to write out a narrative, based on a given scenario. This process was repeated four times, drawing from the following scenarios:

1. You are a young child, it is half term and you are visiting the island via a boat for the first time. Describe what you are most excited about seeing?

2. You are a student in a wheelchair studying at University Centre Weston; you take time out to visit the pier on a rainy day describe your experience?

3. The island is open to the public and the RNLI (Royal National Lifeboat Institution) have returned. As a member of the local community describe the interaction between the visitors and the lifeboat.

4. You are a Birnbeck Trustee and its 2037. You arrive for an evening meeting. Just before the meeting starts you look out the window what do you see?

The scenarios were designed to get the trustees to shift away from their own ambitions for the island and think about the future of the attraction. On completion, the narratives were folded down the centre. The columns of text were then stacked and shuffled along with the visual media selected by the trustees earlier in the workshop. This material was then randomly re-assembled into a patchwork grid. The trustees were then invited to examine this new patchwork of text and highlight the passages that they found resonated with them. From this emerged a series of short sentences (Fig. 39) that helped them discuss the project and its potential programme.

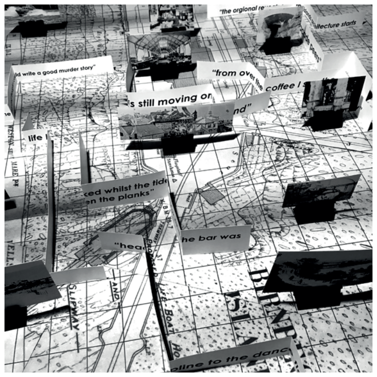
Interestingly, the highlighted sentences had certain characteristics in common. Firstly, they all related to the context. Secondly, they all hinted at how architecture might intervene within the island: suggesting the framing of views, the interventions' profile against the island, the sound that the intervention might make, how the existing might reveal the new. The role of the image within the wider patchwork of the fold-in at first seemed unclear. Unlike the text, which was highlighted and showed connection across the folds the images were left untouched. Discussing with the trustees their significance within the patchwork of folds it became apparent that they were actually triggering a wider connotative reading that did not fall into the lines or grids of the process. Instead, the images transcended the grid and were being drawn in from the wider panoptic field to help the trustees interpret and transition text as it crossed the folds. Whilst inserted into the wider patchwork of the folds, the images resisted being read in a textual linear manner. Instead, they sat above the grid capable of shifting and aligning beyond their physical position to aid the interpretation of meaning. This iteration of the fold-in demonstrates how images can potentially help with the transition between different narratives, smoothing out but not eliminating what I have previously described as an architectural jump-cut. In effect, the images operate as an eye trace, establishing a chain of thought that leads the reader across the transition. The eye trace, in instances, also operates through architectural match-cuts. An example of this was the homonymic shift from 'pier' to 'peer', aided by an image with lots of openings, where views could be seen beyond it. In addition to this, an interesting finding of performing the fold-in technique in this way, is how it helps develop a further understanding of the significance of the grid within divergent processes. As with the cut-up grid in the Community Centre project, the grid here, too, helped connect adjacent media across the folds;

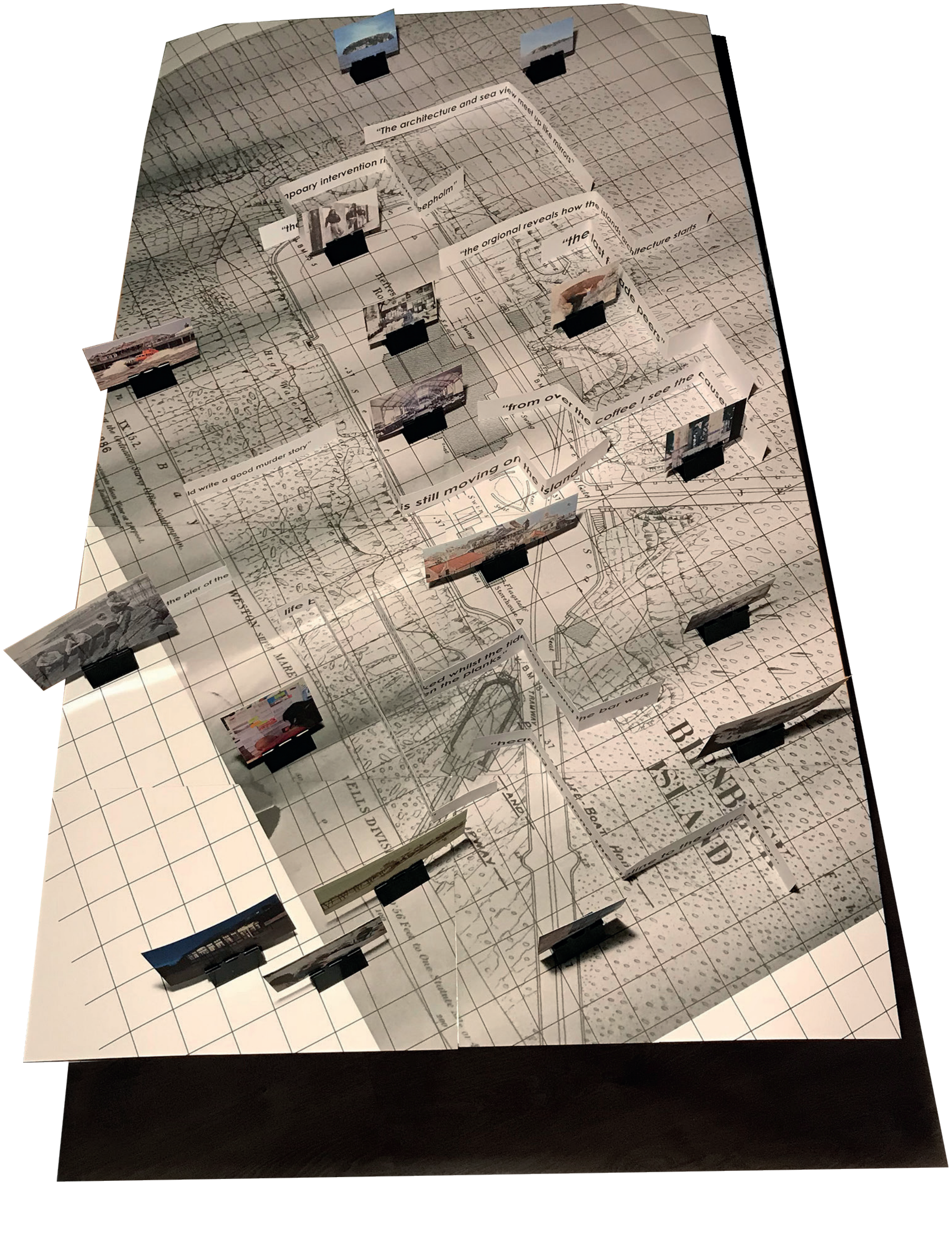
however, it was also possible to pass over the grid and look for connections between media within the wider field of the fold-in's patchwork.

Following the narrative workshop, I continued to examine the findings of the fold-in, this time developing a physical text and media-based map. This three-dimensional map used an 1886 survey of the island and pier as a base. The survey was specifically chosen as it showed the attraction in its heyday. On the map's surface a grid was established to help with positioning the media and with allowing it to fold and stand perpendicular to the base surface. The literal separation of the media from the grid built on the earlier finding that, at times, the reader could jump across the grid and make connections beyond the textual left-to-right flow of the media. During the making and composing of the map, clues were taken from the text to help situate it as close to its topographical location as possible, forging spatial associations between the narrative and the physical context of the pier and island.

As an object, the map re-introduces the text into the spatial context of the island whilst continuing to look for new juxtapositions between text and image. On walking around the map, the folded text and images continued to collage and juxtapose creating new sentences, which restarted the search for new narratives and clues towards a potential architectural form within the viewer's mind. The final map can then perhaps be seen as a 'installation/drawing' as defined by Banou: a situated spatial practice that although installed in three-dimensional space operates in a representational rather than simulative mode (Banou, 2016a). By means of its spatial allocation the text, which stands vertically against the lateral map surface, can be read in multiple configurations depending on the viewpoint. Its instrumentality, however, relies both on its spatial and its textual/linguistic qualities. Combined then with the poetic nature of the text, the map can also be considered as a three-dimensional 'concrete poem': an arrangement of linguistic elements in which the typographical effect is more important in conveying meaning than verbal significance. The spatial unfolding of the text through its 'modelling' proposes a three-dimensional exploration akin to French poet's Stéphane Mallarmé technique (2011), as exemplified within 'A Throw of the Dice will Never Abolish Chance' (1896), which played with the tension between words and the way that they were displayed on the page. What emerges then from the map is not simply an iteration of the fold-in technique, neither a three-dimensional manifestation of 'concrete poetry' nor an 'installation/drawing' but a new hybrid medium. This hybrid medium, which maps the site three-dimensionally using text and images, continues the enquiry into the value of the grid and introduces us to the divergent possibilities of mapping processes, which will both be explored further in the following chapters.

(Opposite page) Fig. 40: 'A dance floor and a zip line', three-dimensional paper composition (2018). A mixed-media map exploring an iteration of William Burroughs & Brion Gysin's fold-in technique, driving an enquiry into the value of text-based divergent architectural thinking.




“The architecture and sea view meet up like mirrors”
“the orgional reveals how the island
“the last
architecture starts
“from over the coffee I see the cause
ld write a good murder story”
is still moving on
the island
the pier of the
ed whilst the tide
on the planks
the bar was
ISLAND

3.6 | Conclusions

The iterations of the cut-up technique within this chapter helped form a temporal understanding of how divergence can enter and alter the design process. Key to this understanding was the cut-up's temporal nature, which led to possibilities of reordering and distilling material beyond its original syntactical form. In particular, the explicit presence of the cut was critical in also gaining a syntactical understanding of how divergence enters the design process, expanding the discussion into a filmic syntax of cuts, which were examined as an analogy with design thinking through a series of architectural design projects. In these projects, acts of dissecting, fragmenting and reordering both text and image-based media, took on a distinct spatiotemporal character revealing a serial process of iteration, which is common in architectural as well as non-architectural design thinking. All three, the cut-up as a divergent technique of composition, the filmic transition and the process of architectural design are non-linear but, yet, sequential in form and operation. As such, these processes contain (more or less explicit) temporal syntaxes that enable conceptual shifts.

The conceptual shifts emerging within these cases of expanded architectural cut-ups rely on the designer's ability, afforded by the process itself, to navigate connotative and denotative interpretations of the material at will, or perhaps through *'skill and cunning'*, as Dali suggests (1930, p. 116). This interplay between the connotative and the denotative function of the media allows for an interchange between text and image, akin to the associations between verbal and visual found in text and film, to enter architectural thinking. This is evident in projects where the cut-up is anchored to more explicit forms of architectural expression, such as the first workshop projects (see pp. 70-76) that directly address the design process by introducing key words. But, it can also be seen in conscious misreadings of the material, such as the homonym shifts in words seen in the same projects as well as the visual appropriation of forms in the Masters student's alternation between floor and ceiling components (p. 78-79). All of the image-based cut-up projects exhibited similar conceptual shifts, where the designers were able to match and thus reinterpret, either denotatively or connotatively, elements within the cut-up material back into their design processes.

It was also found that the divergence entering the design process through cutting the drawing was affected by how the cut was performed. Whilst cutting text parallel to its flow maintained a syntactical coherence within the newly composed material, cutting a drawing in this way had a far greater impact on its syntax. This was due how drawings are read not in parallel lines but as a panoptic field. Generally, within the various projects, techniques that helped retain more of the denotative meaning and a balance with the connotative meaning included considering the cut as a collage-like process, where the designer would actively look for forms within the drawing and cut around this. In those cases, the cut material remained more recognisable to the designer following reassembly, with much of the interpretation and potential for divergence taking place at the point where the collaged fragments met one another. Another similar technique, which sought to transfer some of the denotative meaning of the drawing into the cut-up form, was seen in the insertion of the grid. This process, particularly seen in the Community Centre project, helped with establishing a scale for the proposal and also provided direction for the cutting process itself. Taking this a step further, in the Birnbeck Pier project the use of a grid allowed for a structuring of text and images. Despite the seeming rigidity of the grid it was possible for the designer to see past it when necessary, making connections between media beyond their immediate adjacencies and reading conventions of scanning in lines left to right. Leading on from this understanding came the development of a mapping technique that took the ideas of the fold-in to propose a new three-

dimensional ‘installation/drawing’, capable of further exploring the divergence between text, images and grid.

A further finding from exploring how the denotative meaning might be altered within the cut-up was the discovery of how the cut itself performed as an agent of contamination within the design process. Parallels with the filmic jump-cut as a technique, which contaminates the filmic sequence by exposing itself to the viewer, were useful in observing how the cut itself moved from a functional element of a process to a formal intervention. Within the Community Centre project, the contamination of the design process from the cut became part of the resulting proposal when it was traced over. This in part can be put down to the cut being assigned a syntactical meaning of its own in the form of the grid, which helped match the proposal with its context. However, the act of tracing and the effect of the obscuring nature of the media should not be overlooked, as an existing architectural technique that has the potential to alter the meaning of media placed below it.

The application of the cut-up within design has seen a number of the characteristics of this text-based technique transfer into the field of architectural design. Here, the temporal aspects of writing were found to enable new possibilities of reordering the media beyond its original drawn conventions and syntactical form. The architectural applications of the process, like its text-based equivalent, provided the means for the designer to alter the balance between denotative and connotative meaning enabling processes of matching and jumping between media and ideas. The field condition of drawn media rather than the linear structure of text meant that the application of cutting could take on new divergent possibilities and, depending on how the designer enacted the cutting, could increase or decrease the levels of divergence entering the process. Lastly, the cut became part of the drawings figural manifestation taking on the role of the line. The cut, although introduced here from artistic production and film, once situated within architectural contexts amplifies and reveals the leaps that remain latent but inherent in architectural design practice: narrative, temporality and interpretation are only functional here because architectural thinking already involves them.

Leap Two

4 | Pixelate: The image between the drawings

This chapter discusses how the process of pixelation can lead to divergent thinking and the emergence of new ideas, through a series of design projects. Pixelation, here, refers to the effect of individual pixels within a digital image becoming visible to the eye as a grid of squares. Pixelation is often associated with low quality images, which are degraded to the point that they lose their definition and reveal their underlying digital structure. This visual restructuring of an image sees its original meaning lost through a reduction in information.

Within this chapter the pixelation of an image and the obscuring that it entails is explored as a process that is able to provide new meaning. Pixelation, here, is proposed as an action that can be applied to architectural drawings in order to transform them to the point that they are temporarily removed from their original meaning while, importantly, still carrying the structure of their original form. The 'original form' of the drawing/image, here, refers to the information put down by a designer when constructing the drawing, including line work, use of conventions and the embodied thinking process.

The projects discussed here have been extracted from the wider body of design research carried into the investigation of creative divergent thinking at the threshold between media. Within these projects, I and other designers examine pixelated images and attempt to process them back into drawings through an iterative process of working through design problems. Iterative processes have been discussed within earlier chapters of this thesis with regards to their importance in allowing reflection and action within the design process (Schön, 1982). This chapter places focus on the iterative process that follows the pixelation of an image, which is structured as a series of thresholds between the designer and the image. At that stage, the image becomes a threshold between an initial drawing, an emerging drawing and the structures and contexts that each one is derived from. The notion of the threshold, here, refers to the cognitive separation between the designer and the original media and the physical separation between the various stages of signification of the drawing, both of which are achieved through the act of pixelation. Within this definition, the physical refers to the way in which drawings are broken down and obscured by the pixelation process. Here, obscuring relates to a common phenomenon within media where pixelation is used as a process to make elements of an image, such as a face, unrecognisable to the viewer. The cognitive separation refers to the way in which the original meaning behind the drawing is removed by the distortion and therefore syntactical decontextualization that the pixelation produces. This threshold and the emergence of new drawn concepts that it enables is the focus of this chapter. The examination of the pixelation action through these projects has resulted in the structuring of the chapter into three distinct dimensions:

Translate: Structure revealed

Transform: From drawing to image

Transcribe: The return to drawing

4.1 | Slipping, moshing, diverging

Beyond architecture, the pixelation of images for creative endeavour has become a key part of the artistic genre known as Glitch art. 'Glitch', which is believed to have originated from the Yiddish glitsh,' meaning 'slippery place', was popularised by NASA astronaut John Glenn during his Mercury orbital mission of 1962 (Fig. 41). Here, Glenn used the term to describe technical issues encountered during the mission (Holmes, 2011). Whilst Glenn's glitch may appear as a slippery place of terror, glitch art on the other hand would appear to be a slippery place where one can visually slip between the media and the digital distortion to find new material. New media artist, Nick Briz defines Glitches within art as: *'anytime an artist intentionally leverages (a) moment, by either recontextualizing or provoking glitches'* (Briz, 2015, p. 5). Briz points out that the important part of glitch art is the intentional practice of using digital or analogue errors to either corrupt digital data or physically manipulate electronic devices. Similarly, Rosa Menkman (2011, p. 2) proposes that digital media offers a series of membranes where an artist must constantly try to move between them in order to remain creative. Here, however, she highlights that this is becoming difficult in the face of technologies allowing increasingly noiseless movement between media. Here, Menkman (2011, p. 9) proposes the glitch as an exoskeleton to progress where its ability to interrupt a process and shift it away from its original form continues to enable moments of creativity to occur.

A common visual effect of the corruption of digital data in the form of images and video files is the pixelated image. Video artists Owi Mahn and Laura Baginski pioneered a sub-genre of glitch art, known as 'datamoshing', after discovering pixelated errors within digital video they had captured (Haridy, 2017). Datamoshing is a technique used to compress two videos together and remove their keyframes so the videos' pixels 'bleed' into one another (Fig. 42). The effect of these videos on the viewer would appear to be twofold: firstly, a heightened awareness of the underlying digital structure and, secondly, the potential for glimpsing interesting juxtapositions between images within the scrambled frames.

Fig. 41: (Left) Image of Astronaut John Glenn, who popularised the term 'Glitch' during his Mercury orbital mission of 1962.

Fig. 42: (Right) Filmic still from Takeshi Murata's *Monster Movie* (2005), showing datamoshing through the removal of keyframes.

At this point I started to investigate whether architects had already used pixelation as a means to generate architecture. An example found was Mr House by Marin-Trottin of Périphériques architects (Fig. 43). Here, the design process saw Marin pixelate images of the initial site, a sloping orchard, and then use the images to develop the buildings façade. The result of this within the final design being a series of chromatic pixels that helped blend the house into the site (Trottin, 2003, pp. 210-221).

Whilst this example was intriguing, the translation of the pixelation process seemed very literal and specific to the individual project, with its focus on the development of a façade that blended into its surrounds. Pixelation, here, was not about creating a novel one off solutions but for allowing the design process to contain a divergent 'slippery place', where new ideas could be generated. A paper by Matthew Austin and Gavin Perin tilted 'Drawing the Glitch', which examined the potential of introducing glitches into the production of architectural drawings, proposed such possibilities (Austin and Perin, 2016). Within the paper they explore redrawing Ludwig Mies van der Rohe's (1929) Barcelona Pavilion using a set of digital survey drawings by Kieran Patrick (Fig. 44). The output is four images, which each have a different glitch performed on them. The paper finds that in interpreting these the designer is not presented with a singular option and instead it is '*… dependant upon the individuals capacity to interpret and spatially reconcile a reworking of the surface representation of what the surface of the drawing originally represented*' (Austin and Perin, 2016, p. 18). A key part of the glitch, here, seems to be the breakdown of the drawing and, in so doing, the distortion of drawing conventions, line work and the designers embodied thinking. This infusion of the drawing with divergent possibilities enables the designer to use their agency to reinterpret them.

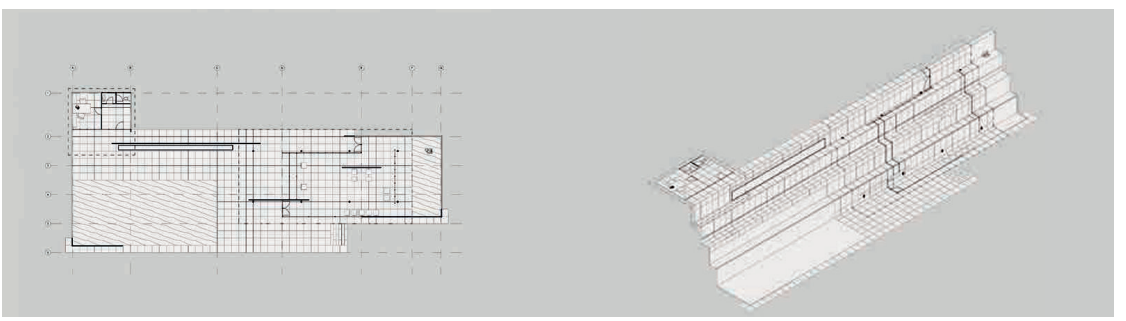


Fig. 43: (Top) Images showing 'Mr House' by Peripheriques Architectures (2002). The initial site, an orchard, was captured as a digital image and pixelated. This was then used to generate the form and façade (Marin Trottin, 2003).

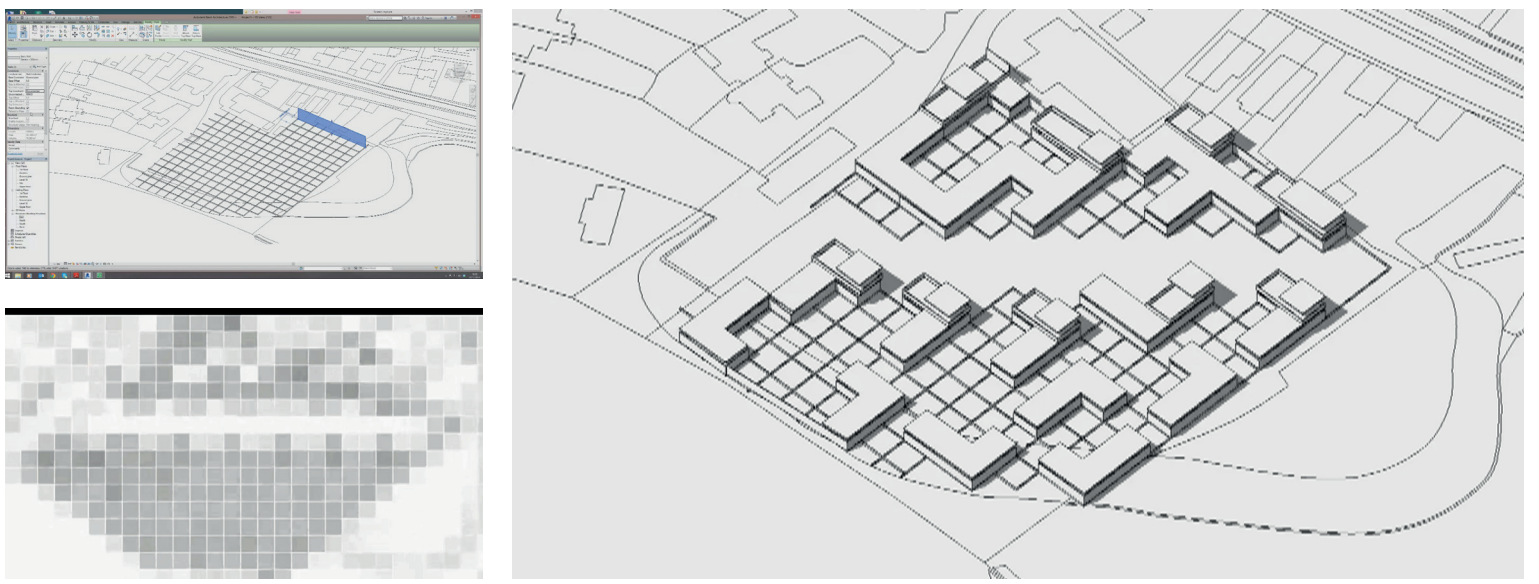
Fig. 44: (Bottom) Kieran Patrick's glitched drawing of the Barcelona Pavilion. From 'Drawing the Glitch' (Austin and Perin 2016, pp. 14-19).

4.2 | Translate: Structure revealed

Pixelation has been part of my exploration of divergent tools from the outset. Initially, it was seen as an action within a proposed mobile phone application that saw a designer use the phone camera to capture a creative block (Fig. 12, p. 43). The app would randomly perform one of the six actions on a captured image and present this back to the designer to translate. To translate is most commonly associated with moving something without altering it (Simpson, 1989). However, architect and educator Robin Evans points out that during the activity of translation within languages *'…things can get bent, broken or lost on the way'* (Evans, 1997, p. 154). Evans argues that a similar process occurs during design and that rather than a problem this a necessary part of the process for the designer. Evans goes on to suggest that *'something similar occurs in architecture between the drawing and the building, and that a similar suspension of critical disbelief is necessary in order to enable architects to perform their task at all'* (Evans, 1997, p. 154). This *'critical disbelief'* lies in architectural drawing's ability to create the opportunities for the designer to step away from a convergent step by step process and allow divergent possibilities to the translation process.

Developing on this understanding of translation it is relevant to consider the etymological origins of translation into the Latin terms *trans-*, meaning 'across, beyond' and *lātus*, meaning 'borne, carried' (Harper, 2001). Within the pixelation process the idea of something being carried across and beyond is related to the way in which the designer moves from the pixelated drawing onto the reading of a new drawing within the same material. During the translation the designer continues to draw on the abstracted elements from the original drawing, whilst generating new material that carries the designer beyond their original creative block. This has been observed in a series of projects carried out in the context of this research, which will be discussed in the following pages. In particular, the earlier projects demonstrate how this emerging new material can be derived from the way that pixelation produces a grid, acting as a visual structure for the designer to translate from.

In architecture, grids are commonly used to help designers rationalise elements within a project. Structural, functional or aesthetic, grids provide frameworks for bringing a design together. In the projects that follow the importance of the pixelated grid can be seen in its operation as a threshold device for translating the image. The first test of pixelation took place within an RIBA architectural competition for a series of retirement homes called Re-imagine Ageing (RIBA, 2012). The competition provided the opportunity to test whether the action would be useful in generating initial concepts. Early in the design process I became stuck on the layout of the homes, whilst drawing them up in CAD. I seemed unable to resolve the increased detail of the geometry when translating the drawings from my initial hand sketches onto the computer (Fig. 45). At this point, I used the pixelation action on the CAD drawing. The resulting image was a pixelated grayscale drawing, which was interpreted by myself as an alternative way of situating the homes across the site. Interestingly, the resulting pixelated image also shed light on a way of potentially varying the heights of structures across the site, by translating the darker pixels as taller structures and lighter pixels as lower structures. The effect on the design was pleasing and made a proposal that helped the overall mass relate to the context and human scale. Whilst pixelation in this test affected primarily the plan and contributed towards a appropriate and creative response to the design brief, the reading it remained very literal. The process is reminiscent of the Mr House façade, where the pixels created a grid structure that was simply superimposed onto the original plan, helping translate earlier hand-sketched ideas into CAD. The process did not radically alter the perception of the scheme, yet, it provided a critical balance between convergent and divergent thinking.



Beyond the app, pixelation continued to be developed as a divergent process because of its ability to obscure an image, providing a designer with the potential to examine it for new meaning. This obscuring effect was found to have correlations with the existing architectural practice of tracing over a drawing, and in particular the way in which tracing paper as a translucent media alters the drawing it is placed over. The type of tracing discussed here differs from the tracing to make a copy of a drawing and is instead about tracing with the intention of exploring new ideas. Marco Frascari expands on this type of tracing and looks at the idea of transitus *'…which refers to the viewer's mental journey across an image in the act of interpretation'* (Frascari, 2007, p. 30). Transitus is made possible by two distinct qualities of tracing paper. The first of these qualities is the translucency of the paper and its ability to allow drawings to be layered. Interestingly, Frascari refers to the paper in the Italian as *sotto-lucido,* which translates simply as under lit. This suggests a light source emanating from behind the paper when it is actually just light refracting within its translucent thickness. The second quality is the paper's structure made up of *'crossing fibres'* of wood or cotton, which gives it its cloudy texture that creates a layer between the designer and the underlying trace. Frascari suggests that these qualities within the medium of trace enable designers to alter their gaze *'…beyond the visible into infinity whereby something new of the invisible is encountered'* (Frascari, 2007, p. 32). Here, Frascari is suggesting that trace is capable of producing a threshold space between the eyes of the designer and the media being traced over. Tracing paper, here, provides a divergent medium for the designer to translate ideas between layers allowing certain elements to be pulled across and reworked and others to be discarded.

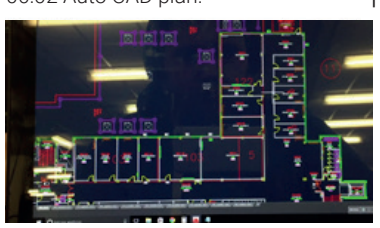
Returning to the digital, parallels can be drawn between the screen based divergent pixelation process and the translucency and obscuring qualities found within tracing paper. Translucency starts with the computer screen which as a device is made up of layers. At the back is a light source the digital *sotto-lucidi*. On top of this is the layer of LEDs (Light Emitting Diodes), which, as a grid of pixels, illuminate to create images depending on input from the computer's GUI (Graphic User Interface). In the case of the first test, the GUI is being controlled by the image editing software

Fig. 45: 'Re-imagine Ageing': pixelation (2012). stills from short film showing the pixelation divergent action in use on an architectural competition. (left) Pixelated image created in photoshop and (right) model created in Revit).

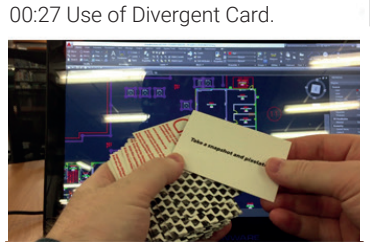
application Adobe Photoshop. Within Photoshop it is the image size dialog box that allows for the PPI (Pixels Per Inch) within an image to be increased or decreased. Unlike the pixels within the screen, which are fixed in number, the PPI within a Photoshop image can be increased or decreased. One of the many practical applications of being able to increase or decrease the number of pixels within an image is to allow a user to optimise an image so that it can be of a high enough resolution to maintain the sharpness of an image whilst maintaining a manageable file size. It is commonly understood that images designed for screen use need to have at least 96 PPI so as not to appear pixelated (Microsoft, 2005). Within the process of pixelation described here, going below the threshold point of 96 PPI is where a type of digital translucency equivalent to that found in tracing starts to occur. Here, the translucency lets the designer see through the image between the layers of the LCD grid and the enlarged pixels within the image. Continuing to lower the PPI further increases this digital translucency and starts to see a separation between the image and its digital structure. Lowering the PPI further sees the image obscured with a gird of squares, the digital equivalent of the crossing fibres found within tracing paper. This obscuring brings in the idea of Frascari's transitus and sees the designer looking between the image on the screen and the pixels that make it up in order to interpret new meaning. Here, the digital pixelation process has an advantage over its analogue equivalent in that it has the ability to alter the size of the image pixels allowing the eye to juxtapose between different variations of pixel densities. The process, which is performed using the Adobe Photoshop pixel size dialogue slider, sees the designer moving up and down in scale looking for shapes to emerge and provide new options to trace over.

This process of looking between the image whilst adjusting the pixel size can be seen in the second test discussed here by an architectural designer working for the universities estates team. Here the designer tests the Divergent Deck and makes a short film about his experience (Fig. 46). Within the test film the prompt is used when the designer is faced with a creative block, whilst reworking a floor plan, for an existing university building he has been tasked with refurbishing. The designer captures a screenshot of the CAD drawing he has produced and brings it into Photoshop. He then proceeds to pixelate the image and use the slider to adjust the pixel size. The result is a series of mosaic like frames within the film that juxtapose each other through the scales.

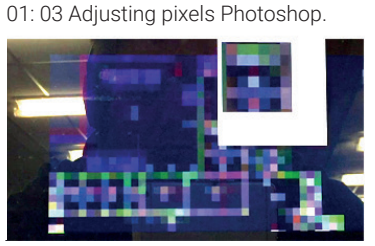
00:02 Auto CAD plan.



00:27 Use of Divergent Card.



01: 03 Adjusting pixels Photoshop.



01:15 Image discussed on review of film.

Fig. 46: 'Take a snapshot and pixelate' (2017) Stills from the Divergent Deck film (2017).

Within their film commentary, the designer suggests they did not find the test useful in this instance, and that perhaps they should have looked at the result in a more abstract way. Whilst the emergence of a new idea did not occur in this instance, having some understanding of the project's aims and watching the film retrospectively, I was able to consider the mosaic patterns differently. Watching the film again, the live process of pixelation can be seen as producing an effect similar to datamoshing, whereby the pixels seem to morph the drawing up and down in scale. These enlarged pixels could be interpreted as an open plan layout, where the corridor is removed and low height walls are introduced or, alternatively, the mosaic pattern could be read as voids into a space below. On later discussing the film with the designer, they became interested in these alternative readings suggesting that both the open plan and void options could be viable options to explore within their project. Returning to Matthew Austin and Gavin Perin's (2016) text, this exchange reminds us of the agency of the individual to interpret and translate the drawing back into the design process.

4.3 | Transform: From drawing to image

The verb to transform is concerned with operations of changing, altering or converting (Simpson, 1989). The word originates from transformare, which means to 'change in shape, metamorphose', from trans- 'across, beyond' and formare 'to form' (Harper, 2001). In the context of this section, transformation is concerned with the alteration of a drawing's original meaning, following the pixelation of its image as purely visual form. This is a change in both form and content. The concept of transformation expands on the proposition that material is both lost and generated during pixelation as an act of translation. This section examines specifically how pixelation provides a re-coding of the drawing as image into pixels. This removes the explicit syntax of architectural drawing and allows the designer to read the image in a purely formal way. In this way, this process introduces more prominently the agency of the designers' interpretation in the transformation of the image back into a drawing.

[Collective pixelation]

I will discuss this through the example of another design project; the entry for the international competition Yeats 2015, organised on the celebration of the poet W.B. Yeats' 150th Birthday. The competition saw me bring together a group of past and current architecture students from the University of the West of England to develop a joint entry for the competition (Yeats 2015, 2015). While working on the project, the group used the five divergent actions of the earlier mobile phone application and an additional action to *Introduce new media*, using a dice to randomly introduce one of the actions when creatively blocked.

The site for the competition was the Lake Isle of Innisfree within Lough Gill, County Sligo, Ireland, where Yeats spent his summers as a child and which he would later reflect on in his twelve line poem of the same name.

The Lake Isle of Innisfree

I will arise and go now, and go to Innisfree,
And a small cabin build there, of clay and wattles made;
Nine bean rows will I have there, a hive for the honey bee,
And live alone in the bee-loud glade.

And I shall have some peace there, for peace comes dropping slow,
Dropping from the veils of the morning to where the cricket sings;
There midnight's all a glimmer, and noon a purple glow,
And evening full of the linnet's wings.

I will arise and go now, for always night and day
I hear lake water lapping with low sounds by the shore;
While I stand on the roadway, or on the pavements grey,
I hear it in the deep heart's core.

(Yeats, 1908).

The competition brief called for designers and artists to propose a *'…poetic intervention for the island of Innisfree which will mediate between Yeats' poetic vision and contemporary architectural ideas'* (Yeats, 2015). During the design process it was interesting to see how in a large group and with lots of discussion we only needed to use the divergent actions a few times. This was because we were solving problems quickly and effectively by discussing them and offering each other different options on how to tackle them. When the actions were applied, it was also interesting to see how they were performed away from the group on an individual basis, when a designer was blocked on their particular task and wanted to test an idea. After a designer had completed the action they would feedback the results to the group, where these were either absorbed into the ongoing design process or rejected. This individual use of a divergent action has correlations with how Brian Eno and Peter Schmidt envisaged the use of the divergent prompts Oblique Strategies (Taylor, 1997). During an interview with Spencer Kelly for the BBC technology show Click, Brian Eno discussed the difference of working creatively within a group as opposed to working creatively alone:

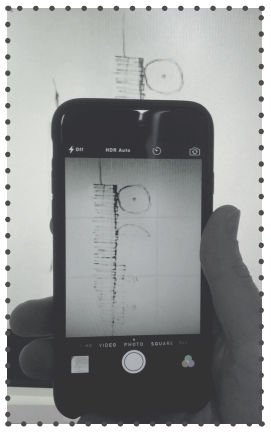
If you're working with other people you get a lot of information and derailment. If you're working alone you can very easily get into a rut where you are just routinely doing the same things over and over, going to the same.

Brian Eno, BBC Click (2018, 00:22:51)

Brian Eno goes on to suggest the prompts could act as a sounding board to test an idea and potentially provide an individual within an alternative insight into how to proceed. This testing process is clearly about establishing the validity of the idea for the individual. In the competition, the use of the actions, similarly saw the validity of the propositions tested at both the level of the individual and the group, as the outputs of the action were absorbed back into the project. In *Designerly Ways of Knowing,* Nigel Cross also highlights the divergent value of group work. In the chapter 'An Example of a Creative Leap', Cross suggests that a creative leap occurs when one of the designers suggest a design concept that is *'…quickly taken up by the team, and the other members collaborate in developing the concept into a fully fledged design'* (Cross, 2006, p. 66).

Within the design process for the competition an important decision regarding the form of the proposed intervention was the outcome of the use of the pixelation action. Pixelation was performed on an initial sketch section, which proposed a series of concave structures that provided contemplation places for visitors to stay on the island (Fig. 48).

Fig. 47: Scaled image of main board for the Yeats competition (2015). Travelling from the jetty causes a shift back through time. The step down onto the small boat forces the viewer to see the island of Innisfree in the memory state that Yeats wrote his poem.



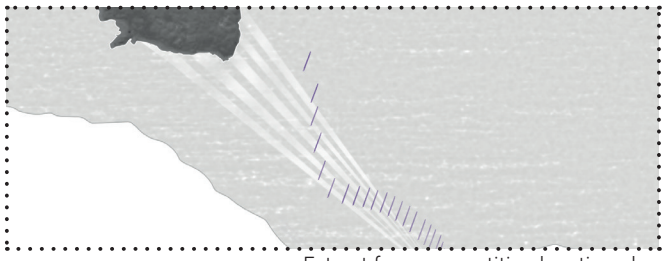
Capture scanned section with phone camera

Update screen with phone camera image

Capture image with phone camera again

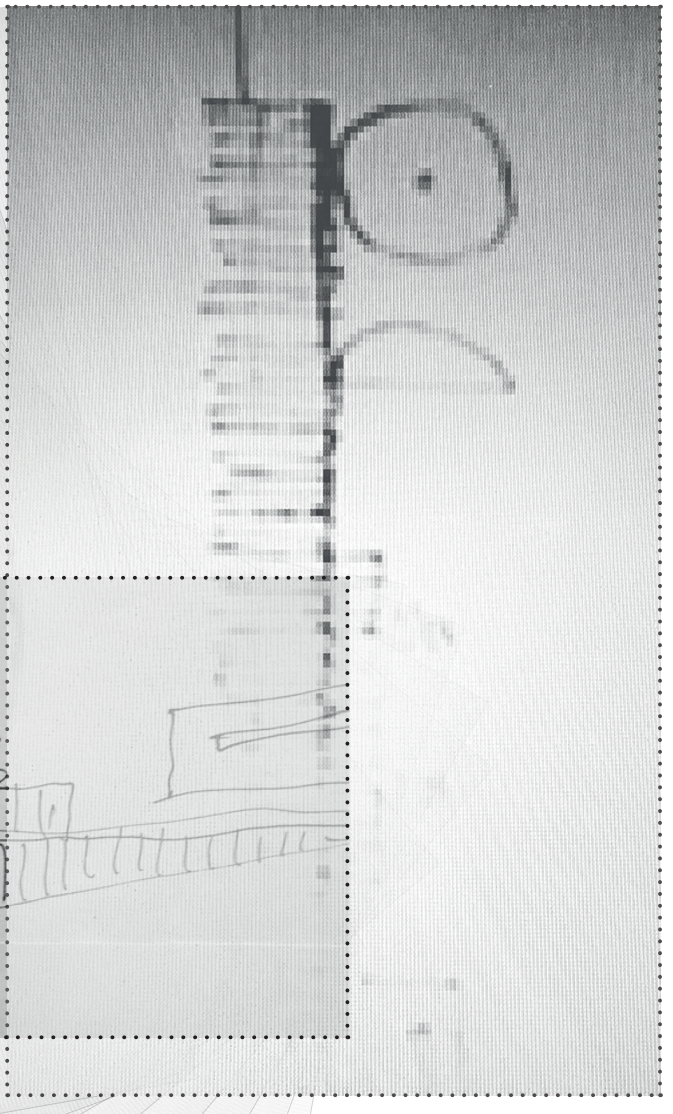
Update screen with phone camera image

Repeat until new forms emerge



Extract from competition location plan
The purple lines on this plan mark a trail of interventions leading out towards the Isle Innisfree which were inspired in form by the breakdown and curves of the emerging pixelated plan.

Emerging plan



Scanned section

Fig. 48: Leap between a section and plan. Performed through repeatedly digitally photographing a drawing of a hand drawn section on a screen, until its original syntactical meaning is lost in the mind of the designer, at which point the designer leaps and reinterprets the section as a plan. Part of the Yeats competition (2015).

The group felt that the ideas behind the section were too detached from the poem and the context of the island, evoking the use of the divergent action. Pixelation was not carried out in Photoshop but, instead, by manually photographing the section and then re-photographing the photograph of the section. The process resulted in the section becoming increasingly degraded and pixelated with the pixels within the screen becoming visible as a grid and starting to distort the image. The decision to repeat the pixelation process over and over was made spontaneously, as each time the process was performed, the remnants of the section became more and more intriguing. This manual process of repeatedly pixelating a drawing has similarities with the live preview slider in Adobe Photoshop used in the earlier tests. Within this test a second dice action was added to help the designer if stuck reinterpret the emerging material. Using a four-sided dice proposed to the designer a spatial component promoting the interpretation of the material as a plan, section, elevation or three-dimensional view. Throwing the second dice here resulted in it landing on the plan side which had an immediate effect on my reading of the section. Suddenly, I realised that the section no longer read as a section but instead it had been transformed into a plan.

During this process the section's syntax had been removed, challenging its original meaning. This syntactical removal combined with the second dice's spatial proposition of plan enabled the questioning of the section and the realisation that it might be read as a plan to emerge. Despite this I still had in the back of my head a grasp of its syntactical meaning. This distancing, rather than removal is what allowed me to transform the image back into section and connect it into the wider project as a context of origin. The drawing that had started to emerge suggested a curved path that stretched out towards the island. This new plan based intervention departed from the competition brief which proposed placing the intervention on the island and instead became about creating an experience of the poem whilst travelling to the island.

A critical dimension then of pixelation lies in the shifting of the drawing into an image and its reinterpretation as a plan. In the essay 'The Third meaning', Roland Barthes proposes that images contain three orders of meaning: the informational, the symbolic, and the signified: the emotion-value. The informational and the symbolic fall into the obvious meaning, whilst the signified: falls into the obtuse. The obvious meaning can be seen in images, which are completely clear with their meaning and have no ambiguity within the frame as to what is being communicated. The obtuse meaning (The third meaning), on the other hand, is disguised and not possible to characterize through language.

Returning to the section for the competition, it becomes clear that even though this is an early sketch and open to some interpretation, the use of drawing conventions means that the meaning behind it is obvious to the designers within the group. Upon pixelation, the obvious meaning of the section became obscured as the drawing conventions were removed over its illegibility as drawing and its consequent transformation into an image. This provoked the designer to pursue an obtuse meaning. According to Barthes, the obtuse meaning *'… extends outside of culture, knowledge, information: analytically, it has something derisory about it: opening out into the infinity of language…'* (Barthes, 1978 p. 55). The continued pixelation sees the eye drawn into an ever-more fragmented image until the pixels themselves start to produce forms and shapes that combine together to produce a new meaning. Finally, the obtuse meaning can be seen as *'an accent, the very form of an emergence…'* (Barthes, 1978, p. 62). Accent, here, being concerned with part of a code emerging within the pixelated form that is not yet syntax but allows the designer to start a transformation process back into a drawing.

The plan was developed further by the group through other architectural drawings and by introducing elements such as movement and colour to convey the experience of the island, through Yeats' childhood memories to potential visitors. The integration of this transformed drawing into the design process as a key driver of the masterplan offered a first point of validation, enhanced later by the entry's 'high commendation' by the judging panel, for its creative response to the brief (Yeats 2015, 2015).

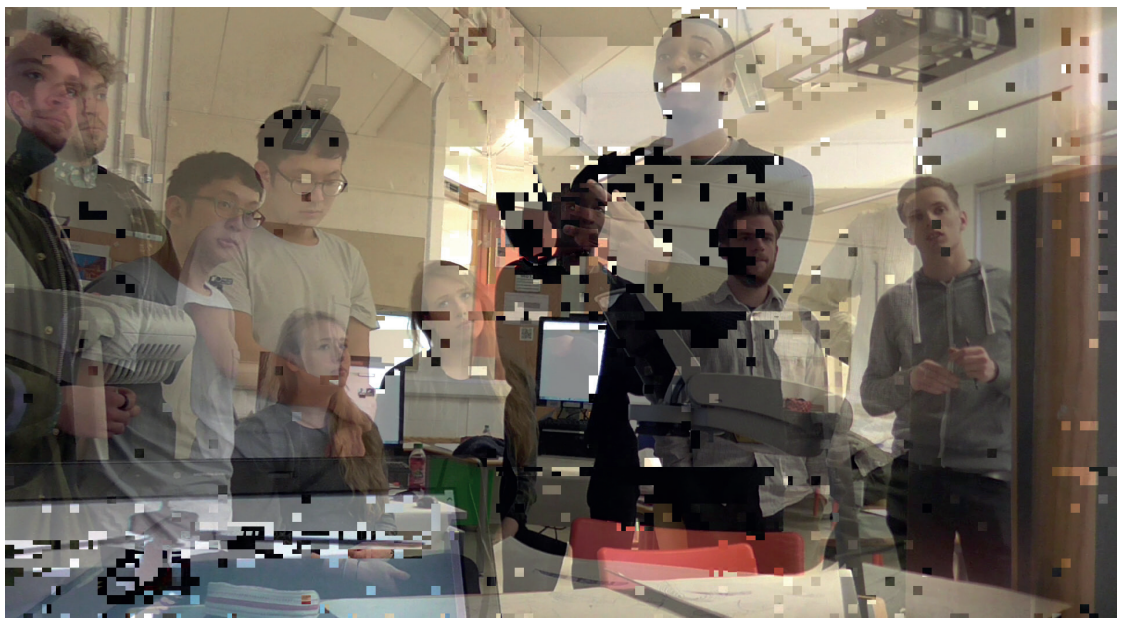


Fig. 49: Competition team working on Yeats competition (2015). Filmic still revealing a pixelated multiple exposure due to accidental moshing, caused hard disk data corruption.

[Pixelation tool]

Attempting to explore the possibility and effects of pixelation beyond its digital screen context, I developed a series of three-dimensional pixelated tools in the form of looking glasses (Fig. 50). Looking glasses, which are traditionally designed to bring clarity through magnification, are here redesigned to pixelate the work they are passed over. The pixelation tools were designed with the intention to extend and iterate the technique of pixelation beyond its digital form into an analogue tool. This new physical pixelated threshold was intended to enable media such as vector drawings, which had proven resistant to digital pixelation due to their linear structure, which caused them to become lost in a pixelated state. Here, the tools can be used either in a digital configuration, by being placed on the surface of a screen, or in an analogue configuration on top of surface-based media, such as paper. In both instances, the designer could peer through their pixelated form and experience the media below broken down through the refraction of light moving between the media and the designer's eye (Fig. 51). The devices, which are designed to be held between the thumb and forefinger, enable the designer to continue looking through them whilst scanning across the media for interesting juxtapositions between the grid of pixels and the original field of representation.

Testing the various pixelation tools found that, whilst they were capable of fragmenting the view, attempting to translate this fragmentation back into new material was not possible. This was due to the cast nature of the pixel grid, which could not be varied in scale, something that had proved critical in the earlier pixelation projects. Switching between different versions of the tool with different pixel densities, like an optician might switch between optics in an eye test, did not help with this issue.

Whilst these artefacts, did not prove effective as tools, in terms of producing divergent legible alternatives, they prompted an examination of how divergence might occur when a layer or filter is placed between the user and the media. However, what this physical digression of a digital effect highlighted, was a parallel between effects of fragmenting and obscuring within the digital and the long history of fragmenting and obscuring within architectural representational practice. Thus, though failing to produce divergent moments of their own, the pixelation tools helped the research converge back to basic architectural tools and practices, such as the grid and the tracing paper. Although such practices were largely intended for the transference of forms, and through them ideas, they can be seen in the examples that follow, as enabling something far more important: the divergent transformation of architectural ideas. Through that return to architectural practices, the research can then begin to project the actively evoked divergent practices examined previously, back into a wider understanding of normative practices of creative thinking in architecture.

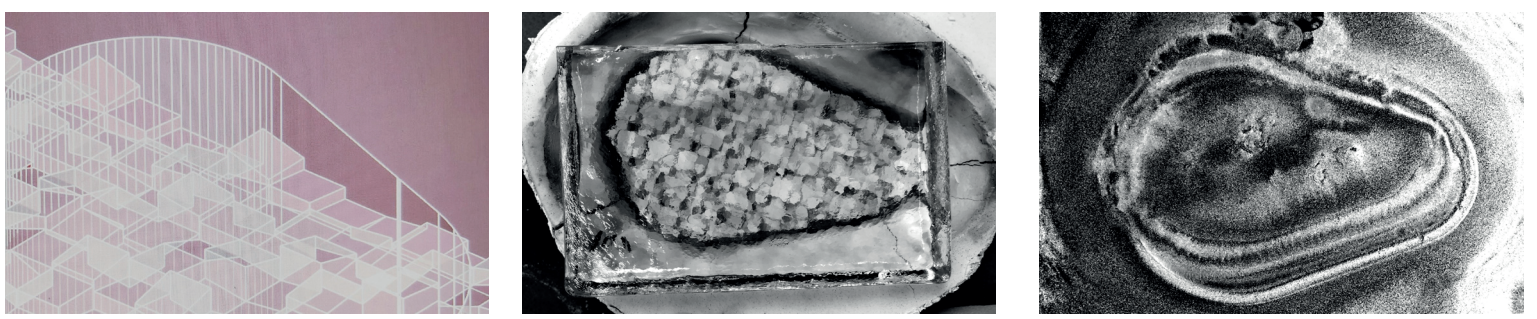
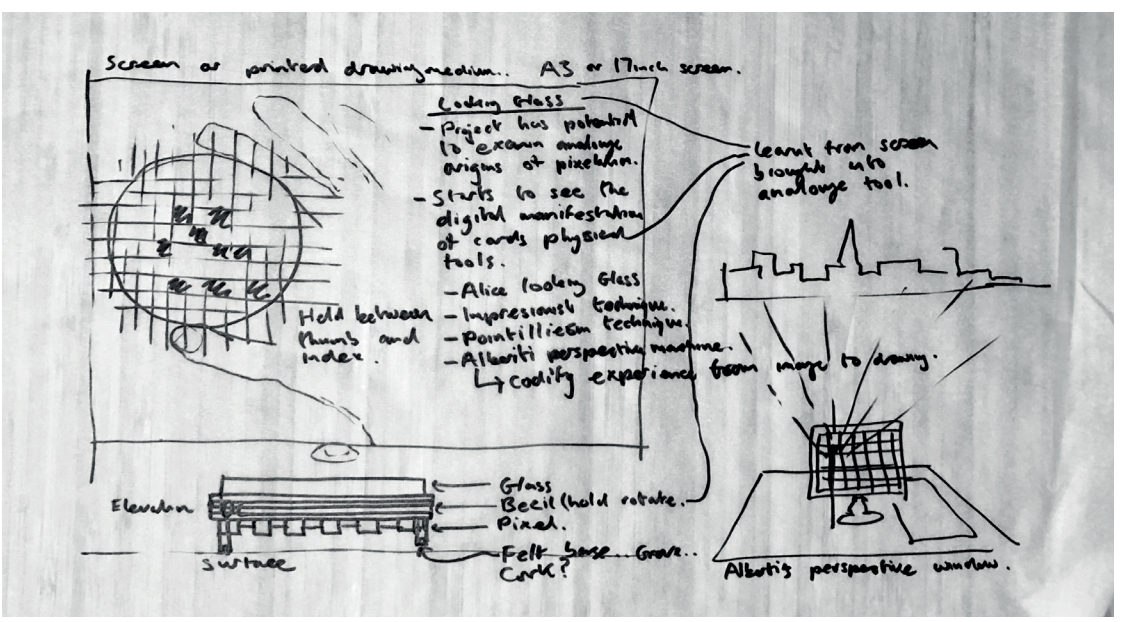
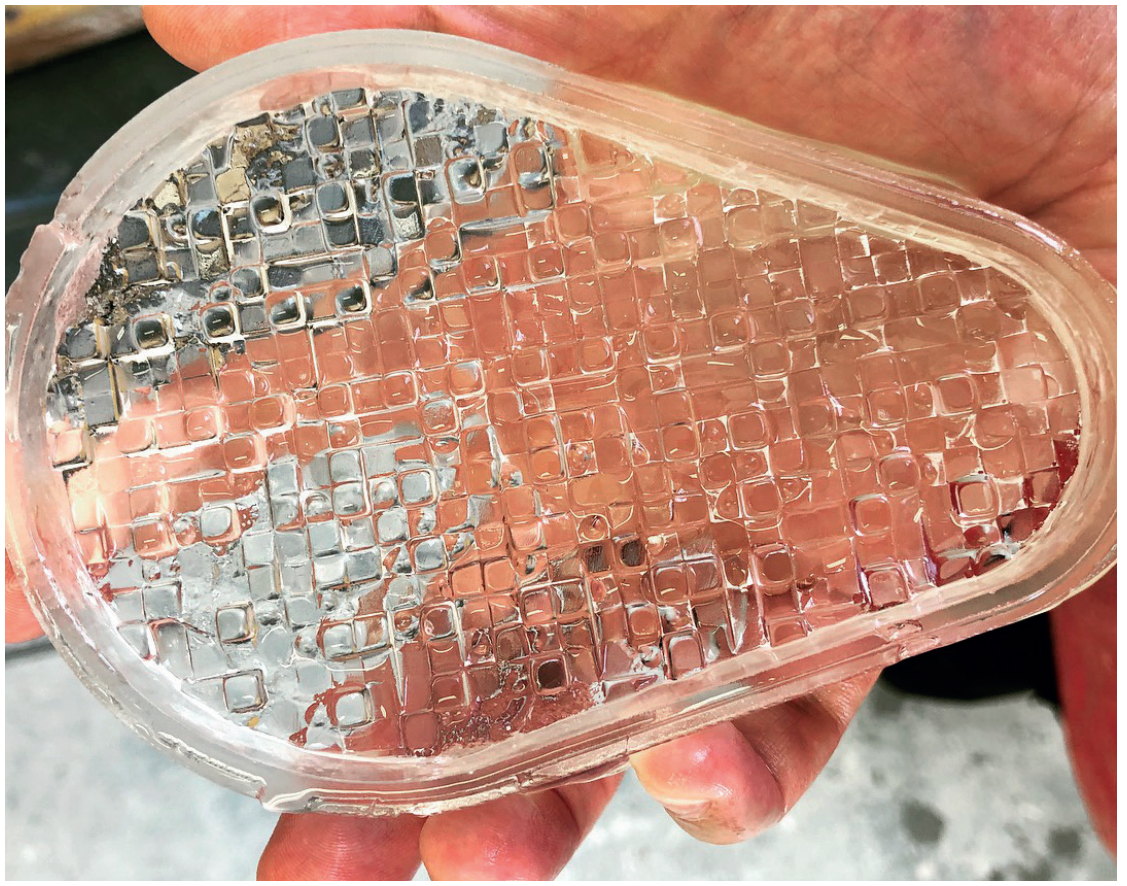
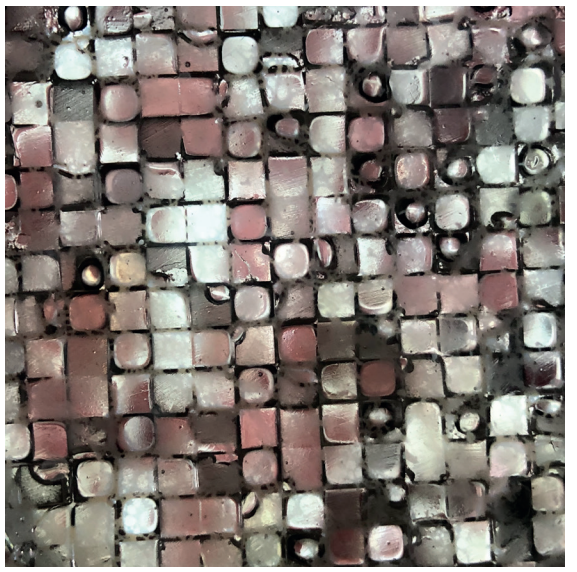


Fig. 50: Pixelation tools development (2018). (Right) Extract from CAD model exploring the form and pixelation detail. (Middle) Bullseye Glass placed above reservoir before firing. (Right) Traces left by the wet sand polishing process.

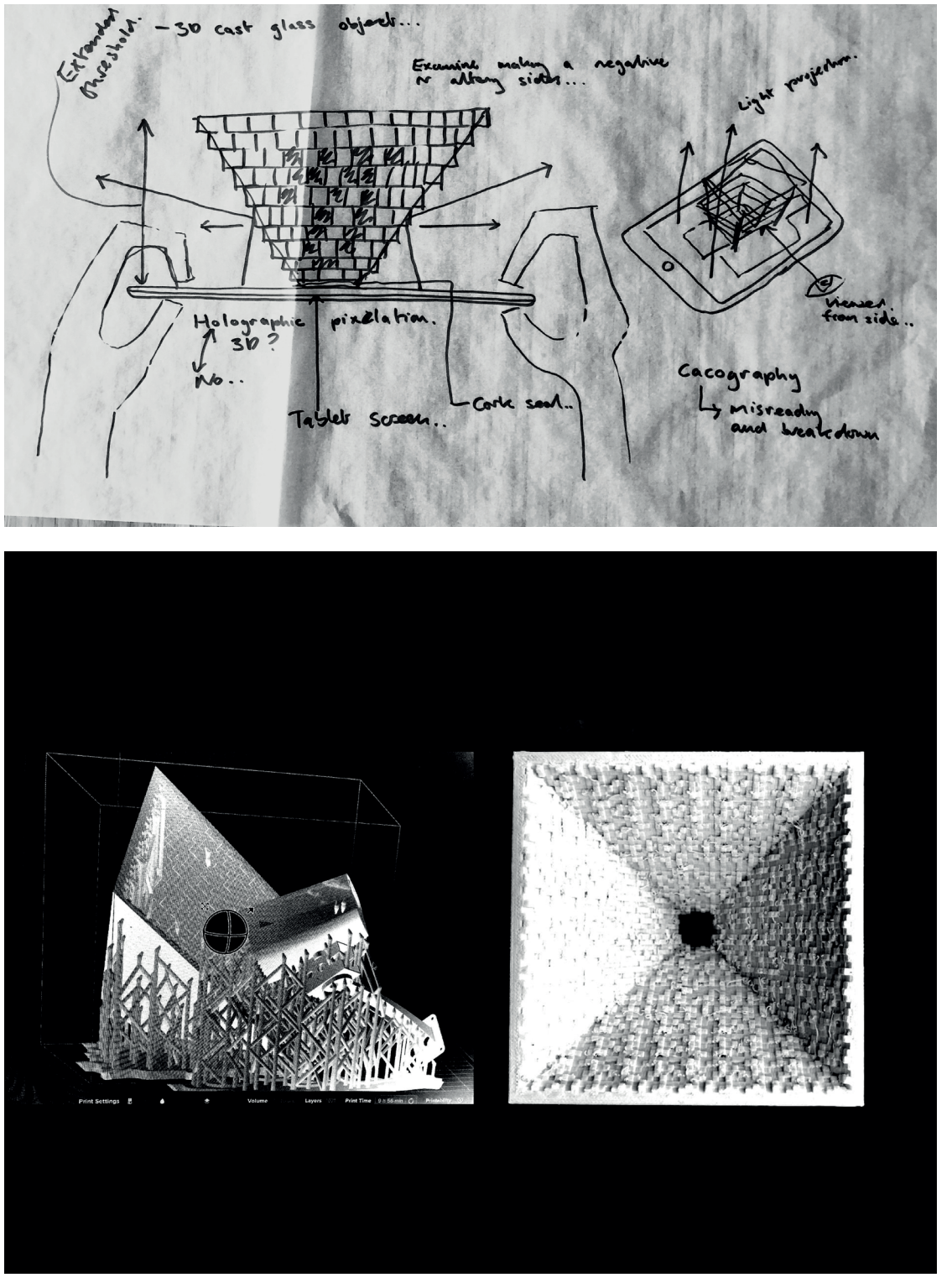






The looking glasses were constructed through a process similar to that of lost wax casting. Lost wax casting involves sculpting forms out of wax before encasing them in plaster and then burning the wax out through a kiln firing process. Following this a new material is placed in its solid state within a reservoir chamber attached above the mould before a subsequent firing sees the material turn to a liquid and fill the void. Here, the wax was substituted by a three-dimensionally printed model made from PLA (Polylactic Acid) which like its wax counterpart can be removed from its plaster encasing by kiln firing to leave a void. Bullseye glass was then chosen over Gaffer glass due to its higher level of transparency. The process of positioning the reservoir for the Bullseye glass to melt into the pixelated void was designed to allow the glass to lay horizontally on top of the pixels and again provide the maximum transparency through the tool. Anomalies that occurred during the both the three-dimensional printing process and glass casting process saw pixels within the densest version of the tool contain small glitches where the glass had not managed to enter the complex void structure. These glitches were hoped would further infuse the device with divergent potential for the designer to uncover.

Fig. 51: The Pixelation Tool, (top) as an initial sketch and (bottom left) in its finished state. (Bottom right) Filmic still of the pixelation tool scrolling across a screen.



A further tool was developed using the same technique, this time looking to expand the threshold further beyond the screen by offering the ability to shift flat projections into three-dimensional forms. The device was based on a 'hologram pyramid', which similarly translates flat images into three-dimensions, with the addition of the analogue pixelation effect of the Pixelation Tool on its surfaces. The tool's inclined walls were designed to collect and pixelate the reflections from the screen, producing a three-dimensional pixelated hologram. The user would run the tool over the surface of a tablet looking for interesting juxtapositions to emerge. This device aimed at providing new layers of divergence for the designer to explore. Unfortunately, the form crumbled in the kiln due to its complex form and it was not possible to recast the tool.

Fig. 52: (Top) Initial sketch of the three-dimensional pixelation tool and (Bottom) image showing the printed tool mould.

4.4 | Transcribe: The return to drawing

Transcribe comes from the Latin *transcribere,* meaning 'to copy, write again in another place, write over, transfer,' from *trans-,* meaning 'across, beyond; over' and *scribere*, meaning 'to write' (Harper, 2001). 'Transcribe', here, refers to the process of recoding the drawing with the purpose of enabling a removal of its syntactical content to enhance the potential for divergent readings. It is useful to consider, however, what other processes might involve transcribing an image by breaking it up into pieces. Historically, we can look at Alberti's Window as a device that divided a view using perpendicular threads attached within a frame enabling an artist to assemble an image piece by piece (Fig. 53). Whilst, at first, the copying of an image piece by piece might seem highly convergent, what is actually remarkable is the transcribing of a three-dimensional view into to a two-dimensional drawing. Art historian Erwin Panofsky proposes that this window acts as a transparent plane through which it is possible for the artist to see between the canvas and the space beyond (Friedberg, 2006, p. 42). Heinrich Wolffin (quoted in Friedberg, 2006, p. 12) proposes that the Alberti's Window is actually a visual metaphor which *'…functions to reinscribe its image onto another image, the painting'*. The parallel between Alberti's Window and the pixelation process is found in the way that both start by breaking an image down before providing a process for its translation into something new.

In the earlier projects, the layer of pixels that sat on top of the drawing provided the agency for the designer to creatively interpret it into a new drawing. In these projects, the pixelation process was capable of obscuring the meaning through the enlargement of pixels and creating a threshold for creative interpretation. However, within this process, these pixels remained connected to the pixels in the original drawing. The two projects that follow explore three-dimensional mapping techniques which allow for a digital separation between the original media and their recoded layers to occur. This widening of the threshold and separation of the designer and the media sees a layer of transcription enter the process in the form of the map. Maps are used, here, for their potential to uncover the unseen and unimagined: *'… mapping unfolds potential; it re-makes territory over and over again, each with new and diverse consequences'* (Corner, 1999, p. 213). Maps in this sense are not copies but objects *'… oriented towards an experimentation in contrast with the real'* (Deleuze and Guattari, 1988, p. 12).

In the following projects, the conceptual device of the map, as Deleuze and Guattari propose (1988, p. 12), offers the possibility of constructing the designer's unconscious desire as, by drawing it out as a layer within the map's transcription of something that is yet to exist. Within these projects photographs are used as the starting point for the mapping exercise. These photos are then recoded, not by distorting through a grid of pixels, but by replacing their surface with a three-dimensional polygonal mesh. Polygonal meshes are commonly used within computer drafting software to model complex three-dimensional shapes that are made up of planes of polygons (Botsch *et al*., 2007). Here, the polygons act like pixels providing a grid, which starts to obscure the overall form. Where the difference lies, is in how the mesh itself provides a divergent layer that facilities a shift in view from tracing the underlying media to the creation of a transcription that has the potential for creative interpretation. Here, certain parallels can be drawn to the grid within Alberti's Window as a reversed transcribing of a two-dimensional image into to a three-dimensional form. The two projects that follow use different methods for making the meshes. However, the common theme is the potential for divergence to creep into the map through the interpretation of two-dimensional surfaces into a thee-dimensional forms.

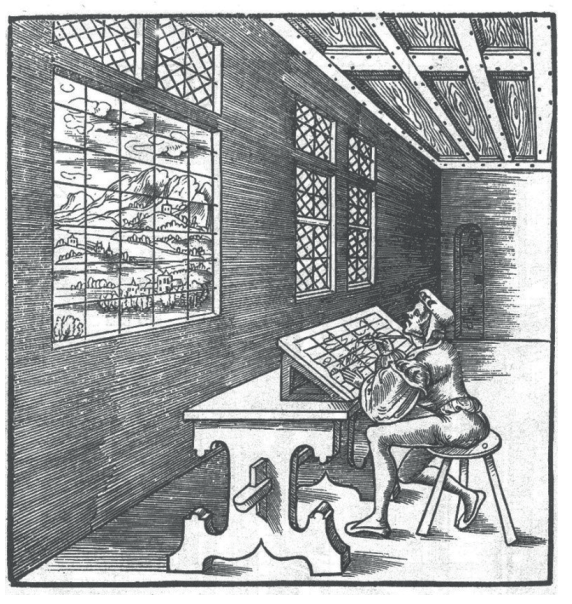
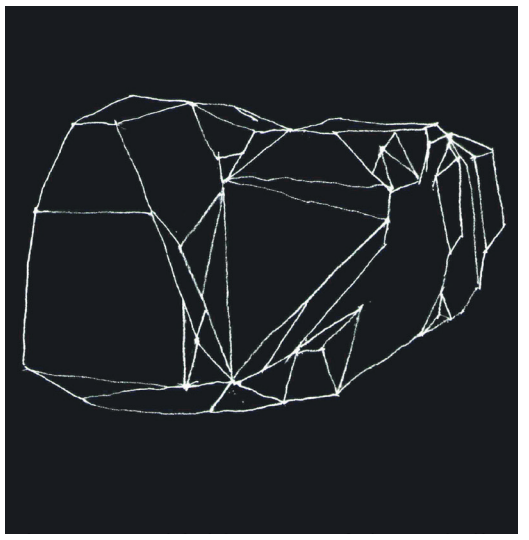


Fig. 53: 'Alberti's Window' (1435), woodcut illustration (Johann II of Bavaria and Hieronymus Rodler, 1531).

[Brutal object]

Brutal object was a short collaborative project with artists Sophie Warren and Jonathan Mosley to reproduce a model of a removed column head from the former Bristol and West Tower (Fig. 54). The column, which had been part of the tower since its construction in 1967, had been removed during a remodelling process that saw the tower become the Radisson Blu hotel in 2003. Following its removal the column had been relocated by the artist to a gallery space at the Red Lodge, Clifton, Bristol (Fig. 55). Here, it was exhibited as an object that examined the narratives of multiple protagonists who had come into contact with it during its construction and removal (Warren and Mosley, 2015).



In 2015 with the column head lost, Warren and Mosley set me the task of reconstructing the column head as a digital model from five photographs. The intention of producing this three-dimensional mapping was to be able to print it as a wireframe form that could further explore the relationships between the different protagonists. The process of mapping the object back into a thee-dimensional form started with analysing the five photographs and attempting to map a polygonal form of its surface. This process started with hand tracing over the photographs large polygons (Fig. 56). This lowering of the artefacts definition allowed me to analyse specifically where each photograph was taken within the gallery. Within this project the use of a mesh and its parallels to the pixelation process can be seen in the way that it enabled the designer to simplify the overall form of the object reducing the amount of information within the original image. This reduction in information during the transcribing process allowed for divergence to creep into the process, as the designer had to interpolate the missing. In essence, the process became a reversal of Alberti's Window, where instead of translating an image from a three-dimensional space to two-dimensional surface the process became about transcribing a two-dimensional surface into a three-dimensional object using the reduced detail of the polygon as a projected mapping tool. Here, projected mapping refers to the process of creating maps of the various elevations of the object, which has similarities to

Figs. 54-56: (Left) Image of the Bristol and West Tower, circa 1990, before its transformation into the Radisson Blue. (Middle) The Brutal Object before its disappearance (Sophie Warren and Jonathan Mosley, 2015) of and (right) image traced over photos of the Brutal Object (Jonathan Mosley, 2015).

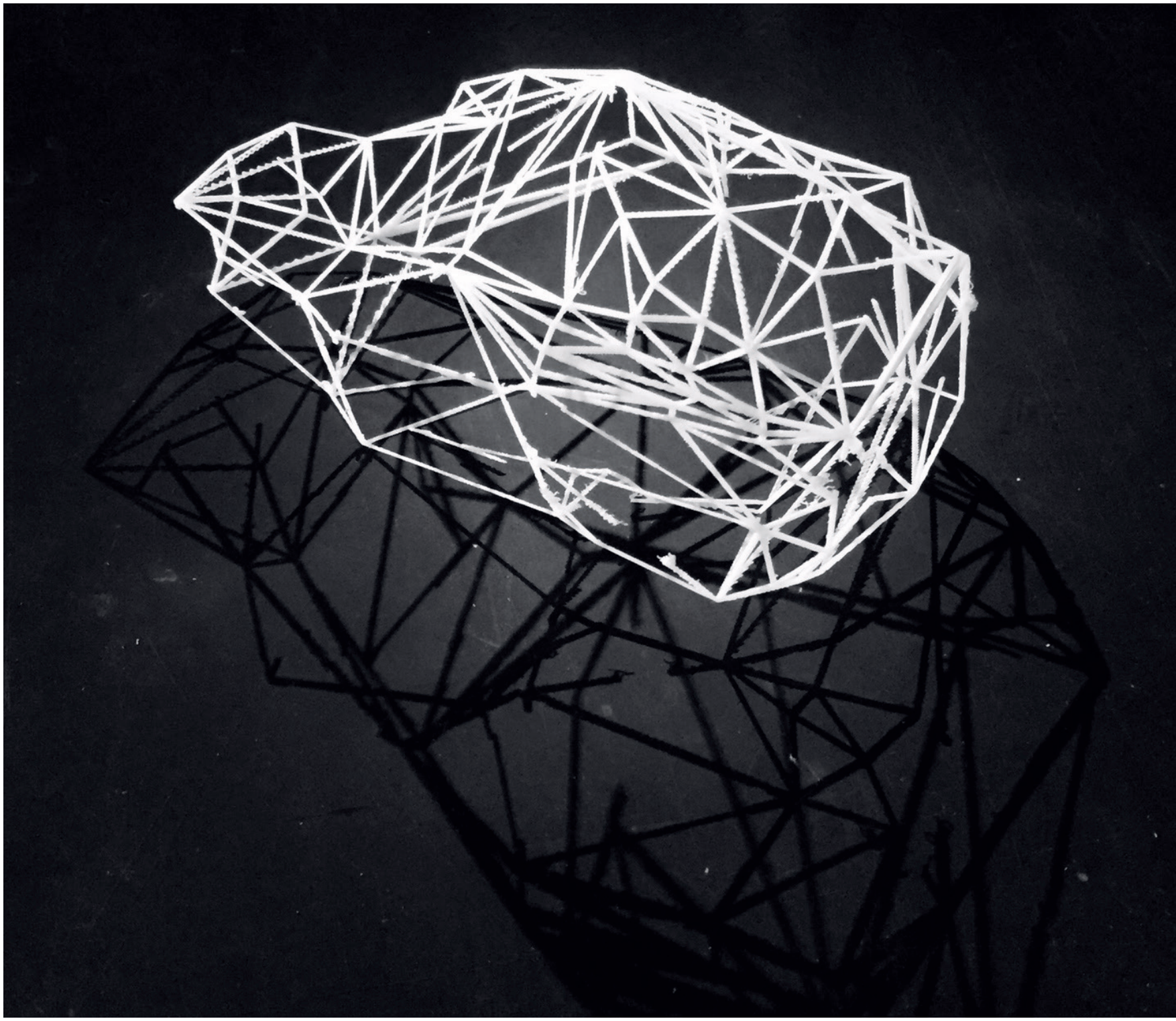
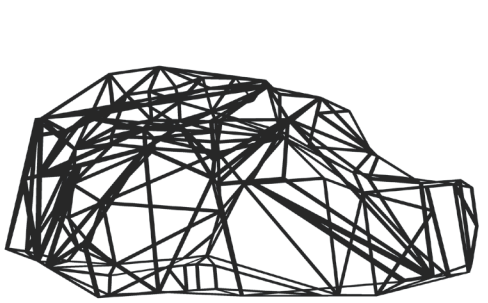


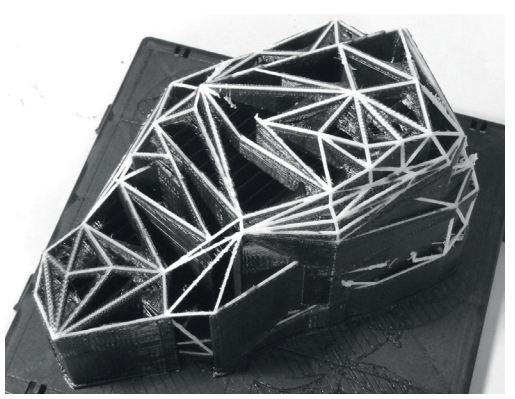
Fig. 57: Brutal Object, model after printing (2015). Note the serration of spars between polygons. Some broken polygons were trimmed for final display.

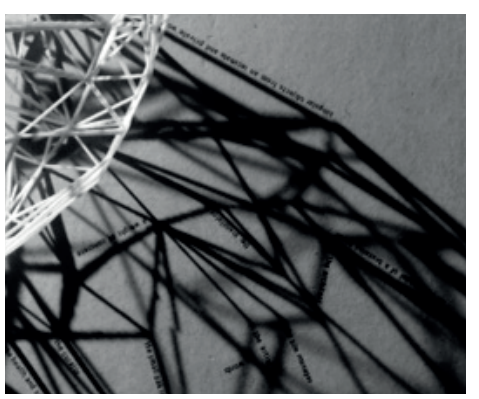
how architects produce developed surface drawings to understand a proposal's three-dimensional envelope. As the process continued, the maps were inserted into a CAD package where they were offered up initially to a rectilinear form as a series of elevations. Gradually this rectilinear form was developed by adding polygons until it resembled the maps. Within this process my interpretation as the designer played a key part in the end form of the object. Repeating the process multiple times with other designers would have undoubtedly led to other creative reinterpretations of the object's overall form.

The next step saw the model stripped of its polygons and reduced to a wireframe model. The wireframe was then given a thickness so that it could be three-dimensionally printed. The small scale of the print meant that in places the process created serrated edges instead of smooth spars between the wireframe nodes. This by-product of the layer by layer printing process further emphasised its repeated transcribing from concrete column head to a hollow lightweight skeletal printed outline.

The final model (Fig. 60) was displayed within Spike Stuidos alongside an audio piece as part of Spike Island Open Studios 2015. Here, it was carefully lit by a spotlight which cast through the object creating strong shadows of its wireframe silhouette onto a base plinth. The silhouette provided a flattening, enlarging and distorting of the object. Most interestingly, the new form created a new network of shadows, which the artist proposed as previously unseen and unimagined encounters between the object and the protagonists of its removal from the tower and exhibition. At this point the transcription process was complete. It had seen a photograph rewritten through a polygonal mapping process into a three-dimensional model. This had then been transcribed into a three-dimensional print with traces of the printing being left behind in the model. Following this, the curation of the object allowed had seen new two-dimensional maps emerge from its shadows.







Figs. 58-60: Brutal Object. (Left) CAD model showing polygon structure. (Middle) Three-dimensional print before dissolving support structure. (Right) Photograph from the final exhibition at Spike Studios, Bristol (Sophie Warren and Jonathan Mosley, 2015).

[A chaotic topography]

The chaotic topography develops on the technics found within the Brutal Object of using polygons as a means to transcribe spatial surfaces. As a speculative project, it was concerned purely with testing further the potential relationships between pixelated forms and meshed forms first explored within Brutal Object. In particular, the focus upon how both could see a reduction of information within an image and the potential for divergent interpretation to enter the process. A critical technical advancement over Brutal Object was the technique employed to generate the mesh. Here, rather than the mapping technique starting with hand traces over photographs, a digital process known as photogrammetry is used to make a three-dimensional mapping of an architect's office from a set of one hundred photos that cover all angles. Photogrammetry software takes two-dimensional photographs and through a process of interpolation creates three-dimensional forms. It does this by first looking for overlaps between the photos uploaded and common geometrical forms. It then calculate depths by looking for shifts in perspective between images. From this data the software is able to create a three-dimensional mesh and then stretch over this a photographic texture. Within the architectural design process photogrammetry is most often used as a way of mapping existing space and then bringing it into a digital environment so that a designer can work on a proposal with an understanding of the existing.

This type of technology is still very much in its infancy and, as such, is prone to glitches. Examples of these glitches have been celebrated by Glitch artist Peter Norrby, within his collection of stills grabbed from IOS maps, which use a similar process to three-dimensionaly map the city (Norrby, 2012). Here, glitches can be either the user not capturing the right information for the model or the software misreading the input images. The glitches presents opportunities for divergent readings of the mapping process. Mark Dorrian and Adrian Hawker talk about a similar effect, where glitches can enter the surface of maps as noise from the process of photocopying them. The noise leaves behind something that cannot be repeated and creates the '*… possibility of the image, simultaneously unfold(ing) patterns of productive interference*' (Dorrian and Hawker, 2002, p. 10).

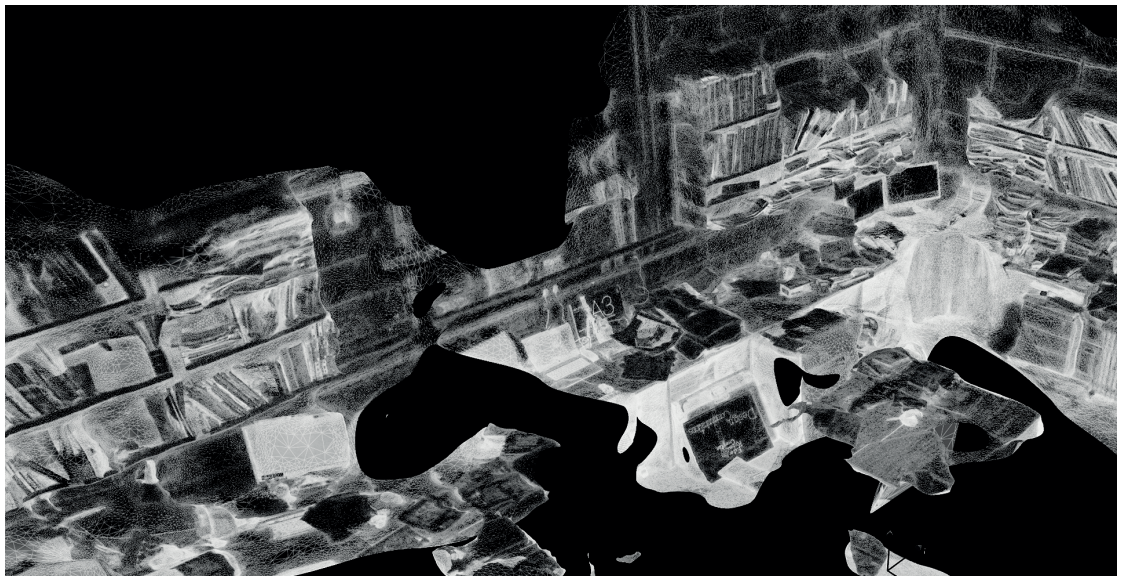


Fig. 61: 'A chaotic topography', image of photogrammetry model showing photographic skin with glitches.

After the computer had processed the model, I made the decision to strip it of its photographic texture and explore it as a mesh (Fig. 62). Unlike the Brutal Object, which had been stripped to a wireframe and rendered transparent, the chaotic topography retained its surface, which when viewed gave it a scalable quality. This scalable quality meant that when viewed in its totality on a computer screen it was still recognisable as an office with piles of books on the desk. At this point the polygonal mesh was detailed enough so that the viewer could still read the mapping as the surface of an office.

However as I zoomed in, the polygon surface enlarged and the glitches within the model became more apparent. Glitches, here, included the back faces of objects within the office that had not been captured and rendered as they sloped away from the camera's view. Glitches also included dark areas of the photos where the software did not know how to render the mesh and instead left holes or flat areas with enlarged polygons. Zooming further into the computer's mapping, the surface started to read not as an office space but as a landscape of indeterminate scale where the transcribed mesh offered the possibility of new creative interpretations of forms. To put this in Mark Dorrian's and Adrian Hawker's words the transcription's *'(l)egibility had lapsed: codes of representation and reading have become unhinged; chance, polysemy and a new interpretive demand ha(d) entered'* (Dorrian and Hawker, 2002 p. 9) the reading of the surface. The multiple perspectives of this project open up the possibility for such unhinging moments to occur within the map's surface as they are generated at the crossover of the digital process of mapping and the designer's framing of the model. What is left is a transcription of a space that offers up divergent readings though its polygon surface (Fig. 63). Rather than freezing the mesh for the viewer at a set representational scale, by printing it as 3D model like the Brutal Object, I decided to generate a short film. The film allowed for the tracking into and around the meshes surface, which provided the shift in scale between the office and landscape to occur. The film became increasingly about the agency of the viewer to interpret the mesh as the scale of the polygons increase and the camera shot frames individual features as it tracks across.

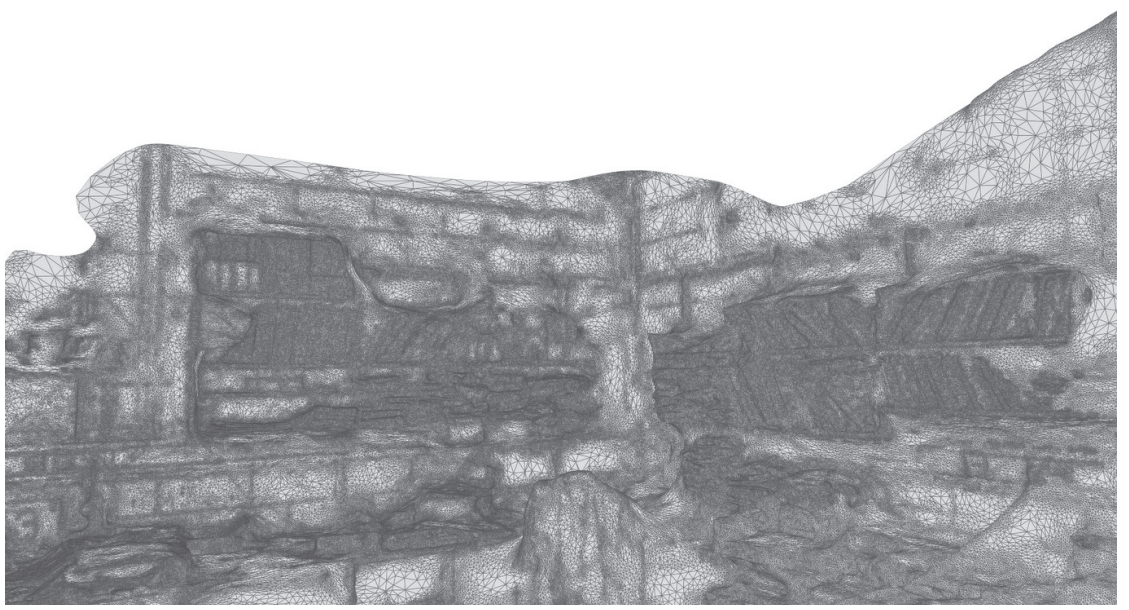


Fig. 62: 'A chaotic topography', photogrammetry model stripped of photos exposing polygonal mesh, Filmic still (2018).

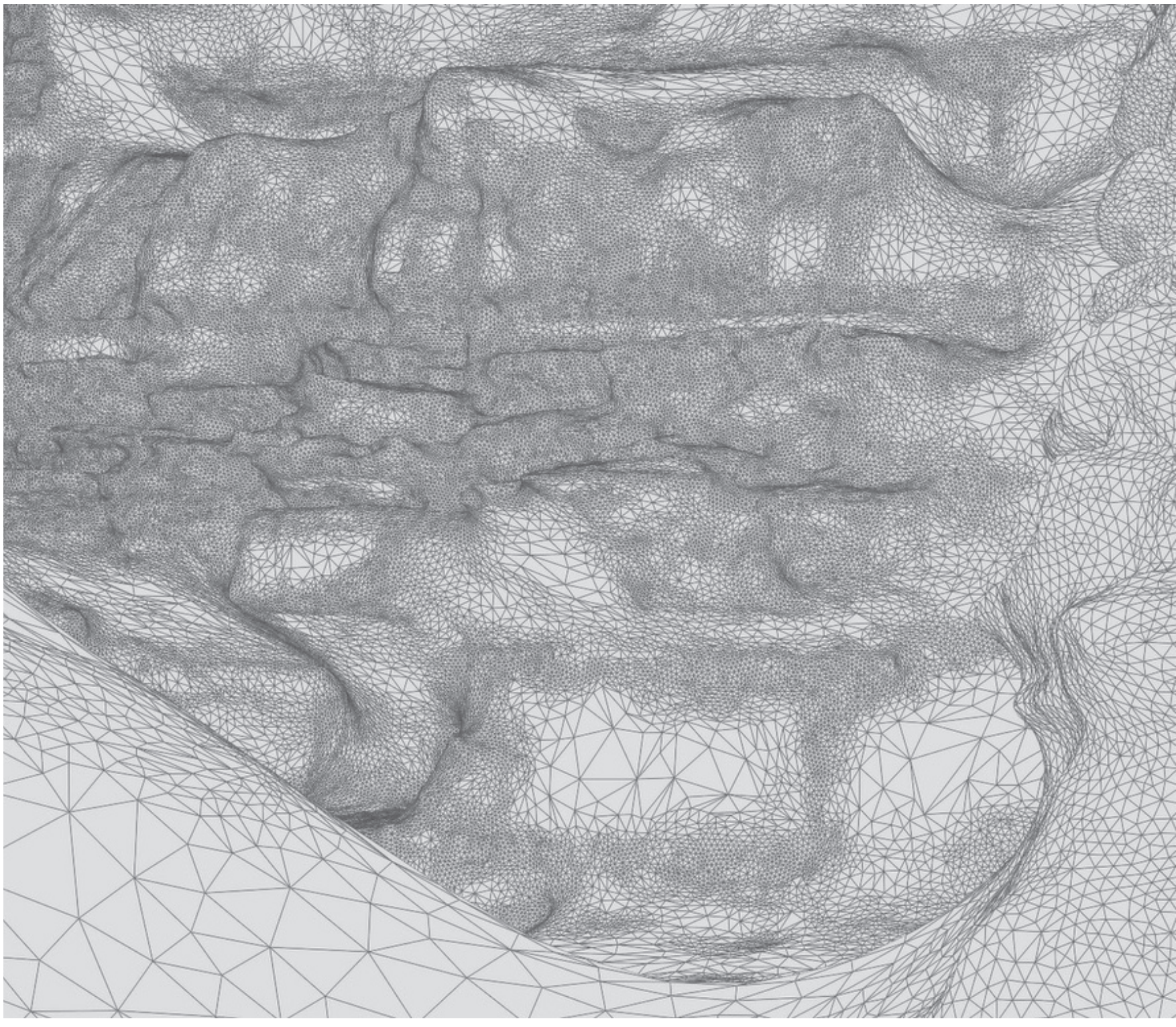


Fig. 63: ‘A chaotic topography’, detail of polygonal mesh, Filmic still: (2018).

4.5 | Conclusions

The exploration of how pixelation can lead to divergent thinking and the emergence of new ideas has seen a process develop that is capable of creating a threshold between the designer and the screen. Threshold, here, refers to both the physical and cognitive separation between the designer and the media through the act of pixelation. Within this definition the physical refers to the way in which drawings are broken down and obscured by the pixelation process. The cognitive separation refers to the way in which the original meaning behind the drawing is removed by the pixelation process. Here, the definition of threshold expands to include the agency of the designer and their skills in being able to interpret the pixelated image back into the design process. Critical to this threshold exploration has been the prefix trans- and its etymological meaning of 'across, beyond'. Here, the idea that something is carried across and beyond was examined through the dimensions of translate, transform and transcribe.

Translate explored the transparent and obscuring qualities of pixelation comparing it to the qualities found in tracing paper. Comparisons between trace and pixelation continued with the finding that both had the ability to stimulate 'transitus'. Transitus, here, refers to Marco Frascari's (2007) definition of transitus and the mental journey across a drawing and linking back to the physical and cognitive thresholds. The obscuring quality within pixelation was due to the reduction of information within the digital image as the pixels increased in size. Critical to this process was its ability to detach the drawing from its original form, which referred to the information put down by a designer when constructing the drawing, including line work, use of conventions and the embodied thinking process. Simultaneous to this detachment from original form the process sees the introduction of the pixel grid. Here, it was noted that this grid had parallels to the use of geometric, linear grids in architectural design which are used to formalise drawings. The rescaling of the pixel grid offered something further to this, enabling the designer to cycle through interesting juxtapositions that in some cases offered new material for the designer to interpret.

Transform showed how pixelation is capable of altering a drawing to the point it no longer carries its original form. This process saw a recoding of the drawing and the removal of its syntactical meaning. Within the Yeats competition the loss of form became evident when a repeatedly pixelated sketch section turned into a plan. Here, pixelation provided a deeper threshold than those seen in earlier projects, enabling the transformation from one drawing to another drawing through the intermediate stage of the pixelated image. However, the recoding of the pixels was still bound to the original and still tracing its original form.

Moving beyond the pixel the research started to investigate polygon structures as the underlying grid of a 3D model as having an equivalence to the pixel in the way that it fragments the overall form of the model, bridging the visual and with the spatial through the context of digital modelling. Polygons provided an opportunity for transcription where a degree of interpretation was introduced into the process of mapping the initial visual media into a modelled form. Unlike the pixel, which is fixed to the image, the mesh was found in both projects to be, more than a trace of its surface, a map open to creative interpretation.

Throughout the chapter, we have seen an increasing depth between the media and the designer investigated through the dimensions of translate, transform and transcribe. This depth has been

generated through the iterative testing and development of pixelation within this research. The main output of this process is the recognition and understanding of a ‘deep threshold’ occurring between digital media and the architectural designer. This deep threshold, which is capable of instigating creative divergent thinking, manifests across three levels of intertwining between the manipulation of the digital image and the cognitive agency of the designer.

The first layer is the obscuring of media, which, included pixelation through software, pixelation through repeatedly photographing and pixelation through stripping a form of its surface. In all instances, obscuring was concerned with the reduction of information within the media.

The second layer is the separation of meaning. Here, the design thinking is removed and the drawing becomes an image. At this point the obvious has been removed and there is an increased potential for the obtuse to reveal itself. The obtuse here could be new forms emerging through the grouping of pixels. This, to recall Frascari’s (2017) idea, is the start of transitus: the designer’s mental journey to reinterpret the image into something new.

The third layer helps to focus the journey and sees the pixel grid manipulated in size allowing for a deeper exploration of the image. Here, the process sees the importance of the grid come into play as something that is familiar to the designer as a tool for constructing drawings. It acts in a similar way to Alberti’s Window (1435) as a framing device for isolating bits of an image and allowing them to be deconstructed in one setting and reconstructed in another. However, unlike Alberti’s Window, which, can be viewed as a convergent process where the aim is to maintain the translation from view to drawing, the pixelation process allows for divergence to enter during the translation. In this way, the process has more in common with the fictional ESPER machine seen in the film Blade Runner (Scott, 1982), which, through the use of grids, was capable of exploring an image in an extreme depth creating the impression of expanding it beyond its original two-dimensional plane. In the later iterations of the pixelation process, the Brutal Object and Chaotic topography this became even more apparent in the way that photographs were used to construct three-dimensional forms.

The information produced beyond the original dimensions of the photographs within these projects offered a divergent map as the final layer of this deep threshold. This map differed from a tracing of the original form in that it introduced new material, gathered as part of the digital survey process. This material created a productive interference over the object and allows the deep threshold to become infused with the agency of the designer. This synergy reveals the pixelation process as a map for the designer; not just to a journey across but towards an immersion in its geometry, from the original form into a new landscape of divergent possibilities.

Leap Three

5 | Trace: Analogue fronts and digital substrates

This chapter examines techniques of tracing digital media from the screen onto tracing paper as a process that accumulates divergent ideas and draws them through into the realm of the architectural drawing. The specific focus on tracing follows on from its identification within both the cut-up (p. 80) and pixelate (p. 98) chapter as an important technique that facilitated the movement of ideas across and between media. Here the investigation focuses specifically on how tracing as a form of architectural drawing is capable of not only capturing divergent ideas from digital media but bringing them into a recognisable drawing syntax. Here, the importance of being able to transfer divergent ideas back into drawing is critical because drawings remain fundamental to the architectural design process, as the productive space where ideas emerge and transform rather than simply 'translate' into buildings (Evans *et al*., 1997, p. 165) This accumulation of divergent ideas starts with an investigation of how tracing in its traditional sense provides the designer with an interface into architectural drawing. Interface here expands on Marco Frascari's proposition of 'transitus' (2007), which was first referred to in the pixelate chapter (p. 98). Here, it is used to explore how seemingly invisible ideas are captured from the screen within the very fibres of the trace before emerging into architectural drawings. This is then expanded to examine how it can also provide an interface to digital screen-based media where it acts as an intermediate field for digital media to be gathered into a drawing.

The chapter will demonstrate how the act of tracing, through its ability to return ideas to drawing, enables the designer to work simultaneously between a state of divergence and a state of convergence. Divergence manifests in the drawing out of new ideas from the traced over media, while convergence manifests through the desire to see these new ideas express the possibility of a physical presence. This balance aligns itself with Lawson's idea that the architectural design processes require an equal balance of convergent and divergent thinking (Lawson, 2006, p. 153). Critically, what is found here is that this hybrid form of tracing over the screen is capable of maintaining the balance by facilitating further divergence between media and also converging the ideas into a drawn form.

Fig. 64: Tracing over a digital image, whilst testing the *zoom in* dice action, still from film (2015).

This investigation takes place across three projects each exploring the emergence of the drawn from digital media and through the sub sections of tracking, plotting and projecting. The origin of this digital to analogue tracing technique, within this research, emerged whilst testing divergent techniques on an architectural competition for Re-imagine Ageing' (RIBA, 2012). Within the test, a number of divergent techniques were trialed to attempt to understand how they might operate within the design process including cut-up, pixelation, rotation, colour adjustment and zooming in. Whilst the techniques tested had varying degrees of success, what was noteworthy was how tracing over the screen became instrumental in returning the divergent outputs to the architectural drawing. This process of tracing over the screen went on to became a prominent theme within the development of the Divergent Deck (p. 54). In this chapter the three projects examined all come from the short films made as part of the testing process of the deck.

5.1 | Between faces

Tracing within this chapter is seen as an interface where, etymologically speaking, it provides *'a plane surface regarded as the common boundary between two bodies'* (Harper, 2001). In this sense, the trace here forms the boundary with the digital media of the screen providing the body behind it and the emerging drawing providing body in front of it. Looking separately at 'inter' and 'face' it becomes possible to expand this further. Inter refers to 'between, among, during' and here is concerned with the passage of ideas between the back and front faces of the trace. The trace having two faces is discussed by Marco Frascari (2007) with regards to the *recto verso,* where designers would use the opaque qualities of trace to produce one drawing on one face of the trace and then a further drawing on the reverse face of the trace. An example of this would be the tracing of an elevation on one face and then the production of a section on the other face, which used elements of the first to inform its composition (Fig. 65). Whilst this use of the trace may at first seem more to do with the convenience of the media in developing two similar drawings efficiently what is useful to consider is how the faces of the trace can have a reciprocal dialogue between each other. Here, the designer has the opportunity to switch back and forth between the faces drawing, erasing, redrawing all the time iterating and developing the design.

Moving across into the interface of a digital drawing package, such as AutoCAD, a not dissimilar process can be observed where the designer can position a drawing under another drawing as a reference (Fig. 66 on the following page). As with trace they are able to switch between updating the drawing or to updating the reference. However, examining this digital tracing technique further there are differences between the digital interface and its analogue counterpart. A key differences is to do with the grammatization of the technique into the digital and the addition and removal of certain gram. Grammatization here referring to Bernard Stiegler's concept that during the digitalization of tools and techniques *'… that all forms of knowledge become grammatized via cognitive and cultural mnemotechnologies'* (Stiegler, 2010, p. 33).

Within the digital form of tracing discussed, the grammar has shifted away from hand drawn lines to a digital process that sees digital vector lines, stretched from a starting point over the surface of an underlying drawing towards a further point. This process sees the designer digitally trace by clicking between points without leaving any trace of pencil or pen on the surface. The grammar behind this process is influenced by the grammar of the CAD software, which it is based in. This grammar stems from a coordinate system where users draw on a longitude and latitude grid testing their

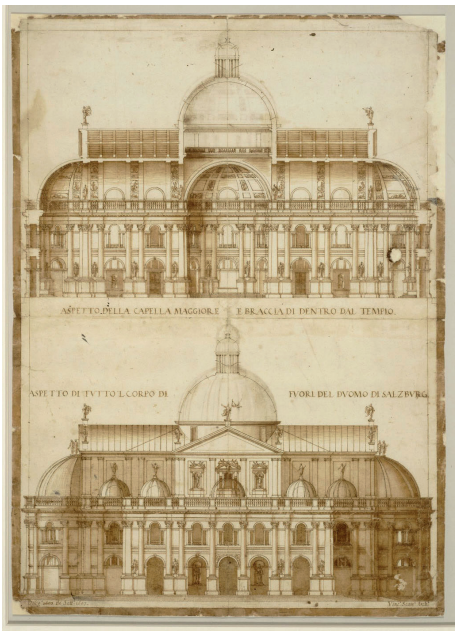


Fig. 65: Recto elevation and verso section of the Salzburg Cathedral (Vicenzo Scamozzi, 1607)

projects at one to one. The idea of drawing at one to one scale makes the process sound like the digital equivalent of a cathedral tracing floor, where the design is traced out at full scale. However, as already described, no marks are left by this digital process and what allows the designer to navigate this full-scale digital drawing is the ability to zoom in and out of different areas using the mouse. Unlike in Chapter 4 (Pixelate) where images became degraded by zooming in as the pixels became visible, CAD software operates on a vector base where lines remain sharp to the eye no matter how far you zoom in. In terms of tracing, this ability to zoom in and focus on an element further abstracts the tracing from a process of looking for forms through an obscured sheet of trace into a digital surface where the user can overcome the unclear by zooming. Whilst the ability to zoom in and see between the layers clearly has helped increase the accuracy of tracing it has lost much of the opportunity for the eye to glimpse divergent juxtapositions between the traced lines and the media beneath.

In order to discuss further the importance of tracing's obscuring qualities it is necessary to briefly reintroduce Frascari's (2007) idea of transitus, which examined the passage of an idea as it moved between the faces of the trace. This was touched upon within Chapter 4 (Pixelate: p. 98) and was used by Frascari to describe the physical fibrous semi-transparent qualities of trace, which resulted in an obscuring of any media placed under it. Frascari's proposition of transitus proposes that ideas move through the trace from one side to the other. Here, he refers to the transparent qualities of trace as the *sotto-lucido* or backlit, eluding to how the drawing surface might be layered with other sheets of trace allowing for light to pass through to the underlayer thus revealing its traces to the designer. Here, the type of tracing I refer to is not concerned solely with accuracy and the production of presentation drawings but with *'architectural gestation'* (Frascari, 2007, p. 31), where ideas start to emerge into the drawn. The transitus here goes beyond the reciprocal nature of the trace by suggesting that its physical fibrous nature creates a metaphorical spiritual equivalent where ideas coalesce until drawn out by the designer (Frascari, 2007, p. 30).

In the discussed projects within this chapter tracing moves beyond the familiar technique of tracing over another drawing or even between the two sides of a drawing to a hybrid form of tracing. Here, the tracing takes place against the vertical digital screen and acts as an expanded interface between digital software, the drawing as a consolidated terrain of architectural representation and the designer.

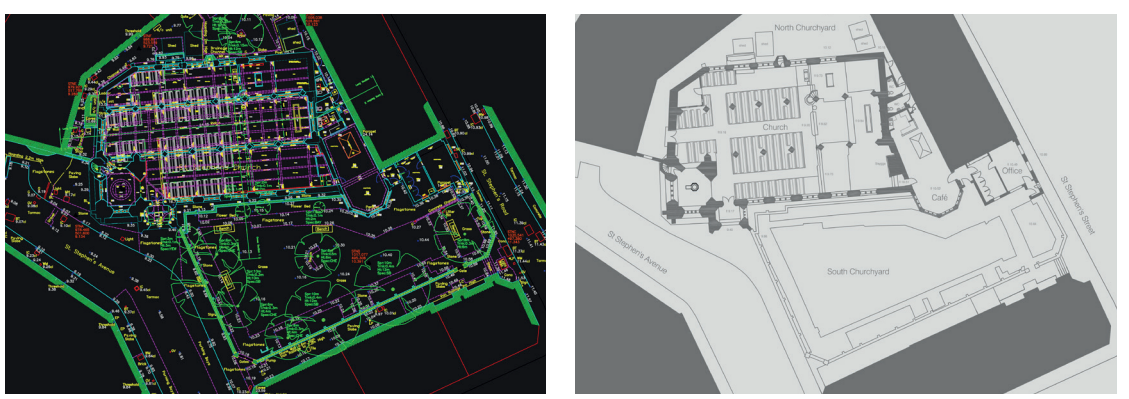


Fig. 66: (Left) Image showing multiple reference drawings loaded into AutoCAD for digitally tracing over. (Right) image showing the traced plan emerging from the designer tracing between the digital references. Drawings of St Stephen's Church, Bristol by (Matthew Hynam, 2012).

5.2 | Tracking

The first project discussed here was produced by a designer in the final year of their architecture and planning studies at the University of the West of England as part of a conceptual massing exercise. The project, situated in a quarry near Salisbury, proposed the development of a new landscape and rehabilitation centre for those suffering from mental health illnesses. The massing study here, is a three-dimensional accumulation of the building's programme into a volume that fits within the context of the quarry. The part of the project examined here, is a short Divergent Deck film, which sees the designer stuck on developing the massing study further (link to film with Fig. 67).

The film starts with the designer sat in front of a computer screen looking at the massing model and explaining how they want to develop their scheme into something that is less linear in its nature and reflects the complex topography of the site. From the model on the screen we get an understanding of the proposed mass, but not of the site's topography. Whilst we might argue that the designer should draw the site in order to understand the buildings relationship to its context, this is not a critique of their design process. Instead, the narration of the video shows a hidden chain of thought that goes beyond what is reflected within the digital model.

Here, the designer is looking for something that exists beyond the field of the digital screen. What I propose is initially happening here is a process of tracking between the model on the screen and the designer's knowledge of the project so far. The concept of tracking builds on an idea put forward by artist and architectural theorist Paul Carter within the book *Dark Writing* (Carter, 2009). The concept of 'dark writing' refers to *'a landscape rather than a straight line from a problem to its solution'* (Carter, 2009, p. 1). Here, Carter (2009, p. 10) proposes that until points and lines are determined across a landscape they remain an open abyss *'both in thought and nature'*, where *'… only creative imagination can bridge these gaps in reason'*. In *Dark Writing,* tracks refer to the trail marks left behind by animals or humans that have no fixed structure and cannot be drawn as roads or paths.

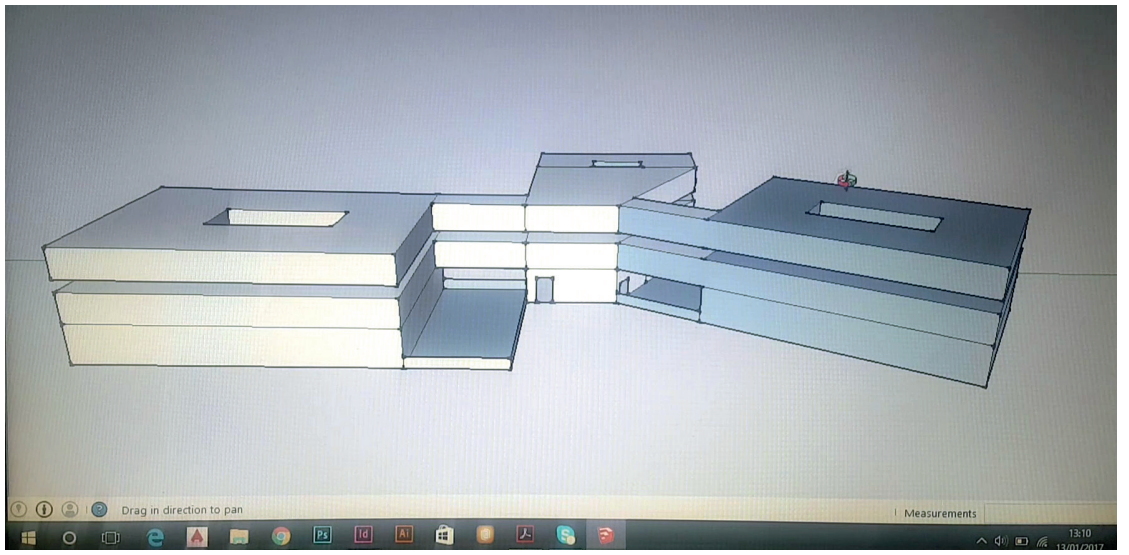


Fig: 67: 'Trace over screen and then rotate from an off-centre spot. Layer and repeat trace until new forms emerge'. stills from a Divergent Deck film (2016) showing the original three-dimensional model, at the beginning of the process.

Within the project discussed, the tracks can be viewed as an intuitive hunting process between the buildings mass and the existing knowledge of the designer. Whilst the tracks remain latent to the observer, due to our inability to see into the designer's mind, the introduction of the divergent prompt within the film starts to see the latent become explicit. Divergent prompt:

Trace over screen and then rotate from an off-centre spot. Layer and repeat trace until new forms emerge.

Divergent Deck (2015)

Here, the prompt not only provides a divergent technique for the designer to interpret and follow but also provides a set of processes that can be followed to understand the nuances of the tracking. A critical part of making explicit this tracking process is the act of tracing over the screen. Critical to this is the relationship between the scribing hand and the eye. Here, the hand is not producing a physical manifestation of a saccadic pattern (Fig. 68), where eye movement surveys and tracks the visible, but instead a transversal tracking between the model, the designers knowledge and the emerging field of drawn out tracks.

The above prompt gives the designer clues as to how to go about the process of finding tracks between the model and the trace. In writing the prompt, I had envisaged the designer tracing over an orthographic plan or section on the screen, then carefully rotating from an off-centre position and then re-tracing it repeatedly to find interesting juxtapositions between the screen and the traced forms. The inspiration for this divergent prompt came from Eisenman's (1999, p. 15) 'perpetual revision' of forms through operations such as rotation, scaling shifting and folding, amongst others. These operations set up a recursive condition for the designer to examine the material emerging between the layers of the superimposed and traced forms. In this context, Eisenman (1986, p. 5) proposes that the designer is capable of looking speculatively beyond the original geometry and seeking out conditions of *'self-similarity',* where analogies of repetition overcome those of geometry. Eisenman (1986, p. 5) contextualises this point, whilst talking about the Romeo and Juliet project, where he describes how the re-scaled lines of the city walls of Verona generate a condition of 'self similarity' with the lines of Romeo's castle and together generate new meaning.

In the divergent prompt film you do not see such a direct analogical association, where the original geometry completely escapes. The process instead sees the designer start to break away from a formal generation of geometry, which is based on massing the necessary spaces to generate a rehabilitation centre, and start to track between the trace and screen. This process sees the designer take a trace of the model and then rotate it before tracing over it again (Fig. 69 opposite). The process, which is repeated three times, sees the designer carefully rotating the model back and forth behind the veil of trace looking for interesting juxtapositions between the model and traced forms.

The traces occur when the model is rotated horizontally around the vertical axis. This rotational movement gives the seated designer the sense of tracking back and forth around the building. Only once does the designer rotate the model vertically around the horizontal axis but does not make a trace. Here, I propose the vertical movement moves the tracking away from the idea of hunting within the landscape of the quarry. Instead, the horizontal movements and the traced tracks result

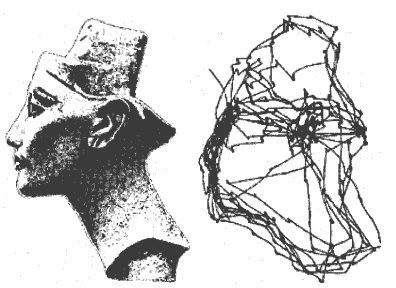


Fig. 68: Saccadic patterns. (Left) Drawing of a bust of Queen Nefertiti and (right) a diagram of the eye movements of a subject viewing the bust (Noton and Stark, 1971).

in a compiled view, where the designer is still aware of the original geometry, but now has available to them a wider network of possibilities. These possibilities emerge from the overlapping nature of the traces shifting the geometry from the perception of a solid mass to that of a series of points and lines. These points and lines, whilst at first appear as tangled juxtapositions of traces that visually we might draw parallels with a multiple exposer photograph, where elements appear suspended in time and suitably duplicated. However, when the combined traces are examined more closely they reveal that the geometry of the mass has transformed from a solid made of edges and faces to a skeletal network. Returning to Carter's (2009, p. 163) *Dark Writing*, we see that this new network of lines sees ambiguity emerge as the massing model sheds its volume and loses its rigidness.

What is interesting about this, is how, as a compiled view, it presents a new field to the designer. This field is viewed not in plan view, as anticipated in the interpretation of the prompt or through the eyes as a first person perspective but instead as an oblique aerial view somewhere in between. This view combined with the rotating and then tracing of the tracks contributes to the fact that the designer never completely loses sight of the original geometry. However, combined with the transversal view and layering of trace the designer is exposed to an expanded network of tracks that present not ambiguity but divergent potential for understanding the proposal within the quarry.

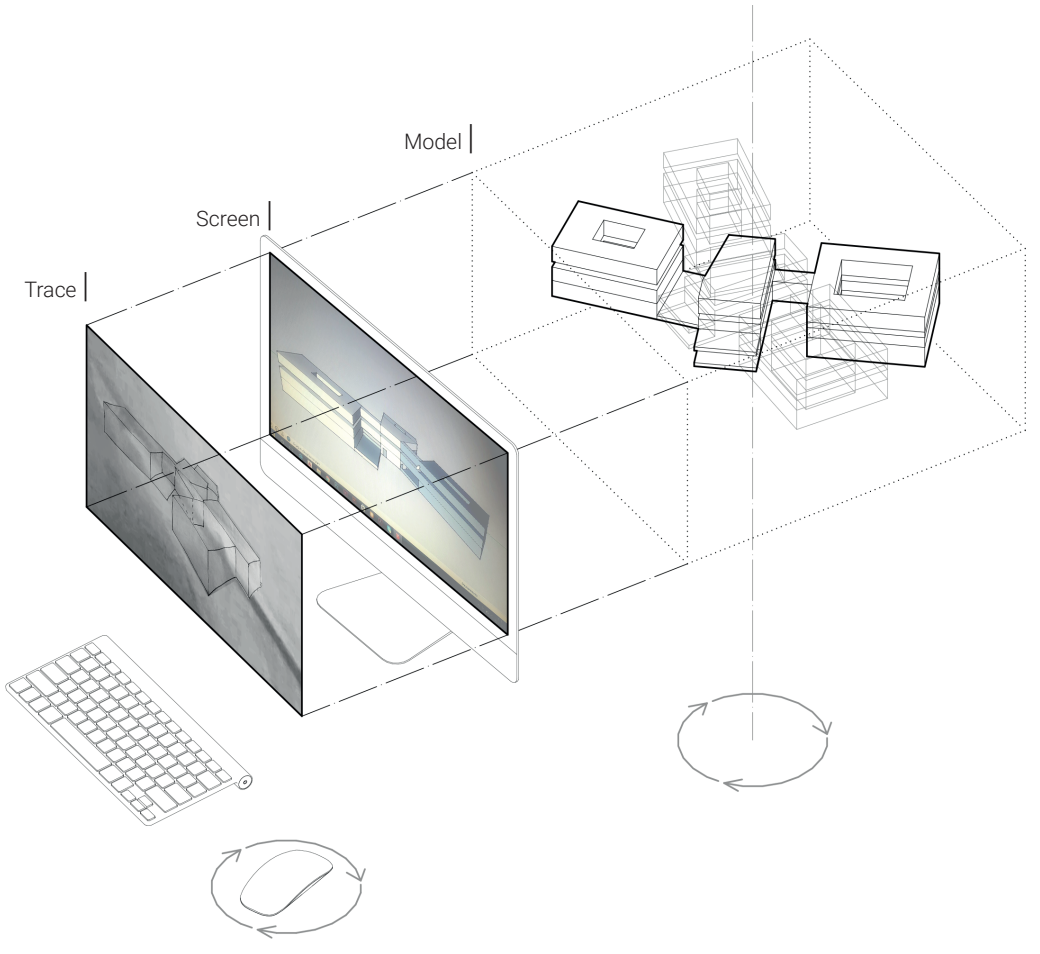


Fig. 69: Compiled view showing how the trace captures and tracks the rotation of the digital model behind.

5.2.1 | Shifting views

Within the film this is the point when tracing shifts from a divergent technique, which has been gathering tracks, towards a convergent technique where the designer starts to analyse the tracks. At this point the designer removes the trace from the screen and places it in front of them on the desk (fig 70 opposite). This act transforms the designer's orientation with the trace switches the designers interface from a forward facing perspectival view to downward looking. Before exploring what emerges from the downward tracing it is necessary to consider further drawing on the screen.

Drawing on the screen using CAD software is discussed by architectural theorist, Gevork Hartoonian, who observes that traditionally drawings are developed horizontally on the surface of a table, whilst screen-based media such as the massing model discussed within this chapter are developed in the 'painterly'(Hartoonian, 2010, p. 35). The painterly here refers to an equivalence with how a painter might operate in front of an easel looking between the subject matter and the canvas. In the project discussed a more subtle shift occurs with regards to the painterly before the filming of the process even starts. This shift occurs when the designer decides to create the massing model and switches from operating in a two dimensional software package to operating in a three dimensional software package. In creating the massing model the designer switches from a digital plan view presented on the screen to a perspectival view that matches there perpendicular view to the screen. This is done by exporting the plan of the building to a three-dimensional software package and extruding forms. This alignment of the media with the designer results in the objectification of the project, where the lines and shapes that make up a drawing have become solid masses, which through their perspectival nature start to push the designer towards a process of simulation. Hartoonian (2010) uses Alberto Pérez-Gómez's argument set out within 'Questions of representation: the poetic origin of architecture' to explain the difference between these two types of representation (Pérez-Gómez, 2005, p. 224). Pérez-Gómez proposes that screen-based media cannot be compared to drawing with a pencil, which allows a designer to *'transcend reduction'*, because it is inherently concerned with the perspectival and *'objectification'* of the world through pictures. Hartoonian proposes that the adoption of the 'painterly' as a way of drawing within architecture is a technological choice and can be seen as a digital manifestation of Alberti's (Friedberg, 2006, p. 42) drawing machine which was discussed within Chapter 4 (Pixelation: p. 109).

Here, the drawing machine, which allowed the replication of a perspectival view through a gridded window onto a gridded drawing surface is re-programmed into the digital coordinate space of the three dimensional modelling software. The issue with the shift away from the orthographic as a way of developing a project towards the objectification of architecture is that it reduces the opportunity for abstraction and, thus, the potential for the designer to think divergently. This is because geometrical replication in this way does not allow for either the visible to be omitted, such as the Quarry walls in the project explored, or the invisible to be made visible, such as the elements within the designer's mind to manifest within the drawn.

Hartoonian (2010) discusses how the work of Swiss architect Bernard Tschumi has been able to escape the objectification of the screen through the introduction of processes drawn from his Manhattan Transcripts (Tschumi and Young, 1994) The transcripts here offer a process to start distilling spatial events from a photograph through the development of a sequence of abstracted plans, sections and diagrams. This process sees the initial photograph transcribed into a sequence

of drawings that start to reveal the complex relationships between objects and events (Tschumi, 1976-1981). The Transcripts offer a means to *'protect architecture from the aesthetic consequences of the technification (digitalization) of architecture'* (Hartoonian, 2010, p. 38). Hartoonian explains how the processes underlying the Trascripts have infiltrated Tschumi's wider body of work and can be seen as a way of working between objects such as three-dimensional computer models and more traditional drawings. The example Hartoonian (2010) uses to make this connection are two drawings for the Museu de Arte Contemporânea, São Paulo, Brazil (Tschumi, 2001), one being a computer rendered image and the other being a sketched section. Here, he draws parallels between the two and suggests a reciprocal nature, where the diagrammatic sectional sketch is able to inform and offer a transcription of the model. Likewise, the sketch, here, takes on an element of the painterly model matching its orientation and form and starts a process of transcribing the potential circulation and events through a series of diagrammatic arrows and gestures.

Tracing over the screen not only offers a way to transfer ideas back into architectural drawings, but as with the Tschumi's Transcripts (1994), a way to start a reciprocal dialogue with the screen-based model. However, unlike Tschumi's transcripts, the trace offers a direct interface between the model and the emerging drawing. Critical to this part of the tracing process is the painterly angle, which maintains the designers orientation and connection back to the model.

As mentioned, following the rotating and tracing of the model, the designer removes the trace from the painterly orientation of the screen and places it on the desk in front of the them. In this new orientation the designer places a new sheet of trace over the traces and begins a process of tracing through lines. The removal of the trace from the screen sees the end of the divergent tracking process and the start of a new convergent tracking process, where the designer starts to track between the three traced forms in an attempt to find a new mass. Removing the trace from the screen means the designer detaches themselves from the three-dimensional environment of the software package, which shades the mass in a way to make it more object like. The traced lines on the table now appear flattened, compressed and less three dimensional. The designers relationship to the screen is now a process of glancing up to the model and then back down to the trace. The new mass emerges as the designer makes choices about which lines and forms to pull from the tracks. Even in its detached state the surface of the trace remains as a common interface between the model and the drawing continuing to provide transversal views across the two media and modes of subjectivity they suggest.

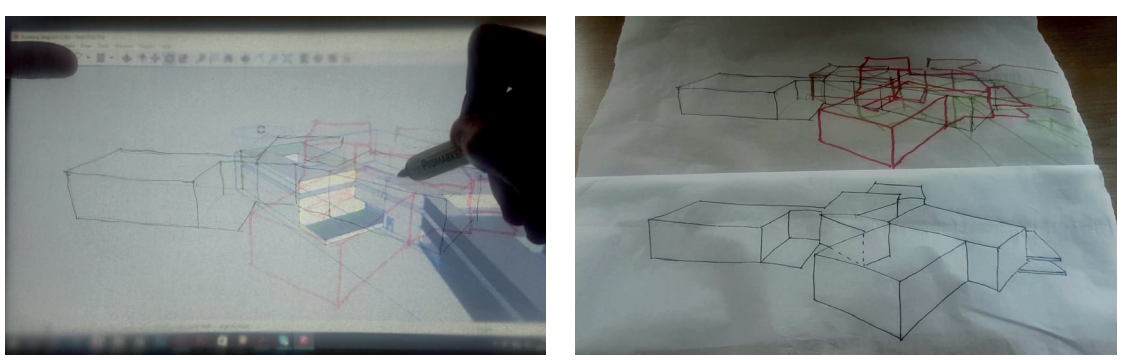


Fig. 70: 'Trace over screen and then rotate from an off-centre spot. Layer and repeat trace until new forms emerge', stills from a Divergent Deck film (2016). (Left) Image showing the compiled traced view on the screen and (right) the process of converging towards a new form on the desk.

5.3 | Plotting

The second project to be discussed within this chapter was produced in the same final year architecture and planning studio as the first project, taking place on the same quarry site in Salisbury and at the same master planning point within the design process. Here, we see how the divergent tracing exercises, which again emerge from the designer using the Divergent Deck, differ and reveal further details of how tracing is capable of returning ideas back to architectural drawing. The Divergent Deck film starts with the designer opening the Divergent Deck of prompts and carefully framing the creative block they are facing as a question: *'How to make the site more engaging / interactive for its users?'*. Following the framing of the problem the designer draws the following prompt from the Divergent Deck:

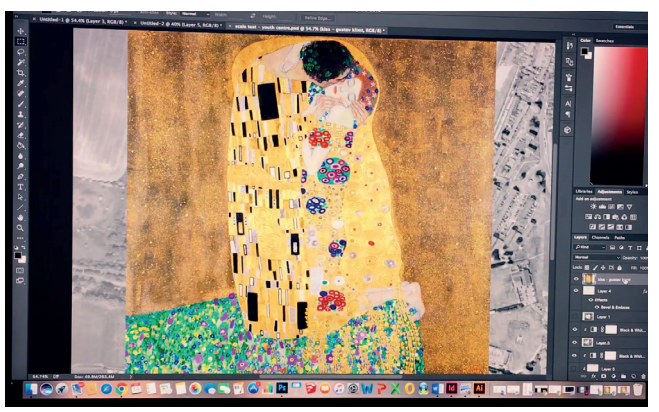
Hatch with colours from a painting you like.

Divergent Deck (2015)

As will be apparent from watching the film, tracing over the screen features heavily within the process; however, there is no mention of tracing and in particular no mention of tracing over the screen within the divergent prompt (Fig. 71). From this, it could be surmised that the designer looked at other prompts within the Divergent Deck containing tracing and decided to incorporate those process with this prompt. Or perhaps the designer saw their colleagues tracing as part of the Divergent Deck process and saw it as a useful way to get results, faced with the task of decoding a screen based hatched painting the intuitive response is to tackle this by tracing over the screen. Whilst it is not possible from the film to understand why the student introduced tracing it does not really matter. What matters here, is how tracing is introduced and how it plays a vital role in plotting between the forms that emerge from hatching over Gustav Klimt's The Kiss (1907-1908) and an aerial photograph of the quarry.

00:39 Aerial photograph of the quary

00:45 Inserting The Kiss (Klimt 1907-1908)



00:54 Blending the quarry and The Kiss

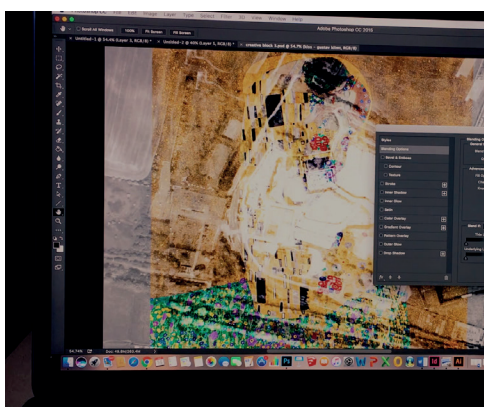
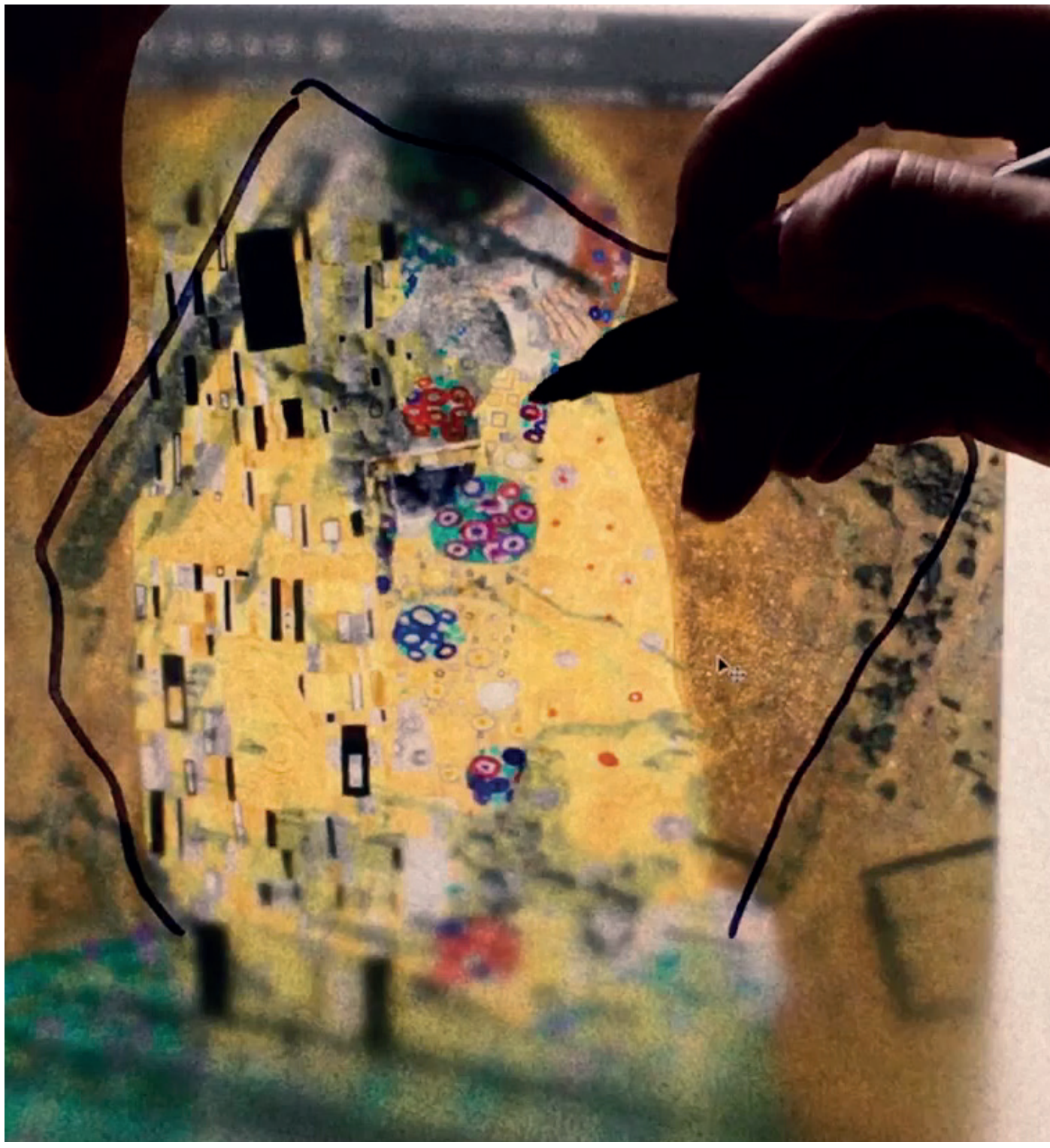
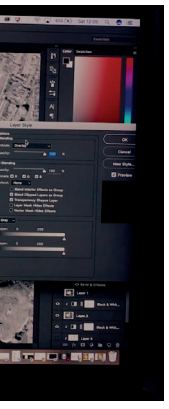


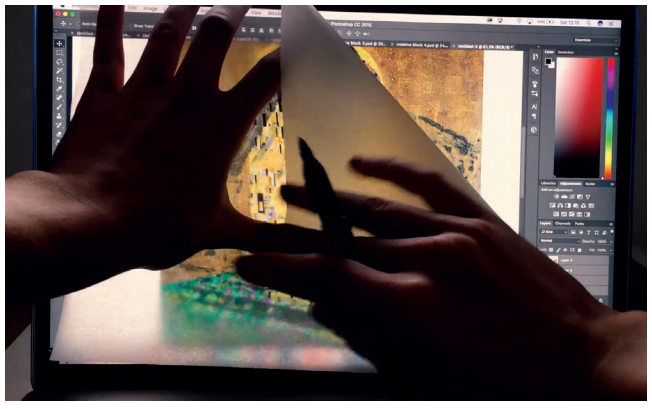
Fig: 71: 'Hatch with colours from a painting you like', stills from a Divergent Deck film (2016).

01:44 Tracing between quarry and The Kiss



01:40 Postioning trace against the screen





Plotting carries multiple connotations referring to its etymological origins of plot both in the sense of *'to lay plans for'* and *'to make a map or diagram'* (Harper, 2001). Plotting, here, also examines the grammatization of the process into a means for transferring digital information onto paper. The introduction of tracing over the screen sees a new hybrid form of plotting emerge, which enables the designer to plot between digital screen-based media and the trace as an emerging drawing field.

As mentioned earlier, the film opens with the designer clearly framing the problem they want to tackle. This initial ability to clearly frame the problem is what sets this process apart from the tracking process of the previous project, where there is less certainty about how to tackle the problem. According to Schön (1982, p. 39-40), the act of problem framing (setting) *'… is a process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them'.* Within the analysis presented here, framing the problem is a step towards the next stage of using the Divergent Deck's prompt. Here, however, the designer goes beyond problem framing and, after reading the divergent prompt, begins to introduce further processes beyond the identified problem and the prompt. An example of this is the decision to layer Gustav Klimt's The Kiss (1907-1908) with an aerial photograph of the quarry and start manipulating the opacity between the two.

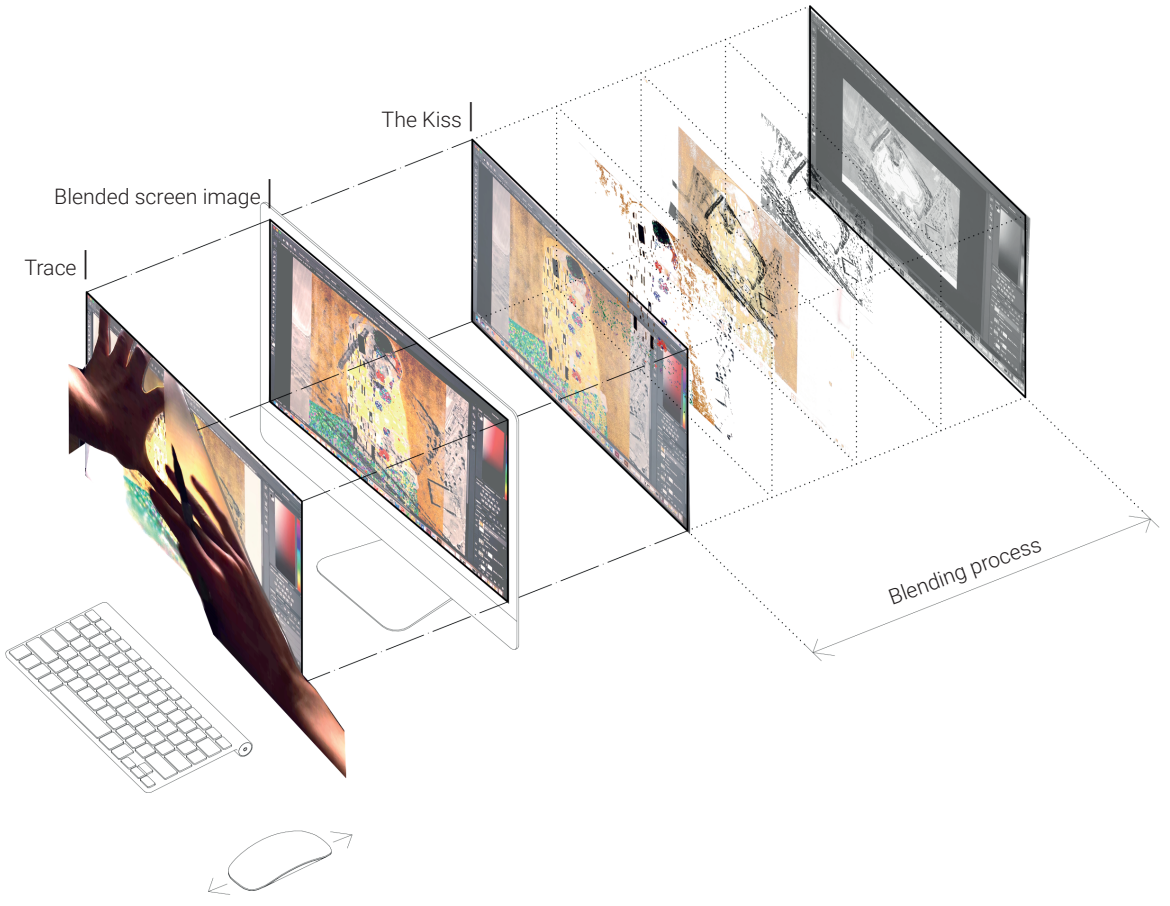
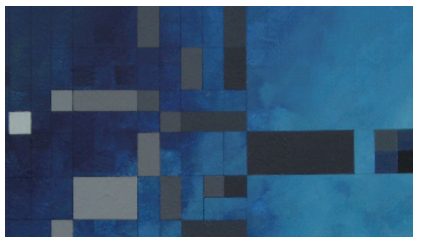


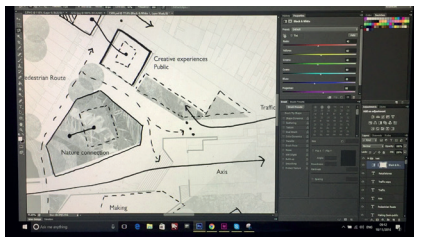
Fig. 72: The quary and 'The Kiss' (Gustav Klimt, 1907-8) being blended in Photoshop and, consequently, traced over.

Taking a step back, the intention behind this divergent prompt had been for a designer to transform a drawing by hatching in areas with colour so that it might take on a more diagrammatic form and start to help them understand relationships between spaces. Hatch here, referred to carefully filling an area of a drawing with parallel lines to denote areas, such as rooms or zones. The selecting of a painting was intended to provide the designer with a colour palate that would take away the need to develop their own colour scheme and allow them to focus on hatching forms and shapes within their drawing. An example of a different designer using the same divergent prompt (Fig. 73). Here, the designer takes a more literal approach to the prompt and as anticipated hatched a plan for a project transforming it into a colour coded diagram. In this instance, a divergent leap does not emerge.

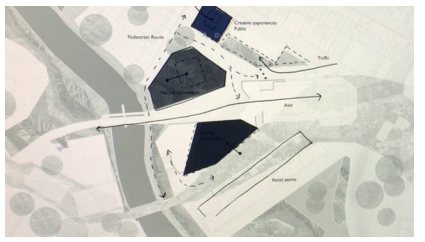
00:51 Painting selection.



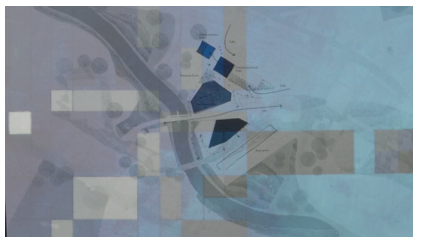
01:09 Project master plan.



02:57 Hatching the masterplan with the painting.



03:04 Overlay view of masterplan and painting.



5.3.1 | Field plotting

Returning to the project, the opaque layering of The Kiss with the aerial photograph also sees a departure from the divergent prompts suggestion of hatching. Rather than block hatching the forms, as proposed in the prompt, the designer plays with blending the painting with the photograph through Adobe Photoshop trying to find an interesting juxtaposition between the two media. The process starts by turning the aerial photograph into a black and white image heightening its contrast so that the different levels and textures of the quarry and its surrounds become more abstract. This abstraction process shifts the aerial photograph towards the painterly qualities of the Klimt, in the sense that it starts to homogenise areas of the photograph to the point that new forms start to emerge. Examples of this are the trees that wrap around three of the Quarry's sides start to take on a figural quality similar to the couple embrassing within The Kiss. Also, the more sporadically dispersed vegetation around the Quarry particularly to the East starts to produce an equivalence with the embroidered mosaic patterns on the garmets (Fig. 74, p. 131). What this abstraction amounts to when combined as an opaque layer with the Klimt is that of a double exposure where the resulting image is capable of being read by the designer in multiple ways. As established in Chapter 3 (Cut-up: p. 68) double images by their very nature offer up newly juxtaposed fragments between the two images, which the designer can reassemble into a new whole.

Fig. 73: 'Hatch with colours from a painting you like' (2016), filmic stills from the second film to use the Divergent Deck card.

Further, the two images start to create a field condition between them where the designer can start to trace out lines and forms. Field condition are defined by architect and theorist, Stan Allen (1999, p. 92) as *'…any formal or spatial matrix capable of unifying diverse elements while respecting the identity of each. Field configurations are loosely bound aggregates characterized by porosity and local interconnectivity'.* Here the field becomes the divergent plotting ground where the designer can plot back and forth between the two media. Here, tracing becomes the field, which physically sits above the screen but operates between the layers plotting and scheming and new forms. This process differentiates itself from tracking by moving beyond the initial divergent prompt, carefully mutating the processes and, here, producing a field where the designer can plot new material. Plotting here is not about hunting for the problem within an existing landscape but instead creating a new landscape (or landscapes in this case) where the designer takes control of the emerging field and is capable of choosing what is and what is not plotted.

Within the film the plotting is further amplified by the designer, manipulating the two landscapes of The Kiss and the aerial photograph. This results in the production of four options (Fig. 74). One of the options created sees the designer invert The Kiss changing the gold leaf to a midnight blue. What is apparent from this manipulating is how it results in four completely different field plots.

At the end of this process the designer takes the plots from the screen and starts a process of combining them on the desk. This is a similar process to the first project within the chapter and again signals the start of a more convergent process, where combining the plots enables the designer to look for the emergence of new plan options. Here, the designer finds that combining two of the plots with the aerial photograph gives them a new plan which outlines potential solid and void spaces and routes between them (bottom right image, Fig. 74). However, unlike the first project (p. 121), which saw the designer track between the multiple traces of the rotated model to converge on a new form. Here, the designer works with The Kiss and the aerial photograph to uncover new readings of the site.

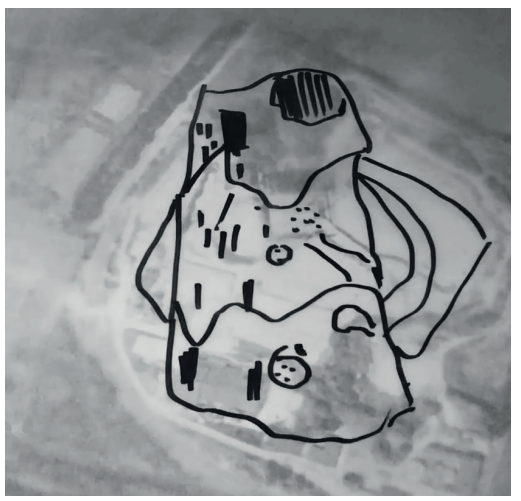
What differentiates plotting from tracking goes beyond simply scheming for ideas and, instead, requires the designer to start a rigorous design process, where they methodically search between the plots in order to uncover a new landscape. Within the discussed project the initial divergent prompt provides a ground for this search, where it is possible to observe the designer adding to and developing their own process, thus, mutating and enabling the plotting process to be revealed. In terms of divergent thinking, this process differs from a position of problem framing where we attempt to 'frame the context in which we will attend to' (Schön, 1982, p. 39-40), to a process where the context is unframed and open to manipulation and, through a rigorous process of plotting, new ideas can be uncovered.

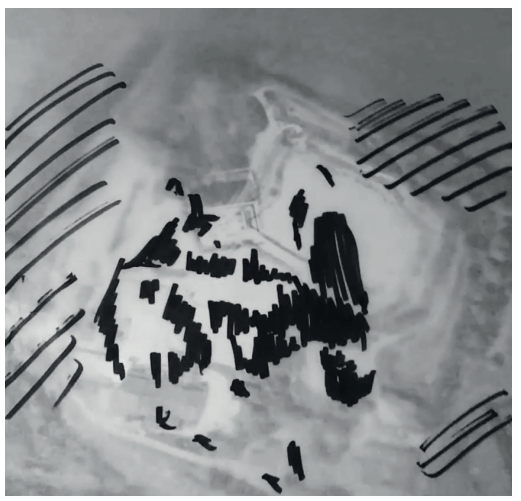
01:39 Blend 1 and resulting trace.

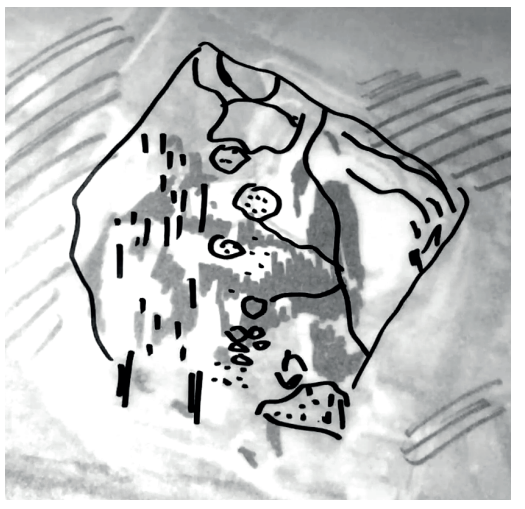
01:58 Blend 2 and resulting trace.

02:09 Blend 3 and resulting trace.

02:25 Blend 4 and resulting trace.







03:12 Combination of trace 1 and 3.

Fig: 74. 'Hatch with colours from a painting you like' Stills from a Divergent Deck film (2016) showing the four blended options between the quarry and the 'The Kiss' by Gustav Klimt (1907-8), with the trace positioned underneath. The bottom right image shows the combination of Traces 1 and 3, which led to the resolution of the project.

5.4 | Projecting

The final project within this chapter was undertaken by myself and involved the brief for the Birnbeck Pier and Island project, used previously within Chapter 3 (Cut-up: p. 87). As previously stated, Birnebeck Pier and Island comprise a dilapidated Victorian attraction, which sits within the Bristol Channel and is in urgent need of restoration. This use of the Birnbeck Pier and island brief occurred before the cut-up project brief in parallel to a Masters of Architecture studio, where students had been asked to produce proposals for the pier and island (link, Fig. 75).

In a moment of curiosity, I decided to take the brief and the material I had collected at the outset of the project and use it myself to develop a proposal and test the Divergent Deck. As with the other projects within this chapter the test of the Divergent Deck was recorded as a short film, which captures me developing a concept for the pier and island along with using the prompt. Within the project again tracing emerged as a key technique for returning the emerging divergent ideas back to architectural drawing. However, unlike the earlier projects discussed, which saw tracing paper placed over a screen, here we see tracing paper projected onto. This will reveal further qualities of trace, including how as an interface it is capable of capturing and iterating the desires of the designer. Whilst this element of desire is arguably present in other forms of tracing, here this will be made more explicit through the reordering of conceptual spaces and fields of action that projection allows.

The film starts with me experiencing a creative block, where I have looked at so much information regarding the pier, I am unsure where to start. This confusion extends to whether I should develop ideas for the both the pier and island or just focus on one. The information I have gathered at this point includes maps and surveys of the pier, a database of historic photographs and finally notes from conversations with the piers trustees.

Within the film I mention that I am trying to carry out the process quickly and, as such, perhaps have not had sufficient time to let the information I have looked at, sink in and start to form ideas. The pressure of time is something that designers often face and part of the idea behind using the Divergent Deck is to instigate a process, which helps the designer interrogate the material further. On turning to the Divergent Deck, I pull out the prompt:

Trace over the screen scan and reinsert.

Divergent Deck (2015)

This prompt was developed as a way of exploring moving back and forth between analogue and digital interfaces with the intention to examine moments of divergence occurring between them. On initially reading the prompt, I was still unclear on how to start the process so I decided to quickly read the instructions I had developed for the prompts, which included an example of how you might interpret a prompt. The instructions gave an example where if, say a prompt contained the word ‘mirror’ one could interpret this in multiple ways, such as horizontally flipping an object. However, one could as well be more divergent, perhaps translating this as *looking into* a mirror whilst designing. On reading these instructions I decided to introduce *mirror* into the process, not just because it featured on one of the prompts within the deck but also because it had become a common digital CAD process, where you might horizontally flip an object such as a door so that it can be used within

a different orientation without being redrawn. Whilst not include within to the prompt I had originally pulled, in the haste and speed with which I was attempting to develop an idea the term ‘mirror’ stuck with me and infiltrated my thinking about this project. This in turn initiated a chain of events that led to *mirror* becoming merged with the initial prompt to *Trace over the screen scan and reinsert*.

Drawing from the CAD origins of the term, in the context of the specific project, *mirror* was interpreted as entailing a doubling or copying of the screen image. Within the process this was performed by re-projecting my laptop screen onto a piece of tracing paper, by placing it on the bed of a digital overhead projector and projecting the image of the screen. The screen of the laptop, shifting through a series of preliminary images and drawings from the project, was in effect being mirrored or copied onto the wall by the projector. The tracing paper, allowed me to iteratively record the projections and gradually look for interesting juxtapositions between the emerging traces and projected media. It is important to note that the overhead projector used was a digital device, which could zoom in on an image, freeze an image and sharpen it through automatically focusing. However, a seeming downside to the digital overhead projector was that it produced a delay between the screen and the projected image where at times frames would be dropped from the projection sequence. The result of this lagging was that the projection at times slowed and then sped up, which, whilst fragmenting the persistence of vision, had the benefit of offering me sudden glimpses of objects to trace.

The introduction of the screen to projector mirroring also allowed for an analogue manipulation between the screen and the projection. Here, the insertion of my hand as I first manipulated the digital image and then went on to trace it directly affected the emerging trace. As I began to intuitively trace over the lines of the projected digital media my hand would temporally block the projector light reaching the surface of the trace.

00:47 Sifting information. | 01:19 Mirror interpretation. | 01:40 Projecting laptop. | 01:39 Tracing projections.

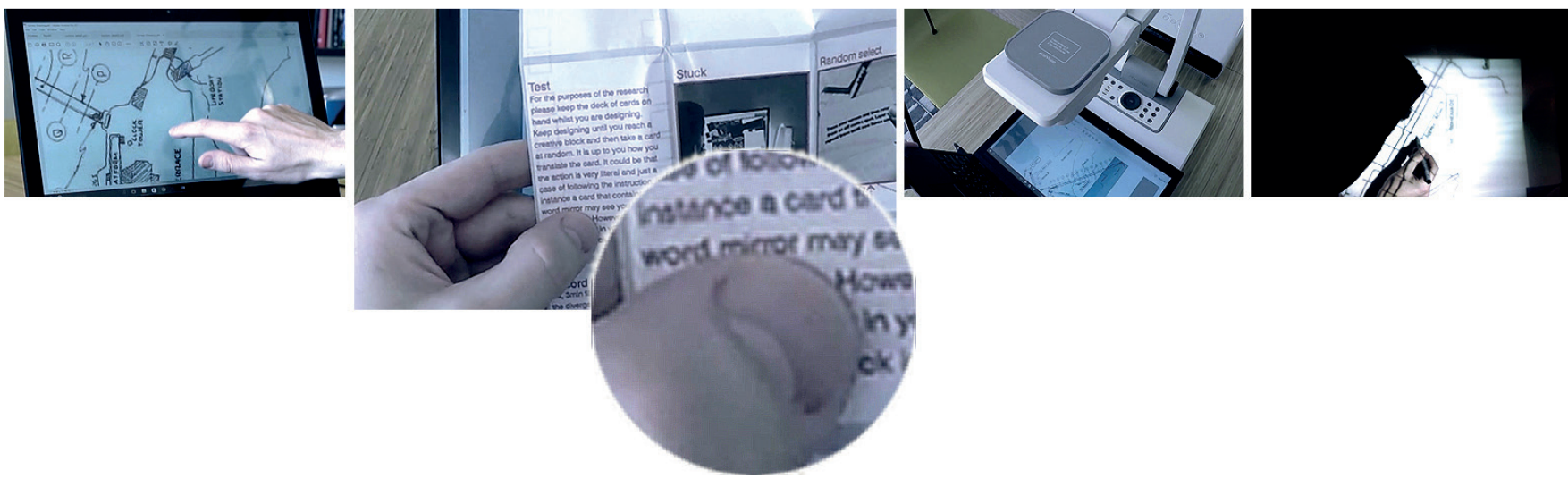


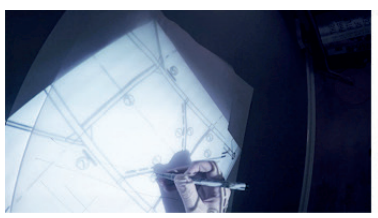
Fig. 75: ‘Trace over the screen scan and reinsert’, stills from a Divergent Deck film (2016).

Whilst projecting onto the trace had removed the opportunity for the *sotto-lucido* effect, where divergent possibilities could emerge from below, the hand created a shadow between the projection and the trace which causes a temporary visual suspension within the digital interface and offers new opportunity for divergence to enter the tracing surface. In this process as the hand and pen tip move towards the projected line it eclipses the projection meaning it must approximate the intended trajectory of traces. When the shadow passes the brightness of the projection floods back over the trace and the traced lines appear feint to the eye. This process leaves the eye switching between the projected image and the emerging drawing field within the shadow. As the drawing field builds through the iterative switching and tracing of the projected media, the trace starts to emerge from the shadow and become visible even when projected over.

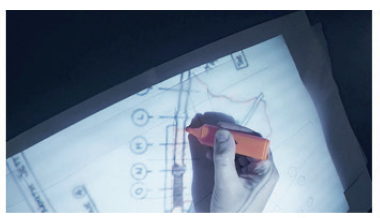
This reading of the shadows within the process can be expanded further by examining Stan Allen's (2012) reading of the classical legend of 'Diboutades' and the origin of drawing. The story as narrated by Pliny the Elder has been brought into architectural theory by Robin Evans (1997) and offers further insights into both projection and shadow.

Within Joseph Suvée's 1791 painting of the story we see Diboutades using a stick of charcoal to trace over the projected shadow of her lover on the wall. The shadow here is created by the proximity of the candle within the scene and has the effect of transforming the three-dimensional figure of her lover into an abstracted two dimensional form that can trace around. Similarities here can be drawn with orthographic projection, however what is most interesting is how the trace records Diboutade's lover who exists within the scene but will soon become absent (Allen, 2012, p. 4). Allen here proposes that this tracing of absence has parallels with tracing a physical form such as a building. However in architecture it is the trace that arrives before the building and absence here is not sadness but instead an expectation of the arrival of a physical form. Allen goes on

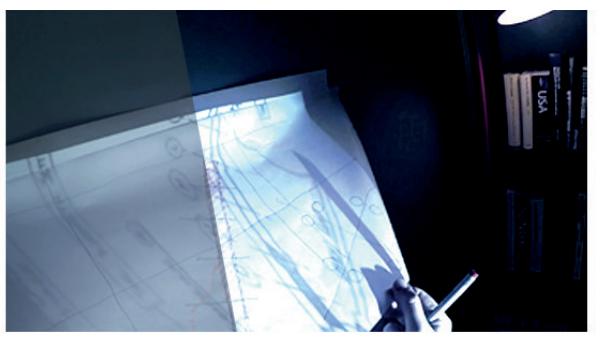
02:02 Tracing information.



02:26 Highlighting elements.



02:44 Pulling trace causes shadow line to radiate.



02:54 New geometry emerges.

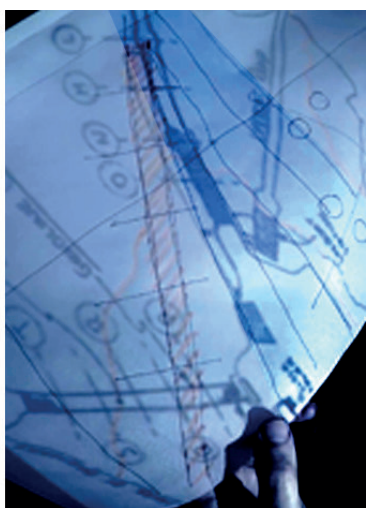


Fig. 76: (Top right) 'Invention of the Art of Drawing' (Joseph-Benoit Suvée, 1791).

Fig. 77: (Bottom) 'Trace over the screen scan and reinsert', stills from a Divergent Deck film (2016).

to propose that in both cases tracing the absence results in desire (Allen, 2012, p. 7). Within the painting we can see the tracing as the desire for Diboutades' lover to return and within design we can see desire as the emerging traces of a project being projected out as a physical form into the world. Here, desire can be more accurately aligned with a type of convergence that seeks to trace ideas back into the architectural drawing, where they remain fluid enough for further divergent ideas to contribute towards the design process but fixed enough that the project moves towards a physical projection.

Returning to the film, a critical moment occurs when I start to pull the trace from the wall but stop as I realise that the lines from the projected pier plan start to radiate out from the end of the pier. I carefully trace these radiating lines adjusting the pitch of the paper to the projection.

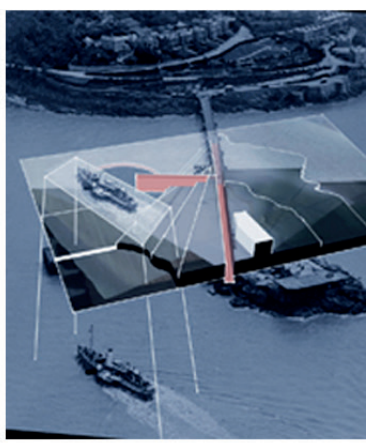
On finishing tracing the radiating lines I place my hand into the projection to make them clearer and, whilst I am not completely sure what has emerged, I decide to scan in the trace and begin to work on it within a three-dimensional CAD package. Here, I transform the sketch first into a two-dimensional plane and then start to draw over the traced lines. I begin to treat the radiating lines as contours that step down from the pier and create a new landscape. In this process I transform the sketch into a model by projecting out its surface. At this point, the idea being traced fully emerges and manifest as a new jetty structure for boats to moor at the pier. This idea fits in with the history of the pier, which had a North jetty that provided a ferry terminal for paddle steamers to dock at as they moved passengers across and up and down the Bristol Channel. As the idea is developed further it goes beyond the jetty and starts to propose a sunken marina, which is capable of harbouring boats during low tides.

03:18 Trace scanned into CAD.

03:34 Jetty idea emerges.

03:44 New jetty drawn.

04:13 Final form.



The projecting and tracing techniques found within this project have seen further expansion on the ability of tracing to return divergent ideas to drawing. What is more important, however, is how the mirroring and re-projection techniques enabled the designer to position themselves between the screen and the projected image. Here, the designer's hand, which created a shadow between the interface of the screen and projection, allowed for a further understanding of projection through the idea of desire as expressed in the legend of 'Diboutades', on the origin of drawing as an act of tracing. This in turn allowed for ideas of desire but also absence, to be explored as a type of convergence that are not only expressed in the return of ideas to drawing but also in the projection of physical propositions. Convergence here, goes beyond the term defined by Guilford (1967), which concerns being able to logically hone an idea through a step by step process which does not require any significant creativity (Cropley, 2006). Here, convergence requires divergence and is aligned with a desire to trace though divergent ideas into the physical, which can then be projected out into the world. Critical to this idea of convergence is its continued balance with divergent thinking, which, as eluded to by Lawson (2006), is necessary within a creative architectural design process.

5.5 | Conclusions

In this chapter, the investigations of tracing over digital media have demonstrated how tracing surfaces can operate as an interface for designers that enables them to draw through divergent ideas as recognisable drawing syntax. This syntax underpins structure of architectural drawing and, in this sense, the divergence explored here is about the return of ideas back to the architectural design process through drawing. Here, the obscuring qualities of tracing paper identified previously by Frascari (2007) as transitus, where ideas cross between the fibrous faces of the trace, were expanded upon and found to contribute towards the divergent transformation of drawings into images and back again.

The development of new techniques for tracing over screen-based media has allowed for an expanded investigation into how divergent ideas emerge through trace. These techniques have seen myself and other designers examine trace's qualities as an interface by testing them on actual design based problems. What these projects have revealed is that the ideas, which emerge through tracing over digital media, do not just exhibit qualities of divergence but also qualities of convergence. This convergence is not as Guilford (1967) defines as a logical step by step process that sees the solution emerge through a reductive process of focusing in on the problem. Instead, a process driven by the desire to see ideas emerge through trace into the realm of architectural syntax, where they can start to project out physical propositions into the world. Whilst these findings come from the examination of expanded tracing techniques, where trace becomes an interface to the digital, the conclusion that trace is capable of returning divergent and convergent thinking to the landscape of the architectural drawing are equally applicable to more conventional uses of trace. Here, the ideas of tracking, plotting and projecting can be related back to processes that will be familiar to all who employ trace as a means to develop and think through ideas.

The analysis of the first project (p. 121) looked at tracking, the movement of the eye following an object, as analogous to the act of tracking in the sense of hunting for ideas. This hunting manifested within the tracing process where the designer tracked between a digital screen-based model and a sheet of trace. Here, an iterative process of repeatedly tracing and rotating the model saw the designer look past its objectifiable form and transform it into a series of traces. What emerged from

these traces was a skeletal network of tracks that through a further tracking process the designer was able to draw out into a new form.

Within conventional practice tracing over a printout of a digital model is commonplace. Whilst this is often done in order to make a presentation drawing look sketchier and appealing at an early stage within the design process, it can also be used as a development tool. In this sense, sketching over a model on a desk, whilst manipulating a model on a screen, allows the designer to explore an idea through multiple media.

What is particular about the ways that tracking manifests within the discussed project is that it takes place on top of the screen making an explicit interface between the digital and the analogue. Here, ideas are tracked in a painterly orientation and drawn through into an emerging traced field. This sees the semi-transparent qualities of the tracing paper soften the digital image enabling the designer to capture the transitus of digital ideas emerging within the field of the trace.

The analysis of the second project (p. 126) saw plotting both in the scheming for ideas and in the ability to plot new landscapes between media. Here, plotting emerged in situations where the designer acquired the confidence to depart from an existing process and carefully plot a new set of moves. Within the project this was seen when the designer started a process of adding to and developing the suggested techniques within the divergent prompt they used. What this plotting process led to in terms of a development of how trace is able to return divergent ideas to drawing syntax was an understanding of how it is used within a process of problem framing. What was found here was that, contrary to Schon's (1982) suggestion that problem framing is concerned with framing the problem within its context and deciding how to tackle it, here the context of the problem is itself opened to manipulation, where through a rigorous process of plotting between the emerging context new ideas can be uncovered. This, in turn, led to a realisation that the divergent and convergent qualities of tracing are concerned not with drawing around a problem but with drawing out the solution from within.

The analysis of the final project (p. 132) saw the emergence of analogies between tracing and projecting. Firstly, quite literally, the digital media were projected on the tracing surface rather than illuminated by the screen. Secondly, tracing allowed for a greater understanding of how, through the shadows, ideas can converge towards the designer's desire for their manifestation into the world.

In all three projects examined, despite the Divergent Deck's intention to diverge, the tracing techniques employed enabled the designers to return their ideas back to architecture by converging them into drawing. In terms of understanding divergent thinking, this builds on Lawson's (2006) proposition that within the architectural design process there must be an equal balance between divergent and convergent thinking. Expanding on this, throughout the projects discussed we can see that, regardless of how divergent the process becomes, this is always balanced by the designer's desire to converge ideas back to an architecturally meaningful articulation through drawing. In this sense, tracing, by entailing the divergence of acts of tracking and plotting through projection, becomes a convergent interface for the appropriation of media and ideas from both beyond and within architecture.

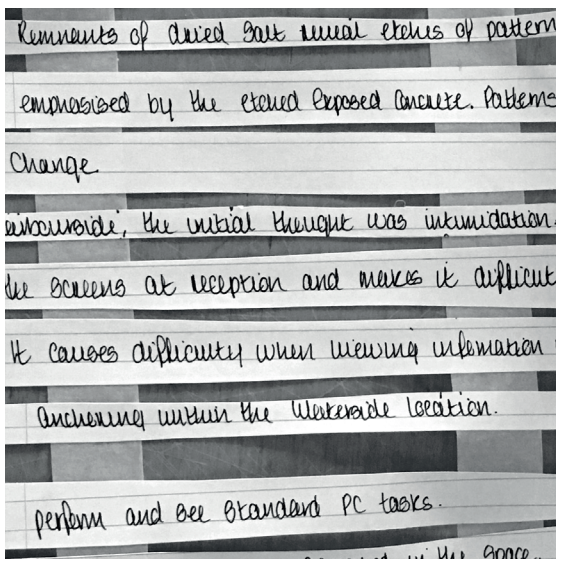
6 | Towards an architectural divergence

6.1 | Converging divergence

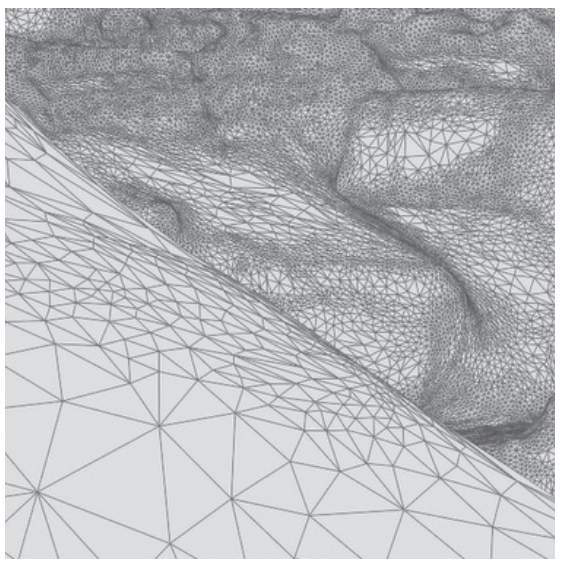
This thesis set out to examine the ways that divergent thinking takes place within and defines the architectural design process, not to demystify and model creativity, as others have tried to do before (Lawson, 2006; Cross, 2006), but rather to understand how it emerges beyond the designer's behaviour, between and across media and their corresponding cultures. It did so by introducing, tracing, scrutinizing and eventually defining more explicitly the concept of the design leap, as an identifiable act of divergence that enables creative productivity within the process of design. The research responds in part to the digitalization of architectural media, which first emerged in the late 90s with the advent of CAD packages and photo editing software. As illustrated, this trend has today led to a further move towards the systemization and simulation of the design process through software and their digital environments. The shift to a design process that is understood and played out as a simulation of building, rather than a process of creative abstract thinking that has been consolidated by software such as BIM, over the last decade, presented this research with a critical starting point that led to a wider examination of design thinking. Through this move to simulation digital approaches to architecture commonly evade the opportunities for creative leaps and, by extent, limit the fecund field of creative and critical divergence, presenting a convergent, systematized and predictable approach to design for the built environment. This tendency moves the design process away from the plurality of media that had formerly comprised the architect's field of thinking, by collapsing the design process into a singular simulative medium. The focus of this study is exactly this now contested plurality, which emanates not only from the diversity of architectural media but also from the movements and moments of divergence that the thinking leaps, which emerge and flourish across them evoke. Concerned with the idea of the designer's cognitive 'leap' as an integral component of the creative process, the research examined these creative transitions and the ways that these become enabled in a range of media environments. In doing so, the research located the design leap, not so much in moments of conceptual 'bridging' (Cross, 2006, p. 78), but rather as the iterative manipulation of techniques that take place within and through the media used.

Critical to this framing of the design leap was the definition of the architectural habitus as an expanded set of dispositions, which embody both the designer's tacit skill and cunning. This was carried out by extending the concept of the 'habitus' as previously defined by Bourdieu (1967), out into the milieu of architectural media and the ways these become appropriated from within the design process. The research posits that it is this symbiosis of the designer and media that enables the manifestation of divergence and consequently its consumption and iteration back into the design process. This bending of habits, tools and conventions, which the research has shown, relies on the representational abstraction that architecture's own spatial syntax entails. Furthermore, it is this attachment to architecture's tradition that reveals the design leap as a diachronic condition of architectural creativity, that is informed and enabled by media. The thesis ultimately defines the design leap as an inherent to architecture quality of difference that, even though flourishing out of the plurality that mediations create, is neither limited by their specific conditions nor motivated by their conventional utility. Rather, the design leap operates from the co-optation and instrumentalization of the translative gaps that media, architectural or not, create through their grafting onto a core of architectural representation and, by extent, spatialisation of meaning.

| Cut-up



| Pixelate



| Trace

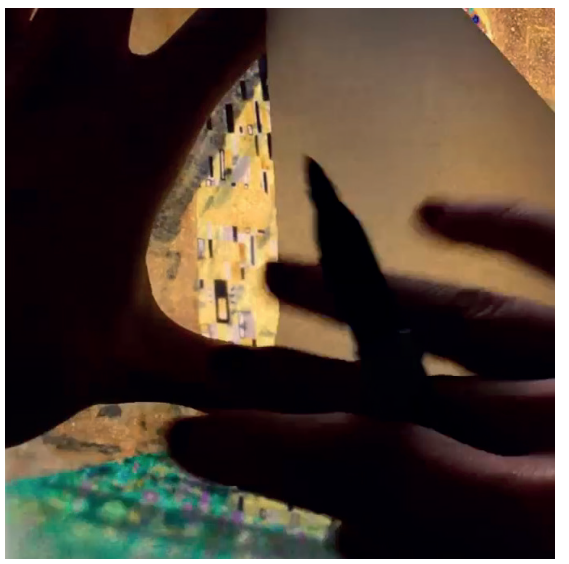


Fig. 78: Images from the three leap chapters: Cut-up, Pixelate and Trace.

6.1.1 | Leaping by design

The methods of this investigation reflect themselves the dynamic balance between convergence and divergence, and the appropriateness of the approach through a design-led process of inquiry. The articulation of design as not only a field under examination but also the method of research, was in this context twofold. On one hand, the design of the prompts employed the quality of a critical survey, collecting, gathering and redeploying a range of gestures, techniques and responses to media, themselves drawn from the habitual reflections of design practitioners. Thus, the investigation began with opening the architectural design process onto pre-existing elements of divergence from both within and beyond the architectural design process, characterised by their qualities of enabling creative processes to occur. These elements, regardless of their origins, were either already situated or re-situated, and thus repositioned, in the architectural design context, through a process of semiotic interpretation and appropriation that offered ways of intentionally promoting the rerouting of the thinking process back on to a renewed reading of the material. Specifically, techniques of divergence were initially incorporated into the development of a Divergent Dice Game (p. 45) and later expanded through the formation of a Divergent Deck (p. 54), which was modelled after Brian Eno's and Peter Schmidt's Oblique Strategies (1975).

On the other hand, the application, iteration and re-examination of these divergent tools unfolded across a series of design-based projects, workshops, architectural competitions and engagements with artist and community groups. The expansion from the six actions of the divergent dice game to the fifty Divergent Deck prompts demonstrates how the divergence of the field, expanding through iterative testing, called for a respective divergence and proliferation of tools and applications. The creation of the Divergent Deck saw not only the initial dice actions expand into multiple prompts but also the techniques that had emerged repeatedly within and between the dice actions formed into new distinct prompts. The range of design contexts to which these were experimentally applied, either by design through the explicit use of the deck, or by observation, through an a posteriori recognition of divergent processes responding to those included in the deck, are not presented here

Fig. 79: Image of dice being thrown. Image of Divergent Deck (2016).

as definitive verifications of the value of the leap, but rather as elements of a survey themselves that capture and, thus, allow for the observation of the leap to occur.

As such, the prompts and the 'by design' divergence that they evoke do not propose a universal toolkit to safeguard and promise divergence as a token of design quality or productivity. Instead, through their prompting of the leap, they provide a range of precedents for a reflection on action. Despite their commonalities, the various design project examples discussed in this thesis, each offer distinct responses and outcomes to the idea of design as a 'problem'. The aim of the design leap is, after all, not that of repeatability, which, as discussed in the context of other processes of systemization (from BIM to cognitive science models of creativity) pursue a convergence of a creative process that is at least paradoxical, in their short-circuiting of novelty and uncertainty. The design leap's reliability, as captured in this survey of diverse creative operations, lies precisely in the embrace of the difference and diversity through which architectural design proceeds as an indefinite, ever-evolving body of knowledge and, thus, as a form of knowledge that is forever able to adapt, produce and create. This knowledge is, as shown in the discussion of the projects, at the same time consolidated and fleeting; embedded in a both embodied (individual) and mediated (contextual) architectural perspective of spatiality. This spatial perspective emerges in the complex interlacing of an architectural tradition of representational convention, the various media that develop and evolve spatial mediations and representations personal and, lastly, the tacit and therefore often personal appropriations that the gaps within those allow. Each of these elements actively contributes to the development of the architect's dynamic habitus, motivated by the convergence of an architectural tradition of signification onto the divergence required for creativity to occur. The question of the validity of the design reflection as method, here then lies, as in the design leap, not in the repeatability of the process but in the ability to demonstrate architectural intent and control over the process and the media involved. It is this ability to direct divergence by responding and partaking into both architecture and the collateral media employed across each project that defines each one of the projects discussed here as successful, relevant, and therefore valid manifestations of the design leap. The agency of media, and most importantly of architectural syntaxes of spatiality that this understanding of the architectural habitus suggests, on one hand, challenges the authority of the designer as the leading mind, exposing the limitations of the human-centric cognitive models that have preceded this study. However, it is important to underline that the divergence that this theorisation of the design process entails, does not and should not intent to 'relieve' the designer from responsibility. The resistance of architectural design and the complex architectural habitus that enables and validates it to formulation and systemisation, relies both on the versatility of media and the designer's ability to harness these to their desire. Either the systemisation, and thus convergence of the creative process or the relinquishment of intent, would both entail the lack of design rather than its resolution. In this context, neither the availability of media nor the provision of designed prompts can be seen as a 'solution' for design.

6.1.2 | The leaps within the leap

Across the projects studied in this thesis, the expanded range of divergent prompts actively re-contextualized divergent techniques into new contexts of media and action. The most obvious example of this was tracing, originally a key technique for drawing between and across print media, both within the dice game and within architectural tradition as a whole. Through the testing, however, tracing emerged again and again, as a means of transposing the thinking process between analogue

and digital forms of representation. As a result, the tracing prompt became integrated into a number of the divergent cards, inherited from the architect's traditional toolkit, into a means of appropriating analogue, as well as digital forms by merging screen with paper. Less obvious was the expansion of pixelation, which revealed affinities between the architectural grid, the screen and the polygon mesh of digital modelling, defining a process of visual fragmentation across media as a way of producing new meaning. Similarly, the cut up, marking a primary divergent prompt from outside architectural tradition, moved from text within Dada creative practice, into figural collages and drawn grid-like delineations of architectural briefs, programmes and sites.

It is important to note, rather than assuming the primacy of any technique against the other, how the exchanges between techniques, tools and modes of creative production, were enabled by the dice and the deck as convergent tools of divergence. In their ability to systematize and organize the prompts, while introducing randomness, it was the dice and card as systems of both organization and random retrieval that allowed for a transposition of ideas and techniques across the various prompts. This transposition of ideas and applications in turn allowed, through the analysis of the tests, the further understanding of the three key techniques: cut-up, pixelate and trace.

The patterns of diverging and converging that emerged within the design components of this research can be seen within the organisation of the three Leap Chapters. The recognition of these leaps and the formation of the respective chapters, came as a result of an overview of the significant number of projects that were carried out for this research, both by myself and other designers, which revealed the prominence of these key techniques, their expansions and transpositions, across a wide landscape of divergence. Although Chapter 2 offered a chronological unpacking of the creative practice component of this research, the leap chapters, instead, re-arranged and framed them around the three key techniques, examining their multiple and diverse articulations across a key selection from the projects carried out.

Reflecting on the projects by focusing primarily on the methods and result, of the design processes rather than the wording and form of the initial prompt, the leap chapters drew from post-structuralist responses to image and language in order to further explore and nuance the exchanges between media and the ways that these trigger moments of divergence in the context of architectural design. Central to this examination of media exchanges was the clash between the connotative qualities of abstraction, which often aligned with the notational and conventional syntax of architectural drawing, with the denotative nature of the image as a visually explicit, and therefore semiotically more convergent, form. This clash, but also the opportunities for divergence that it created, became particularly relevant to the research through the prevalence of the image within digital media: within the treatment of the architectural object as image through the screen's framing and rendering of digital modelling (seen in CAD and BIM software), as well as within the introduction of external, non-architectural imagery into the process through digital collage and image editing.

Chapter 3 (Cut-up) put forward an exploration of divergent thinking by drawing together a series of projects that had been carried out using the cut-up technique. The projects discussed, expanded the technique beyond its text-based origins into images and architectural media. The notion of the cut was considered firstly in terms of its ability to re-sequence text and then subsequently, through its filmic connotations, was iterated in the dissecting of images and drawings, transferring this ability to enable divergence into architectural media. A key idea in developing this approach was that the cut-up provided a means to understand the emergence of divergence within creative thinking in temporal

Fig. 80: Cut-up design process for the Bristol Community Centre. Close-up of a filmic still from the 'Cut-up' exhibition film for 'Leap!', at the *Design Research Symposium*, UWE Bristol (2015)

terms, through the sequential re-ordering of the initial material beyond its original syntactical form. The temporal nature of the divergent opportunities introduced by cut up, not only provided an explicit starting point for this research but also enabled analogies to be drawn with filmic syntax, through filmic transition and the non-linear forms of spatiotemporal composition that this entails. These analogies allowed for a new critique of the design process and, in particular of iterative architectural design thinking, through the distinct spatiotemporal narrative composition of the cut-up.

Drawing parallels with the non-linear, yet sequential temporal syntaxes of the cut-up (visual and literary) and the filmic transition, offered a more explicit understanding of the temporal syntaxes entailed within the process of architectural design and the conceptual shifts that this can enable. A critical part of these conceptual shifts emerging across the cases of expanded architectural cuts explored, was revealed in the designer's ability to navigate between connotative and denotative interpretations of the material. What emerged here was a pattern of leaping between connotative and denotative meaning, involving the habitual skill and cunning of the designer. This conceptual leaping allowed for an interchange between text and image to occur, thus contaminating the architectural design process with new meaning through the conscious misreading of the material. The homonym shifts that had been previously observed in text-based cut-ups, where words switched meaning, here gave way to image-based cut-ups, where visual shifts occurred as architectural forms and drawing conventions were altered and assigned their own new meaning (p. 78).

The performance of the cut on the media was found to be critical to how the divergence emerged within the design process. While cutting text parallel to its flow maintained much of its syntactical meaning, cutting a drawing in a similar way had a far greater impact on the formally non-linear syntax of the drawing as a panoptic field. Contrary to this, projects where the cutting dissected the image along existing borders and outlines of forms, remained closer to the denotative meaning of the original material, revealing instead moments of divergence in the juxtaposition of collaged fragments. This observation highlighted the importance of maintaining a critical awareness of the shifts between the denotative and connotative meaning of the material, particularly in the case of drawings of architectural meaning. Similarly, the introduction of a spatial component, such as a grid, as a tool of reading the media before cutting was recognised as a way of achieving this anchoring to architectural meaning by providing a reference of scale and direction.

A further revelation regarding the cut as a source of temporal divergence concerned the ways it contaminated the sequencing of the design process. This was exemplified through the jump-cut, a technique that deliberately contaminates the screen by exposing the viewer to the cutting process and breaking with rules of continuity editing. Similarly, within the architectural cut-ups examined, the resulting lines from the cuts became part of the media itself, thus, seeing the remnants of this explicit technique drawn through into the design process.

Overall, the research proposed a series of new cut-up techniques for use within the architectural design process. The conclusive piece of this chapter accumulated these in the development of a new hybrid form of representation, which incorporated both word and image into a three-dimensional map. Using architectural drawing to create associations between the two media, and allowing the designer to read it in multiple ways due to its spatial configuration, this map demonstrated the creative possibilities latent in the exchanges between verbal and visual material for architectural design and the expansion of its native means of representation, such as drawing.

While cut-up introduced an existing divergent technique from beyond architecture, in order to explore possibilities of divergence within the architectural design process, Chapter 4 (Pixelate) focused on how divergence emerges in the exchanges between analogue and digital media. This exploration built upon themes that had already emerged in the previous leap, including the transference of ideas between media and the use of conventions such as the grid, to reinterpret media. At this stage, the research employed the effect of pixelation as a divergent technique in order to understand the translation, transformation and transcription of ideas that take place in the interpretation of digital media. Here, pixelation offered a means of stripping off of their denotative meaning, digital instances of architectural material, to the point that these could be misread and reinterpreted. This examination further revealed an understanding of the digital screen as a both physical and cognitive threshold between the designer and the media, expanding the concept of the threshold to include the agency of the designer and their ability to interpret the pixelated image back into a meaningful architectural context. Critical to this expansion of the term was the notion of the divergent leap as a change in the designer's position towards the subject through the media, as articulated in the prefix trans- and its etymological meaning of 'across, beyond'. Drawing parallels between screen and paper, pixelation was revealed as enabling the designer to detach themselves from the original, familiar form of the drawing, including the line work, the use of conventions and the embodied thinking that went into generating it. In the projects explored, this was articulated in the re-coding of the drawing through examples, such as the switching of orthographic projection from section to plan (pp. 100 - 105). The level of this detachment uncovered a more complex type of threshold, compared to that found in earlier projects, in enabling interchangeable readings of drawings and images, while the re-coding of the pixel was still bound to the tracing of the original form.

As with the cut-up, the linear grid emerged as a structuring device that was, however, this time embedded in the technique itself: as a consequence of the increased visibility of the pixels. The rescaling of the pixel grid, possible in applications such as Photoshop, enabled the designer to cycle through interesting juxtapositions offering new material to interpret and integrate in the design process. Making explicit the inherently grid-derived structure of digital media, and the ways that, techniques of pixelation and zooming open them up to increased connotative reinterpretation, the chapter outlined the quality of the threshold between digital media and the architectural designer across three levels of intertwining between the digital image manipulation and the cognitive agency of the designer:

1. The first level is concerned with the obscuring of media, which in all instances involves the reduction of information within the media.

2. The second level concerns the separation of meaning, whereby design thinking is removed in the reduction of the drawing into image, increasing the potential for obtuse rather than obvious (Barthes, 1978) meaning to reveal itself through the emergence of new visual groupings and forms. This defines the beginning of what Frascari (2007, p. 30) terms a transitus: the designer's mental journey to the re-interpret of the image into something new.

3. The third level helps focus the transitus of ideas, through the emergence of the inherent grid of the pixel and its manipulation, allowing for an exploration of the digital medium's own structure.

The chapter framed this pixel grid as a divergent version of Alberti's Window: as a framing device for isolating sections of an image to be deconstructed in one setting and reconstructed in another, yet, doing so in order to diverge from, rather than maintain fidelity to, the original view. The emergence of this grid enabled the research to move beyond the pixel and into investigating the underlying structure and geometry of 3D architectural media. In the latter iterations of pixelation, the Brutal Object (pp. 110 -112) and A Chaotic Topography (pp. 113 -115) (Fig. 81), the potential depth of this mode of divergent transformation became even more apparent in the digitally automated ways that photographs can be used to construct three-dimensional forms, involved in techniques such as photogrammetry. The polygonal mesh that is produced as a spatial transcription of the image offered an opportunity to examine this move from the spatial meaning of the drawing to the image and back, from the reverse: from the flatness of the image to a virtual space that is equally structured by a form of reverse pixelation in the space of the polygonal mesh. Unlike the pixel, which is fixed to the image the mesh was understood, in the projects explored, to be more than a retracing of a surface due to the degree of interpretation that is already involved in the automated process of mapping the initial media into a form. The information produced there, beyond the original dimensions of the photographs, offered a divergent map as the final layer of this deep threshold (p. 116). This map differed from a tracing of the original form in that it introduced new material, gathered as part of the digital survey process. This material created a productive interference over the object and allowed for the deep threshold of the screen to become infused with the agency of the designer. The synergy observed more clearly in this third level of 'reverse' pixelation, allowed for a wider understanding of pixelation effects as a divergent map for the designer: not just to a journey across but towards an immersion in the geometry of both the content and the screen, from the original form into a new landscape of divergent possibilities.

Chapter 5 (Trace) revisited the common architectural practice of tracing as an interface between the designer and the screen articulation of the digital. In the projects discussed, the act of tracing over a screen was introduced as a way of challenging the convergent effects of digital media, allowing designers to draw out divergent ideas as recognisable drawing syntax, and to thus return these ideas back to the architectural design process through drawing (Fig. 82) Here, the obscuring qualities of trace, which had been already identified in Chapter 4 (Pixelate), were expanded and found to contribute towards the divergent transformation of drawings into images and back again.

The development of new techniques for tracing over screen-based media revealed the paradox that the ideas that emerged did not just exhibit qualities of divergence but also of convergence. This convergence, however, is not as Guilford (1967) defines, a logical step by step process that sees the solution emerge through a reductive process of focusing in on the problem. Instead, it concerns a process driven by the desire to see ideas emerge through trace into the realm of architectural syntax, where they can start to project physical propositions out into the world. Whilst these findings come from the examination of expanded tracing techniques, where trace becomes an interface to the screen-based digital, the conclusion that trace is capable of returning divergent and convergent thinking to the landscape of the architectural drawing are equally applicable to more conventional uses of trace, such as the commonplace practice of using trace to transfer ideas between print media. However, situating the act of tracing on the screen and examining the visual tracking of the digital image in the sense of hunting for ideas with the eyes, revealed a skeletal network of tracks that allowed the designer to draw out new forms. The tracking of the screen through the trace became, in this chapter, an opportunity to define a direct interface between the digital and the analogue, which was made more explicit through the painterly orientation of the monitor heightening the experience of action within the emerging drawing field.

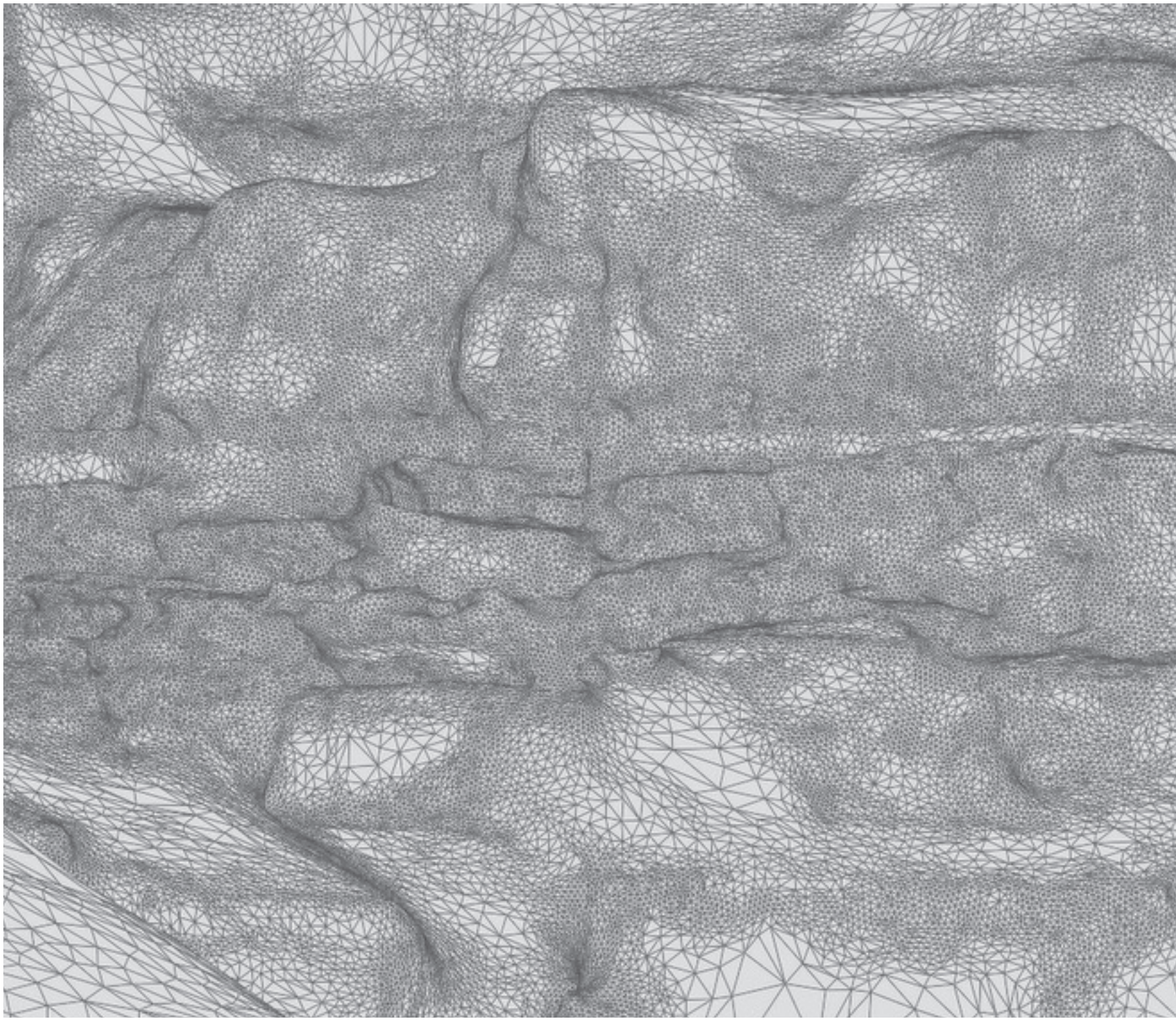


Fig. 81: ‘A chaotic topography’, close-up detail of polygonal mesh (2018).

Lastly, the idea of plotting offered a useful perspective for understanding and associating the scheming of ideas with the emergence of new landscapes between media. Tracing over the screen was revealed as an act of not simply returning divergent ideas to drawing syntax but also problem framing. Contrary to Schon's (1982) suggestion that problem framing is concerned with framing the problem within its context and deciding how to tackle it, the understanding of tracing as plotting demonstrated ways of opening to reframing and manipulation the context rather than the problem itself, towards the plotting of a new emerging context that can evoke new ideas. In this perspective, the divergent and convergent qualities of trace are, therefore, not concerned with drawing around a problem but with drawing out the solution from within the juxtaposition of the media, its content and the syntactical presuppositions of the designer. Further to this, inverting the relationship between screen and paper by projecting onto trace rather than illuminating it from behind, radically expanded the surface of this creative interface into the space of the designer. Spatial glitches, such as shadows, drew attention to the convergence of thinking through the designer's speculative desire.

What the tracing leap revealed after all, was that whilst, as Lawson proposes (2006), the architectural design process needs to combine divergent thinking with convergent, the idea of maintaining a 'balance' between them, in the sense of a fixed equilibrium is limited. Chapter 5 (Trace) instead demonstrated that this balance is dynamic, as divergence is only countered and contained by the designer's desire to converge ideas back to architectural space through drawing, revealing spatial syntax as the only necessary point of convergence, appropriating media and ideas from beyond and within architecture.

6.2 | Cuts, moves, glitches and other leaps

Across the three leap chapters, the design leap is located in the moment of productive divergence within architectural design: the moment when a designer departs from an otherwise convergent process by shifting between conditions of representation. In the historic definition of the creative leap, such moments of sudden illumination were characterised by ambiguity and uncertainty of design resolution. However, these moments have been here revealed as enabling the conceptual opening of the design process through the material and semiotic leaps of the designer, which become particular to architectural thinking and making. This thesis started with investigating the leap as a critical component of the creative design process, which had remained since its inception somewhat ill-defined despite the multiple attempts of architectural educators to re-define it (Lawson, 2006; Cross, 2006). The necessity to study the leap in this context of architectural design and to debunk its framing as a repeatable and modellable phenomenon comes in the face of attempts to systematize design through processes of simulation. Previous studies might even be seen as aligning with the idea that design, and by extent creative leaps, could actually be modelleable to the extent that we might, in fact, be able to transfer their essence into a purely digital environment through processes of grammatization. However, through the close study of design projects and their techniques, this thesis has illustrated that such leaps are not simply cognitive or conceptual as previous studies have suggested, but acquire material and semiotic dimensions, which reveal the tangible aspects of design as a process that otherwise resists precise formulations.

Even when those dimensions are informed by cultural contexts outside architecture's traditional means, this situation of the conceptual leap of divergence within a wider architectural framing of media, sheds light to the widely problematized question of architectural creativity, particularly as it

Fig. 82: Tracing over a digital CAD drawing whilst testing the rotating divergent dice action (2015).

emerges under the impact of new digital media, and outlines architectural design's ability to diverge through appropriating and converging things back into architecture.

Cut-up's iterations of cutting and reordering material, revealed the temporal qualities of divergence in design, with the help of terminology and examples drawn from both literary and cinematic methods. In doing so, the cut-up set out a syntax of cuts across the design process that made explicit the act of the leap as an opportunity for divergent shifts across both media and concepts: from text to image and from one syntactical order to another. Following this, Chapter 4 (Pixelate) moved on to a more diverse range of divergent actions, enabled by the synergy between digital screen-based and analogue print media. This exploration of pixelation as the wider effect of grid-derived operation of visual deconstruction, ranging from normative pixelation to the polygonization of digitally modelled forms, outlined and expanded the threshold between digital and analogue media for architectural design by defining the digital screen interface as 'deep threshold' (pp. 116-117). These thresholds can allow, beyond the surface obscuring of pixelation, the uncovering of new meanings through the transposition of the media's own structure into content. Divergent actions from both chapters, revealed the prominence of tracing as a constant operation, that was always able to gather and re-situate ideas back within an architectural context of drawing. Trace, therefore, provided the understanding of the design leap with the quality of convergence, as derived from the desire of the designer to return ideas into architecture, enabled by the ability of drawing to ground ideas into a spatial syntax.

The design leap, therefore, emerges out of this thesis as a temporal occurrence of divergence, which allows for the production of new meaning through cuts, breaks or disruptions that are motivated by the movement across different media. Across the Leap Chapters, we have seen the ability of drawing to harness and draw into the architectural design process a plethora of media, as a representational hinge that enables the designer to not simply shift between different modes of representation but also advance their thinking within the design process. Consistently, in the projects discussed, architectural drawing techniques, both analogue and digital, act as a field to gather and converge and consolidate ideas back towards design. However, whilst the chapters have led to a greater understanding of how designers make leaps, perhaps of most interest is how the leap as a phenomenon, rather than being ironed or smoothed out by attempts to systematize the design process, has found itself re-emerging, accidently or fortuitously, within new techniques and technologies. To a degree this has often been articulated in those periods when new technologies (such 3D environment scanning techniques, digital image editing or modelling) still being in an early period of development, whereby their intended function and technological aspiration is not yet fully achievable. This observation underlines the value of the semantic gap or fault, which we have seen take on various forms across the chapters. Rather than seeing these faults as liabilities, the leap sees a field of opportunity and 'critical disbelief' (Evans, 1997, p. 154), that extends from architecture onto a wider milieu of media.

The three chapters demonstrate that this quality of creative thinking is not undermined, but rather enriched by the introduction of new forms of media, be them digital, verbal or cinematic, yet it is always reliant on a syntactical grounding into an architectural language of representation. Cut-up, pixelation and tracing, demonstrate, not the means but some of the media condition through which, both the breaking and the grounding of creative divergence can take place in architectural design. Framed through these contexts that provide detours to the visual, the textual and the digital, only to return with trace, to architecture's own ability to subvert formulation from the inside, the design

leap, sits alongside and expands the previous terminology of the leap as found in cognitive science (p. 13). In a manner that particular to architectural design, the thesis has recognised and signposted architecture's exchanges (or at least the capacity of exchanges) with wider cultural contexts of signification. Rather than pursuing the perfection and exactitude that has defined the achievement of digital media, each of the three wider categories of leaps defined in this thesis, is borne out of a definitive effect of semiotic and, therefore, communicative disruption: the cut, the glitch or the obscurity of the trace are not leaps themselves but the disruptions that allow and nurture divergence and the emergence of the leap as and by design. Processes of selective swaying between connotation and denotation, of translation, transformation and transcription, or tracking, plotting and projecting through tracing, all converge on defining a vocabulary of movement that nuances and uncovers the complexity of the design leap as a recalibration of meaning that takes place through the shifting across, media and their perspectives.

In the current context, it is this ability to move that contests the emergence of the leap and, with it, design. What we see is that the leap itself sits in contrast with the increasingly systematized centre-ground of architectural media, which require the designer to be increasingly willing, conscious and active in their pursuit of creative divergence, side-stepping the system to find moments of creativity within emerging and developing digital media. In part, the development of techniques such as the Divergent Deck, attempted exactly this: to prompt the designer to sway and remain vigilant of such creative opportunities, not as a solution but as a trigger. Even though then, the Divergent Deck does not present a definitive toolkit or solution, its proposition and its ability to expand from a previously defined pool of prompts, is symptomatic and paradigmatic of the capacity entailed within architectural design and its habitus; a capacity that is shared between the designer and architecture's disciplinary traits. Whilst at present the very notion of creativity, and the awkwardness that its resistance to systemization suggests, seems secondary, backed into a corner and facing extinction, it remains inseparable from the architectural habitus, which extends out from the designer to encompass the media and techniques of the design process. New media will no doubt continue to offer exciting opportunities for precision, speed and efficiency; however, the need of the creative designer to leap will persist as definitive and constitutive of the design process.

Across the error of the digital glitch, the temporality of the filmic cut and the material obscurity of the trace, emerges the architectural design leap that defines lack and distance as integral components of creativity. It is only in the abstraction of the leap as a semantic interval, that interpretation can occur; be it in the form of iconographic connotation, morphological transformation or syntactical adaptation. Regardless of the diversity of media articulations that the distinct operations discussed in this thesis entail (each more or less defined by the specificity of the media they employ), what is constant and recurring in the observations that the design reflections sketch out, is the productive quality of a gap that emerges, not between the drawing and the building, but between the medium and its architecture. This architecture is engendered in the ability of architectural signification to project and, thus, represent and describe a spatial condition, by means of, but perhaps regardless of, the medium. It is this spatiality to which external media are eventually forced to converge if they are to be useful to the thinking process of architectural design. The vocabulary of leaping that this thesis has provided, across both the discourse set out by the emerging terminology and the mechanism of the prompt, illustrate and underline the value of recognizing design as a divergent open-ended process, while revealing architecture's ability to apply its representational core on harnessing media environments as productive fields of creative practice. This revelation comes with promise, as well as caution for the possible futures of architectural design practice.

6.3 | Leaps in practice

In concluding this thesis, it is necessary to reflect this new understanding of the leap back onto the contexts where the enquiry emanated from: architectural design practice, as articulated across the educational environment of the design studio and the wider world of professional architectural practice. The overlooking of the divergence that currently dominant technologies and trends illustrate, suggest that as a critical component to creative practice, the concept of the leap requires greater attention within both the educational and the professional context. As we have seen within this study, design leaps have somewhat been displaced within the convergent grammar of current digital single-software environments resulting in the misrepresentation of design as a 'solvable', formulaic process. In this context, a process of intentional prompting could enable designers to actively hunt for opportunities in order to creatively leap beyond the traditional drawing field of new emerging media technologies and through transposing those back to informed expansions of architectural techniques of drawing and modelling, such as those presented within the body of this thesis. There is currently a clear demand for single-software environments due to their ability to seemingly offer a silver bullet for tackling issues of cost and calculating such quantifiable aspects of the built fabric as the environmental impact. However, as important as these elements of construction are, it is important to note that the disciplinary core of architecture does not explicitly or primarily concern such utilitarian aspects of design production. In other words, the merit of architecture and its design is not defined by such factors. That is to say, that to reduce architectural design to such parameters through convergence, puts architecture at the peril of underplaying and drastically compromising its cultural value (aesthetic, social and experiential) for the sake of commercial economies.

This distorted expediency of design as a commercial field, has inevitably trickled down to the education of architectural designers, through the pressure to produce oven-ready apprentices, who are proficient in procedural practical skills rather than the acute criticality required in the creative practice of design. The emphasis on media environments as pre-set skillsets rather than critical tools of design leads to the consolidation of limited perspectives of media, while at the same time detracting from the iterative practice of design and the habitual practicing of design leaps within the pedagogical design studio. These tendencies are at their core vocational, rather than educational, and the consequences of the limits that their convergent framing of architecture imposes will inevitably reduce the designer's opportunities for experimentation.

What this thesis therefore argues, through the reframing of the leap as a critical condition of architectural design, is that architecture schools, and accrediting and professional bodies, need to push back against the commercial demands and recalibrate their focus, from the overemphasis on software skills to the nurturing of the architectural habitus, which, as the thesis has illustrated, encompasses and relies on the development of tacit and embodied interactions with media environments. As such, the thesis, does not support a stance of resistance against new or simulative technologies but, instead, proposes that architectural design practice and education take on a critical position towards convergence, in order to be able to fully take advantage of emerging media; not taking those verbatim as processes that need to be adopted as they are but, instead, recognizing them as media contexts that require testing, exploring and situating within the existing milieu of architectural. This requires that emerging media are offered up to the designers for critical evaluation rather than as predefined self-contained skillsets within the architectural curriculum, RIBA Plan of Work (2013) and approved continued professional development provisions. This can

be carried out through explicit process of prompting divergence, such as those presented in the Divergent Deck, anticipating however their constant expansion in the discovery and speculation of the capacities that emerging media may themselves entail, as well as the constant pursuit of the new within creativity.

Alongside the acceptance that these technologies have their place within, and not instead of design, professional bodies and accreditation boards need to start considering more carefully the value of creativity within architectural design and as to reinforce this as a criteria of how a professional gains their qualification. In itself, the concept of accreditation falls into the paradoxical trap of defining and systematising creativity by defining a list of criteria. The recognition of the design leap as an identifiable but diverse phenomenon of convergence can perhaps offer the vocabulary through which such criteria may be set out on an institutional level. Returning back, however, to the essence of design as the creative field of a cultural production (one defined by desire and intent over architectural space), what the design leap and its definition of architectural divergence promise, is architectural design's ability to survive and persevere through the anticipation of an ever-evolving field of media. Seen in this way, the design leap exemplifies architecture's own ability to mediate and harness a wider milieu of mediation from a privileged position of interpretation.

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