

INHABITING THE DRAWING

1:1 in time and space

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Abstract. One of the fundamental characteristics of architectural drawing is its use of scale. Since the Renaissance - during which architectural production shifted from the construction site to paper - this scalar understanding began by using bodily measurements. In developing designs, the architect projects future occupation of the drawing with their eyes and hands moving over both its physical surface and represented space. The different relationship established between the digital drawer and the body has been criticised; Paul Emmons argues that CAD's full scale - or rather scale-less - capabilities omit this bodily presence of the drawer (Emmons, 2005). Due to the use of full scale data recording, the drawer zooms in and out to consider aspects, severing the drawing's relation to the operator's body. This paper explores ways in which the body and drawings intersect, beyond Emmons definition, and hence considers the influence of the method of drawing on perceptions of scale and the inhabitation of digital drawings. It uses ongoing collaborative research projects and exhibitions to explore the inhabitation of digital drawing at full scale. These works highlight the fundamental importance of the line within architecture, not as demarcation, divider or indexical reference, but as a traces of bodily projections.

Keywords. Architectural drawing; architectural scale; full scale drawing; post factum documentation.

1. Introduction

One of the fundamental characteristics of architectural drawing is its use of scale. Since the Renaissance - during which architectural production shifted from the construction site to paper - this scalar understanding began by using bodily measurements. Marco Frascari describes the essential role of the compass in perceiving and conceiving architecture (Frascari, 1993), so 'the compass *becomes* the architect walking across the drawing' (Emmons, 2005). In this way, the architect projects future occupation of the drawing with their eyes and hands moving over both its physical surface and represented space during the act of drawing.

The different relationship established between the digital drawer and the body has been criticised; Paul Emmons argues that CAD's full scale - or rather scale-less - capabilities omit this bodily presence of the drawer (Emmons, 2005). Due to the use of full scale data recording, the drawer zooms in and out to consider aspects, severing the drawing's relation to the operator's body. This Cartesian approach to scale forgoes the senses to assume that scalar understanding is solely in the mind (Emmons, 2005).

This paper explores the ways in which the body and drawings intersect, and hence the influence of the method of drawing on perceptions of scale and the inhabitation of digital drawings, beyond Emmon's writing. It uses the mode of exhibition and installation - undertaken by the authors - for this examination. These include an ongoing collaborative research project, titled 'Drawing the Room | Drawing within the Room', and the exhibition *Penumbral Reflections*. Both of these works highlight the fundamental importance of the line within architecture, not as demarcation, divider or indexical reference, but as trace of bodily projections and hence, inhabitation.

2. Drawing, scale and the body

It is understood that early architectural drawings were made to represent construction procedures which occurred on site. Emmons writes that the scale lines on drawings were 'derived from the knotted lines of ropes that were stretched on site to lay out the building' (Emmons, 2005). These early practices conflated scale with bodily actions and procedures - ideation and production are linked. By the end of the sixteenth century, drawing tools such as the compass, had architectural scales engraved on their sides (Hambly, 1988); soon after, the scale was affixed to the drawing (Emmons, 2005). In this production of drawings, maintained for many years, the presence of the body is inextricably linked with the act of making physical drawings. Due to the fixed scale of the drawing, it is held within the space of the paper in a constant scalar relationship with the drawer.

Architects spend time with the drawings that they create: eyes and hands move over both the drawing's physical surface and represented space. Reading the sketched marginalia on physical copies of these drawings, we sense the duration of the architect's imagined inhabitation of the rooms depicted during the design process. Charles Rice writes that the architect and client are 'future inhabitants' of these drawings (Rice, 2007). When reading a plan, one's miniature self moves through the spaces, 'walking across the surface of the drawing' (Hedges, 2009). Therefore, the body is a gauge, and measure, by which decisions are made: the imagined presence of the body within the space helps us to think *through* drawing. Additionally, as documentation of an existing space, we may use the plan as a mnemonic device, revisiting our steps through the space in order to conjure it up in our mind. Hence, the space of the plan may be seen as a surface over which we travel due to the inherent inhabitation present within representation.

The conventional practice of digital architectural documentation records data at full scale, allowing the drawer to zoom in and out within the developing design proposal. Emmons argues that digital drawing's scale-lessness results in

the drawer perceiving the work objectively, rather than projecting oneself within the image through an 'imaginative inhabitation' (Emmons, 2005). Antony Pelosi argues for the need for strategies to improve how people navigate and comprehend digital space due to inaccurate spatial cognition, which can be implemented either during the design phase or into BIM editing and viewing software (Pelosi, 2017). These offer a frame of reference to understand the scale of what is being viewed and assist decision making during the design phase. Emmons writes that while Cartesian approaches 'assume that scale is merely numerical dimensions known to the mind, early explanations of scale show that empathetic bodily projection is critical to imagining a future edifice' (Emmons, 2005). One strategy researched by Pelosi is Your Grid, an egocentric one-metre square grid, located between the viewer's position and the nearest floor level - rather than oriented on the origin of the digital environment - which can be used to gain a sense of scale (Pelosi 2017).

A scale-less mode of drawing therefore severs the perception of the represented spaces in relation to the body of the drawer, both in the act of making drawings and in thinking through drawing. The digital drawer is not judging the size of things relative to one's body, undermining the importance of relative size proportional to the drawer in making design decisions. In these situations, scale is returned for the viewer of these drawings: sited within the space of the paper artefact they become understandably scalar.

However Emmons's focus on the act of thinking *through* drawing conflates the introduction of digital drawing as instigating a shift away from embodied drawing practices. In highlighting other bodily relationships within drawing - occurring during the act of making the drawing and encountering the drawing - digital drawing practices provide territory for the presence of both the body and a return to scale, which has benefits for future practices of thinking through drawings.

Additional to focusing on the acts of making the drawing and encountering the drawing, a shift in the content of drawings may be made. Architectural drawing is predominantly concerned with generative drawing, that is, drawings to 'get to' a proposed future design. Due to classifications of architectural drawings, there exists a hierarchy of importance of drawings that are produced, and therefore, examined. Drawings made after-the-fact, that is, *post factum* documentation, have been seen to exist separately from the design process, as recording it having occurred. The emphasis of architectural design education is predominantly concerned with 'getting to' the design of the building, and so the potential speculative nature of *post factum* drawing has been under-examined. In examining drawing through this lens, and focusing on how we make and encounter drawings, a different view of scale and inhabitation of drawing is possible.

3. The inhabitable drawing

The notion of the inhabitation of architectural drawings usually refers to the architect's imagined self within orthogonal representations of the future built project due to the inherent interiority within these drawings. As designers, we put ourselves within the drawings we make, occupying the emerging spatial proposition, imagining inhabitation. The word inhabitation implies full scale

occupation. Full scale inhabitation of drawing is considered in terms of the body's making and encountering drawing.

3.1. 1:1 DRAWINGS: THE FULL SCALE DRAWER

The notion of full scale in architecture is commonly associated with simulated mockups to aid the perception of proposed space; as partial built form recreations for exhibition; and as documentation of details. There is evidence of the importance to Greek architecture of paradeigma, full-scale specimens of detailed building components, such as capitals, made of wood, stucco or clay (Coulton, 1977). From these mock-ups, repetition from replicas could be achieved without the need for scaling up or conversions, as builders could extract detailed dimensions with callipers (Porter & Neale, 2000). Francis Henry Bacon, an advocate for making full size detail drawings of architectural remains on archeological sites, wrote in 1938: 'When you draw a full size of a good Greek original, you "shake hands" with the man who made it ... Half size will not do; it is not the same thing' (Edlund-Berry, 2005).

The interchangeability of the noun and verb forms of the word 'drawing' allows different interpretations of the intended form of the word. By using the word drawing, the action and the result of that action are inseparable, due to the interchangeability of the word itself. Historically, the action of drawing is less inherent within architecture, and so the word exists more strongly as a noun within this realm. Focusing on the body in drawing implies a performative drawing practice, one in which marks are made by movement and actions conducted by the drawer or artist. This highlights drawing-as-a-verb, rather than its residual (noun) artefact.

Günter Barczik writes of the importance of activating designers' whole bodies for design, additional to their minds, and has researched the importance of bodily movement for thinking, particularly in the field of immersive technologies (Barczik, 2018). Barczik's work emphasises the importance and benefit of creating objects not with the hands only or via input on flat surfaces, 'but with the whole body through movement in space' (Barczik, 2018).

Motion capture technology allows for this full scale method of performative drawing. Having origins in practices of scientific management and work efficiency, in the early twentieth century the technique was applied to domestic housework. In this way, it also acts as full scale *post factum* architectural drawing. Elizabeth Diller and Ricardo Scofidio write: 'Time-motion studies which had been developed to dissect every action of the factory laborer with the intention of designing ideal shapes of movement and, ultimately, the ideal laborer, were imported into the home to scrutinize every movement exerted in housekeeping in order to produce the ideal housewife' (1994).

Here, the body enters and *makes* the drawing: it is a trace of the body's movement within space. Rather than drawings having the presence of the human figure as a scale reference, in this technique it is the movement of the body itself which generates the drawing. The ability of motion capture to record the body in space undertaking specific tasks - and the linework residue of these actions - has

been exploited for the benefit of domestic efficiency. Separating the technique from this outcome aligns it more closely with a manifestation of the imagined inhabitation undertaken by the designers in the development of built space.

The project 'Drawing the Room | Drawing within the Room' uses motion capture technology as a form of creative post-occupancy data taken from five built houses by PAC Studio, New Zealand. While this is a work-in-progress - to be exhibited in September 2019 - its development offers commentary on aspects of drawing before its final outcomes are established. Lois Weinthal writes that it is within the house that we first understand both the act of dwelling and 'an architectural scale that gives us a gauge by which we encounter all other architecture' (2006). By recording this act of dwelling through motion capture, this scalar understanding is given a drawn manifestation. The quality of full scale is doubly present: measurable in space and in time as they hold the duration of the event of inhabitation.

This motion capture data documenting the use of built spaces is converted to linework animation. This data is projected full scale, exhibited in the space of the architectural office - the site of conceiving and production of both drawings and architecture. These *post factum* drawings of inhabitation are coupled with projective documentation - the drawings to 'get to' the houses - also viewed at full scale.

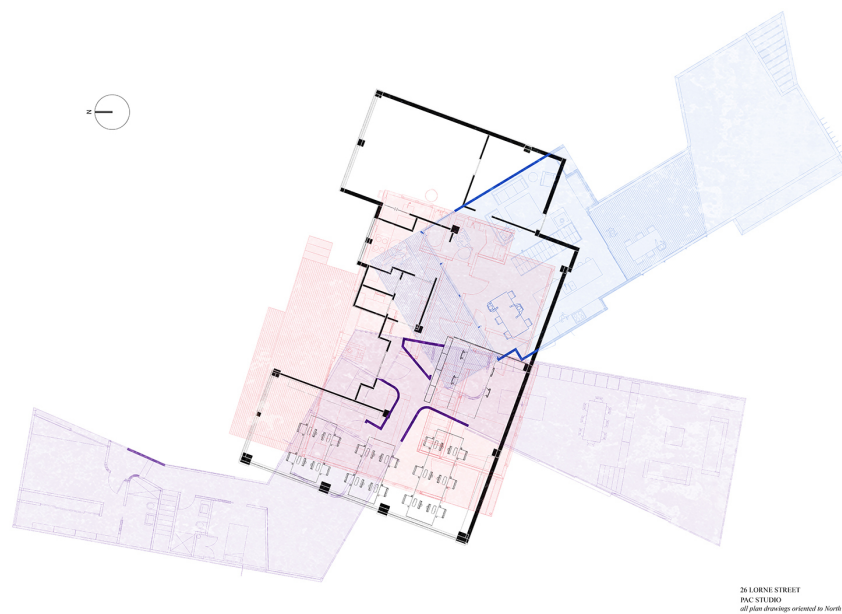


Figure 1. Superimposition 1: PAC Studio plan, overlaid with three built house plans. .

The exhibition of these drawings within the office operate on two different superimpositions. One superimposition overlays the plans of the built houses with

the PAC Studio, at the same scale. These are all oriented north, with the point of tethering being a coincidence of the place of motion capture within the house aligning in function with a part of the office [Figure 1]. For example, the act of cooking documented in the Fyvie Road house is superimposed with the space of the office kitchen [Figure 2]. Similarly, the Sefton Road house recording of eating a meal is projected over the long office meeting table, an analogously communal space. Additional to the linework bodily traces are audio recordings captured at the same time - these offer atmospheric clues to the reading of the projected drawings and make explicit the temporal duration.

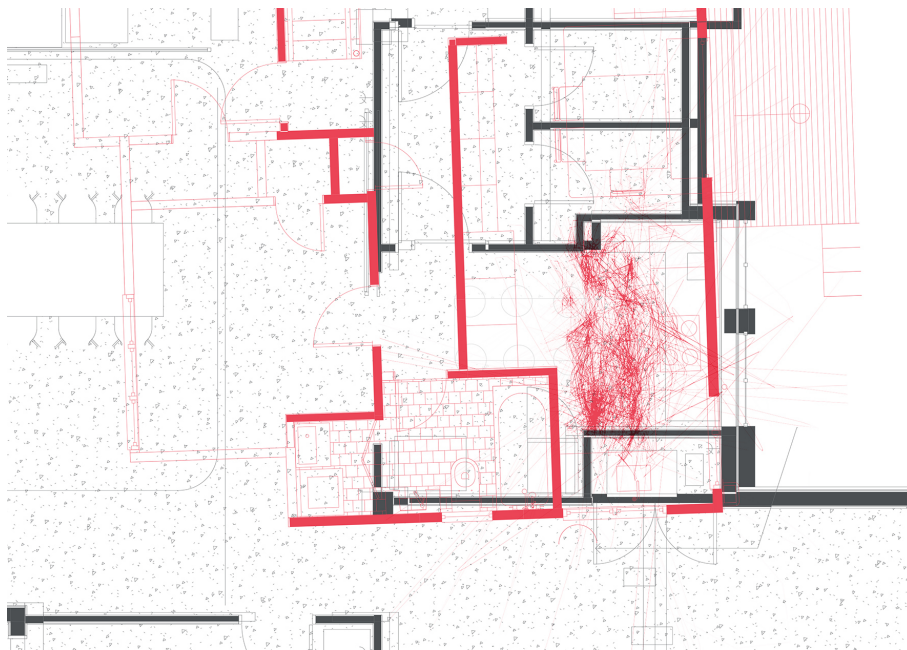


Figure 2. Superimposition 2: spatial fragments from five built houses. .

The artist Daniel Crooks has explored and manipulated the recordings of the body in space in various works. *Truths Unveiled by Time* (2014) uses SICK laser trackers, Kinect cameras, and polygon point-clouds, to document the movement of figures, including the duration of time. These traces of movement are solidified and hence, as gallery visitors, we view the works as sculptural objects, 'like beings from another dimension sliding into the gallery and sliding out again' (Raggatt, 2018). However, these are not representations with which we interact; their placement and orientation within the gallery is divorced from their origins.

The second superimposition of drawings within the office space is section-rather than plan-based: the dominant section lines of each built house are used to select a fragment of the house which operates as a threshold between exterior and interior. These are superimposed, using the original documentation drawings. These drawings are layered and aligned with the glass internal wall of the office, to

become a full scale assemblage. Rather than the plan-based downward projection of motion capture animations, these projective drawings operate vertically to produce a new built assembly of full scale details [Figure 3].

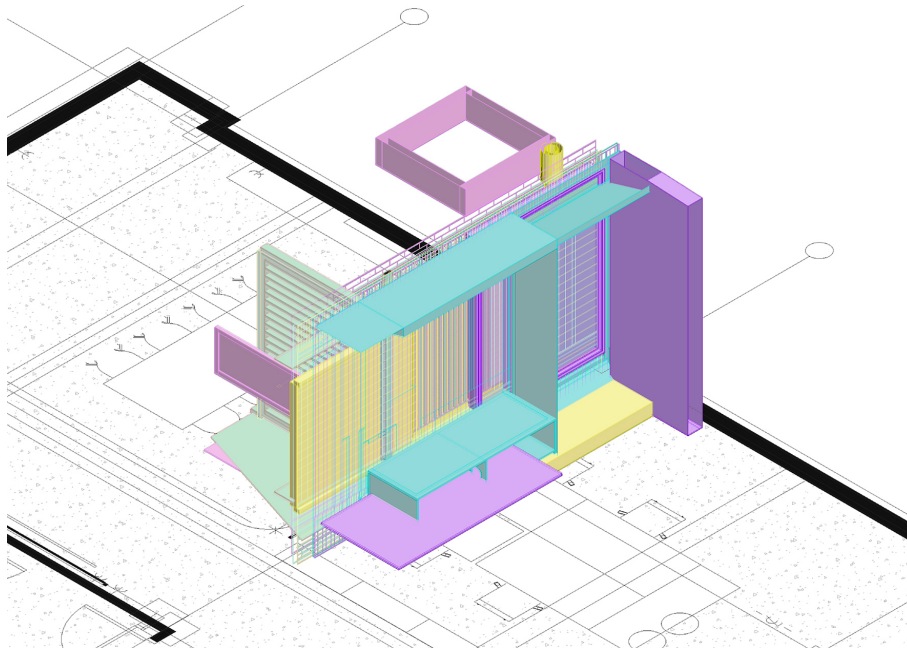


Figure 3. Superimposition 2: spatial fragments from five built houses. .

3.2. 1:1 DRAWINGS: THE FULL SCALE READER

The installation uses the architectural office as the space of exhibition: these animated traces and drawings are projected and built and therefore encountered at full scale. It makes explicit the architects' imaginative inhabitation of both the space of production and construction, coupled with the drawer's inhabitation. This installation merges design intentions with realised outcomes, allowing the architects to inhabit both projective and *post factum* drawings - full scale in time and in place.

In the Soane Museum, in London, hangs a Joseph Gandy painting called 'Public and Private Buildings Executed by Sir John Soane between 1780-1815' (1818). This depicts over one hundred projects designed by Soane, as models of different sizes and materials packed into a single huge room. Robert Harbison writes that this 'brings out the miracle of models, which can put the whole world in a small space' (1997). However, displaying models in this way exacerbates a potential dormant in all models: 'to make distance unreal and thus free us from our own spatial identity' (Harbison, 1997). The differing scales of the depicted models creates a disjunct amongst them and maintains the sense of the miniature inherent within models. Shifting the common scale to 1:1 eradicates a perception of

hierarchy between representation and the built. This full scale comparison - using both motion capture and drawing projection - allows for a merging of the architects' and owners' experiences in their parallel inhabitations and for the designers to examine built works, through these drawings of inhabitation, simultaneously.

An examination of the workplaces of architects is published in *Where Architects Work* (Ballhausen, 2013). A range of practices were asked to submit an interior and exterior photograph of the office, and a floor plan, reprinted at 1:333. This publication focuses on the correlation between the style of the studio and the attitude of the respective architectural practice in the spaces they create in their designs. As an alternative, 'Drawing the Room | Drawing within the Room' considers the architectural office as a place of creative production by aligning function and scale of built work, rather than style, with their place of production.

'Drawing the Room | Drawing within the Room' continues a seam of speculation and production regarding inhabitable drawings for the authors. *Penumbra Reflections*, by Mulla, Paterson and PAC Studio, exhibited at Objectspace Gallery in Auckland in 2018, presents a stainless-steel mirror inside a 3.6 metre cubed aluminium skeletal frame within the gallery space [Figure 4, 5]. Moving projections, which are simulations of the frame and mirror from four projectors onto two of the gallery walls, are cast across the frame, with the result: 'sinewy shadows of the cage bars cast on the floor and the walls amongst moving simulations of the same thing - is intriguing, a little bit threatening, ominous' (Barton, 2018).



Figure 4. Sarosh Mulla, Aaron Paterson, PAC Studio, *Penumbra Reflections*, Objectspace, Auckland, 2018.

Architects occupy the space in between the moment of imagining some sort of future and the harsh reality of that realisation in the physical form. The penumbral space of architectural practice can be thought of as the place of emerging ideas. It is a place of half-light on the periphery, where ideas can be gently germinated without the full glare of the profession's regulatory framework. It is a space where new opportunities can be formed, tested, broken and reformulated in the service of future projects. It is for PAC Studio, a projective space on the edge of

traditional architectural practice. *Penumbra Reflections* places the visitor in the shadow of this mutable zone - between the hard light of realised architecture and the shadows of its imagination - to demonstrate this place that architects occupy, and where creativity resides. Light and shadow are manipulated to create an occupiable volume, rather than a single object in the gallery, or a two dimensional drawing. *Penumbra Reflections* focuses on how shadow effects can influence the occupation and representation of spatial environments when considered from this edge.

In this respect, both projects are inhabitable drawing devices to explore architecture as a consequence of its media. Encountering drawings as able to be inhabited, rather than viewed on paper or screens, allows for a retracing of the captured movements, the traces of the evidential marks left behind, and to imagine a conceptual space of architects' imaginings. Emmons writes that researchers in neuroscience concluded that when watching the actions of others, we simulate these through our own muscle's slight sensations, using mirror neurones in the brain (Emmons, 2014). This empathic link with others in the world can be elicited through drawing. Watching the animation of lines of the captured movements of others coincides with the the viewer's understanding and inhabitation of the drawing in parallel. We understand the gesture and movement of the body which created the trace of line. It is drawing-as-verb which is predominant.

4. Conclusion

These drawings explore the realm of inhabitation of drawing; they make manifest existing built space and imagined mental experiences. This combination of the body with drawing technologies results in three dimensional drawings in space and time, not as simulation but as recordings of inhabitation. In encountering these, we are able to occupy and inhabit the space of these drawings. These demonstrate the making of architectural drawings and the encountering of them, as engaging the entire body, beyond imagination, to instead be inhabitable. Emmons writes that when 'no clear relation exists between body and drawing, this inhabitation is at best partial and shifting' (Emmons, 2005).

By examining the potential of the inhabitation of drawings, in their making and encountering, highlights the role of thinking through drawing differently. The location of this thinking, within the space of the office, reveals the imagined inhabitation of architects. Here, the ghostly presence of full scale built works merge with the space of intention. These are tested and examined within the full scale space of the office: both for designers and clients, the space of the office is used consciously and unconsciously in design decisions.

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