



Proceedings of the Annual Design Research Conference 2019

Edited by Laura Harper

Published in Melbourne Australia, by Monash University, 2020

ISBN: 978-1-921994-52-4

The bibliographic citation for this paper is:

Leanne Zilka and Caitlyn Parry. "Experimenting with fashion, textile and movement to develop architectural propositions." In *Proceedings of the Annual Design Research Conference 2019: Real/Material/Ethereal*, edited by Laura Harper, 692-706. Melbourne: Monash University, 2020

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Experimenting with fashion, textile and movement to develop architectural propositions

Abstract

Building the ethereal explores architecture from the scale of the body to the scale of buildings and we use material qualities to drive the form rather than form driving material. The research looks to disciplines such as fashion and textile design and how they work with the form of the body to capture forms in creating a drape, or a pleat. By simulating these qualities digitally, we can speculate on how these non-architectural beginnings can result in extraordinary spatial qualities where the work has been incrementally scaled up to resolve issues of structure, form and enclosure.

Simultaneous simulation is taken for granted with fashion and textile as the body is always present defining the form and structure of the garment. By exploring these ethereal qualities and translating them into architecture, the intricate is maintained and experienced as space.

The models shown exhibit the work from 2 practices, Person 1 and her research on the intersection between architecture, fashion and textile design and how this nexus is rich territory for the investigation of fabrication techniques foreign to architecture but useful in the development of an intricate architecture and Person 2 and her research through teaching that explores the digital techniques that capture the dynamic movement of the human body to generate complex geometries and spatial experience.

Introduction

The two practices of Person 1 and Person 2 are brought together for the first time in the Ethereal Material conference because both seek to develop opportunities for architecture through the investigation of non-architectural starting points where the experimentation lies in the realm of the ethereal defined as “extremely light and delicate, as if not of this world¹”. Exploring such qualities and developing them as inhabitable spaces at the scale of buildings has obvious challenges both technically and spatially. For something to appear light and delicate there is a relationship between its material, form and structure where the difficulty lies in the discovery of an equilibrium that doesn’t privilege structure over form, form over material, or material over enclosure, because when one of these elements becomes dominant its ethereal suffers and they become skewed in favor of the dominant focus. This paper discusses the processes used in each practice which involves iterative moves to test where this elusive equilibrium lies. The design research model here is one that places importance on conducting research in the medium of design and documenting the discoveries. The research discussed here and shown in the exhibition show the iterations that are driven by a complex cohesion of influences manifested in physical outcomes.

PRACTICE 1: Person 1 – Investigating the Floppy

Floppy_Logic is the design research practice name used by Person 1 to understand the underlying logic that makes up a garment, structurally and materially to apply this knowledge to the practice of architecture. The scale differences between fashion, textile design and architecture means that the principles of what makes a pleat a pleat or a dart create form is where the key translation between the disciplines occurs as these terms are embedded with tacit knowledge around materials that when studied reveal useful knowledge for architecture.

Floppy Logic has been about the development of judgement in relation to digital processes that draw from observation and understanding of an alternative discipline to architecture. The research is about the potential of material and understands material as having intrinsic qualities that can be exploited, where a condition is not taken to the material but rather the material dictates what the condition is.

The starting point of this approach is to explore the qualities of fabrics and non-structural materials which include materials that deform without support, as well as materials that are structural but require support over a certain distance. This exploration requires many points of investigation including structure, scale, and role of the body that are involved in translating between disciplines. Person 2's approach to design lies in the realm of capturing the ephemeral, lightweight nature of fashion and textiles which work closely with the body accommodating movement, structure and form to express a range of ideas from the perspective of the designer.

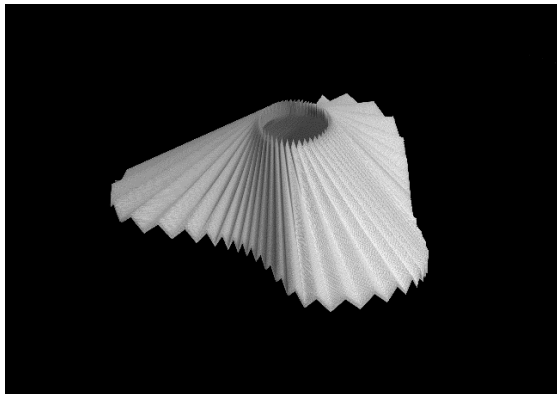


Figure 1 Digitally generated pleat

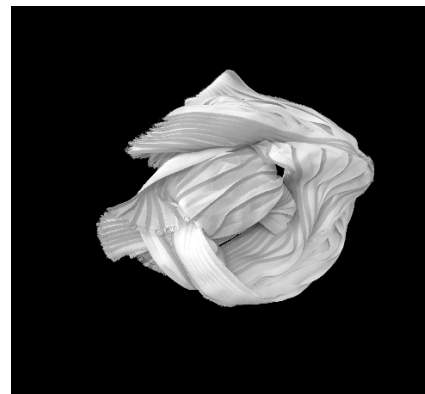


Figure 2: manually generated pleat

To capture the ephemerality as the research shape shifts from fashion and textile design to architecture. Person 2's has produced a series of digital 3d prints focused on one technique – the pleat- for this exhibition to show the process of traveling from initial observations of fashion to architecture. Figure 1 and 2 show the observations of the manually generated pleat (figure 2) where creating form produces an expansion and contraction of the pleat to accommodate the change in direction. These basic observations are then scripted into a form (figure 1) that shows the pleat expanding and contracting as the need for structure arises and uses this to dictate the form. While the floppy pleat in figure 2 does not have the structural capacity to produce enclosure the stiffness in the 3d print uses the pleat to give strength and form.

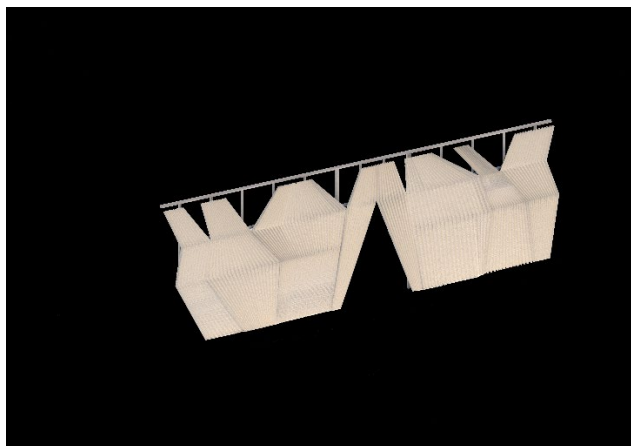


Figure 3 Digitally generated pleated curtain



Figure 4 Pleated curtain in the space

In the pleated curtain, the reason to compress and expand, lay in the programming rather than the structure (the pleats were held in place with a galvanised steel frame). The pleated curtain (figure 4), avoided services and access by compressing around the required openings. The curtain was then gathered along midrails to hold the pleated pattern in place. The digital models simulated this movement of opening and closing until the number of pleats seemed correct, any fewer and the fabric lengths would be visible and any more pleats and the pattern would become texture.

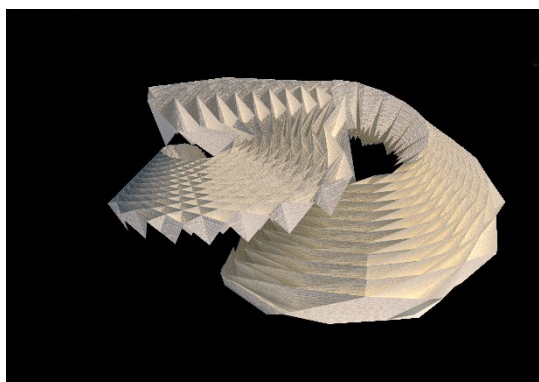


Figure 5 – pleat module

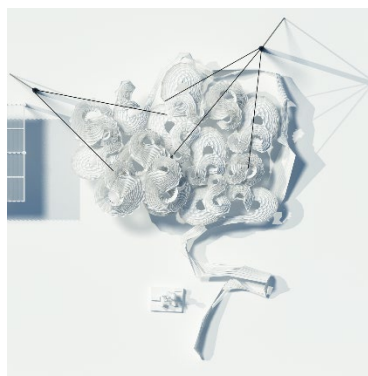


Figure 6 – pleat canopy

The pleat pattern became more complex as it needed to hold a more complex form that could be suspended from cables, so not using gravity to form the pleats in figure 4.

These explorations show incremental shifts in development as each project demanded. The constraints were used to help the form and pattern making and the equilibrium between these were visually tested in a series of pleated examples. This way the ultimate aesthetic drivers of each project of ephemerality through intricacy were able to be pursued.

PRACTICE 2: Person 2 – Expressing the dynamic

The interest in capturing the ephemeral nature of movement is explored in the practice of Person 1's work through both her own research practice and that which is embedded in studio teaching.

There are obvious challenges to the enquiry of the relationship between movement and architecture, namely how one begins to capture something dynamic and fleeting into something with spatial and architectural intent. The practice uses simple 3D scanning and mapping, methodologies frequently used in typical architectural practice, to generate highly intricate formal outcomes and spatial arrangements.

The practice was seeded by the interrogation of forms generated by the body of dancers over the duration of a dance piece. Simple point cloud motion techniques were used to capture sequences of the dancer's body. As shown in figure 1, every single second was recorded to generate and temporally flatten a number of moments in time. This technique caught movement from the front plane, generating a somewhat ghostly hollow mesh, abstracting the body to some degree, yet still capable of being understood as a series of discrete moments (Figure 6), akin to a 3D version of a Eadweard Muybridge photo. Further studies, shown in Figure 7, explored the dancer moving in the axis towards the camera. The clustering and overlapping of the moments in time resulted in a dense mesh, abstracted from the pure legibility of movement into a form with intricate surface details and dynamic moments such as those flung off the edges of the body. It was interesting to note, how studying the final outcome could be fed into effecting the original movement. The scale of the body providing most of the massing where the arms and finer elements of the body gave the finer grain resolution. Changes in these limb elements, could be expressed as finer surface elements, or 'dissolved' into the massing depending on the motion.

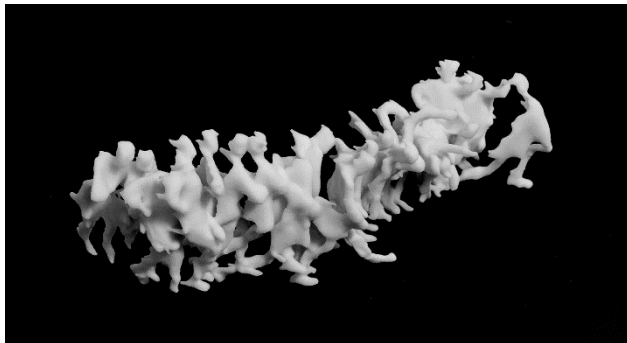


Figure 6 - Sandstone 3D | Staggered 10 seconds of time

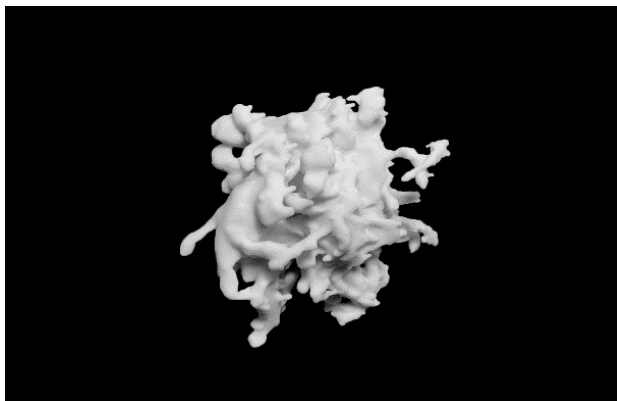


Figure 7 - Sandstone 3D | Compressed 10 seconds of time

The interest in the relationship between performance, diagramming and methodologies for capturing dynamic qualities of movement into a static formal representation, was the driving research enquiry for a number of Design Studio taken at RMIT Architecture. The studios were interested in not only ways of generating form from motion, but also in fostering experimentation with capturing the dynamism of dance and ways to communicate an expressive spatial experience. Both studios worked with Melbourne based dance artists and choreographers Jo Lloyd² and Deanne Butterworth³.

Mapping Movement

One of the initial methodologies used for capturing the movement of the dancer was to map the body over filmed sequences. Breaking the body into regions to diagram provided a framework to break down complicated movements. The locations of the regions were then digitised and computational tools developed to essentially stitch them together generating ribbon like surfaces expressing compression and expansion of the body as it responds to a text read out by students.

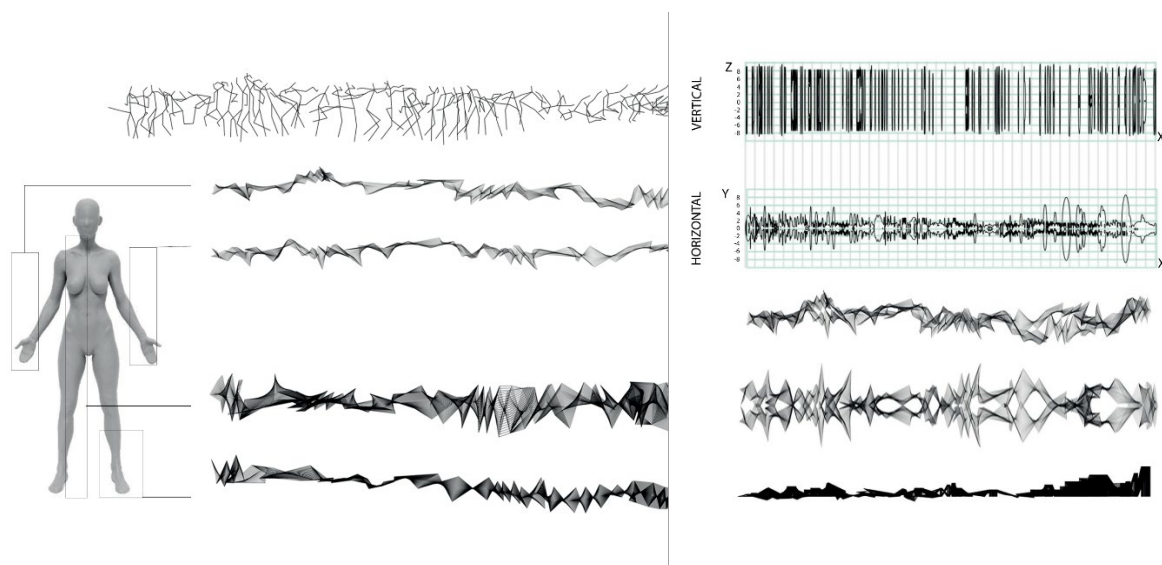


Figure 8 | Entresort Design Studio Student: Alice Gooi

The generation of diagrams of movement were informed by the work of William Forsyth and Motion Bank⁴ who's choreographic practice seeks to digitise movement and develop a more robust notational system for the reproduction and communication of dance. While the images captured the dynamic qualities of the movement over time, processes for rendering the qualities into a spatial gesture more done on a more intuitive basis. Instead of trying to faithfully capture the exact movement of the dancer, the project shown in Figure 9 and 10 below focused on modelling gestural moments that were an interpretation of the how the student read the moments of the performance. Figure 9 depicting the scanned object on the left, in opposition to the interpretive 3D sketch capturing the qualities of the movement. While the point cloud capture is highly details, it becomes somewhat softened and noisy by the several moments conflated. In contrast the work shown in figure 10 has a stronger articulation of movement and duration seen by the dynamic curving flicks of the mesh.

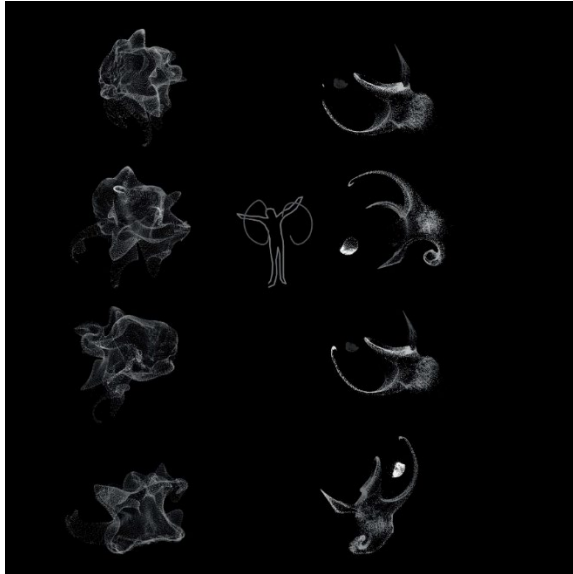


Figure 9 | Entresort Design Studio Student: Fook Yi Lo

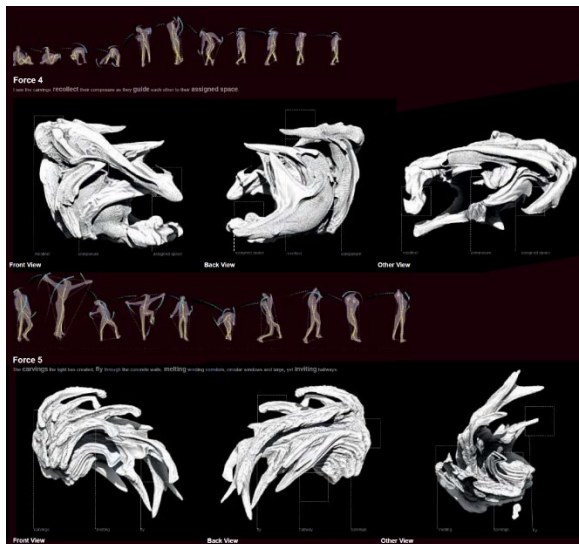


Figure 10 | Entresort Design Studio Student: Fook Yi Lo

Translating Movement

The technique of mapping and qualitative representation of movement resulted in highly expressive gestures. The methodology of translating such gestural and notational qualities into something with more architectural intent was one of the key enquires of the design studios. Taking a more choreographic approach to the individual 3D dimensional diagrams was one approach as shown in figure 11 and 12. Drawing from the Tschumi *Parc de la Villette* grid, each gesture was treated as a separate object in a string of events that one could navigate through space.

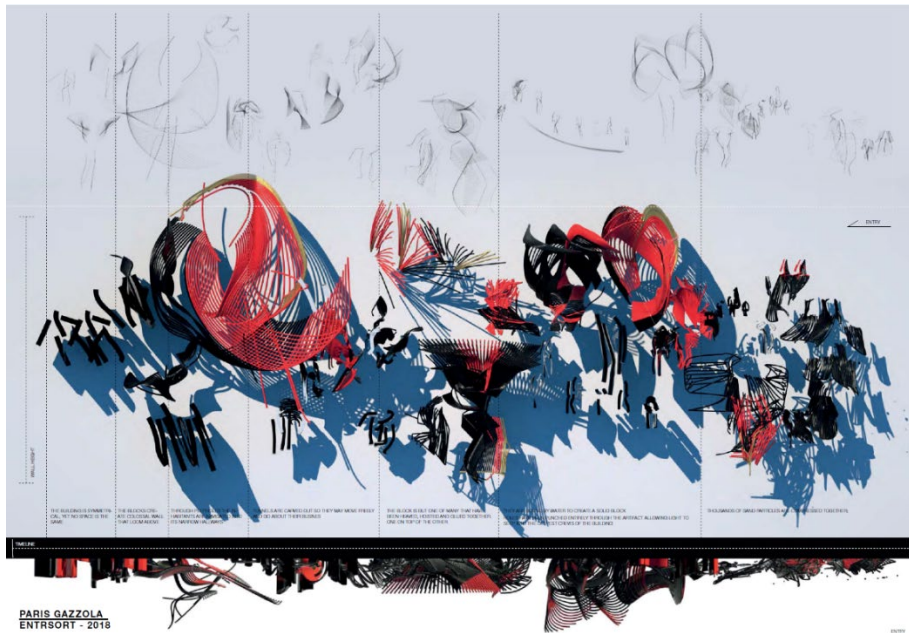


Figure 11 | Entresort Design Studio Student: Paris Gazzola

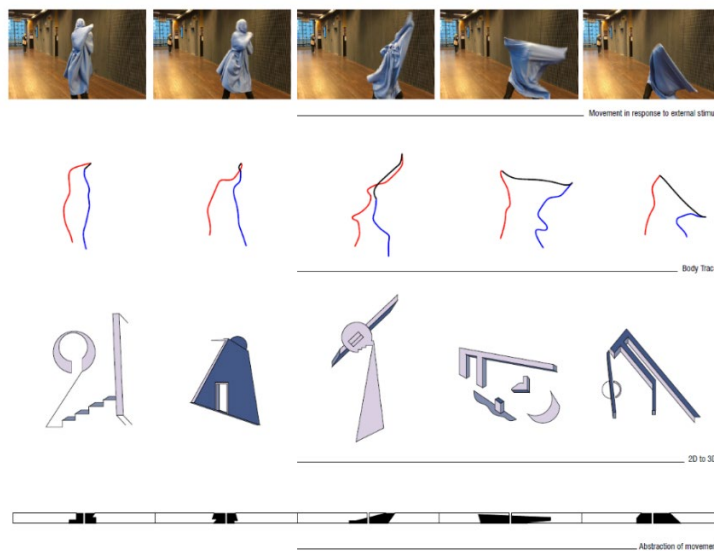


Figure 12 | Liminal Design Studio Student: Sam Torre

This methodology was interesting in its discussion of what constitutes an architectural object and the limitations inherent in trying to take the trace of something (ie. movement) and scaling it to an architectural scale. The ephemeral transient quality of dance and movement is challenging to capture in one static moment, designing a series of moments to walk through was one way of developing multiplicities of form with different spatial qualities and directionalities. In response to trying to consolidate the field of objects, the idea of capturing a trace and expressing the relationship between the movement of people through the site over time and historical use of the site was explored. Layering the methodology with this narrative device enabled a more unified architectural proposition. One such example is shown in Figure 13, where the site was deconstructed into a number of panels that were given their own agency degraded over time in response to simple algorithms derived from the mapping of the original dancer. The panels then grounded the glass enclosure which was to be a more transparent theatre space expressing the gestures of movement cause

once as the internal framing, and the other being the fleeting movement of bodies seen only during a performance.

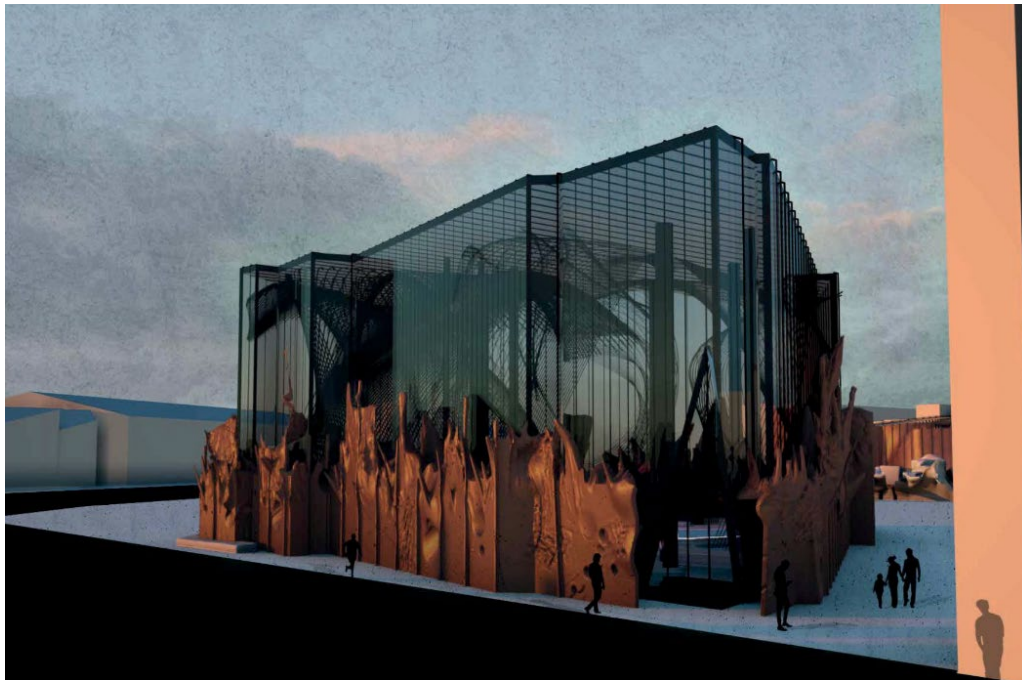


Figure 13 | Entresort Design Studio Student: Paris Gazzola

Summary

The investigations from both practices unify in their translation of scale from small sample or croquis to architectural scale. While this may sound simple, it is not a matter of creating a form that then is supported by a complex level of structure where the form and skin are separated from the structural demands but rather a way of scaling up that abstracts the information into an alternative form that has more architectural possibility. For this integration to occur an incremental refinement of the concepts is undertaken so that the architecture is not beholden to scaleless exploration. Person 2 overcomes this by playing directly with fabrics and Person 1, through the development of the algorithm that works to distil the expressive movements without simply rendering them. In a way this body of work is a reaction to the fantastical form that are freely generated in a digital environment that has no gravity or other forces, where the structure and enclosure is subservient to the overall form. The models shown freeze the moment of equilibrium in the process of turning gesture into architecture.

Endnotes

¹ Cambridge Dictionary definition

² Jo Lloyd is a dance artist and choreographer who's work is interested in dance as a social encounter revealing behaviours over time.

³ Deanne Butterworth is a dance artist who works with Chunky Moves and collaborates extensively with Jo Lloyd who's work is interested in site specific performance and translation from other mediums into movement.

⁴ William Forsyth is an American Choreographer who started a project called MotionBank which acts as a research platform for choreographic practice and dance documentation.