

## TANGIBILITY: HIGHLIGHTING PHYSICALITY IN INTERACTIVE INSTALLATIONS

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### Abstract

Touch is our connection to our world and, as digital technologies develop, we must find ways to recontextualise touch within emerging digital spaces. This paper discusses the development of 'Tangibility', an installation combining tangible interaction, synaesthetic visualisations, and lens based animation techniques to encourage audiences to explore tactility. It introduces a system of sensual analysis and presents an interpretation of Laban's effort analysis as an evaluation tool for the effectiveness and design of tangible interfaces. It also explores how Kennedy's "Aesthetics of Sensation" can be adapted for synaesthetic visualisations and discusses how materiality within lens based animation techniques creates physicality within an image.

**Keywords:** Interactivity, Synaesthesia, Tactility, Installation, In-camera animation, Tangible interfaces

"in the skin and through the skin, the world and body touch, defining their common border... the world and body meet and caress in the skin" - Michel Serres [1]

Touch is important, it is what connects us to our world [2]. As our world becomes increasingly mediated, through the prevalence of screen and virtual interaction technologies, it is important to develop systems of physicality and representation of touch within these digital spaces. *Tangibility* is a practice based research project, exploring how tangible interfaces, synaesthetic visual language and physical imagery combine to create interactive spaces that celebrate and encourage tactile engagement. Designed as a cinematic interactive installation, 'Tangibility' is an attempt to explore how lens based animation techniques can be used to preserve physicality within digital, tangible interaction.

The current prototype explores a single aspect of physical interaction, the relationship between force and resistance. It consists of a brilliant white screen and a tabletop interface of stretched fabric. Tactile engagement with this interface changes the composition of the screen, adding dynamic, lens based imagery that explores representations of the sensations present within the interface.

This paper will detail the process of developing this work, examining my research approaches and conclusions within sensation analysis, interaction design, synaesthetics and animation mediums.

### Sensation Analysis

Touch is essentially an experiential entity, and thus the development of any language of touch must be approached through an iterative exploration of experience. In his work, *The Five Senses* Michel Serres [3] playfully explores the senses, particularly the sense of touch, "I touch my lips... with my finger... The I vibrates alternately on both sides of the contact, and all of a sudden presents its other face to the world" [4]. Since the aim of the project was to encourage an audience to playfully engage with tactility, I attempted to approach my own research with the same experiential curiosity as presented here.

*Tangibility* explores four tactile experiences: running a hand along a chain-link fence; walking in high heels; sipping a cup of tea; and sinking into an armchair. These activities were selected as they demonstrate the different levels of intention, temporality, comfort and emotion present within physical contact.

Of the four, running a hand along a chain-link fence is the only activity undertaken for the simple joy of tactile exploration. Playing with tactile experience in this way produces some physical discomfort that is somehow negated by the emotional response of curiosity and playfulness. The sensations within this experience function to highlight the causal and reflective relationship between numbness and vibration. Prolonged physical vibrations build to remove all other sensations from the fingers, and continue to persist beyond physical contact. Temporality is key, as the relationship builds and fades over a drawn out period of time, independent of direct physical contact with the fence.

Walking in high heels is at the opposite end of the intention spectrum. Here tactile experience is an unconsidered, often painful, consequence of an aesthetic choice. There is a disconnect between tactile and emotional response - while the actual experience is uncomfortable, the emotional response is one of confidence and empowerment. This duality demonstrates the functions of force and resistance, highlighting how one both conflicts with and depends upon the other.

As force upon an object increases, so does the resistive sensation, until a tipping point is reached and one must yield to the other.

Sipping a cup of tea is a ritualistic act, where tactile experience is secondary to emotional comfort and taste, however it is the tactile experiences - warmth of cup in hand, steam rising onto face - that fuel the comforting emotional response within the experience. Here, familiarity and repetition function to create comfort. The relationship between ritual and comfort is particularly evident when it is disrupted by unfamiliar and unexpected sensations. The subversion of anticipation within this set of sensual experience creates a jarring discomfort.

Sinking into a comfy armchair is an anti-tactile action. The desire is to remove tactile input. There are, however, numerous physical experiences that exist within this context - pressure on the back and thighs, the slow relaxation of muscles over time. Sensations develop over time as pressure builds, creating discomfort from comfort. This shifting of experience highlights the relationship between weight and absence in tactile sensation - where there is weight there can be no absence of sensation.

The four pieces of *Tangibility* explore these relationships: numbness and vibration; force and resistance; temperature and comfort; and weight and absence. The work will produce interactive representations of each of these relationships, combining tangible interfaces, synaesthetic visualisations and physical imagery to produce an immersive whole.

While three of these four pieces are currently in the design phase, a working prototype of the force and resistance element has been constructed. This prototype consists of a tangible fabric interface that controls a series of animations made from dyes, oils and water. User interaction creates a series of parameters that select the video played and directly influence its playback. The following will explore the interaction design, aesthetic and material development of this specific piece, while also providing an explanation of the conceptual structure of the work as a whole.

### Interaction Design

'Tangibility' aims to create an immersive, tangible interaction that encourages the

audience to playfully explore tactile experience. This was achieved through highlighting materiality within the interaction medium. The use of physically embodied objects within an installation design creates a heightened sense of physicality. *Tangibility* builds upon this sense, creating a tangible experience by combining a physicality in image and tactile interface. The interface was designed to reflect the nature of sensations present within the aforementioned tactile experiences, encouraging exploration of the relationships present in tactile experience, rather than the literal action itself.

Force and resistance have a symbiotic relationship: as one element grows stronger so does the other. The interface required a medium that would push back against the participant forcing them to decide whether to push onwards or yield. To this end stretch fabric was secured over a wooden frame, providing a flexible membrane with which the audience can engage. This fabric would give easily at first, building resistance, eventually forcing the user to abandon their forward motion.

In order to further develop the work it became necessary to find a method of evaluating action through which interactive parameters could be identified. For this purpose, I have adapted Laban's effort analysis. As Schiphorst explains "for Laban, touch enables the relationship between movement and space to be discerned within bodily-experience" [5]. He explored this idea through detailed analysis of effort, categorising action into spectrums of weight, space and time [6]. Actions are classified in terms of particular gestures according to where they sit on the spectrum. A movement, or in the case of *Tangibility*, an interaction, that is flexible, strong, and sustained would be classified as 'wringing', while

another effort that is direct, light and sudden would be classified as 'dabbing'. This system allows the gestures enacted through the interface to be identified, analysed and evaluated.

The tactile relationship explored through this prototype, force and resistance, functions most conspicuously across the spectrum of weight and is best represented through sustained and direct contact. Three kinds of action - thrusting, pressing and gliding - can be identified by the system to produce different visual outcomes. This is done through the use of three short range proximity sensors, placed below the fabric. These sensors track the depth to which the fabric has been pushed downwards. This data is used to determine the speed and intensity of the engagement. A quick thrusting motion will trigger a short animation in which the white background is quickly overtaken by an intense colour. Pressing, a slightly slower, more deliberate engagement, produces a fast flowing and shifting imagery that gains intensity as the interface is further engaged. An even more controlled engagement by the viewer will result in a longer, more subtle animation, consisting of shifting tones of blues and greens. As resistance mounts against the user, a persistent, yet gentle, exertion of force will reveal a breakdown of this colour, to reveal a pattern of concentric shapes.

User engagement controls playback. Each depth is mapped to a specific frame within the animation, and the further one engages the interface the more of the animation is revealed. This also functions to demonstrate the push and pull relationship of force and resistance. As the user yields to the resistance and removes their hand, the imagery is reversed. This scrubbing interaction provides a tangible and immediate visualisation of the state of dominance within each element of the

work.

In this way 'Tangibility' seeks to exploit the material nature of its interface to highlight the functioning of tactile relationships, allowing the audience to make their own connections between the sensations they experience and the imagery they see. Users are encouraged to play with the system, exploring the different forms of tactile engagement within the interface and examining how they produce different outcomes within the visual aspect the work.

## Synaesthetics

*Tangibility* required the creation of a visual language that produced a synaesthetic representation of touch. Such synaesthetic representations exist across many forms of visual and new media. While many artists from various backgrounds (Henri Matisse, Golan Levin, Zach Lieberman and Rushland Khasanov) influenced the visual development of this work, it was *Synchromy* [7] and *Lichtspeil* [8], the works of experimental animators Norman McLaren and Walter Ruttmann respectively, that formed the basis of a process of investigation that led to the production of my own synaesthetic language. Each of these works seek to create visual representations of sound while celebrating their material mediums, highlighting the physical nature of their subject matter. Physicality permeates their work as they seek to represent sound as sensation, a tangible, temporal, knowable occurrence.

Analysing the language of these works using a series of classifications loosely adapted from Barbara Kennedy's "Aesthetics of Sensation"[9], an interpretation of Deleuze's discussion of the function of sensation within visual work, allowed for the production of a lens through which to view my own visual experiments.

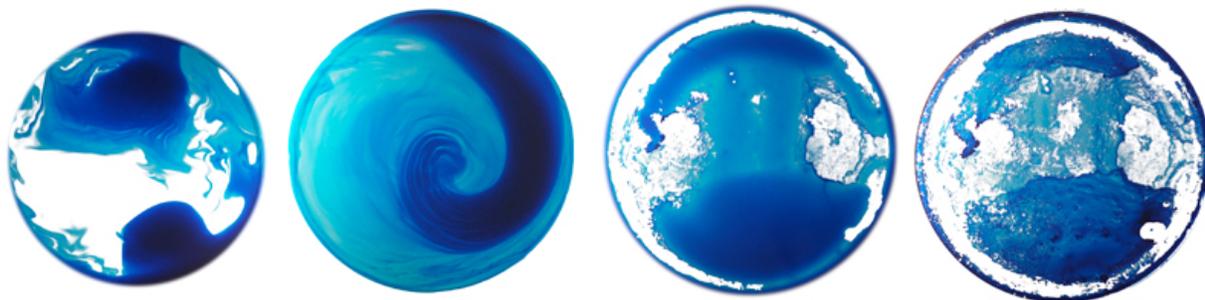


Fig. 1. Stills from an evaporation sequence (©Rachael Priddel)

Within her book, *Deleuze and Cinema: the aesthetics of sensation* [10] Kennedy discusses three ways - vibration, resonance and forced movement - in which rhythm, colour and form behave to create sensation within an artwork. These classifications were loosely adapted for the movement based works of McLaren and Ruttmann.

Vibration uses the rhythmical oscillation between the intensity of colours to produce a sensation that is “more nervous than cerebral” [11]. Representations of these rhythms rely on the fluidity of the image, presenting tonal shifts, and waxing and waning forces. Materiality and matter function as the vessels of colour and movement, to create synaesthetic imagery as “each tone or modulation of colour exercises a force upon a corresponding body” [12]. The rigid aesthetics of *Synchromy* [13] demonstrate this kind of functionality, consisting of vertical lines over a solid background disrupted by small flickering rectangular shapes, beginning with layers of the same tone at varying intensities, and continuing on to produce more complex colour relationships. In this way McLaren reflects the nature of the sound he is representing as a complex series of temporal, tonal relationships.

This outcome was desired to demonstrate the emergence of tension and strain before the inevitable tipping point and tonal shifts were employed to portray this within the final prototype. The series of animations that deal with a drawn out struggle consist of varying intensities of colour congregating, pulsing and shifting, battling to dissipate into the paler tones around them. As the participant engages, the image begins to collapse in upon itself, moving into the second of Kennedy’s sensation-creating behaviours - resonance [14].

Resonance is the state in which two

entities shift intensities, “embrac[ing] each other as if in a state of symbiotic energies” [15]. This interaction produces a sensation of sustained contact, slowly shifting and developing over time.

Resonance functions strongly within Walter Ruttmann's work as shifting forms of light and dark create sensation. *Lichtspeil: Opus III* [16], the third element of the series, includes a section of vertical black waves moving across a blue background. Here Ruttmann can be seen to demonstrate how synergies of movement, symmetry and metamorphosis function to create corresponding give-take relationships within all areas of the image, conveying sensations of weight and force.

Force and resistance have a similar symbiotic relationship, one is useless without the other. In the absence of force there is nothing to resist, and conversely the lack of resistance renders force unnecessary. Resonance functions within *Tangibility* to produce a visual representation of this search for unachievable dominance. The imagery creates a series of stages of resonance. First, a vibrant bleed of colour emerges to fill the projection area. This is then pushed outwards from within to reveal a white form, punctuated with instances of colour. This resonance is complimented by the audience’s control of the playback speed and direction, causing these forms to interact continuously. These elements combine to produce visual sensations that characterise force and resistance.

The final category - forced movement - is a distortive aesthetic characterised by division and withdrawal – “two sensations draw apart, release themselves, but also, now to be brought together by the light, the void, the air that sinks between them” [17]. This functioning of sensation relies on expectation and anticipation, as unpredictable variations of intensities and disruptions within individual frames

create a sense of rhythm and discord within the whole. Within his film, *Synchromy* [18], Norman McLaren uses symmetry to create this effect, establishing relationships between elements through the mirroring of movement and form, suddenly severing those connections as elements behave individually. This division is continued within the work as the established relationships between vision and sound are subverted, punctuating the piece with periods of black. This subversion functions to produce divisive, disorienting effects, reflecting the disparity between expectation and consequence, creating a sensation of uncertainty and disconnect between body and mind.

Force and resistance are interdependent, and as such there has been no use of forced movement within the current prototype of *Tangibility*. This mode of representation, however, will be further explored in the elements of the installation that represent relationships of weight and absence, and numbness and vibration, as these possess a more discordant nature. These functions work with the tangible interaction interface to produce a visceral and immersive work.

The physicality of the lens based animations add to this experience to convey further dimensions of touch and tangibility.

### Animation Medium

Physicality was the primary concern when determining the animation medium to be used within *Tangibility*. This work demonstrates how physical processes can explore the nature of a sensation to produce materially embodied imagery.

Lens based animation techniques were used to provide a material, “real world” feeling within the imagery of *Tangibility*. The materiality of force and movement is one of ebb and flow, smooth morphing

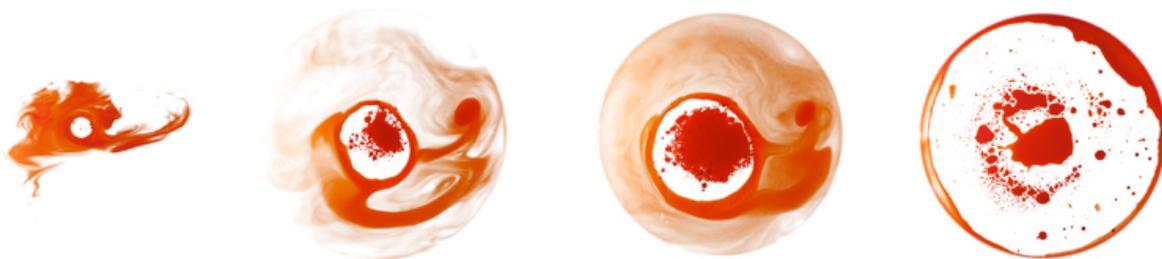


Fig. 2. Stills from an oil sequence (©Rachael Priddell)

forms, and sharp shifting tones. The transient, dynamic nature of fluids proved to be highly representational of the push and pull sensations required for this work. The intensity of tones perfectly suited the creation of vibrating and resonant images. Testing was carried out with a number of fluids from which water, dyes and oils were selected. These mediums produced imagery with a strong sense of shifting physical dominance. The flexibility and transience of fluid make it the perfect physical repository for the relationships between vibration and resonance.

The final imagery used within the work fall into three categories. Blends (see Figure 1) - created by adding small amounts of dye to water and using time lapse photography to capture it dissipating - are used to portray sudden and strong interaction as resistance gives way to brute force. Oils (see Figure 2) - where oils were mixed with dyes and slowly added to water – correspond with a more measured interaction. Evaporations - time lapsed footage of dyes evaporating - begin with a vibration filled struggle between tones. Once resistance yields, the intense colour retreats resonantly, revealing concentric patterns of light and shade.

By using these photographic techniques the imagery maintains a material connection with the world. The light, colours and forms exude physical presence, culminating in an aesthetic that compliments and extends the tactility of the interaction space.

## Conclusion and Future Directions

Our body is our connection to our world, it is important to recognise the value of tactility within our interactions with digital space. Interactive installation works allow the viewer to explore and redefine the relationships that exist between their sense of self, their bodies and the world. By investigating the functions of touch, representing them through synaesthetic forms and physical imagery, and presenting these outcomes within a tactile interactive space, we can explore the relationship between our physical world and our sensory perceptions, highlighting and reinvigorating the role of the tactile.

This project will continue to develop and refine these aesthetic functions, exploring how they can be applied to all identified tactile relationships: numbness and vibration; ritual and comfort; and

weight and absence. The final outcome of the work will be a series of four installations, each with differing forms of tactile engagement and visual outcomes.

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