

ANALOGUE REFLECTS



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ANALOGUE RELIQS

The imprint of making

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ABSTRACT

This research asks how analogue making might expose tensions within the abstract digital systems that people live with today. Through a process of media archaeology, obsolete media and tools are reintroduced to contemporary design practice through transmediation, creating a digital analogue hybrid that extracts the new from the familiar.

This research uses nostalgia as a critical lens rather than something sentimental by reasserting material resistance through methods involving 16mm film and ZipZap machines to provoke analogue instability; in doing so, failure is reintroduced into systems that seek perfection. These failures or ‘glitches’ suggest the materiality of media, helping to expose material traces often erased in digital production, revealing the hidden labour and invisible systems that underpin digital capitalism.

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ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the Acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed Paul David Garvey

28 /April 2026

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Paul

INTRODUCTION

An analogue process can generate new forms. These forms emerge from unanticipated spaces, teased out through material collaboration. When chaos and intention meet, materials and maker collaborate to elicit authentic errors that are possibilities rather than mistakes.

Analogue methods can be understood as active collaborators rather than mere tools of production. By slowing down and introducing points of friction through multistep processes, intricacy, akin to a Rube Goldberg machine (see Fig.1), becomes a way of making. Its complexity can provoke volatility and error. Rather than seeing this instability as unproductive it can be framed as generative; a way of making where these errors (or “glitches”) become an important part of the collaboration and contribute to the process in ways that cannot be foreseen.

Fascination with analogue tools and their quirks drew me toward the question of how analogue making might expose tensions within the abstract digital systems that we live with today. This prompted exploration around tactility in contemporary design practice, using hybrid workflows that leverage legacy tools and media formats or “analogue relics.” These analogue relics are more than a nostalgic medium, their qualities and potential are used to reveal truths about our relationship with modern technology.

The rise of digital formats and tools has enabled the rapid reproduction and distribution of content, but the line between human and machine is becoming increasingly blurred. By rehabilitating analogue relics assisted by digital tools, nostalgia becomes a critical lens rather than something sentimental.

POSITIONING

Growing up during the rise and fall of countless audio and visual formats as both consumer and artist gave me firsthand experience of how this can impact creative practice. Starting as a DJ, the preeminent format was analogue, and the experience of sourcing vinyl was a communal one; hours spent scouring record stores, dissecting each tune before purchase. This attention would extend to preparations for playing out. The crate of records would be meticulously selected and packed before leaving the house; I placed high value on the music and how it was curated. As time passed, vinyl was replaced by the CD and eventually digital files (see Fig. 2). The loss of tactile representation and instant access had a profound effect on my practice as a DJ. Less scrutiny was applied due to a perceived lack of value, resulting in a lack of curation and a dilution of critical evaluation.

Living through this transition has given me insight into the exciting possibilities of both digital and analogue formats. Reflecting on the analogue past, it is with rose tinted glasses. Outputs felt gritty, raw, and authentic; limitations were parameters rather than roadblocks. The reality for a maker is that these processes were often tedious, frustrating, and required significant time and capital investments. As a solution to counter this, digital tools have helped facilitate and expedite the process but lack the materiality to be a truly organic collaborator. Digital processes have become so streamlined that moments of creative friction and limitations are no longer present, producing work that is seamless, though devoid of humanness. Its glitches quickly extinguished and mistakes never embraced.

I had a fixation on digital space as a Communication Design undergraduate. Making took place inside a screen; printing was an unfortunate chore at the end of the design process. During my journey through the programme, curiosity led me to the print room facilities and the darkroom, where my understanding of design was fundamentally shifted. I was no longer designing in a silo; ideas and knowledge were shared with technicians and peers, and material collaboration was engaged. Analogue making became an integral part of my design process; experiential and experimental. I felt more connected to my work as my knowledge expanded through tactile and human experiences.

Progressing through my design education I became acutely aware of my role as a designer and what that entails. Design is often described as a service based industry, which has seen it co-opted into a role of delivering or packaging content for the masses. The

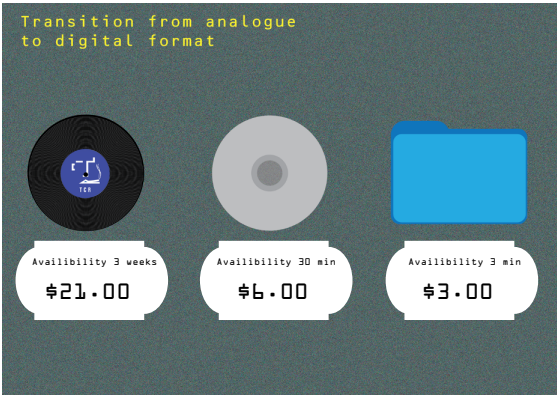


Figure 2. Shows prices and relative availability of music formats, transitioning from vinyl to digital files.

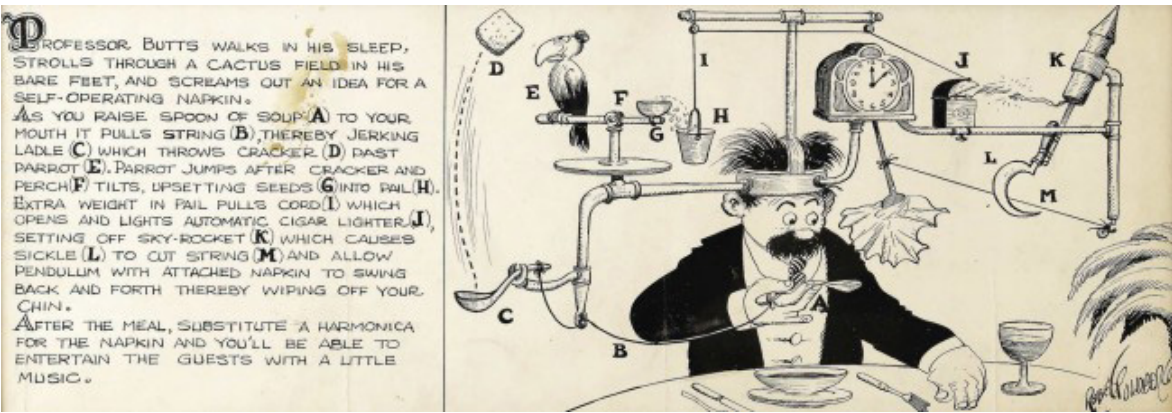


Figure 1. Rube Goldberg cartoon *Self-operating napkin*, 1931, shows an overly complex system for a simple task.

CONTEXTUAL REVIEW

shift towards digital platforms has dramatically changed the way we serve and consume content. Graphic Designer Neville Brody¹ describes the shift from print to digital as the death of editorial expression, claiming that digital media creates homogenised work that is shaped by the medium itself. He argues that design was once concerned with expressing content but now works in a model of safety where content is delivered with little editorial oversight. I share this sentiment and encounter this frictionless design through a myriad of applications and interfaces on a daily basis.

I see design as a democratic way of making, something accessible that can function as both a service or agent of chaos. Design can simplify through order, or disrupt through challenge of structure. Good design strikes a balance, using order to clarify the abstract or bringing chaos to texture the regimented. Design is about making sense through interpretation and translation—it should challenge and disrupt.

E. M. Forster's *The Machine Stops*² is a dystopian novella written in 1909. The ideas and themes contained within the novella make it prescient. The novella explores human's dependence on technology; its deification (see Fig. 3), and the mental and physical consequences of this reliance. No longer self-sufficient, humans languish in a hyperreality built upon facsimiles of real experiences.

The experience of making is most potent when senses, variables, and materials collide. Unfortunately, in contemporary digital design practice, material resistance can be reduced to a glass screen, a frictionless, inauthentic replication of a gesture; anticipation and chance replaced by cold precision, surface tension and viscosity reduced to a slider. The texture of making is more than the final result; it is the ink on our hands, the smell of fix that permeates our nostrils, or the coffee that stains our draft.

I. DIGITAL CAPITALISM

The modern creative will find this connection to process has been compromised for productivity. This commodification of creativity is driven by digital capitalism, where production is valued over craft. Critical theorist Michael Betancourt³ writes about this deliberate abstraction of materials and labour as being a consequence of the transition to digital capitalism. This dissolution of concerns with physicality and a denial of material basis has resulted in a massive cultural shift in the way content is developed and delivered. This determination of physicality and materiality as inefficient and unimportant has resulted in digital technologies becoming ubiquitous.

This shift from analogue to digital is mirrored through the evolution of credit card transactions. Credit cards were invented in 1921 but did not reach high circulation until the 1960s.⁴ As an object, they are the embodiment of virtual money, something that gives access to but does not reveal financial status. In the past, cards were embossed with details that imprinted data via carbon transfer allowing consumers to enter into a monetary contract with vendors. As technology has evolved the functionality of the

¹ Amy Frearson, "Digital Content is all "Fed through the Same Sausage Machine" says Neville Brody."

credit card has been further abstracted to activate with NFC technology. While credit cards remain a familiar object, they have transitioned from a functional tool to an icon.

If something is abstracted enough times it starts to lose meaning and becomes untethered from reality. In contemporary society, there is still a connection made between the gesture of swiping a glass screen and painting with a brush; people have experienced the analogue. Eventually, this gesture will become an unrecognisable facsimile. If one makes a photocopy of a photocopy, it loses fidelity. Repeating this process enough times, the image can warp, becoming a misrepresentation of the original.

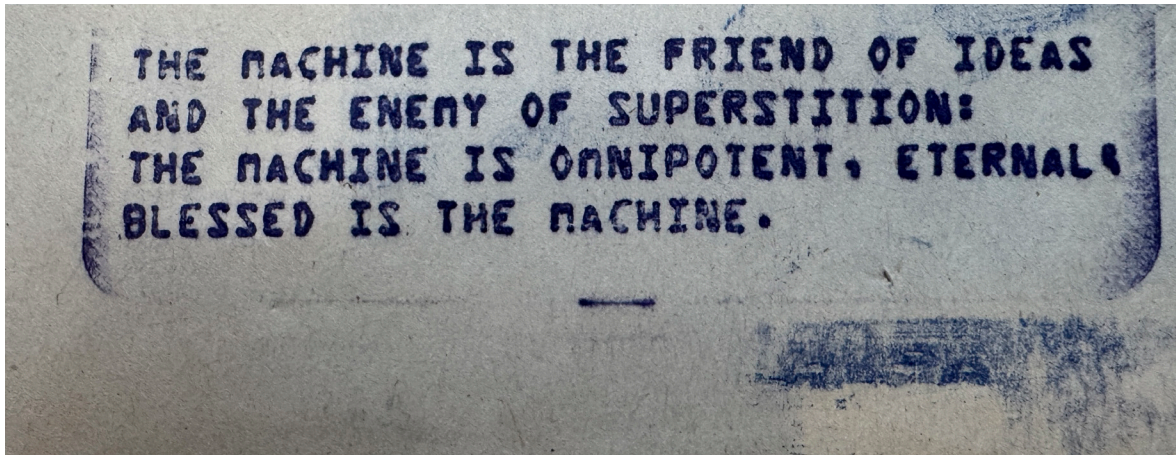


Figure 3. Direct quote from the novella The Machine Stops “the machine is the friend of ideas and the enemy of superstition: the machine is omnipotent, eternal: blessed is the machine” printed from ZipZap machine.

II.CHAOS, CHANCE, AND THE GLITCH

Dada was an art movement that had a substantial effect on design. Through absurdity it mocked and held a mirror to the establishment. It was political by being the antithesis of order, revelling in nonsense and highlighting the futility of the structures that governed people’s way of life. Dada was accessible and encouraged individual participation, a reaction against systems and mechanisation that reduced humans to a cog in a machine. It mirrors contemporary concerns with AI, data processing and algorithmic manipulation.

Spiritually Dada aligns with glitch art. Both hold a critical view of systems and celebrate the error, seeing it as a way to expose uncomfortable truths hidden within these systems. In his book *Glitch: Designing Imperfection*, Iman Moradi ⁵ defines a visual glitch as an artefact that results from an error. It is neither the cause nor the error, but a visual manifestation that marks a deviation from the anticipated result. While the term “glitch” has a strong visual association with digital processes, it can be broadly applied to describe an unexpected result of digital, human, or mechanical processes.

The term “glitch” derives from the Yiddish term *glitsh*, which translates to “slippery place.” We are in this slippery place at the moment, sandwiched between an analogue past and a digital future, where our value as humans can be reduced to numbers that feed an algorithmic beast. How can we navigate this new future while maintaining a grip on tactility?

Michael Betancourt ⁶ argues that the glitch is more than an aesthetic choice. It can also be a disruptive force, signifying a quiet form of activism: “The glitch can act as a stoppage of this autonomous production, a transitory failure whose critical potential depends on violating this aura of the digital. Glitch, in this interruptive role, suggests the materiality of media, offering the potential for a transition into a critique of digital capitalism.”

This framing of the glitch is also reflected in Rosa Menkman’s *Glitch Studies Manifesto*.⁷ Considered one of the leading theorists of glitch art, Menkman sees the limitations and imperfections of formats as fingerprints—traces of process that expose the medium. These fingerprints are often viewed as accidents, Menkman reframes these “accidents” as opportunities. When viewed through this lens these limitations become an authentic celebration of reality that reveals a truth.

This celebration is also echoed by Brian Eno.⁸ Eno sees these fingerprints as not just opportunities, but the essence of what gives work its unique character: “Whatever you now find weird, ugly, uncomfortable and nasty about a new medium will surely become its signature. CD distortion, the jitteriness of digital video, the crap sound of 8-bit - all of these will be cherished and emulated as soon as they can be avoided.” These fingerprints act as a counterpoint to the perfection demanded in digital capitalism.

2 E. M. Forster, “The Machine Stops” and Other Stories.
3 Michael Betancourt, *Glitch Art in Theory and Practice: Critical Failures and Post-digital Aesthetics*. 8
4 Ruben Pater, *Caps Lock: How Capitalism Took Hold of Graphic Design, and How to Escape It*.

5 Iman Moradi, *Glitch: Designing Imperfection*.
6 Betancourt, *Glitch Art in Theory and Practice*.
7 Rosa Menkman, *Glitch Studies Manifesto*.
8 Brian Eno, *A Year with Swollen Appendices: Brian Eno’s Diary*.

III.CAPITALISM AND THE MACHINE

During the 1950s banking and financial institutions in the United States began a significant push towards automation.⁹ The need for large volumes of processed data or information saw an adoption of both magnetic and optical reader technologies. Both of these technologies relied on machines that could read data at speed. This required typefaces with unambiguous characters to limit errors. Magnetic ink character recognition (known as MICR)¹⁰ was established in the 1950s, and was in wide use by 1958. By 1963, 85 percent¹¹ of all cheques were being encoded using this process. E13B was the primary typeface used. Consisting of 14 characters including the numbers zero to nine, and symbols representing Amount, On-Us, Transit and Dash (see Fig.4), E13B is a typeface of extremes that is shaped by machine requirements. A combination of thick and thin strokes created a magnetic profile that was easy for machines to distinguish.

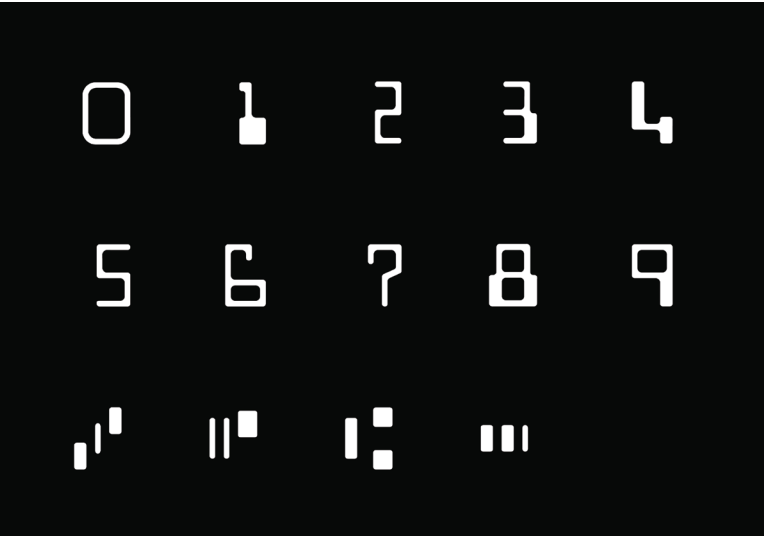


Figure 4. Full Suite of MICR typeface designed for magnetic ink recognition, from left to right bottom row: Amount, On-Us, Transit, and Dash

IV.MAKING CAPITALISM LEGIBLE

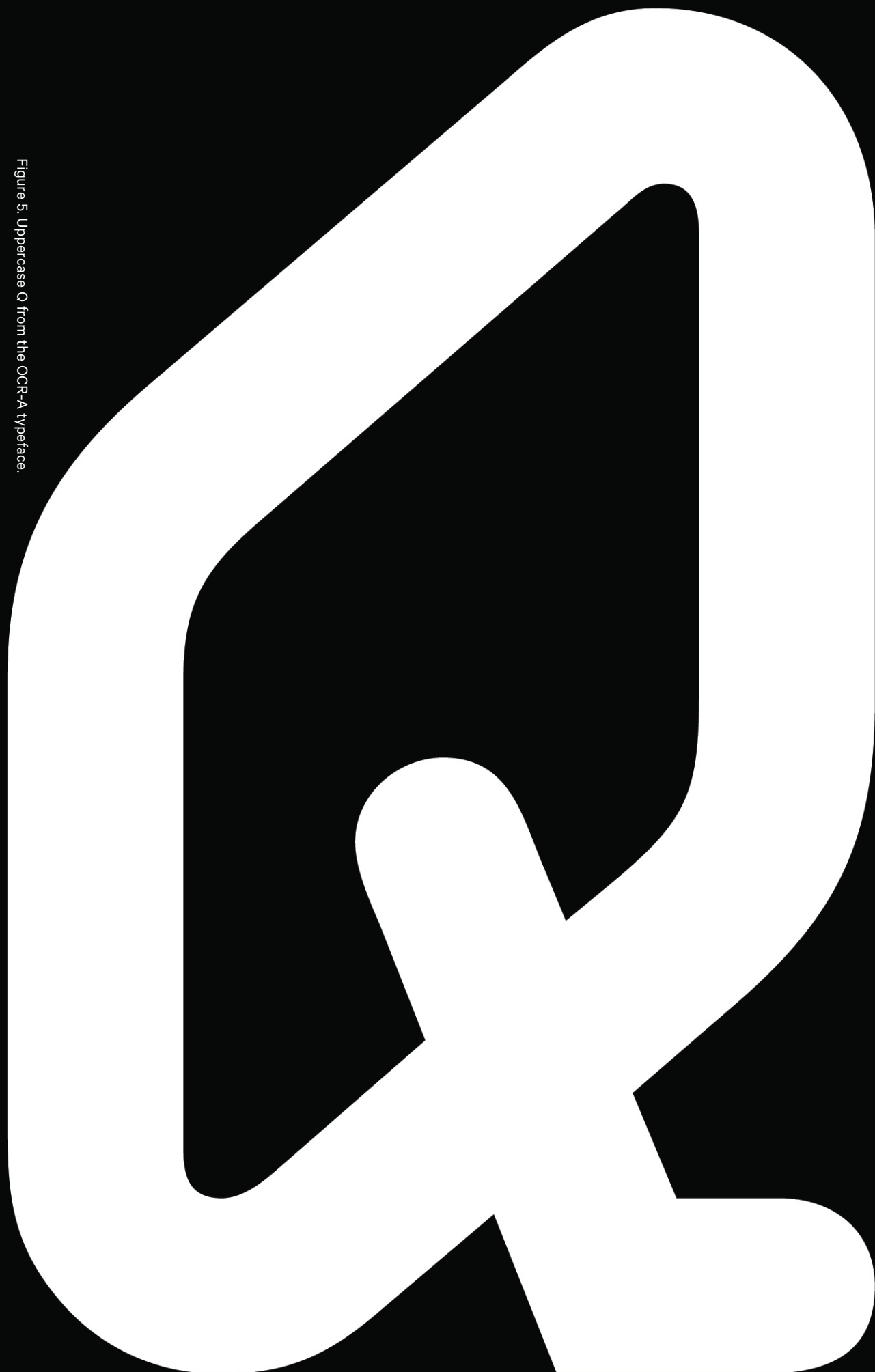
OCR-A was a typeface for optical readers designed by the American Type Founders in 1966. Machine requirements resulted in a monospaced typeface with a suite of quirky characters. In particular, the uppercase Q (see Fig. 5) stands out as a decision governed by function over form. In 1963, Adrian Frutiger¹² was approached by the European Computer Manufacturers Association to design an OCR typeface that was more humanistic.¹³ The problem of designing OCR-B to be readable not only by the human eye but also by mechanical ones stirred up an aesthetic conflict for Frutiger. While completed in 1968, OCR-B was not formally recognized as an international standard until 1976.¹⁴

While these machine-readable typefaces are still in use, their popularity has diminished as technology has evolved. However, they yet evoke and represent a capitalist infrastructure, an idea of machine perfection that has found favour with contemporary designers as an expression of both digital interfaces and the future.

9 National Research Council (U.S.) et al., eds., *Computer Chips and Paper Clips: Technology and Women's Employment*.
10 'Generic MICR Fundamentals Guide - Xerox.'
11 National Research Council, *Computer Chips and Paper Clips*.

12 Heidrun Osterer and Philipp Stamm, *Adrian Frutiger - Typefaces: Complete Works*.
13 Osterer and Stamm, *Adrian Frutiger*.
14 Osterer and Stamm, *Adrian Frutiger*.

Figure 5. Uppercase Q from the OCR-A typeface.



METHODOLOGY

This project uses media archaeology as methodology where obsolete tools and media are reactivated using modern tools—generating the new but familiar. A hybrid way of making where tactile and sensory feedback reconnect the designer to physical realities. Nostalgia is used as a critical lens to explore the realities of digital capitalism by exposing the silent processes that are purposefully hidden.

By applying a modern lens to older media formats and tools, an alternative future is suggested. One where these analogue relics have been repurposed rather than discarded, generating new ways of making.

The workflow in this research relies on “reflective practice.” Established ¹⁵ by American philosopher Donald Schön, reflective practice accommodates both intuitive and analytical knowledge; applying both to practice and the outcomes themselves. This methodology forms a dialogue with the process of experimentation, its outcomes, and the materials themselves. These reflections became a driver for iterative design, where digital fabrication increased the potential of a process or allowed for its complete rehabilitation. Each experiment expanded tacit knowledge and uncovered new information that could be applied to future prototypes. These new prototypes themselves provided “glitches” for further analysis. Holistically, these methodologies provided a cyclical feedback loop that allowed for materials, tools, and external forces to actively collaborate with the project, while ensuring that resources were respected and results were delivered.

This research is underpinned by Martin Heidegger’s concept of *Ereignis*,¹⁶ where the intersection of structure and unpredictability allows for emergent properties to reveal themselves. Rather than being created through deliberate action, they are facilitated. These events arise into being through an interplay of chaos and intention. This methodology parallels the approach of experimental filmmaker Maya Deren, whose films develop within a framework of controlled parameters that provide space for unexpected outcomes.¹⁷ Using this idea of the controlled accident as a generative exercise is not about imposing will on the process, but about ensuring that experimentation is focused.

This methodology strikes a balance between control and openness, giving intention to the unpredictable. The controlled accident is reflected in experimentation within this research. There is an intentionality with the mediums, typefaces, circuitry, and chemicals used. However, the complexity of the systems produces an instability that generates moments of chance. Glitches that reveal themselves from this process are viewed as suggestions, not errors.

¹⁵ Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action*.

¹⁶ Martin Heidegger, *Contributions to Philosophy: From Enowning*.

¹⁷ Sarah Keller, *Maya Deren: Incomplete Control*.

METHODS

I. MATERIAL COLLABORATION

Analogue making is a collaborative experience involving the maker, tools, materials, and the process itself. The interaction of these elements of production causes points of friction where emergent properties or glitches can reveal themselves. These glitches can manifest through resistance of materials, chemical reactions, or even the work space. These processes are inherently unstable and volatile because of many variables.

The act of making is not undertaken by an individual but many silent collaborators. In Barbara Bolts¹⁸ paper ‘Materialising Pedagogies’ she explores the idea of tools and processes having their own intelligence, and the act of making as a relationship of collaboration rather than one of mastery. This idea of the uncredited collaborator is further explored in Tim Ingolds’¹⁹ book *Making*, where he examines external forces that silently guide a process. This unseen collaborator can be embedded within the materials themselves, or be an external force that impacts the making.

During the course of this research, many materials, mediums, and techniques were tested. Not all of these experiments are documented in the main body of this thesis, but were nonetheless important steps that helped establish my current practice and subsequent experimentation. Material collaboration became method with explorations that focused on process and materiality. Situating oneself as an active participant, more collaborator than master. Making deliberate choices that layer complexity. The interplay of these decisions allows for emergent properties, becoming a generative method of making. An idea that can be seen through the use of 16mm film, in which materials, chemicals, light, and space act as interdependent elements shaping the final outcome in this research.

II. TRANSMEDIATION

Working with obscure analogue formats presented challenges due to their incompatibility with contemporary digital systems. To reactivate these formats, digital tools were required to rehabilitate or translate them. Hybrid workflows materialised as a result, generating new ways of making. This workflow rerouted through various media and channels can be understood as “transmediation.”

As Garrett Stewart²⁰ suggests transmediation does not simply transfer content, it transforms and redefines it. Transmediation routes perception across collaborative formats, producing new visual and conceptual fields through the interaction of technologies and representations. This process engages in dialogue with materials and systems. The reintroduction of material resistance to systems that seek to eliminate or abstract it, creates a new critical lens that reveals the framework that supports these systems.

Aligned with the thinking of philosopher Marshall McLuhan,²¹ this redefinition of a medium has a profound influence on the message. These new forms are a convergence of previous contexts and associations that are shaped by intentional choices. The typefaces, tools, and media formats selected for this research all carry encoded traces of the previous broadcast that assimilates and transmits a new message.

¹⁸ Barbara Bolt, “Materializing Pedagogies.”

¹⁹ Tim Ingold, *Making: Anthropology, Archaeology, Art and Architecture*.

²⁰ Garrett Stewart, *Transmedium: Conceptualism 2.0 and the New Object Art*.

²¹ Marshall McLuhan, *Understanding Media: The Extensions of Man*.

III. CREDIT CARD IMPRINTER

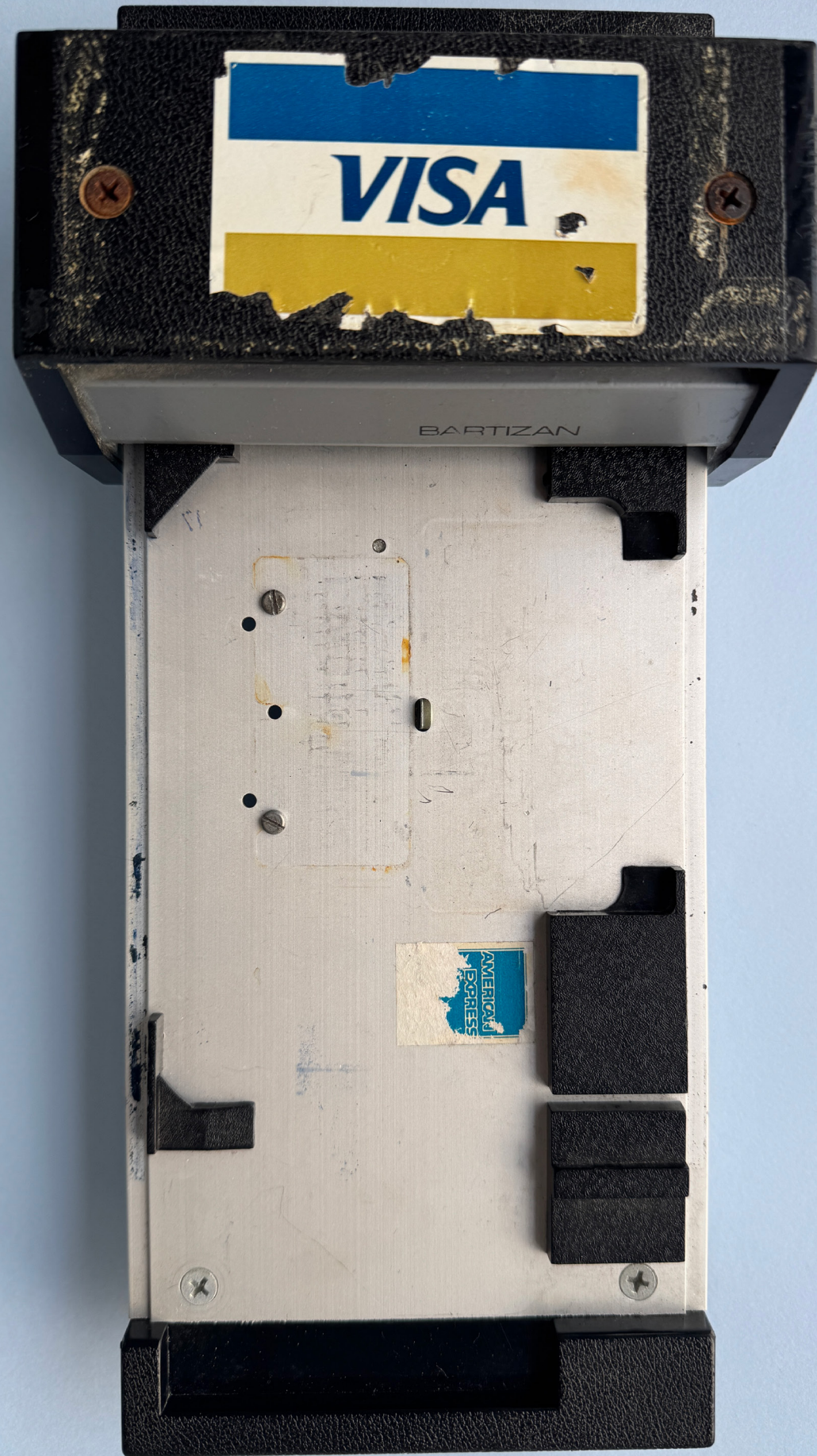
Before NFC and electronic payment systems, credit card transactions were facilitated through a manual device commonly called a credit card imprinter. The device worked by taking an imprint from embossed details with carbon paper. These embossed details, often set in OCR typefaces, recorded information to facilitate a transaction of money between two parties.

These credit card imprinters became colloquially referred to as ZipZap machines (see Fig. 6), an onomatopoeic reference to the sound they made when imprinting information. The ZipZap machine required manual intervention, gave tactile feedback, and left a material trace of a transaction. The shift from analogue to digital within banking systems saw this once essential tool become obsolete. While this shift brought a halt to its primary operation, it can still function as a compact printing press. The main mechanism is two rollers that apply pressure to imprint information. A metal plate details vendor business information and the customer’s credit card carries their account details. When the rollers are pulled across the surface, the embossed details of both the card and the metal plate are transcribed to paper. Creating a material trace of a transaction.

The act of printing with the ZipZap machine is satisfying on a fundamental level, providing immediate tactile feedback through mechanical resistance. This aspect of the process is an experience worth sharing. It extends an invite to the audience asking for active participation within a system, forming a direct physical connection to not only the process of making, but also to the underlying systems the ZipZap machine symbolises.

Through a combination of 3-D printing and laser engraving this obsolete tool of capitalism is rehabilitated into an interactive printing press that provides transcriptions of materials, movement, and chance. A relic of the past enabled with digital tools to create a new form of production that reintroduces tactility and carries associations with financial and banking systems.

Figure 6. Salvaged ZipZap machine.



IV. 16MM FILM

16mm film found favour in experimental cinema because it allowed for unconventional methods of production.²² The 16mm format had been seen as a tool for propaganda or for archiving of institutional knowledge. Experimental cinema challenged and disrupted this notion through exploration of the materiality of the format. Reframing a tool of propaganda into a creative force.

Dadaist Man Ray²³ was a prominent figure in early experimental cinema, and was the first to apply the photogram technique directly to 16mm film. This experiment dubbed the “rayograph” formed the basis of his film *Le Retour à la raison*, which became his calling card. This technique involves briefly exposing film to a light source while objects lay directly on the film. These objects suppress light to shape image and form.

The 16mm format is revisited in this research to explore its potential in a contemporary context. Utilising out of camera experimentation, the materiality of the medium is scrutinised through the rayograph technique (see Fig. 7). The results of these rayograph experiments are spliced together, then digitised to create a short looping video that echoes digital glitches, and evidences the materiality of film through visual anomalies.



Figure 7. Digitised still from 16mm film, shows evidence of materiality through detritus and light bleed.

²² Betancourt, *Glitch Art in Theory and Practice*.

²³ Rudolf E. Kuenzli, *Man Ray's Films: From Dada to Surrealism*.

EXPERIMENTATION
& PROCESS IMAGES



Darkroom tool fabrication started with CNC machine



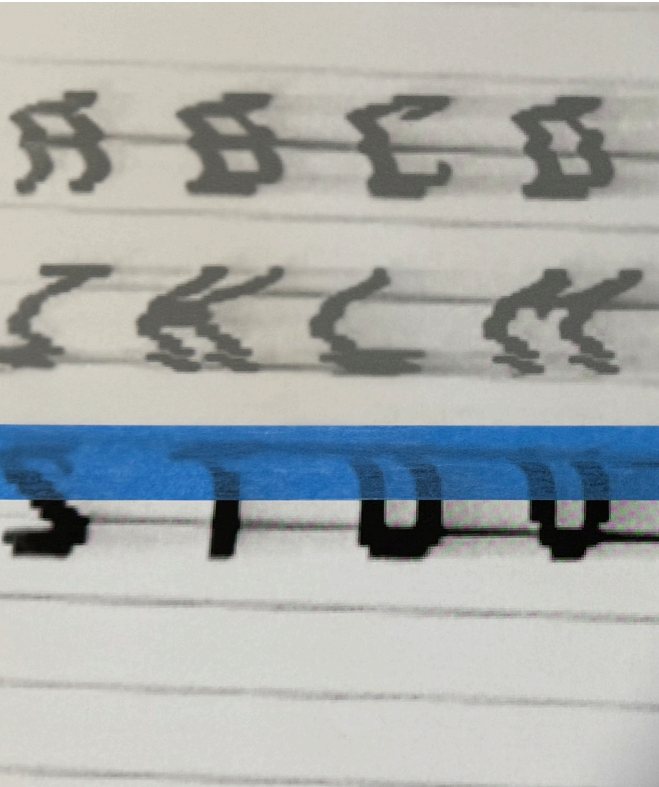
Early experiments involved laser cutting MICR
Glyphs from wood.



Using a CRT distorter to disrupt a typeface. The distorter is an analogue device that sits between the source signal and the CRT and allows for manipulation of the signal

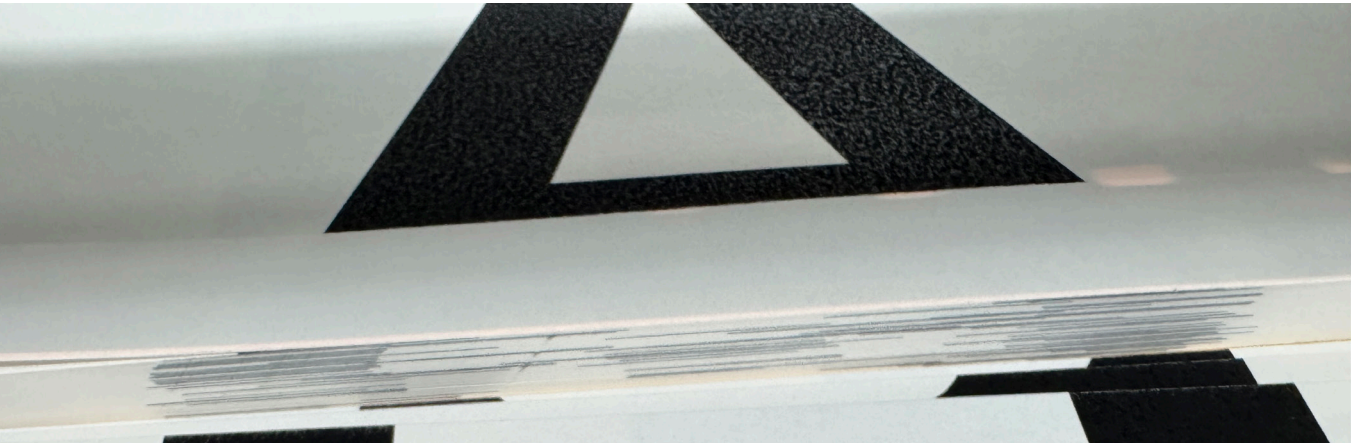


Miscalibration on etched text from
laser cutting process



Disrupted typeface extracted from CRT still. Scanlines stretch and pull the typeface exploring analogue instability.

EXPERIMENTATION
& PROCESS IMAGES



Lessons from CRT instability informed subsequent experiments. Individual characters from the OCR-A typeface are guillotined into 15 strips, contained in an acrylic tool inscribed with measurements. The strips are moved left and right, aping the interlacing scan lines. The freedom of movement allows for fast and loose experimentation with form and distortion.



DOCUMENTATION

A. RAYOGRAPH EXPERIMENTS

For the rayograph experimentation Kodak Double-X 7222 16mm film was used. This is a high-speed black and white negative film. This choice was both financial and pragmatic, as it is cheaper and processing involves less steps and tolerances are more lenient. Working with 16mm film can be chaotic with no guarantee of results. The first experiments would often be over exposed resulting in pitch black film with no image.

Through trial and error, structure was added to the experimentation through adjustments to exposure times, intensity of the light (see Fig.8), chemical dilution rates, and other controllable parameters. There was never complete control over the process but resources were being respected. Through this iterative experimentation a process that could consistently produce results was established insofar as there would be an image captured. How the image appeared was a different story.

To produce an image on 16mm film there are two main steps, the first is exposure and then chemical development. Both steps require manual intervention and management of chemicals and materials. The end result is the transcription of light directly to film stock. Capturing traces of a moment in time.

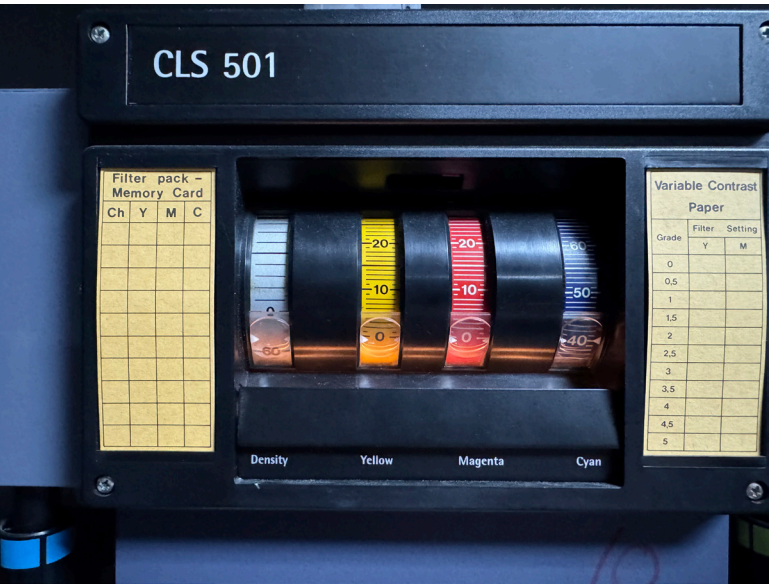


Figure 8. Shows filter options available on photographic enlarger, giving control to light exposure.

I. EXPOSURE

Exposure is the first step in the process, where light is imprinted to film. The light source is a photographic enlarger that allows a timer to be set. The shortest time you can set the enlarger is one second, this is a long exposure time when working with high speed ISO 250 film. This meant decreasing the intensity of the light was important. The following settings, as shown in Table 1. below, produced the best contrast for the rayograph images

Table 1. Settings for photographic enlarger.

PARAMETER	ACTION OR INCREMENT
F STOP	16
FILTER	60
FILTER YELLOW	0
FILTER CYAN	0
FILTER MAGENTA	0
SECONDARY FILTER	engaged
ACCORDIAN	full extention
HEIGHT	65.3mm

Source: the author.

In darkness, film stock is cut into small strips and fed into a fabricated tool (see Fig. 9). This tool has CNC machined channels and a clear acrylic lid that allows for the strips to be accurately fed in zero light conditions. Marshall McLuhan's essay 'The Extensions of Man' ²⁴ explores this concept—where objects become more than tools, and they become extensions of the individual. This tool became my eyes and hands, increasing the viability of the process by helping me navigate the darkroom space.

For exposure, pithy statements set in the OCR-A typeface were printed on acetate sheets. These sheets were then placed on the acrylic top of the CNC tool and exposed to light for one second. Instances of black ink on the acetate sheet suppresses light from the film stock. These exposed strips are then collected and placed inside a light sealed box. During one session, scissors were left in the exposure area (see Fig. 10). This object left in error spanned multiple frames and manifested as a flicker when played as a moving image. The audience will not be able discern what it actually is. But it will be interpreted as a visual error or glitch..



Figure 10. 16mm film shows the imprint of scissors left in the exposure area.

24 McLuhan, *Understanding Media*.

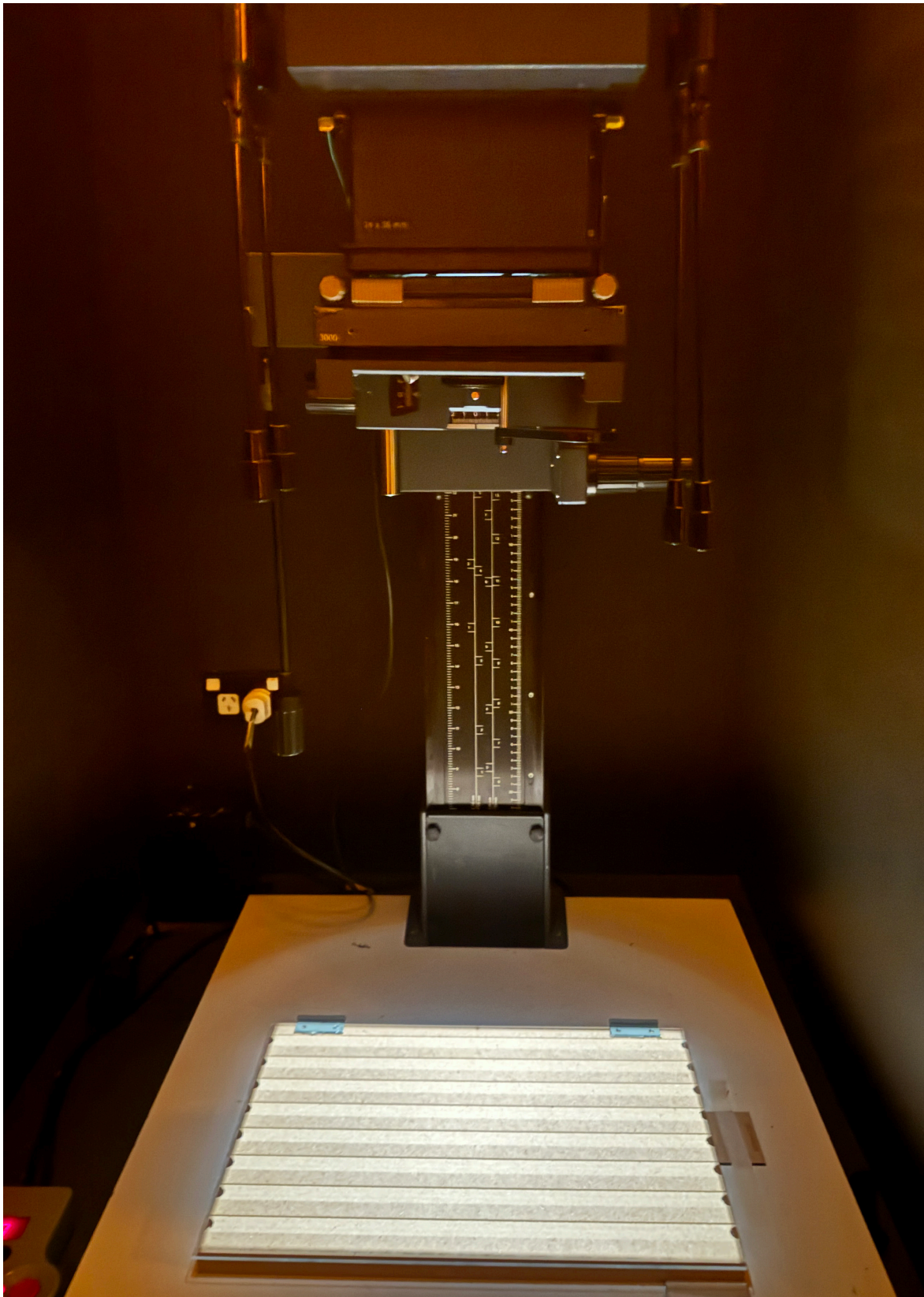


Figure 9. Darkroom exposure process. A fabricated tool sits under the photographic enlarger. Strips of film are fed into the channels to establish control in darkness.

II .PROCESSING

Processing the film is the most volatile step, with less ability to impose rigid control. Chemical dilution rates and volumes can be fairly accurate; however, other variables are at play. The film is treated through a three-step chemical bath (see Fig. 11). Each film strip is processed individually and starts in a developer bath for six minutes. The film is then rinsed and moved to the fix, where it bathes for another six minutes. All of this has to be undertaken in zero light conditions, so touch and sound become the dominant senses. Once this step is complete, the film is rinsed and then placed in a wetting agent for the final step. Table 2. below shows the dilution rates and times used for processing.

Table 2. Chemical dilution rates and times for processing film.

STEP:1	1:29 Dilution Ilford LC29 Developer	
	Developer 6min	Rinse 3min
STEP:2	1:4 Dilution Ilford Hypam Fix	
	fix 6min	rinse 3min
STEP:3	1:500 Dilution Ilford lifotol Wetting Agent	
	Wetting agent 4min	n/a

Source: the author.

During processing the solutions are agitated to help remove excess compounds. Due to budget constraints, chemicals were reused in the development process. This recycling provided unanticipated detritus that attached to the film (see Fig. 12). This flotsam and jetsam become part of the work, evidencing the process itself and presenting as visual noise on playback of the moving image.



Figure 11. Darkroom developing process. Strips of 16mm film sit in a water bath, for post-fix rinse. The image is now stable so it can be exposed to light. This is the last step before applying wetting agent.



Figure 12. Post processing. The film shows traces of detritus left from the development process.

III. SPLICING AND DIGITISING

Once the film strips have been processed, they are spliced together using a manual tool and tape (see Fig. 13). This is then spooled as a continuous reel for digitising. The tape has a profound effect on the digitising process with each splice causing the image to jump as it runs over the tape. A frame by frame investigation of the digitised footage will also reveal physical evidence of the splice itself as seen in Fig. 14. The medium is placed under heavy scrutiny through its scaling, minute flaws in process are magnified and become part of the project. Hair, tape, and detritus when viewed as moving image become glitches, interrupting the viewing, slowing perception, and forcing an awareness of the medium's existence.

The project reintroduces imperfection to the OCR-A typeface through analogue labour. The normally clinical OCR-A has been transformed by the medium. As shown in Fig. 15, the normally imperceptible dot patterns produced by the printhead introduces a fragile quality. Stacked text mimicking lines of code in Fig. 16 looks to be decaying or eroding. The clash of low fidelity and machine precision creates a material dissonance.

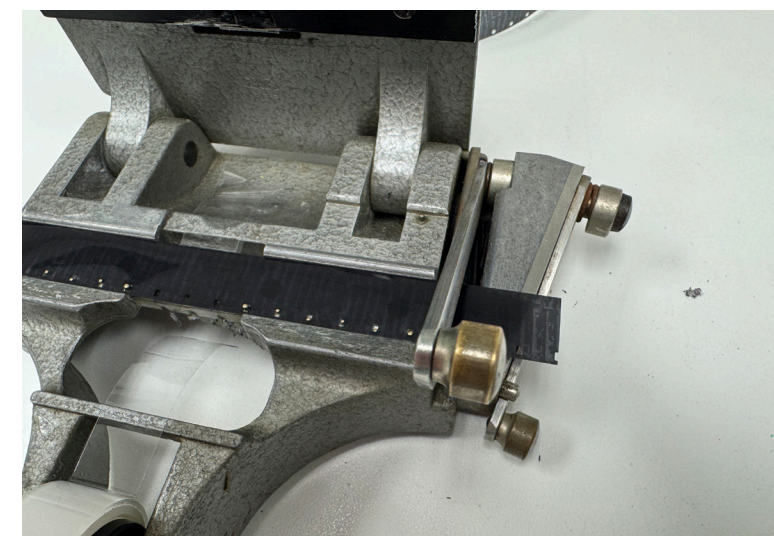


Figure 13. Post-processing, using specialised tape and a guillotine splicer, strips of 16mm film are joined together.

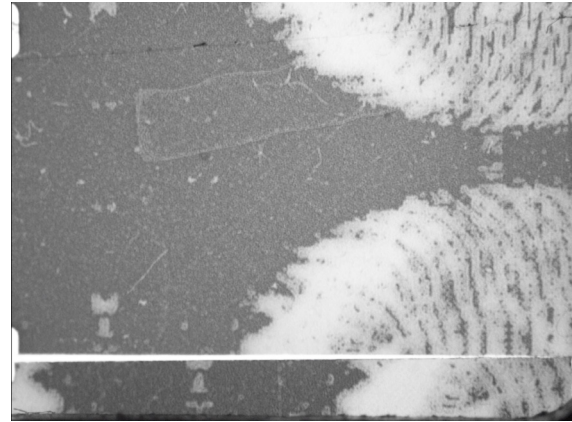


Figure 14. Digitised footage shows tape splice



Figure 15. The texture of the printhead path.

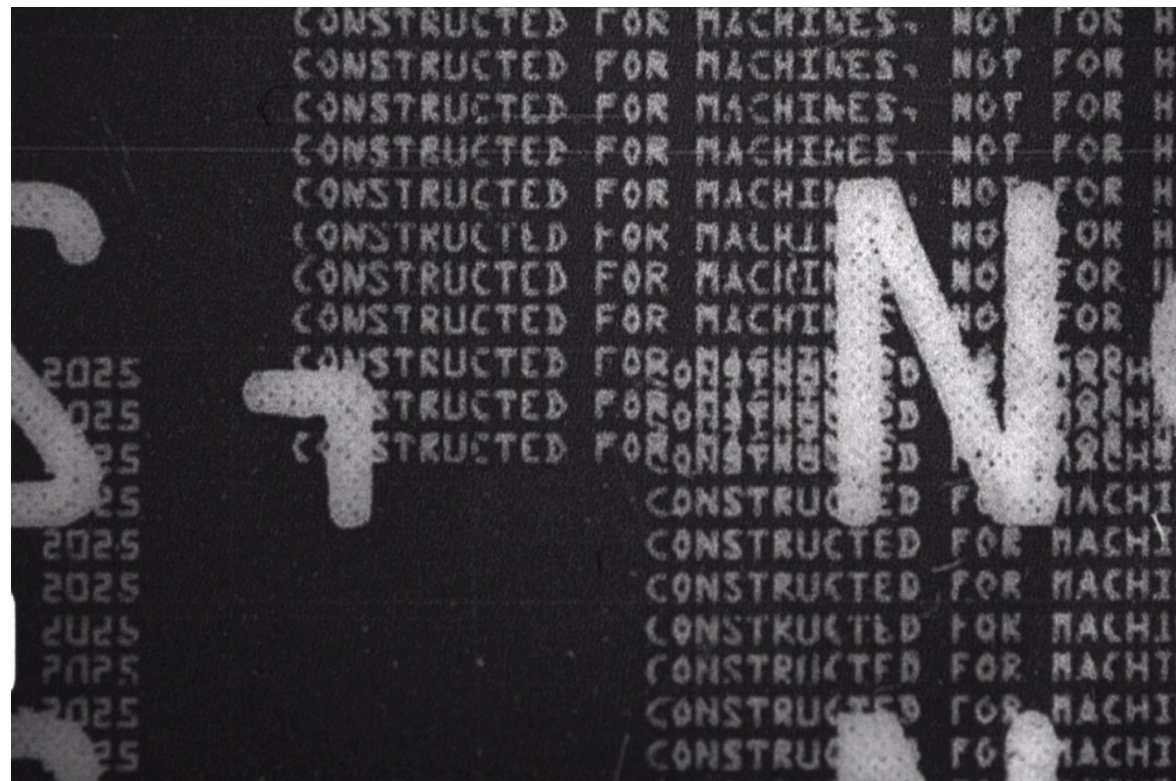


Figure 16. A 16mm still shows the application of labour to the normally clinical OCR-A.

III. SPLICING AND DIGITISING

Digitising the 16mm film proved to be an unexpected ordeal. My long-standing contact had recently retired, and it is rare to find someone who has the tools, knowledge, and patience to do this. The details will be spared but desperation saw a road trip to Tahuna where the film was entrusted to an unknown entity.

A phone call was received a couple of days later claiming that there was no footage on the film. The film was inspected before delivery, so I knew this to be untrue. Not wanting to cause any further delays a request to return the film was made.

The silence was deafening, no replies, ghosted, the film trapped in purgatory. After several desperate pleas a menacing text message suggested that the film could be collected from an associate of the digitiser at a Queen Street location. The handover was uneventful, however the film's integrity had been compromised, its perilous journey leaving visible scars that can be seen in Fig. 17. While initially upset at what had transpired, my mood quickly shifted upon realisation that this error could be transcribed to film.

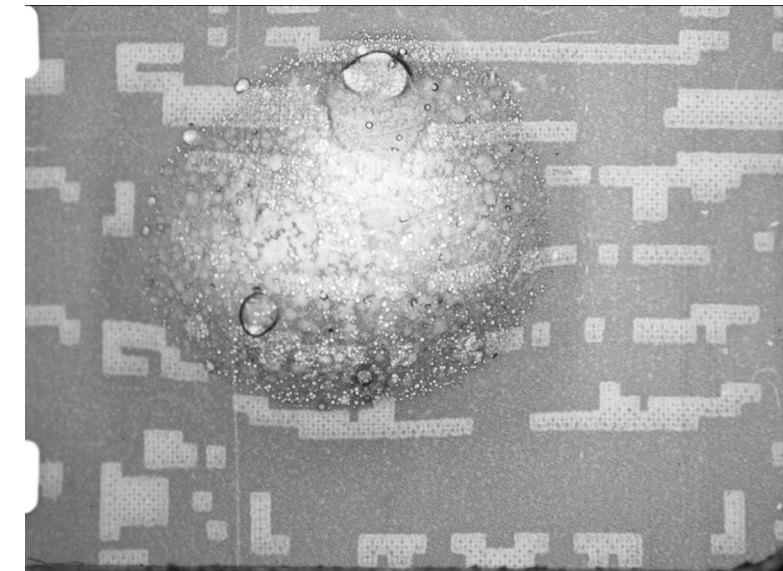


Figure 17. Digitised footage shows where the heat of a projection lamp has started to melt and bubble the film stock.



Figure 18. Wairau Zero Waste Hub where ZipZap machine was found

B. CREDIT CARD IMPRINTER

During this project sourcing a ZipZap machine proved unexpectedly difficult, further enhancing its perception as a legacy technology. After many unsuccessful leads, a device was found nestled among the rice cookers and kettles at the Wairau Zero Waste Hub (see Fig. 18). The hub allows registered collectors to pick through inorganic materials to upcycle and repurpose them. This is a free service with the only requirement being to share a story of how the upcycled materials were used.

Once in hand there was an immediate sense of nostalgia. There is a satisfying clunk that accompanies each lateral movement of the rollers. This ZipZap machine once belonging to a dental practice in an affluent Auckland suburb represents the past, a signifier of temporal and technological cycles. Its connection to banking and financial systems reveals the shift from analogue to digital within these systems.

Rehabilitating this machine through a combination of 3-D printing and laser etching, allows for the reintroduction of tactile feedback to the audience. This feedback helps to expose the frictionless transactions prevalent in modern digital systems by highlighting the absence of materiality.

I. 3-D PRINTING

To reproduce the embossed details from credit cards, experimentation began with 3-D printing. Models were converted in Rhino from vector images created in Adobe Illustrator. A rectangle measuring 85.6mm x 53.98mm was printed out at a thickness of 0.8mm using PLA (Polylactic Acid). Images and text set in OCR-A were printed at a height of 0.3mm on top of this rectangle to replicate the embossing found on credit cards; Fig. 19 shows examples of these dual-colour 3-D prints.

There are limitations when printing with PLA, especially when reproducing smaller characters. The 3-D printer struggles to accurately reflect the digital image. The limitations of the materials are unable to reproduce digital perfection, instead printing partially formed characters with stringing and oozing as seen in Fig. 20. These new letterforms generated through chance and limitation become evidence of materiality.



Figure 19. Shows dual-colour PLA printed object. Image shows forms of the OCR-A typeface disrupted through analogue play.

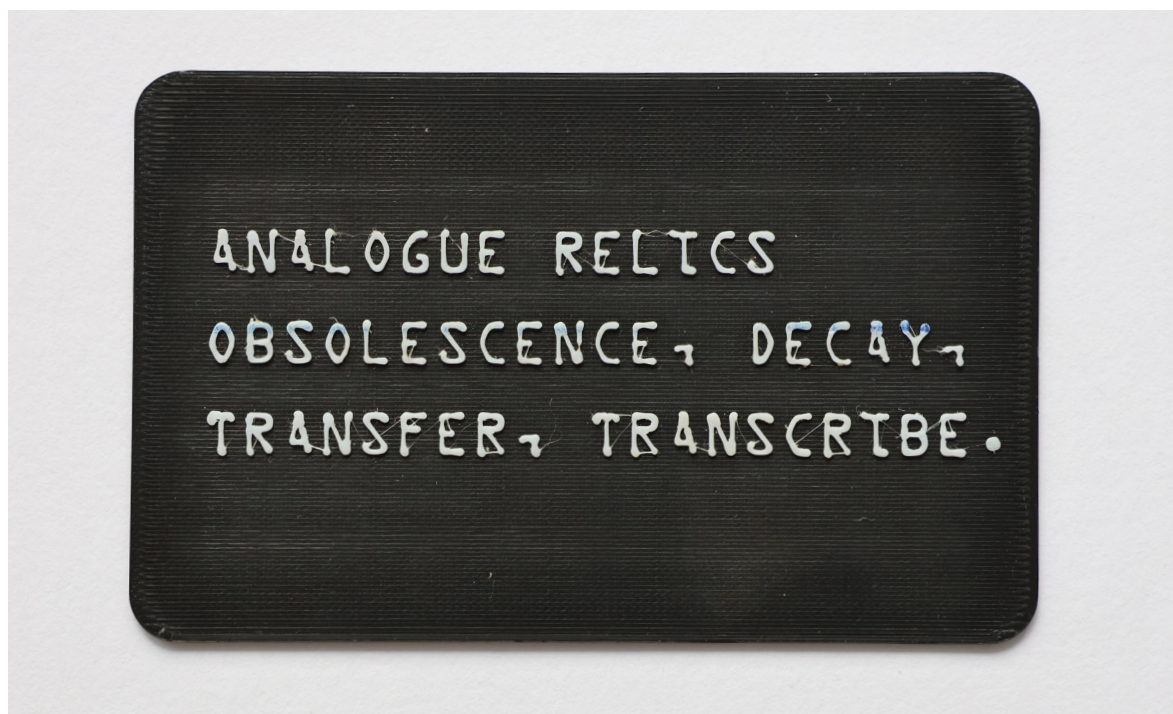


Figure 20. Close up of 11 pt. OCR-A typeface 3-D printed bearing marks of process.

II.FIBRE LASER

What initially appeared to be a straightforward task ended up being a fascinating dive into metallurgy. Some of the most compelling artefacts emerged from this testing with the fibre laser. Experimentation began with the reproduction of the embossing plate. Initial testing was performed on many different salvaged materials, including acrylic, wood (see Fig. 21), copper (see Fig. 22), aluminium, and steel. These materials all brought their own qualities and provided a range of reactions, some burned, others flexed, and some oxidised. Through knowledge gained from the experiments, aluminium was judged as the most stable of the materials as it was better at conducting and dissipating heat.



Figure 21. Wooden plate laser etching test.



Figure 22. Shows copper metal plate with laser etching.

II. FIBRE LASER

There are two viable techniques to emboss on aluminium and both of these were trialled. The first involves building up the characters using oxidised layers. This is caused by the laser's heat reacting with oxygen in the air. When material is vaporised during engraving, some recondenses as fine black particles.

This technique delivers an embossing that has a hard edge but inconsistent fill. It looks appealing as an artifact, giving a strong colour contrast between the metal and oxidation (see Fig. 23). The texture of the oxidation is rough, contrasting with the smooth surface of the aluminium.

The last technique is a deep etching that removes material from around the characters to create the depth as shown in Fig. 24. This resulted in a much cleaner embossing, more closely aligned to the digital image. This technique takes much longer and leaves a rough textured surface where the metal has been etched.



Figure 23. Aluminium plate with characters built up through the oxidation process



Figure 24. Aluminium plate embossing created by removal of metal from around the characters.

III. CARBON PRINTS

There was a stark difference in the quality of the prints. Both were tested on newsprint, chosen for its porous quality. The oxide technique produced a heavy print with an incomplete fill (see Fig. 25), giving a ghostly effect, almost a faux 3-D. The thickness of the plate also pushes more carbon onto the paper, picking up residual traces of past prints with the carbon paper acting as a mechanical palimpsest.

I see the deep etching technique as being the most successful. It still carries imperfect qualities but is more defined. The texture of the plate as well as its outline are still visible, you can read the movement of the rollers through directional smudges of carbon (see Fig. 26).



Figure 25. Print taken from oxide technique. Ghostly images of past transactions are faintly visible in the bottom middle and left-hand side of the image.

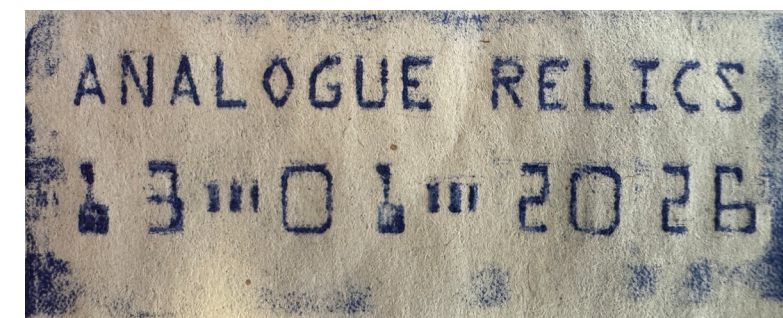


Figure 26. Carbon print of the deep etching technique produces a cleaner result while still maintaining qualities that evidence materiality.

After initial print experimentation the introduction of different colours of carbon paper allowed for further exploration. Form was tested as well as type, the larger surface area of these forms allows for traces of previous prints to emerge. Characters from the MICR typeface reveal themselves in the red triangles seen in Fig. 27; as well as the outline of the plates and screw heads from the ZipZap machine.

The quality of the prints produced by the process feels simultaneously primitive and futuristic. The typeface and tools represent systems of control but the imperfections of production suggest something more human. There are limitations imposed by the ZipZap machine, the prints are bound to an active embossing space. Consisting of the lower third of the credit card and the metal printer plate. This limitation led to cutting these printed slips and then rearranging them in an “exquisite corpse” like fashion (see Fig. 28). This allowed for larger compositions that make evident assembly and the maker’s hand.



Figure 27. Dual carbon print. Visible outlines of the plate, credit card, and screw heads reveal the medium. The red triangles provide traces of previous prints with faint impressions of the MICR typeface.



Figure 28. Collaged carbon prints show assembly and evidence of the maker’s hand.

IV.METAL CARDS

After the viability of the ZipZap machine had been proven my thoughts shifted to how this would translate as an interactive exercise. The audience is being asked to insert themselves into a system, and the question is how much flexibility is there within this system. With the embossed elements, the metal plate is fixed. This left the PLA cards as the element of choice, which at this stage felt too rigid. Having fixed text limits the audience's participation to mechanical intervention and a single choice. This prompted a change of thinking to where phrases could be selected, mixed, and matched to create more expressive and personal prints.

With knowledge gained from previous experiments, prototyping of metal cards with changeable strips of type began in earnest. A phrase to begin testing with was inspired by Futurist Filippo Tommaso Marinetti's graphic work *Le Soir, couchée dans son lit, elle relisait la lettre de son artilleur au front*. The title was adapted to reflect an abstracted relationship with financial concerns, and the onomatopoeic sounds of war were replaced by ones from a ZipZap machine.

“In the evening,
lying on her bed,
she reread the statement
from her personal assistant
from the bank.
ZIP, ZAP, CRUNCH, PING”

While testing settings on steel, a tangible artefact emerged from the process (see Fig. 29). Never intended as an outcome this organic convergence of chance, error, and materiality came into being. The artefact feels enigmatic, authoritative, and ambiguous in equal measure, suggesting something operating beneath the surface that is not fully explained.



Figure 29. Steel testing plate, for laser fibre laser settings

Based on my previous experience with the laser etcher I thought that this process would be fairly straightforward. What followed was an extended conversation with materials that saw multiple shifts in processes, requiring technical advice and tools from multiple departments including the 3-D labs, print studio, mechanical engineering, and the digital print lab.

Tests were essential to identify a material that could produce a good emboss and be robust enough for frequent use. The smaller scale of the object meant that initial ideas around 3-D printing a frame for text were not feasible. After a conversation with technicians, magnetism seemed a workable solution. Testing began with magnetic foil, allowing for metal type to be directly attached.

The pivot to magnetism required a change of materials, as aluminium is nonferrous (nonmagnetic). Testing shifted to steel, where I quickly learned that it has many forms, grades, and types. I learned that stainless steel can be magnetic, but is most often austenitic (nonmagnetic). Carbon steel is ferritic or martensitic, which is excellent for magnetism, but harder to source in the thinner sheets required to maintain a low profile to fit under the rollers of the imprinter. Various grades and thicknesses were sourced from New Zealand and China (see Fig. 30) for testing. These ranged between 0.25mm–1mm in thickness.

Working with steel, especially the thinner sheets, created difficulties as it would quickly oxidise as the fibre laser was cutting or engraving. In Fig. 31, the top two rows show heavy oxidation around the cutting line. This oxidation reinforces the



Figure 31. Shows heavy oxidation on the top two lines.



Figure 30. Shows various grades and thicknesses of steel tested with the fibre laser.



Figure 32. The bright orange sparks from the grinder test suggest that this was a form of steel.

metal, adding time and heat to the process. This extra stress affects the integrity of the metal, often warping and further oxidising it.

As the options dwindled a mystery metal was tested in desperation. A series of tests were run to help identify it for safety concerns. This involved a spark test with an angle grinder (see Fig. 32) and an acid test using an eye dropper containing an aqueous solution of hydrochloric acid (HCl, 280 g/L approximately 25% w/w) (see Fig. 33). The orange sparks produced by the grinder and the reaction of the acid suggested that this was a type of steel. This metal ended up being extremely brittle and would twist under the heat of the laser.



Figure 33. Acid test produced a cloudy result that cleaned the surface of the metal suggesting that it was a form of steel.

Working with the steel had become a constant battle, attempts to mitigate the warping and oxidising included changes to the power and speed settings of the laser etcher, jigs (see Fig. 34), and enforced breaks to allow the metal to cool. These results ranged from average to unsuccessful. Ultimately the laser etching method became unviable, the limits of the equipment and materials had been exhausted.

The return to aluminium marked a shift toward adaptability over rigidity. Magnetic tape proved to be the most effective method for introducing magnetism to a nonferrous metal, offering a clean and workable solution. However, stress testing with the ZipZap machine revealed a critical limitation: the softness of aluminium resulted in buckling after repeated passes, compromising its use in an exhibition space.

At this stage, it became clear that the limitations were not inherent to steel as a material but to the thermal processes used. The reliance on heat in fibre laser cutting introduces structural instability through oxidation and warping. Future testing will rely on non-thermal processes, specifically: acid etching, waterjet cutting, and UV printing. These are methods for producing durable, steel strips without compromising material integrity. These approaches continue the investigation into materials and processes, extending the research while remaining open to further material and technical refinement.



Figure 34. Jig setup to help mitigate warping and flexing of the material.

REFLECTIONS

When I was born, the world was a very different place. Digital tools existed but were inaccessible, hidden behind institutional walls; they felt mysterious, almost mythical, a representation of a future that seemed far-fetched. Being born into this period of transition is equal parts terrifying and exciting. Technological leaps have me currently typing on a device out of a science fiction film from my childhood, while contemplating the existential threat of AI.

Living through this period of analogue to digital transition as both artist, and consumer became significant in positioning my research. Feeling increasingly disconnected through layers of abstraction, I sought ways of making that would help me reconnect to the tactile and tangible. Experimenting with materials and processes that engaged multiple senses helped to ground and embed myself within the act of making.

This research became a quiet form of activism, engaging with slow practice as a deliberate act of resistance against digital capitalism. What started as a project about tactility and analogue process quickly moved from something nostalgic to a more critical position. I was surprised at the thread of protest that emerged from my work as I engaged with processes more critically. A celebration of tactility quickly became a critique of the systems that support digital capitalism. As the research progressed my stance shifted from a digital vs. analogue face off to a more nuanced position. My argument isn't predicated on digital tools being harmful, rather they have been co-opted to align with digital capitalism becoming the infrastructure that seeks to abstract and obscure labour and materiality.

Design has shifted its priority to the machine, praying for the algorithm to bless it. This moves judgment to systems that rely on statistical data rather than human experience, that can result in cynical, manufactured work. By following trends dictated by harvested data that rewards conformity, the creator can become risk averse. Creating work under these systems can compromise creativity and experimentation and as a consumer limits exposure to the unexpected. Digital processes can be powerful when wielded as tools rather than an authority, they allow for rapid distribution and reproduction allowing work to be circulated widely.

There are genuine questions surrounding ownership, data harvesting, and concerns of algorithmic manipulation that hide behind frictionless convenience. The promise of digital platforms was democracy and accessibility, when in reality it is a system of surveillance that seeks to obfuscate the truth.

The glitch was identified as a disruptive force that could help to expose these systems by drawing attention to the materiality of a medium. Defining the glitch became an important part of this research, moving it away from this idea of error and reframing it as evidence of existence. The medium is revealed through its own processes of making with the introduction of marks of labour. These “fingerprints” are evident in 16mm film and the ZipZap machine, where material processes remain visible. The reintroduction of material resistance into design practice becomes a method for facilitating such glitches.

This project was guided by glitches, some silent, some spoken. These glitches are the texture of making. They are the marks that reveal a medium, the errors that emerge through limitations, or the new information that reroutes to unanticipated spaces. It is a language that communicates through flaws; transcribing and transferring gesture and movement of both maker and materials. The antithesis to digital perfection—failure that humanises, randomness that surprises. Making should not be a series of prompts or box-ticking, as this flat trajectory results in a solution with no deviations, removing the journey. Learning is undertaken with analogue making, there is less rote memorisation, more tacit knowledge that carries through movement and gesture, and subconscious decisions executed in a trance. Touch, feel, and smell implicitly guide the movement.

I want this project to serve as a celebration of analogue making while critiquing the systems that attempt to erase it. I want creatives to consider the value of analogue making and how it distinguishes humans from machines. Creating work that is unique but flawed carries cultural value. There is an opportunity for analogue relics to be integrated into contemporary practice, reconnecting the maker to genuine errors that influence and enhance ideas. Hybrid making that still values tactile play. Nuanced relationships with technology that sees AI and digital processes as tools rather than generative solutions. Embrace them, embed them, but do not give up agency. Be that point of friction. Remember the physical self that sits between the idea and the output. Resistance is friction.

CONCLUSION

Analogue processes manifest real connections in the physical world. Sourcing materials and knowledge required conversations and frequent changes in geographical locations. From road trips to technical discussions, burnt film, and a crash course in metallurgy, all these moments and experiences emerged from analogue practice. Analogue practice leaves traces of the physical that imprint reality.

This reality can be used as a mediator to expose the hidden infrastructure that supports digital capitalism. Glitches, acting in an interpretative role, unpack layers of abstraction to reveal the evidence of labour and materiality. Marks from the maker's hand and chemical reaction these imprints are all glitches that reveal the medium and in turn the truth about the systems that seek to operate in the shadows.

The relics used in this research represent the past, and through their obsolescence they became signifiers of temporal and technological cycles, highlighting the shift of weight and pressure toward invisible authorisation. These analogue relics are more than nostalgic media; they prompt conversations and carry their own language and texture. They have a unique voice that speaks as both witness and warning—a dialogue between past and present. A nostalgic media that reflects both fear and paranoia of a world that feels increasingly untethered from physical realities.

The groundwork laid in this research creates an opportunity to explore a new pedagogical framework for students and creatives. For example a series of physical workshops could reintroduce analogue complexities and friction into a design process by utilising analogue relics, this shifts the focus from digital platforms to a tactile space. This is not a total abandonment of digital devices, as evidenced in this research, it becomes a strong driver for creative adaption of new technologies to facilitate transmediation. The complex interplay of analogue instability becomes a generative exercise for future generations of creatives, helping to establish the importance of human authorship and authentic creative agency.

These hybrid ways of making become new mediums, encoded with messages of ingenuity, lateral thinking, physical touch and imperfection, all signatures of individualism that lie at the heart of humanity. By pushing against established parameters dictated by digital qualities creatives are forced to engage with making in an innovative way that stimulates their creative potential.

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APPENDICES

The research undertaken throughout the thesis year involved many experiments and artefacts, far too many to cohesively display in an exhibition format. The exhibition ended up reflecting bureaucratic systems through material traces of data. The experiments that didn't align with this intent were still an important part of the research and were included in the exhibition through a publication. The publication also allowed for photos of processes and written content that helped to contextualize the experiments themselves. The chequebook sized format reflected the paper slips used with the ZipZip machines at the exhibition as well as reinforcing the connection to banking systems. The publication utilised a variety of paper stock including samples of acetate and lineflow turning it into a tactile example of material intervention. This was perfect bound with the raw edge exposing how the publication was put together. The publication became an invaluable tool to help share my research with the audience.

As I was putting the publication together it helped me reflect on the experimentations, their purpose and what I took away from them, for me there was a sense of loss, technology has moved us further away from immediate tactile feedback and response. Being able to engage with analogue processes where physical senses are engaged increased my connection to the process of making allowing me to become an active participant. The quiet stillness of the darkroom, the sense of wonder as I watched chemicals eat away at metal, the satisfying sensory feedback of the ZipZip machine these experiences cannot be replicated through digital means.



Figure A.1 A chequebook sized publication was available for the audience to peruse during the exhibition. This became a valuable tool for helping to explain the processes behind the making. (photograph by Kayla Williams)

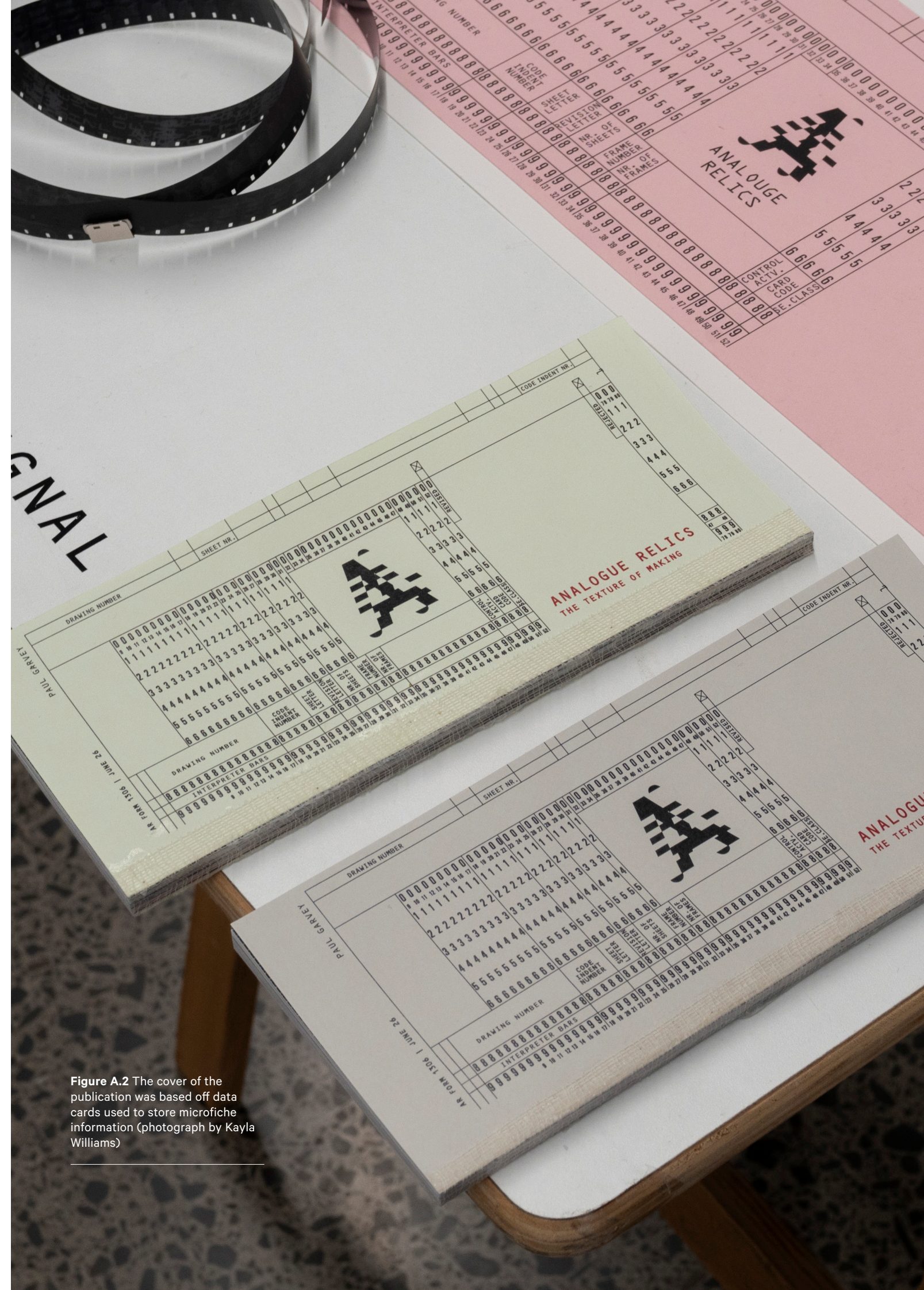


Figure A.2 The cover of the publication was based off data cards used to store microfiche information (photograph by Kayla Williams)



Figure A.3 The rear projection cast an ominous glow over the trestle tables (photograph by Kayla Williams)



Figure A.4 The scale of the projection enhanced the film's texture, drawing attention to the imperfections of process (photograph by Kayla Williams)

The tone of the exhibition space was institutional, set across three trestle tables with an overhead projection of the 16mm experimentations. The projection has an authoritarian tone with fractured text set in the OCR-A typeface. Quotes from the novella *The Machine Stops* aligns with a future where human agency and connection has been replaced by technology. References to surrealist painter René Magritte's *The Treachery of Images* reflects on the digital mediation of reality and Filippo Tommaso Emilio Marinetti's artwork *In the Evening, Lying on Her Bed, She Reread the Letter from Her Artilleryman at the Front* a nod to the speed, mechanisation, and human detachment felt under digital capitalism.



Figure A.5 Samples of 16mm film were part of the exhibition experience, including examples of burnt film and exposure errors (photograph by Kayla Williams)



Figure A.6 (photograph by Paul Chapman)



Figure A.7 Prototypes and failed tests became a part of the exhibition. These normally discarded objects hold their own beauty, carrying marks of process and error. (photograph by Kayla Williams)

The space is shared with three trestle tables displaying examples of material trials and written work. Each table was labeled to establish a link between them, and brought a formality that offered guidance to the audience. The first table read ‘Signal’ this table consisted of mostly contextual fragments of writing, including my own personal memories of bankbooks from when I was a child. This was connected in an L shape to the second table labeled ‘Archive’ this presented material artifacts of trial and error, including examples from the metal experimentations and strips of 16mm film, on the end of the table triplicate lineflow paper cascaded to the floor. The tables were laid out to allow access from every side with a layout that encouraged handling of the content displayed.



Figure A.8 The work was laid out to encourage audience handling. Strips of 16mm film, material prototypes, as well as some of my writing (photograph by Kayla Williams)



Figure A.9 Thesis excerpts as well as some writing on loss of tactility were printed on lineflow paper held together with a two piece clip (photograph by Kayla Williams)

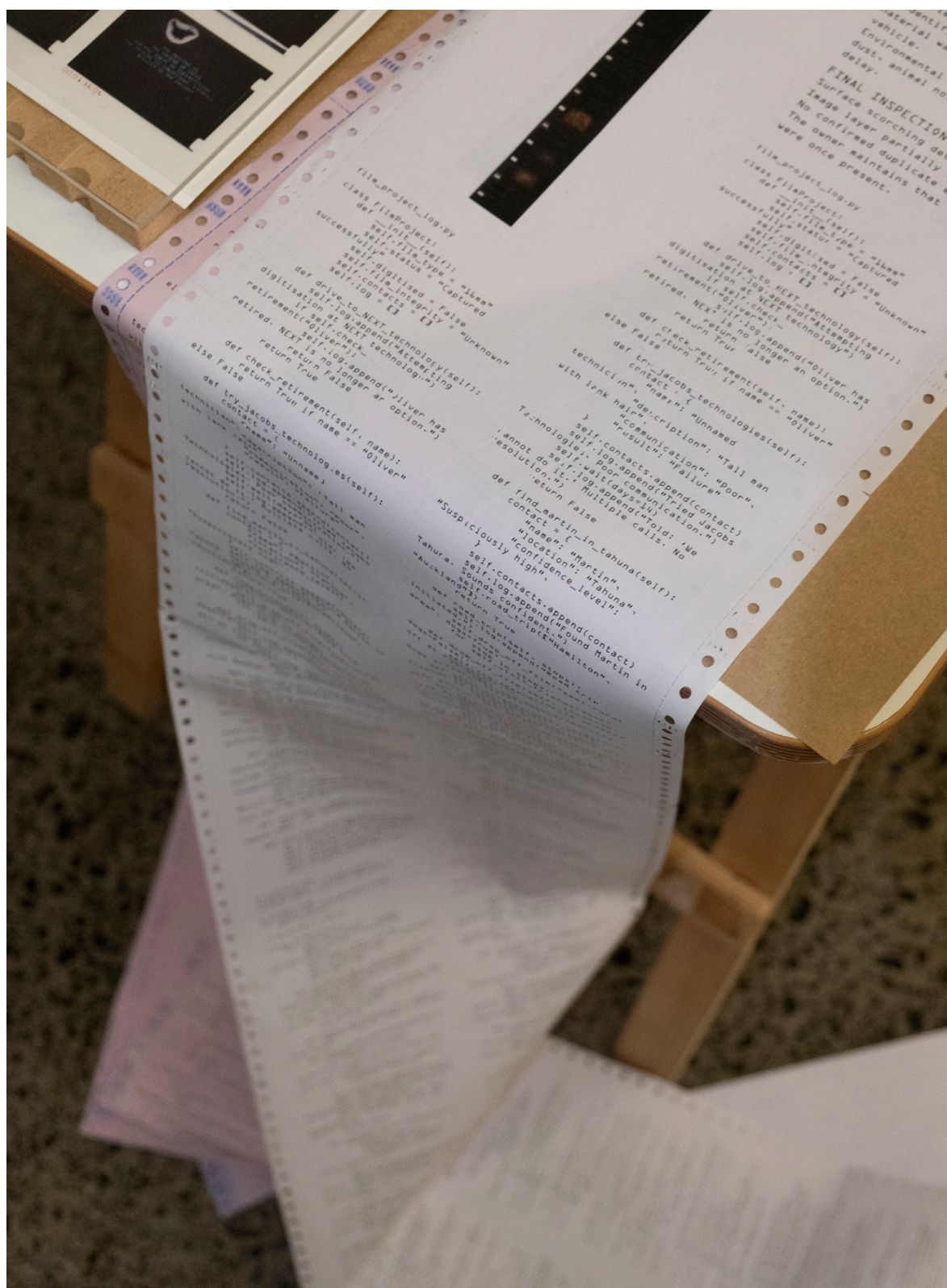


Figure A.10 Triplicate lineflow spills to the floor, it's content a retelling of a real experienced saga, fed through chat gpt. The result a cold and detached version of reality reformed into lines of code (photograph by Kayla Williams)

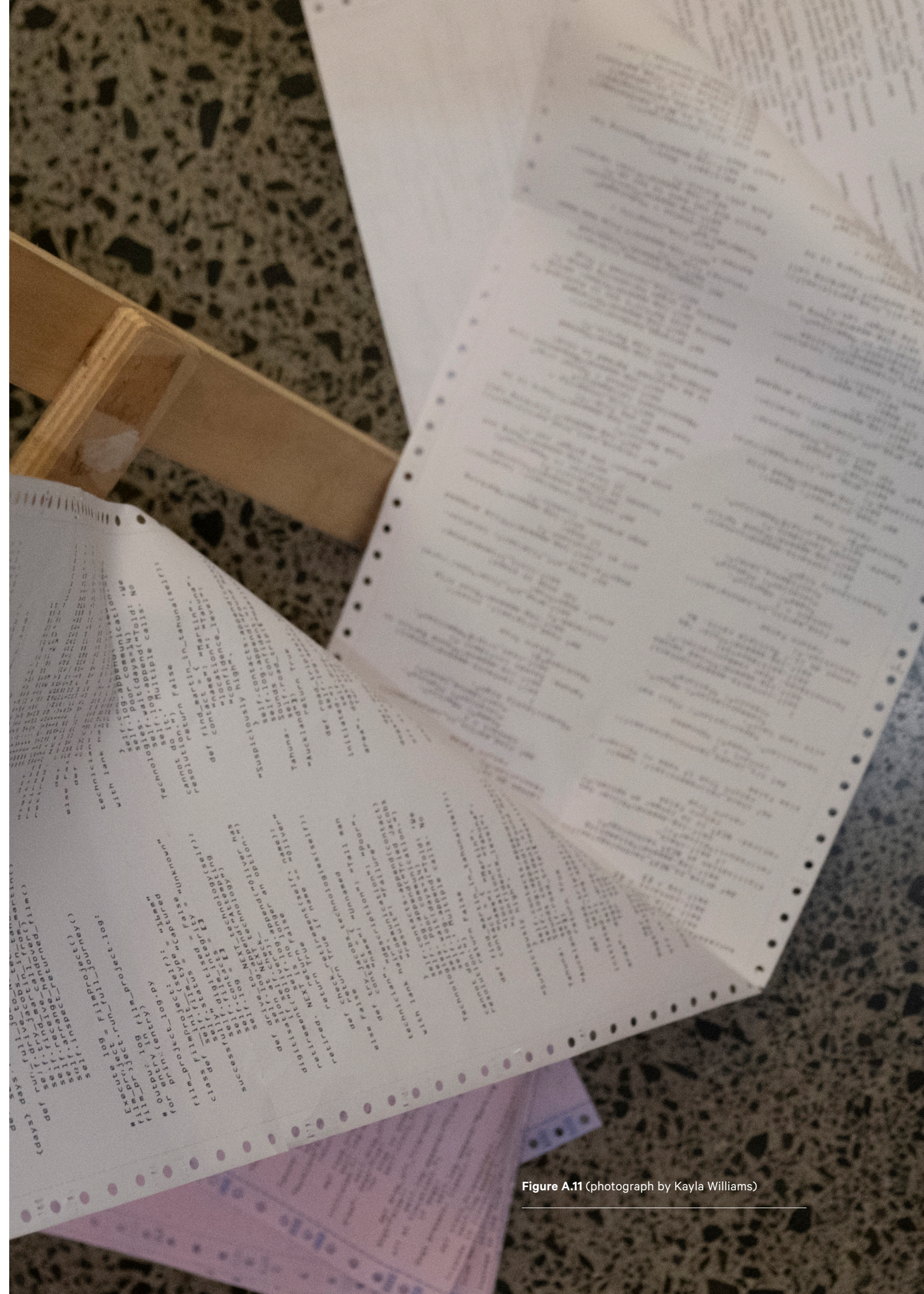


Figure A.11 (photograph by Kayla Williams)



Figure A.12 ZipZip printing process being demonstrated to a captive audience (photograph Paul Chapman)

The final table was an isolated work station labeled 'imprint' an interactive exhibit of three working ZipZip machines, where the audience were encouraged to try the process for themselves. This station of making was the most successful part of the exhibition. Giving both an opportunity to connect with the audience through conversation and allowing them to become a part of the exhibition itself. There was a sense of joy generated through the act of printing with the ZipZip machine stirring up feelings of nostalgia in the older visitors and amusement and wonder in the younger ones. Retail war stories were recounted as older generations shared the quaint and archaic way transactions were made in the past. People enjoyed the ritual of choosing a 3D printed card laying it in the machine then layering the carbon paper over the paper slip. Some people chose to take the slip away with them while others added to the pile that was collecting at the end of the table. It was encouraging to see people really getting into the act of making, swapping carbon colours and cards to create layered compositions. The slips that were left behind have been collected and will be used in a future project.



Figure A.13 Audience participating in ZipZip printing process (photograph Jasmine Lee)



Figure A.14 A selection of 3D printed cards for the audience to choose before printing. Some people chose just one while others used multiple, creating layered compositions (photograph Kayla Williams)



Figure A.15 The results of the ZipZip machine interaction. While some people chose to take home a souvenir, others left behind a contribution to the exhibit itself. These have been collected and will be used as part of a project at a later date (photograph Kayla Williams)



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