The Aotearoa Digital Arts Reader
Edited by Stella Brennan and Su Ballard
Designed by Jonty Valentine

ISBN: 978-0-9582789-9-7

A catalogue record for this book is available from The National Library of New Zealand

Title: The Aotearoa Digital Arts Reader
Author/Contributor: Brennan, Stella (ed); Ballard, Su (ed)
Publisher: Aotearoa Digital Arts and Clouds

Aotearoa Digital Arts Trust
www.aotearoadigitalarts.org.nz

Clouds
PO Box 68-187, Newton, Auckland 1145
Aotearoa New Zealand
www.clouds.co.nz

Every effort has been made to trace the copyright holders of the illustrations reproduced in this book. Unfortunately, this has not been possible in all cases. The editors and publisher would be pleased to hear from any copyright holders whom they have been unable to contact and to print due acknowledgement in subsequent editions.

Unless otherwise noted, all images are repoduced courtesy of the artists.

Editing a book takes a long time, and many people have helped along the way. Stella and Su would like firstly to thank the authors and artists who have contributed to this book, and the institutions and individuals who shared their image archives with us. We would also like to acknowledge the work and support of the following: Nova Paul, Leoni Schmidt, Col Fay, Khyla Russell, Justine Camp, Letitia Lam, Pam McKinlay, Geoff Noller, Sarah McMillan, Robert Leonard, Melinda Rackham, Mercedes Vincente, and Gwynneth Porter, Deborah Orum and Warren Olds from Clouds. And of course, Jonty Valentine for the hours spent in design. Thanks also to the ADA community, and especially to the other ADA trustees, Janine Randerson, Douglas Bagnall and Zita Joyce.

Thanks most of all to our families: Nathan, Moss and David.

The *Aotearoa Digital Arts Reader* would not have been realised without the support of AUT University, Otago Polytechnic and Creative New Zealand.

interesting part. As C5's Matt Mays puts it: "knowing where you are does not mean that you are not lost."

New Zealand artist Rachael Rakena's work *Rerehiko* (2004) envisages place, technology and location in a very different way, exploring negotiation and contingency. *Rerehiko* lays footage of traditional Māori dancers from *Kai Tahu Whanau* moving together underwater over a flow of text extracted from emails between the group's members. The two fluid movements, of scrolling text and swimming dancers, both mobile and without fixed positions, create a powerful and evocative image.

As email travels through the network it produces and supports a collective culture and identity. Rakena suggests that, "The digital text of the email and its aesthetic of pixellated patterns create the new *tukutuku* for the *wharenui (atea)* in cyberspace in which a community often meets."[14] The flickering surface of the screen helps form and embellish a new meeting place.

Like the expansive notion of cyberspace, the watery realm within which the video occurs is specifically non-land-based. Rakena's fluid metaphor evokes freedom from constraint and references travel and migration, but also suggests a loss. "I decided that immersion in water space would create a question, 'who are we without land?'."[15] *Whakapapa*, the genealogical foundation of Māori identity and belonging, has been undermined by separation from the land through colonisation and later urbanisation. Rakena explores how contemporary *Kai Tahu* identity is maintained both through revival of traditional artforms and through the flows of electronic communication.

Rakena and C5's artworks explore the negotiations and superimpositions of 'being there', of being in specific and located geographic and cultural spaces, while being simultaneously immersed in mediated spaces. Rakena's video is located between traditional knowledge of place and belonging and contemporary Māori communities. But unlike the empty landscapes of the C5 collective, who may find themselves lost in this fissure, Rakena finds a populated space, actively generated by its participants.

What do we keep and what do we leave behind when we travel through the mediated spaces of the digital? How do we articulate a sense of belonging? While the physical reality of 'being there' is the key message of Air New Zealand's advertising campaign, the manner in which this is depicted evokes the new metaphors technology offers for presence. In these layered, socially-produced spaces, resisting fixed positions opens up the possibility of disorientation, but it also allows new perspectives to be developed and older stories to be maintained. As the works of Rachael Rakena and C5 suggest, feeling lost or floating both disrupts and expands our sense of place and of home.

14. Rakena, "Toi Rerehiko," unpublished MFA dissertation, School of Art, Otago Polytechnic, Dunedin, 2003, 3.
15. Rakena, "Toi Rerehiko," 23.

What is Digital? Concepts and a Chronology

Douglas Bagnall

The road sign in *figure 1(a)* uses two kinds of symbols. The arrow approximates the shape of the road ahead, while the numerals advise a speed at which to travel.

The form of the arrow is an analogy for the shape of the road, so this kind of symbol is called analogue. Analogue symbols belong to a continuum of possibilities. There are an infinite number of understandable arrows, all meaning something slightly different. They form a family of symbols that, by convention, maps a continuous range of form onto a continuous range of meaning. The symbol doesn't have to look like the thing it symbolises. An analogue clock maps the passage of time onto the rotation of dials—this doesn't look like the passage of time unless you are used to the analogy.

Numerals, as symbols, do not lie on a continuum. They are discrete. There are only ten of them, and they are formally isolated from each other. Symbols that are discrete are called digital, partly because numeric digits are exemplary digital symbols.

That is the entire definition of digital and analogue symbols—it has nothing to do with microchips.

Digital symbols are arbitrary in form. There doesn't need to be anything five-ish about the symbol '5'. It follows that a system of digital symbols is always finite, because you can't read arbitrary signs that you haven't previously seen (as you could with a newly encountered shape of arrow). These restrictions—that meaning can't be improved by refining the form of a symbol, which belongs to a smallish known set—mean that elaborate meanings can only be conveyed through the juxtaposition of multiple symbols, usually in series. '3' followed by '5' means something more than their sum, and less than '5' followed by '3'. The symbols create context for each other, and a complex message arises from the whole. Digital messages are read, not beheld.

fig. 1

One practical difference between digital and analogue messages is shown in the lower signs of *figure 1*, which started the same as *1(a)*, but have suffered various amounts of random distortion. Sign *1(b)* has changed just slightly. The corner looks tighter and the numbers, although wonky, still say '35'. Digital symbols are immune to mild corruption, but distortions in the analogue will alter the message. Sign *1(c)* has had a far worse time, and while the arrow still indicates a path, the numbers are unreadable. This shows the all-or-nothing tendency of digital communication. It is hard to get the wrong message, because it is unlikely for the '3' and '5' to distort into other numbers. This clarity is the trade off for throwing away the infinite possibilities of the analogue.

The real world is neither analogue nor digital, because on the whole it is not making a communicative effort. These terms describe modes of symbolic interaction, not physical reality. The distinction is in our heads. It might seem that the world is inherently analogue, given the apparent lack of physical discontinuities, but this raises the question: if the world is analogue, what is it an analogy for? At the same time, it is now quite respectable to speculate that the universe is a digital simulation in someone else's big computer. But the supposed underlying

nature of things is undetectable under either hypothesis and makes no difference to our use of the world. It is best just to accept that the universe allows both. The genetic code of life works digitally, based on sequences of four symbols, but the surprise and short history of this discovery show how little effect the written nature of DNA has on the experience of living.

The analogue and digital can carry each other quite comfortably. Imagine a digital photograph of the road sign. The picture is known to be somehow digital, but as a photograph it is pure analogy—a likeness. Then again, if you read the '35', you are seeing it digitally. The digital road sign lies in an analogical image which is encoded digitally. This nesting of analogue within digital and vice versa can repeat to infinity, but it doesn't make the embedded symbols any less pure in their digital or analogue nature. If you read a message digitally, it is digital, regardless of the framing, while an image is an image if it looks like an image.

All messages depend on context, and many, like the road sign, have digital and analogue aspects that provide context for each other. It doesn't usually pay to separate the components. They are tightly bound and complementary, at least at any particular time. Across time, though, the digital and analogue aspects of a work tend to separate and follow different paths. This is due to the way their transmission works. Purely digital messages can be copied without any loss of information. Minor errors in the form of symbols are irrelevant. When the copy is read, or itself copied, the Platonic forms are seen through the glitches, and the mistake is not repeated. Larger errors lead to catastrophic failure. Analogue messages, on the other hand, will drift in meaning through repeated copying. There is no way, within the analogy, to identify mistakes.

Examples of this separation are Shakespeare's plays. They were written to be performed in a particular analogue style and setting. The digital aspect, the words, have been transmitted via books and performed using the theatrical techniques contemporary to each time. What little is known or surmised of the works' original non-digital aspects stands more for the period than for the plays, signifying late Elizabethan London.

While digital messages can travel intact through time, their meaning may not. They suffer from what could be called referential drift. The entire system of signs can shift on its foundations, and the perfectly preserved message ends up meaning something else. Numbers on road signs, for example, implicitly refer to kilometres, whereas some time ago they meant miles. The shift can be more gradual, subtle, or ambiguous, as when words adopt new meanings, but the continuity of change doesn't reduce the message's digitality. The form of the symbols doesn't change to reflect the meaning; there is slippage, but no analogy.

The meaning of a message is irrelevant to the question of whether it is digital or analogue. Meaning operates on another level; from its point of view a message's form is a mere technicality. Any message's gist can be conveyed in other ways, both digital and analogue. Although a meaning will be suited to particular forms of expression, it is not bound to those forms (and nor is a message fixed to any particular meaning). At all levels the interpretation or composition of a message is determined by convention and context, but simple formal operations, such as transmission, can be carried out without higher level understanding. This is particularly true of digital messages, where the only conventions necessary are

those relating to distinguishing symbols. That is why even machines can do it.

Another property that digital systems have is that they all map onto each other, perfectly.[1] This is not fully demonstrated by *figure 2*, but it is a beginning. The row of punch card holes is a digital message, or part thereof. This could be read as a row of binary bits, and depending on whether you take a hole to mean zero or one, you read the numbers in lines a or b. If the holes are read as the bits in *line a*, which is then is interpreted as an ASCII character, the holes mean 'f'. If they are interpreted as in *a*, but meant as a pure number, that number would be 102. The number represented by *line b* is 153, which corresponds to 'r' in the EBCDIC character set.[2] The same few holes can encode a huge number of different things depending on what convention is used to interpret them.

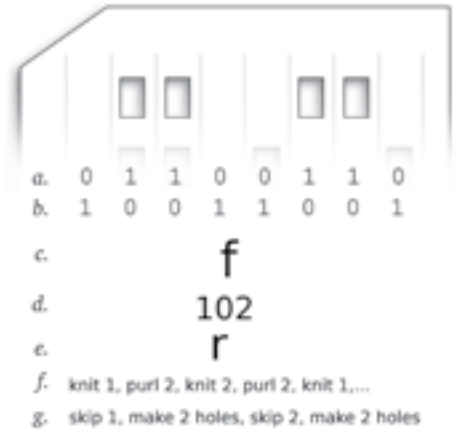

fig. 2: A punch card row with interpretations.

The holes could be read as a knitting pattern, as in *line f.* (Punch cards were invented for textile patterns). Or they could simply be instructions for their own replication.

In any case, the meaning of the holes is determined by convention. This is unremarkable—it is true of all communication—but it is key to the utility of digital technology. The corollary of this mapping (of multiple messages onto a single digital form) is that of a single message onto multiple forms. An 'f' might be converted into a binary form, into knitting, or into instructions on how to reconstruct an 'f'. It could go through any number of digital transformations and encodings, and at the end of it all it could still be converted back. Any digital system can be converted into any other, with no loss or gain of information. They are just different views of the same thing.

This concept is sometimes explained as 'it is converted into zeros and ones', but that lessens the idea. All digital systems are equivalent, so binary has no claim of primacy. It is a convenient system for some technical and information theoretical reasons, just as decimal counting and the Latin alphabet are convenient for cultural reasons. No particular form of encoding has precedence over the other—you could equally claim that all digital messages are converted into letters or words. So, while digital information is always somewhere represented as a series of Platonic forms, itself it has no essential form. This is partly what makes it useful.

1. This aspect of digitality (among others) was a topic of discussions on the ADA list in July 2004. You can find the archive at http://list.waikato.ac.nz/pipermail/ada_list/2004-July/thread.html
2. EBCDIC stands for Extended Binary Coded Decimal Interchange Code, and ASCII for American Standard Code for Information Interchange. They are two of the many codes that have been used for mapping between binary and Latin alphabets. Both were developed in the early 1960s. Most modern character encodings are extensions of ASCII, but EBCDIC is still in use.

With the definition out of the way, I will now look at the development of digital technology through a falsely episodic, universalising narrative. I've avoided dating most of the events and trends discussed—either the dates are well known or nobody knows them, and in any case they are distracting.

Language

Obviously then, speech is largely digital. Words are, on the whole, discrete symbols. There are not words with sounds between, say, 'cat' and 'cot' which mean a bit of both, which would be the case within an analogue system. Spoken words might seem inseparable from their paralinguistic context—the manner in which they are pronounced—but this does not reduce their essential digitality. The linguistic and paralinguistic elements of speech provide context for each other, working in parallel, whether in counterpoint or with no regard for each other. The degree of digitality of ordinary conversation is demonstrated by the way people reading dialogue in novels become oblivious to the utter lack of non-digital information.

This does not mean that you consider a system of signs when constructing an utterance. You just open your mouth and babble, but to the extent that you say anything, the communication is best understood as digital. For what its worth, a computer doesn't think about being digital either.

Some readers with educations of dubious economic value will be reminded of Saussurean linguistics, structuralism and semiotics. Indeed you could, like Roland Barthes, discuss digital and analogue modes in those terms.

Song

Music purifies the digital aspect of speech. The prosody of a song or chant reduces the scope for paralinguistic communication, and by suggesting its own continuation, pre-empts errors. The analogue sound pattern serves as mnemonic reinforcement for the digital message.

Songs regularly transmit digital patterns across centuries, often long after their referential contexts are forgotten. It is well known, for instance, what the grand old Duke of York did with his ten thousand men, although nobody knows when or why. A tune can even carry a digital message in a language unknown to the singer—as when monolingual Pākehā recite stories about Frère Jacques or Te Rauparaha. Advertisers use music to keep their messages coherent when recalled. Many people learn the order of the alphabet through a Sesame Street song, and recite a poem to work out how many days a month has.

If oral usage could be looked at in isolation, song and poetry would be seen to be sticking up for literal verisimilitude, while prosaic speech aims for semantic adaptation. Song is conservative; chatter liberally adopts the forms of its surroundings.

Counting

Numbers, being words, are already digital. But in extending out indefinitely, as some cultures' numbers do, they allow a one-to-one mapping between any sets of countable things. This leads to simple digital conversions or at least numerical shorthand, like street numbers.

Weaving

A weaving pattern can be expressed as a pixel grid, or as the set of rules for the arrangement and manipulation of thread. Both forms are digital, and weaving is the process of translating between them mentally in order to physically replicate the pixellated form, see *figure 3*.

fig. 3: The digital image (a) is encoded as a set of weaving instructions by the weaver (b). These instructions are then decoded by the weaver back into a pixellated representation (c). The original pattern is thus digitally replicated. Automatic looms perform the (b→c) transition, and additionally store the representation of (b) in physical form: expert knowledge is only needed for encoding, and only once per pattern.

In the early days of the Industrial Revolution weavers flourished while spinners starved, because their information processing skill defied mechanisation. Even after the introduction of machine looms artisan weavers could handle more intricate patterns, and handwoven cloth persisted as a dwindling luxury item. In the end, though, weaving was fully automated using the digital punch cards of the Jacquard loom. This achievement inspired efforts to automate other digital tasks, notably Babbage's imaginary engines and later in the ninteenth century, the tabulation machines that made IBM's fortune.

Less directly, it inspired a greater awareness of the possibilities of material digitality. Charles Dickens in *A Tale of Two Cities*, writing after the mechanisation of weaving, about events prior to it, has Madame Defarge encoding revolutionary messages in her knitting, presumably in a binary code of knits and purls. This kind of thinking made perfect sense in the nineteenth century, but would not have in the eighteenth, when the digital nature of fabric was still hidden in the form of a craft.

Writing

Alphabets and syllabaries are obviously digital.[3] You don't get new letters by conflating the forms of old ones, and little changes in their shape have no significance. The digital reproduction of a text is simple, whether you know the meaning or not—you just copy it letter by letter.

The first writing was used for accounting, but it was soon used to augment traditional methods of digital cultural reproduction. Epic poems were put into writing, preserving with the stories relics of oral information management techniques. The oldest written works have a short episodic structure, regular metre, and stock phrases, all of which make a work easy to recount but tedious to read. It was novel to imagine a digital work existing when nobody could properly recall it. As each newly literate culture became used to the written form,

3. Readers are likely to quibble and claim that this is not so clear with, for example, Chinese text, where the range of symbols is so large that it could be seen as effectively open-ended. But this is wrong in a number of ways. Firstly, the terminology was technically deliberate: Han characters do not form an alphabet or syllabary, but a logographic system. Secondly, in any case, they are not infinite or malleable, and do not lie on a continuum. There are not in-between characters. There is a calligraphic tradition that introduces pictorial elements to writing, but this, as I understand it, does not change the underlying digital message but adds an analogue channel in parallel, much as prosody does in speech. Thirdly, the actually used symbols are routinely treated as digital. For example, mainland Chinese text is usually encoded using the 6,763 symbols of the GB2312 code set. Chinese newspapers are not printed from individually shaped blocks.

its works became more complex and casual. Prose is the abandonment of song, not necessarily as a means of presentation, but as a means of storage. People read the Histories of Herodotus and the Icelandic Sagas aloud, but nobody expected to memorise them.

Digital reproduction as worship
During one difficult period in Jewish history, cultural independence was threatened. Rather than let traditional stories adapt, which would risk an overwhelming influx of foreign ideas, the Jews forbade themselves any textual adaptation, making the digital integrity of their beliefs a cultural tenet. It is a sin to introduce errors in the reproduction of the Torah, and more latterly, in the Bible or Qu'ran. This emphasis on verisimilitude bred expertise in digital reproduction and preservation, and the core concepts of transcribing and distributing multiple copies are still used today in the storage of digital data.

Later, the injunction spread to secular law. For example, the constitution of the United States of America contains statements that are now ridiculous, or merely, through language change, unclear, but nevertheless are retained in letter perfect form. Prior to the invention of sacred text, written works were allowed to evolve, mutating as necessary at each reproductive juncture. To some extent they have since, with translations and revisions allowing textual leaps.

Digital music
Western musical notation is digital. There are only so many meaningful musical symbols, and although they contain elements of analogy, as the symbolic notes rise and fall on the staff in tune with their expression, the symbols must jump in discrete quanta. Musical notation maps onto MIDI as easily as text maps onto ASCII, for the same reason—each form expresses identical information.[4]

Written music represents an interesting inversion: music was originally an analogue aid for digital transmission, while musical scores are a digital means to repeat a tune. The vessel becomes the cargo.

Digital automata
In the twelfth century, the engineer Al-Jazari made a programmable drum machine that used a cylinder with regular holes. To programme a rhythm you would put pegs in the holes. This was digital technology: the presence or absence of a peg, and the spacing of the holes are discrete options, not continuous variables.[5] It maps directly to a musical score, or to MIDI. The bumps on the cylinder of a music box are likewise a manifestation of a musical score, with each notch corresponding to a written note.

Automated digital replication
The printing press is not inherently digital—an etching, for instance, is analogue—but movable type is. It makes graphological expression difficult and reduces the set of possible symbols to those found in the printer's cases. Because it is reused and mass-produced, movable type helps standardise symbols between books and across time, as well as within each text.

Movable type was first used in China, where the size of the character set prevented it gaining much advantage over analogue printing. But when it was

4. MIDI is an acronym for Musical Instrument Digital Interface. It carries essentially the same information as a written score—the timing, pitch and volume of the notes to be played.
5. The Jacquard loom, which I have already mentioned, is based on an elaboration of this idea, but with punch cards standing in for pegs on a cylinder.

combined with the small European alphabets, digital printing shattered the existing symbolic order. Miracles are analogical while immutable law is digital, and the reformation and the dramatic invasions of modernity were driven by a shift in thinking toward the latter.

Computers
I'm sure these are mentioned in the rest of the book, so I shall not say much. A digital computer can, by definition, be made to perform any kind of digital work. It can be programmed to process weaving patterns, copy text, orchestrate sound, add numbers, correct spelling and lay out text. Because computers are so digital, it is sometimes forgotten that digital processing precedes and extends beyond computers.

Digital processing for digital effect
Google, BabelFish, and OpenOffice are text-to-text functions. You put a series of words in, and some other words come out. These are examples of digital processing for digital effect—the output is meant to be read.

Digitisation (digital processing for analogue effect)
An image or photograph is analogue, yet there are machines that will treat it as an array of digital symbols. The picture thus gains replicability and endless processability, without anyone having to actually read or write it in digital form. The breakthrough is in the automated conversion between analogue and digital forms, rather than anything to do with computation in itself. A digital image is nothing but a written description of the analogue, and the process is reversed by depicting the described. The whole point of digitisation is to not notice the digital.

Digital age
So what the digital age really means is that the digital disappears. It swallows itself, hiding within every apparently analogue thing.