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Digital myths

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Engineering stories: texts, pictures and myths in the history of engineering

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Digital Myths

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Digital Myths

Many overtly fictional works, such as the collection Digital Dreams[1], that mention digital technology tell dystopian, tragic or disturbing stories which sharply contrast with optimistic assertions about 'the wonderment of both the accomplishments and the possibilities of advances into the digital realm'[2]. People, in specific fields, write approvingly that 'a digital transmission network can operate at higher speeds, carry more information and be more reliable'[3] or that '[t]omorrow will bring new and amazing products for and improvements to digital photography'[4]. They also announce that the '[a]nalogue era is over'[5], but many claims cannot be supported. Analogue and digital methods are incommensurable[6]—so most proclamations linger as claims. It is notable however that claims about digital systems often lend support to a modernist aesthetic that values order, progress, logic, the universal and the clean slate.

Myths

Myths are grounded in hearsay, not experiments or theories, and recounted as allegories rather than as anecdotes. What qualifies a story as a myth is its currency which is localised, physically and ideologically, and thus helps to secure institutional boundaries. Contradictory myths sharpen bounds and throw dominant myths into relief. For example, three renderings of a myth:

> The Boffins say its brilliant. The marketeers say its the future. The national press use it as a superlative.…

are accentuated by the counter claim that

> … My experience is that it is abysmal.[7]

In the field of technology *analogue* is set up in opposition to *digital*; for instance, by suggesting that '[t]he digital world is far more resilient than the analog domain'[8] or by tacitly supporting digital technology by undermining analogue options, for example, in the presumption that 'audiences are demanding more than analogue technology permits'[9]. But sometimes there is a 'digital villain'[10]; for instance, on the figurative 'straight analogue path into the heart of dark, crooked digital technology'[11].

Digital

In 1946, Admiral Lord Mountbatten announced that 'the electronic brain' was 'upon us'[12]. This caused a flurry of correspondence, led by Professor Hartree[13], which censured the use of the term 'electronic brain'. Earlier Hartree, who considered himself to be 'the only person' in Britain to inspect and use Eniac[14], the digital electronic computer[15], had explained that '[c]omputing equipment can be divided into two main classes'[16] and that 'the American usage is 'analogue' and 'digital' machines'[17]. Subsequently *electronic computers* were denoted by a variety of terms[18] but there was &lsq;uo;a tendency, even in the more responsible press, to use the term "electronic brain"'[19]. In 1952, 'digital computor[*sic*]' was merely the 'formal title'[20], and twenty years later the phrase ' "digital computers" was an institutional rather than a household word'[21]. Thus work on early electronic computers generated a public awareness of the term *digital* but did not popularise it.

By 1972, it could be said that 'rare is the field of engineering endeavour which has not felt the impact of digital technology'[22] which supplied an intensively used part of the vocabulary of specialists that failed to infect a wider public. After the introduction of the calculator in 1971[23], the digital watch and in '1983 the launch of compact disc audio made 'digital' a household word, and a magic sales tag'[24]. Later people became 'wary of any piece of equipment … not labelled digital'[25] and then the 'word "digital" … exploded as a '90s modifier and metaphor'[26].

Explanations primarily stress the bivalence of digital technology, by, for example, describing the 'so-called digital technique is based [devices] which … are either turned on or off'[27]. These expositions fail to capture the lyrical use of *digital* where people sit 'digital cheek by digital jowl'[28], dip 'their toes into digital waters'[29], cut the 'digital ribbon'[30] or dangle 'digital carrots'[31].

Even where the metaphor has drifted towards the literal, technical statements about bivalence fail to clarify the 'digital world'[32] with its 'digital territory'[33], its 'digital creations'[34], its 'digital economy'[35] and its 'digital 'miracles''[36].

Digital remains an enigma to 'most people' who 'have no idea what the word means'[37]. but people anticipate that 'digital discovery [is] an awesome and exciting experience'[38] and the mystique sustains the 'Promethean glow surrounding digital matters'[39].

Association

The transmission of coded speech samples was 'known as pulse-count (or code) modulation (p.c.m.)'[40], but once the digital computer was publicised a parallel was drawn with the 'so-called analogue machines and the digital machines'[41] and explanations of PCM revised to say that speech samples are 'transmitted … in a digital form'[42]. Soon after it was felt that '[a]ccurate information … for weapon control may best be transmitted … using some form of digital representation'[43] and now '[l]ots of things are digitally operated … even missiles!'[44]. The development of 'digital guidance computers' took place alongside 'growing demands for accuracy'[45], thus digital technology became linked to outstanding accuracy.

Advertisements for electronic calculators, introduced around 1970, did not mention digital circuits, however the calculator exposed a consumer market and manufacturers sought new products. The digital watch was the result, however, the term digital was used to differentiate the types of display[46]. The 'digital display' was distinguished 'from the conventional big-hand-small-hand

which is called an analogue display'[47]. The novel watches incorporated 'a quartz crystal and integrated circuit technology to control a digital display'[48] with a stress on the quartz crystal and its role in precision timing in the space age[49]. However, the term digital appeared alongside the word quartz with claims like '[a]ccuracy guaranteed to within a second a day'[50] and digital became alloyed with accuracy.

CD's, some ten years later, were said to produce 'perfect' 'digital sound'[51], however the early promotion emphasised the use of the laser[52]. Association with the laser added to the mystery of digital systems and identified them as progressive.

Beneficient technology?

Accuracy is prominent in descriptions of digital products[53]. The claim is that '[d]ata can be represented and manipulated *within* a digital system to any desired degree of accuracy. Furthermore, the digital system can *obtain* this data with astounding accuracy and resolution'[54].

The myth of precision extends to '[d]igital recording—the latest stage in the search for perfectly recorded sound' so that 'copies retain the same accuracy as the original recording'[55]. It is suggested that 'the digital photograph … can be copied electronically without loss of image quality'[56], indeed that

> '[d]igital technology makes it possible to convert text, sound, graphics and moving images into coded messages which can be combined, stored, manipulated and transmitted quickly, efficiently, and in large volumes … without loss of quality'[57]

It is presumed that 'if you make a chain of digital copies, the last can be as good as the first'[58] implying that 'the quality of data reproduction is exact, can be preserved indefinitely and copied repeatedly without deterioration'[59].

Some submit that reproductions are not perfect but 'seemingly perfect'[60] or 'virtually perfect'[61], while others suggest that digital systems can bring about enhancements, so a 'digital copy is as perfect as the original and, with some fancy computing, even better'[62].

Digital systems are reported to dispense a 'pristine digital quality'[63], to be 'digital and clean, rather than massively analogue and huge'[64], with 'crisp, digital pictures'[65], a 'brilliantly clean sound', and although '[d]igital is just another way of storing information … it's a good clean system'[66]. Cleanliness implies a lack of clutter and greater efficiency and it is therefore predicted that 'digital recording' is a step 'in fully maximising CCTV system efficiency'[67] and that 'the efficiency of optical methods … is many times greater when digital rather than analog methods are employed'[68].

Digital systems, it is frequently asserted furnish better quality; 'digital receivers … will bring better picture and sound quality'[69], 'digital technology' will 'provide higher quality … communications'[70], and a 'digital radio service … will provide a vastly superior service'[71]. Apparently, the 'use of digital telephony … is motivated by desires to improve the quality'[72] and it is expected that a 'digital library' will incorporate a 'technology which could dramatically improve the quality of education in the country'[73].

Television is expected to be digitized so that '[i]nstead of transmitting TV pictures in their raw, bulky form, digital TV will convert and transmit the signal into compressed computer-readable data'[74]. For audio there is also 'digital compression — which works on the principle that the ear

does not need all the information in a signal'[75]. These disclosures have led to the generalisations that '[d]igital technology will … increase the capacity of the radio spectrum'[76], that 'digital signals will virtually end capacity constraints'[77] and that '[d]igital communications … will bring new resources in unprecedented quantity'[78].

Modernism

Transitions in the identification of products with the term 'digital' creates a chronology for aesthetic movements[79]. Modernism is identified with the 'high-tech Seventies watch [which] was either instantly disposable or flashed digital numbers and told the time in 17 time zones'[80] when '[w]e thought we had finally entered the space age'[81]. Later, 'digital watches … vanished from windows. The analogue [was] king'[82] but the digital watch made 'a triumphant comeback, this time as the ultimate in kitsch and retro clubwear'[83].

Modernism demands a transition to a new age that creates a contrast between expressions of the modern and the old such as 'the transitions between the library as a place and the library as digital information space'[84] or 'good old hands on dials instead of big, bold numbers'[85]. Thus '[d]igital expression represents … a break with established tradition … that could not have been conceived without digital technology'[86]. So for 'digital transmission' an 'obstacle to rapid progress in new uses of communication is the weight of tradition'[87].

We are, evidently, beyond the 'pre-digital era'[88] at the point where the 'digital era is re-shaping business'[89] where adherence to existing technologies could render whole organisations evolutionary dead-ends so some broadcasters will 'become "dinosaurs" unless they … prepare for digital television'[90].

Once the modern is embraced, what came before is anachronistic; for instance '[a]n analogue BBC would look as odd in a digital world as a black and white BBC1 would look today'[91]. The alternatives are 'traditional analogue equipment' or 'modern digital equipment'[92]; to be digital is to be modern using 'a modern, digital audio editing system'[93], '[m]odern voice networks' that 'take advantage of digital technology'[94] or 'modern technology' to create a 'digital library'[95].

According to the slogan

'the future's bright; the future's digital'[96]

so '[w]e must be positive and embrace the digital age because to do otherwise would be to face … inexorable retreat and decline'[97]. It is a task for pioneers to venture where 'the once uncharted frontier of the digital realm was now being mapped out'[98], for instance, by 'leading the way towards … digital radio'[99], by purchasing '[t]he 6 function Digital Watch of the future' or by considering 'advanced systems' that 'already rely heavily on digital building blocks'[100]. There is a 'digital future' and an 'analogue present'[101]. We are asked to enter 'The Digital Age, where Sharp is shaping the future'[102] and to mimic the p rudent Swiss who realised digital watches 'would be the watches of the future'[103].

Often proponents of digital technology see it as offering an opportunity to sweep aside an old order; for instance,

> 'Since … digital computers were introduced to heating, ventilation and air-conditioning … controls, the transition … has been burdened by the legacy of pneumatic controls … [however] digital … controls offered the promise of a clean slate'[104]

While others speculate that if 'we were to start afresh in building a universally adaptable communication network, there are persuasive arguments that it should transmit digital signals exclusively'[105] or put more bluntly: '[t]he network industry should ditch analogue lines and adopt true digital technology'[106].

Revolution

Some people believe 'developments in … the storage and transmission of information in digital form, will prove eventually to be as revolutionary an innovation as the printing press'[107] and that the 'move from analogue to digital [is] heralding the beginning of a communications revolution'[108].

Companies 'offer digital services' while 'the older analogue networks are slowly being shut down'[109] and 'inefficient analogue systems … have given way to all-digital networks'[110]. Opponents are treated as being enamoured with the clutter and malfeasance of the past, since 'the digital revolution included the sweeping away of the archaic trappings of the industrial age'[111].

There is no doubt, for many, that a digital revolution is in the air[112]—a 'Digital Phoenix is rising'[113]—and this 'Digital Revolution centres around … the pervasiveness of digitisation'[114] and 'has at its core the development, manipulation and dissemination of information stored in the form of "ones and zeroes"'[115].

There is a sweeping assumption that 'communications have become increasingly digital, global and immediate'[116] and that 'in the future, both the telecommunication and the broadcasting industries will convert from analogue to digital technology'[117]. The move is seen to be natural since 'there is a broad evolutionary trend toward the substitution of digital for analogic mechanisms.'[118] So '[l]ike a force of nature, the digital age cannot be denied or stopped. It has … very powerful qualities that will result in its ultimate triumph'[119]:

> 'Digital technology is evolving … It's DNA for machines …. Making them faster, smarter, easier and just plain better'[120]

In this evolutionary process 'each generation will become more digital than the preceding one'[121]. This, it is claimed, will not only bring benefits but will allow us to jettison 'telecommunications … based on 19th century analogue technology' and adopt '[d]igital communications … which offer great improvements'[122]. Analogue systems, it seems, were 'the antipasto in this feast of facilities'[123].

We are, apparently, in 'a fast-forward digitally charged society'[124] 'increasingly swept up in the digital age'[125]. The 'new digital economy moves faster than the speed of light'[126] and 'could accelerate world economic growth'[127]. Though abuse by monopolies might restrict 'the benefits to consumers' measured by the rate of 'deployment of digital technology'[128].

The 'digital data links' will also be 'speeding the flow of data communications'[129] and for phones 'digital versions, … will provide a much faster digital connection'[130]; even '[d]igital-display thermometers are quick'[131]. It is felt that there is 'a great future for' ''digital' computers' since 'they can perform long and elaborate calculations so swiftly'[132], 'add those bits very

fast'[133] and permit 'very rapid logical and arithmetical manipulations'[134].

Error-free

The myth is propagated that when 'a consumer product fails, it is seldom a digital fault'[135] so that a digital watch is a 'watch with nothing to go wrong'[136], that 'digital mechanisms can remove the errors entirely'[137] and that a digital 'machine will never forget or make mistakes'[138] since a digital computer 'is completely accurate and has perfect memory faculties'[139]. Authors claim that 'digital transmission … is not vulnerable to interference'[140] and that 'digital radio' will provide 'interference-free reception'[141], or at least 'robust reception … even under the most challenging conditions'[142].

Commentators may have been influenced by Claude Shannon, who summarised his pioneering results in terms of an 'ideal system' that transmitted without error, but he also noted that 'no explicit description of a series of approximations to the ideal has been found'[143]. As we attempt to get closer to the ideal he indicated that '[i]f the noise is increased over the value for which the system was designed, the frequency of errors increases very rapidly'[144].

Some authors are prepared to admit that errors do occur but that 'certain error correcting codes have now been developed'[145] available by implication to only digital systems[146]. It is suggested that for 'digital media' 'when degradation reaches a certain level (within the error-correction capabilities of the system) the recording can be 'cloned' without loss of quality'[147].

Universal

The transition, it seems, is inescapable: '[i]n the twenty-first century … Everything will be digital'[148], '[s]ince digital techniques are now viable, all information—including voice—inevitably will be transmitted in digital form'[149] because '[n]o matter what it represents, all digital information has certain characteristics in common'[150] or in more colourful terms a 'digitizer devours anything describable'[151]. Different sources lose their distinctiveness so the 'historic dividing lines between different media no longer make technical or business sense'[152]. It is seen as a natural development because in 'the human nervous system we find no distinction among the signals as sociated with different activities and senses'[153].

Not only is it presumed that digital systems operate on universal principles, but also that 'digital machines … are able to handle any computing problem'[154] and that employing 'digital technology means that text and images can be transmitted anywhere on the globe'[155] possibly since 'digital computers are literally everywhere'[156].

Mind

The algebra contrived by the Irish professor George Boole was adopted by Shannon in 1938[157] for the design of telegraphic relay circuits. However Boole's intention was 'to investigate the fundamental laws of those operations of the mind by which reasoning is performed'[158], but his '*symbolic logic*' or 'Boolean algebra' coincidentally applies to 'electronic circuits in computers and other digital systems'[159] and became 'the basis for logical design of digital circuits'[160].

Computers became associated with thought and were seen to 'perform operations in binary logic, the only thought-process known to digital computers'[161], and logic and idealised digital

mechanisms provided, for some, literal descriptions of the brain's operation because they felt that 'circuits in digital computers duplicate the logical processes of the mind'[162] where 'crisp symbolic representations allow for chains of reasoning'[163]. In 1943, McCulloch and Pitts, in an imaginative leap, concluded that the "all-or-none" operation of the neurons 'insure that the relations of psychons are those of the two-valued logic of propositions'[164]. This allowed them to 'conceive neurons as telegraphic relays'[165] and others to see that 'neuron functions can be imitated by telegraph relays or by vacuum tubes'[166] So for some it 'seems proper, therefore, to [stress] the digital character of the nervous system'[167].

The digital style of explanation has also captivated biologists who note that 'genes themselves are clearly parts of a digital system'[168], that '[l]ife is just bytes and bytes of digital information'[169] where '*the corpus of genotypic messages is preponderantly digital* in nature'[170]. This seems to open the opportunity to control the 'river of DNA through time, a digital river of information that marches through the bodies of animals and plants as it flows'[171].

Counter claims

In spite of the weight of rhetoric expounding the virtues of digital technology there are counter claims; for instance, 'more and more people throughout the [television] industry are sceptical', it is claimed, of the ' so-called "digital revolution"'[172]. Claims about the increased capacity of digital networks are countered by statements that assert that 'the transmission of digital signals requires the provision of circuits with a very wide bandwidth'[173]. The claim of 'digital sound as perfect as the CD's'[174] is called into question by a 'new generation of CD players intended to improve sound quality … developed to answer complaints that digital sound is cold and clinical'[175], and claims about accuracy are undermine d by the presence of the Millennium bug, which 'arises because most computers read only the last two digits of the year's date'[176].

The image of invulnerability is tarnished by the statements that '[d]igital systems … are not 100 percent reliable, nor will they become so in the foreseeable future'[177] and that 'an error of only a single bit … can result in the failure of the entire system'[178]. Some challenge the claim that digital systems are in some sense universal, by reporting on incompatibilities amongst digital systems such as the imminent 'onslaught of conflicting standards and hardware when digital TV arrives'[179].

While there are claims that errors can be eliminated others highlight that '[a]nything that can be converted into ones and zeroes in computer memory can be morphed'[180] consequently '[w]e live in a world ruled by fictions of every kind'[181] where 'digital technology has raised the potential for photographic forgery to new heights'[182].

There is also a line of argument that demotes digital by reminding us that it offers an 'imperfect representation of reality …. For example, most physical laws are expressed in terms of the real number continuum'[183].

And some would say 'that a computing machine cannot "think" '[184], that these 'on-off pulses, called spikes, confused early researchers and led some to believe that the brain relied on a digital model to process information'[185] and therefore the digital binary model is inappropriate—'It's binary; we're not'[186] which is an observation hinted at by George Boole himself[187].

Conclusion

While the proponents of digital systems often seem to exaggerate their claims. They will often subscribe to a metaphysics that presumes that natural phenomena have an analogue and continuous character. This in itself must be a myth and can be challenged by a metaphysics that sees the world as fundamentally digital[188]. Either view is resistant to proof. Which renders many claims about digital (or analogue) technology a matters of aesthetics.

Digital mythology has an aesthetic emphasis similar to *modern* philosophy with an accent 'on abstract, timeless methods of deriving general solutions to universal problems'[189]. The emphasis on cleanliness, for instance, is reminiscent of the 'seduction of High Modernity' which 'lay in its abstract neatness and theoretical simplicity'[190]. The desire to "clean the slate" matches the modernist quest to cut 'ourselves off from the inherited ideas of our cultures'[191]. It is also evident that constructing explanations of thought around idealised digital devices aligns to a 'basic element in the modern scaffolding' which demands that '"mentality" should be logical and principled, calculative and unemotional'[192]. Pred ominantly the call to promote digital technology is a call to align with those committed to a modern world who think 'about nature in a new and "scientific" way, and to use more "rational" methods to deal with the problems of human life and society'[193].

Not far below the surface is the desire for the creation of perfect language to eliminate ambiguity and confusion, but opinions are mixed. For some '[d]igital technology is the perfect medium for the communication of ideas[194] but for others '[t]he logician's dream that men should communicate only by unambiguous digital signals has not come true and is not likely to'[195].

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