aus
Dennis Tenen: Plain text. The poetics of computation.
Stanford University Press 2017

that affect the coupling between organ (sight) and device. The illusion of cinematic motion takes advantage of the idiosyncratic particularities of human vision. A more perfected visual apparatus would perceive flicker at much higher rates and have no persistent visual trail artifacts. The socially constructed aesthetic object is shown to contain physiologically determined qualities, undermining the strong version of social constructivism.[50] Screens, at the viewing end of most digital media—film and text—operate at the nexus of physiology and culture.

Finally, where theory often places artificial digital discreteness in opposition to natural analog continuity, a thick description of our perceptual apparatus reveals a complex patchwork of fragmentary cognitive mechanisms, already digital and discrete in their operation. The human-screen coupling is deeply heterogeneous throughout. At some level of analysis, gaps in the encoding format relate to gaps in human visual processing. Neither can be said to represent reality with perfect fidelity. Instead, brains, cameras, and screens stitch together landscapes from unevenly sampled visual topographies, achieving a measure of arbitrary synchronicity in viewing.

Critical literature often conflates the discrete nature of digital representation with human debasement, following the logic by which the perceived material impoverishment in one sphere leads to the implied spiritual impoverishment in the other. The sentiment is everywhere in the popular press and has deep intellectual roots in the history of thinking about technology. Philosophers of technology from Heidegger to Kittler advance a powerful hermeneutics of suspicion toward mechanization, digitization, and the subsequent computability of human experience. To take that tradition seriously is to direct hermeneutic suspicion to aspects of digital being that have meaningful sociopolitical consequences. If, as the case of motion blur suggests, human experience is already and always born digital (i.e., it is discrete and differentiated throughout), then we must find ways of advancing critique along theoretical distinctions that better capture the instrumental reality of media practice. Nostalgia for analog oneness and continuity should itself fall under the critical gaze, examined alongside media marketing slogans that advertise gapless playback and lossless file formats. To long for the analog is to long for the experience of oneness, which was never attainable in the first place.

Indeed, it appears that the whole matter of digital representation rests on arbitrary and contingent assumptions. If language and literature are already digital and discrete systems of representation, why should it bother us when it is otherwise digitized or transcoded into other controlled vocabularies? The Latin letter already comprises an atomic and indivisible unit. When it is further broken down into pixels, the smallest indivisible units on screen, it undergoes only a subtle ontological change. Just as one learns to translate an alphabet's arbitrary shape into distinct sounds, one can learn to translate arbitrary digits into letters and back into sounds and thoughts. The language of machines is merely another language.

Neither do media evolve independently of human sensory constraint. Humans cannot perceive the ultraviolet spectrum, for example. Nor would it be practical to create books that are so heavy as to prevent readers from turning their pages. Media modalities are tuned to average human capabilities, which mature in their socially constructed media modal environments.[51] Sensory constraints shape media, just as media constraints shape perception.

WE HAVE ALWAYS BEEN DIGITAL

A thick description of the human–machine interface at the point of contact exposes our frequent misunderstanding of the term *digital*. What does it mean, for example, to digitize film, if it is already a digital medium? What properties are being brought forth through digitization if the digital cannot simply be equated with discreteness? We can now revisit our initial intuitions in light of the physics of digital apprehension.

The conversation about digital media often begins with the difference between discrete and continuous quantities.[52] For example, in a popular book about what a "well-informed person should know about computers," Brian Kernighan describes analog quantities as those conveying "the idea of values that change smoothly as something else changes."[53] Much of the world is analog, Kernighan explains. A water tap, a pen, or a car steering wheel are all examples of analog interfaces. For example, when riding a bicycle, turning the handlebars one way results in a corresponding motion of the machine. This motion is smooth. Compare that with the action of a light switch. A properly functioning light switch takes on two discrete states only: on or off. A range of pressure applied to the switch does not correspond to any mechanical action of the lever. But once a certain threshold is reached, the switch flips to change states. "Digital systems," as Kernighan writes, "deal with discrete values."[54] The switch contains a limited number of state possibilities, whereas the bicycle handlebars can be rotated in an infinite number of minutely differing gradations.

Nelson Goodman was one of the first philosophers to examine digital representation in the context of aesthetic theory. In the late 1960s, drawing on technical intuitions about devices like pressure gauges and computers, he proposed to call those notational systems analog, which are "dense" and "undifferentiated in the extreme." By contrast, he called "digital" systems those that are "discontinuous" and "differentiated throughout."[55] By these definitions, written language and music notation are digital systems par excellence, having the property of reducing the undifferentiated analog input (human thought) into discrete semantic units (text or musical notation).[56] Following Goodman's logic, one can reasonably maintain that the art of painting, unlike music or language, cannot be reduced to the production of discrete semantic units and would be more of an analog system under the proposed definitions.

In this light, the language of pointillist painting, which breaks shapes down into their modular atomic components, transforms an analog art form into a digital one. Similarly, in the cuboid world of *Minecraft*, players interact with blocks, the smallest differentiated units that constitute all other more complex things in the game. The world of *Minecraft* is sparse and therefore digital. By contrast, the world of the hyperrealistic *Myst* depicts the paintinglike, semantically irregular reality that cannot be broken down into neat components. *Myst*, a digital game, depicts a dense, undifferentiated, and analog world.

Goodman's definitions strain under closer examination. Plainly, *Myst* is also a digital game. All digital images (and worlds) follow the logic of cubism to its deconstructive conclusion in that they atomize analog quantities into discrete and differentiated points of light. The world of *Myst*, like the world of *Minecraft*, is made of pixels. At some deeper level of analysis, both worlds are sparse and differentiated throughout. Could we not say the same thing about all rule-based analog games, such as chess? On the level of syntax, chess is also a sparse game, discrete and differentiated throughout like its computer counterparts. One plays on top of a grid with pieces that move according to rigidly prescribed rules and along binary color distinctions. At another scale of analysis, however, chess is an analog game. The wood grain of the chess board is part of a dense, undifferentiated world. At a deeper level still, at the atomic scale of observation, the chess board again begins to appear sparse, discontinuous, and differentiated throughout. We are left without the critical means to tell wood and (faux) ivory chess pieces apart from the block and pixel pieces of *Minecraft*.

The quality of being digital seems to depend on our perspective. Density and sparseness change with the viewer's ability to perceive differentiation. Ultimately, these qualities belong not to the object of representation (chess or computer game) but to the viewer. In the 1980s philosophers engaging with Goodman's earlier work began to move away from discussing digital representation in terms of properties of the medium. The conversation moved toward a more process-based, viewer-dependent understanding of the terms.

For example, an interesting corollary to the continuous property of analog systems is our inability to duplicate their states exactly. I can approximate the pressure someone else puts on their bicycle handlebars with some arbitrary measure of precision that never reaches perfect reproducibility. This means also that, although more digital art forms such as literature are, in some sense, perfectly reproducible, analog forms, such as painting, are not. Following similar reasoning, the American philosopher John Haugeland proposed to consider the quality of being reproducible as essential to our understanding of digital representation. For Haugeland, reproducibility involved "flawless copying . . . and preservation."[57] To Goodman's criteria of the digital, he therefore added the notion of "feasible procedures," which led to "positive" and "reliable" processes for reading and writing digital tokens.[58]

Let us consider Haugeland's addendum in relation to some of our previous case studies. Chess movements are patently reproducible. Several notational conventions exist to ensure the perfect preservation and reproducibility of chess games. These include the descriptive and standard algebraic chess notations. Individual chess *sets*, by contrast, are not perfectly reproducible. Each is a somewhat unique version of the same regulation ideal. The grammar and the medium of chess answer to differing definitions, depending on the context of analysis. The sometimes drastic differences in the shape of the figures or the materials used to make chess sets are not meaningful in the context of the game. They do become meaningful to those collectors who prize certain chess sets for their rarity or craftsmanship. However, craftsmanship and rarity are not in themselves signifying properties that figure in the game of chess. They are meaningful only in the game of collecting.

For some chess players, chess pieces are therefore perfectly exchangeable; for others they are not. Similarly, at the other extreme, we know that no amount of copying can reproduce an original Rembrandt. Every aspect of the painting is meaningful, including those not visible to the naked eye, such as traces of other paintings or sketches hidden under the surface rep-

resentation. This would hold true even if an invented technique could make a perfect, molecule-by-molecule reproduction of a Rembrandt painting. The rules of fine art collection demand an original work of art that preserves the artifact's provenance, including incidental bumps, scratches, and patina accrued through history. Such marks carry no meaning by the rules of painting, but they do carry meaning by the rules of collecting.

From that perspective, painting is an analog genre. But if we were to disregard the rules of collecting—if we simply enjoyed looking at beautiful pictures—we would be justified in treating painting as a perfectly reproducible art form. Painting would, in essence, become more similar to chess, that is, a reproducible digital medium. Similarly, our newly found ability to reproduce something pushes the artifact closer to the digital side of the spectrum, even though the object itself has not changed. Its ontological status shifts with the viewer's attitudes and technological capabilities: to perceive or to reproduce.

With regard to discreteness, moving images lie somewhere between the extremes of competitive chess and fine art. In the case of the soap opera effect, we may think of analog film as a series of still shots. For some purposes these still shots are reproducible in mass quantities, although not perfectly. Multiple copies of each film reel are routinely distributed to multiple cinemas. Each is authentic in the sense that it is sanctioned by the film studio. From another perspective, each frame is also an irreproducible work of art, which, like a painting, can accrue the patina of time and in some context attain value based on such unique properties as belonging to this or that prominent film director.

Could magnetic tapes become unique works of art by similar logic? Imagine a collectible videotape that was handled by the late Elvis Presley. One could object that humans cannot observe magnetic traces directly; whatever sense of valuable degradation or patina particular to magnetic storage media is lost on the average collector. An objection could also be raised that videotapes were produced in much greater quantities than film. Should we then impose an arbitrary cutoff point, a certain number of copies that, once exceeded, take the work of art out of the aesthetic realm? What about the obverse movement? In 2014, Wu-Tang Clan, a New York–based musical collective, released an album digitally on CD-ROM, but only in a single copy that cannot, by contract, be reproduced by its buyer.[59] Given the restrictions, does the album retain its digital properties, or does it become, in effect, an analog work of art?

These thought experiments show that qualities such as reproducibility, originality, patina, and authenticity depend on an observer's capacities to perceive or enact them and not solely on any intrinsic property of the medium. Film and video are reasonably irreproducible series of paintings and, from another perspective, perfectly copyable facsimiles.

In 2008, the philosopher Matthew Katz proposed two further important theoretical qualifications to the digital-analog debate. First, he distinguished between format and medium. Second, he proposed that the digital-analog distinction often depends on the observer. To illustrate these two amendments, Katz imagined a measuring system that involves a supply of marbles in a large beaker. We can thereby agree to use a "handful" as an approximate unit of measurement in that system. One can imagine a situation in which a beaker contains three handfuls of marbles, for example. Katz's system is analog, even though marbles themselves are a perfectly discrete medium, because it establishes no precise convention to reproduce handfuls. The marble-beaker system violates Haugeland's requirement for positive and reliable standards of reproducibility. My two handfuls might be different from yours because of the difference in the size of our hands. Whereas the medium (marbles) is discrete, the format (handfuls) is analog.

The mechanism of measuring depends on the measurer. It is analog when we cannot accurately perceive approximate quantities. If humans were able to magically discern the exact number of water molecules in a beaker, previously analog systems (such as unmarked beakers) would in effect become digital. Similarly, if humans were endowed with hands of a definite size and volume, handfuls would be counted as discrete and therefore digital quantities. From similar thought experiments, Katz concluded that the physical, perceptual, and cognitive capabilities of users (readers, audience, perceivers) affect the ontological status of the system, a handful of marbles or a work of art.[60]

Katz's seemingly minor amendments to Haugeland entail several radical consequences in practice. The physics of the medium, he reveals, are significant insofar as they are tied to our ability to impose order, to format something. Whether a beaker is full of marbles or water is irrelevant. What matters is our ability to structure the medium into exactly reproducible units. We can do that with marbles by counting. To format water, we would need more precise instruments. Undifferentiated matter like cake is analog only until someone cuts it into pieces. A "piece of cake" is already a format and a unit of measurement. And the technique of cutting is important. The on-

tological status of cake changes depending on the agent doing the cutting. For someone armed with a laser cutter and a microscope, the cake is, on a spectrum, a near perfect digital medium. Alternatively, it is an analog medium for those who eat with their hands.

Our confusion about the dual status of *Myst* resolves when we introduce the distinction between medium and format. *Myst* is digital for those who can access the game's code, to take an obvious example. This binary layer is not normally accessible at the site of the projection. Players cannot access the game's discrete bits, which produce surface images. Players therefore perceive computed scenery as indivisible analog representation. The property of being digital indicates the systematic ability to impose structure. *Myst* is digital for a programmer and analog for the player. The quality of something being digital in that sense separates those able to differentiate from those who apprehend the differentiated structure in the "holistic repleteness of images."[61]

Further, note that from an instrumental point of view, to make something digital, in Katz's final formulation, implies the separation of structure and medium. The painting is wholly analog so long as it remains irreproducible. It becomes digital when the viewer is able to impose structure, by which the visual form is lifted from the medium of canvas. When taken outside their theoretical contexts, the affordances of reproduction—flawless copying and preservation through positive and reliable means—acquire an immediate practical significance. For example, it is important to a librarian that a document is preserved reliably and that it continues to be accessible to the public. By contrast, a copyright holder may be invested in preventing digitization. Reliability and accessibility are thus social, technological, and institutional properties of the medium. They vary by cultural and political contexts.

Once we understand the terms *analog* and *digital* as instrumental properties, which we impose on media from without, we can better perceive their political and not vaguely metaphysical import. Truly digital text can be copied and placed into other hands and minds, feasibly and reliably. The possibility of enacting such procedures is what ultimately gives representation its digital form. Our senses limit our ability to format, to impose structure onto media. We cannot, for example, communicate in the infrared spectrum without proper instrumentation. Our ability to format media, to make it digital, is often limited from without by political means. A classified document, for example, loses some of the necessary digital preconditions. One is literally not allowed to copy it. It has to remain embedded within this particular piece of paper on this particular desk.

Technologies like digital rights management, which limit a reader's ability to copy books, similarly transform digital content into its media-dependent, irreproducible, and ultimately analog forms. Paradoxically, a paper and ink book that places no restrictions on copying and transmediation is, in a sense, a more digital format than a restricted electronic book. Arbitrary restrictions on digital formatting create class distinctions between those with and those without permissions to copy, share, and transform.

The word, already a discrete quantity, comes into digital being as form when coupled loosely to its material contexts. Ontologically, text is by nature a digital format: first, because it represents discrete units of information about the world and, second, because it allows for some measure of flawless copying and preservation. Flawless copying and preservation are in themselves contingent, not essential, properties of writing. Human language operates in the digital mode, then, so long as it continues to participate in the unhindered transmediation of thought—from mind states to voice, from voice to paper, from paper to wire, and then on to other mind states. Without such chains of transmission and transmediation there can be no culture, in the sense that culture constitutes a shared intellectual achievement. I participate in that collective endeavor insofar as I am free to unburden my thoughts from their natural medium, my brain. I speak out loud; I write thoughts down on paper; I pass notes to others.

In the extreme, analog logic entails total censorship. Purely analog thoughts would be ones that could never leave their origins. Media independence in that sense transcends the intellectual confines of an individual. Without digital portability, all representation—art and knowledge—attaches itself irrevocably to untranslatable and irreproducible conditions of their production.

Imagine a world in which ideas forever adhere to their brain-bound media. Imagine also a society that positively prohibits the transmediation of thought, on paper or between brain cells. Envision extreme forms of thought control that restrict fundamental basics of speech and literacy, prohibiting the manufacture of pens, paper, computers, photocopiers, voice recorders, and word processors—language and communication itself. Such prohibitions would amount to total censorship. A radically analog society would also be a radically mute one.

Understanding digitality as a kind of order—a format that arranges matter in certain ways tied to particular affordances of specific devices—recasts the history of computing into something other than simple "mathesis," the idea that computation reduces the world into more discrete and therefore computable elements. That notion would be true if the computer was simply a glorified calculator. But computers are more than that. In practice, they reveal themselves to be self-amending machines for universal transmediation—machines that, depending on the user's acuity and dispensation to access deep structure, separate readers into those for whom texts and images exist as a fixed analog given and those for whom they exist in a fluid form. Digitization implies the ability to impose structure onto the world, a liberty to exchange one symbolic order for another among signs, people, and machines.

THE MEDIUM IS NOT THE MESSAGE

In examining the material conditions of digital representation, we find format—a quality distinct from both medium and content—to emerge as a political construct that governs the physical affordances of communication. We began this chapter with popular intuitions about the essence of digital representation. We end on firmer ground, on which formatting identifies the tactical ability to impose structure onto a medium. Formatting matters because it frames the mode of media apprehension. How the cake is cut also determines how we eat it. To format text without margins, for example, is also to deny marginalia. And to format text in a way that prevents further remediation is to deny the formation of shared culture.

Circumspect critics, like Fish and Golumbia, are rightfully suspicious of unexamined claims about digitization, but for the wrong reasons. Digitization threatens humanity only insofar as it lays claim on the recipient of the message. Paragraphs facilitate understanding by structuring undifferentiated text into units that more closely correspond to our mental ability to retain information. Margins give space to annotation. Conversely, formats can hinder comprehension. A poorly formatted text discourages or prevents critical thought outright.

In his influential essay on the political quality of technological artifacts, Langdon Winner famously argued that in modern times "people are often willing to make drastic changes in the way they live to accord with technological innovation," but at the same time they would "resist similar kinds of changes justified on political grounds."[62] The insight is yet to filter into literary studies. Readers, writers, and critics who would be pained to support laws in favor of censorship or surveillance effectively promote such systems in daily use. The mismatch between political belief and practice comes from the lack of critical engagement with technology, which, as Winner writes, requires "both the study of specific technical systems and their history as well as a thorough grasp of the concepts and controversies of political theory."[63] Winner elucidated this dynamic through the case study of Robert Moses and his twentieth-century highway-building projects in New York. Moses built low overpasses with an eye toward discouraging bus travel, which reflected his social and racial biases. These in effect carried the force of legislation, Winner argued, denying the poor access to public spaces.[64]

Similarly, in our case, claims on a reader's attention can happen through legislation, by social convention, or through specific material affordances—the inability to take notes, for example, or to share books among family and friends. Such technological constraints disproportionately affect those most reliant on informal knowledge networks, which exist outside economies of wealth and prestige. Digitizing the public archive without a thorough understanding of the platforms and technologies involved risks committing the public to an empty and impoverished vision of social knowledge production. Technologies that hinder feasible procedures for reliable copying and preservation create textual artifacts that are less, not more, digital than paper books. They push us toward privatized knowledge economies. To "read" becomes to "purchase temporary reading rights"; to "take notes" becomes to train supervised learning algorithms; personal reading habits, long protected by our libraries, become a matter for bureaucratic control.

Consider the seemingly innocuous decision to distribute scientific literature formatted in the ubiquitous Portable Document Format (PDF). Adobe, the American company responsible for introducing the file format into circulation, describes it as "allow[ing] the faithful, high-quality reproduction of printed matter in electronic form."[65] Text, when transmitted without formatting specifications, loses its shape to some extent. Think about writing an e-mail, for example. What appears to you as lines of a certain width may appear to the recipient in a completely different form. You may have written your e-mail on a large stationary monitor, for example, whereas your recipient reads on a small portable device. Because formatting is not fixed, e-mail programs are able to reflow the lines appropriately. You have in essence delegated the responsibility of formatting the text to the reader's device. Readers are

then free to apprehend it in a manner most convenient for them, tailored to their specific needs, attention spans, geographies, and body types. The downside of having this freedom is that the sender cannot ensure excellence in formatting. The reader's software may render the text poorly or make it outright unreadable.

The PDF solves this problem by guaranteeing that its recipient receives the message exactly as written, without delegating the responsibility of rendering it to the reader. In essence, the format mimics the constraints of a printed page, which similarly preserves the shape of the message during transmission. When writing a letter by hand, you know that your recipient will see what you see, in the same shape and form. But to achieve the effect, the PDF must also limit the document's viewing possibilities. If the sender fixes the width of the page to the standard letter size, the reader would be pained to read such a document on a smaller portable device. The PDF converts digital formats into analog in the name of visual consistency. Strictly speaking, PDF documents do not contain text in the way that an e-mail does. Rather, they contain text like a photograph of a printed page does, as an image. Such constraint is useful for business communication, for example, when writing contracts. The party responsible for drafting a contract wants to know that it will be signed without alteration.

Yet for other purposes, such fixity of formatting is detrimental to communication. Whereas reading paper contracts sent by mail is free, the reading of PDF documents requires specialized software, which may cost money. PDF documents further hinder the copying and preservation of text, the formal prerequisites for digital media. The simple act of taking notes becomes a paid feature of the Adobe Acrobat software. What was gained in a minor (for scholarly communication) convenience of formatting is lost in a major concession to the privatization of public knowledge. We have in effect instituted a document format less flexible than paper. Because copying and preservation are key values for university libraries, the loss of unimpeded copying and preservation should outweigh any gains in purely ornamental stability of document format. This does not mean that we should not use Adobe Acrobat files, only that we must, in all cases, be intellectually invested in the compromises involved.

Technology does not determine literature. Loosely coupled to its material contexts, text continues its relentless drive from matter to idea and onto other matters so long as its passage is not hampered by regimes that prohibit further sharing, remixing, and transmediation. Under certain conditions, in the name of privacy, security, or property rights, it may become necessary to flatten out and to treat text as more of an analog, media-bound modality of communication, limited in its ability to move across minds and cultures. It is also in our broadly human, civic interest to keep such mechanisms of constraint visible to view, under continual scrutiny of critical, close, and closest possible reading.