

## The Suspension of Irreversibility: The Fundamental (and Futile) Task of Media

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NB: Under consideration for publication in *Hardwired Temporalities*, ed. Kyle Stine and Axel Vollmar (Durham: Duke UP). Given as a talk at a conference at McGill University, Montréal, Canada, 2016.

I hope you will permit me to be as elemental as possible. In the company of many who have explored the domain of time-based media, both optical and acoustic, in great depth, I am both humbled to report on my decades-long struggles to understand a few basic concepts and pleased to be doing so in a country with a proud tradition of philosophical-political considerations of time, space, and technology. During this lecture, please keep your seatbelts fastened and your tray tables in the upright and locked position.

We all know what time is, said St. Augustine, until we start to ask what it is, in which case we really have no idea. Such a mixture of self-evidence in the long shot and bafflement in the close-up is not usual in philosophical inquiry. Most things that we know or think we know crumble under closer inspection. Socrates enjoyed terrorizing Athenian notables by demonstrating this fact. We all know that all people are mortal--that point is easy to get. But that I am going to die--that is much harder. Everyone must die; I am not everyone; therefore I am not going to die--this is the sort of warped syllogism that we all live by! We all believe at some level that care should rule our mutual relations, and yet it is impossible to care for everyone in the same way or to the same degree. Nothing separates the universal and the particular like time, death, and love. The more basic the theme, the more the philosophical and existential stakes diverge. I want to explore the media-theoretical and time-critical implications of the facts that we all will die and that we move irreversibly forward through time. Think about it--each of you have been, at some previous time, the exact age of every younger person in this room. A strange thought! We get older only in one direction. This talk is a meditation on the question posed by Sandy Denny, who knows where the time goes?

Let's start with the hypothesis of Karl Ernst von Baer, the nineteenth-century Estonian nobleman and founder of the field of embryology, that there is a correlation between an organism's length of life and its sense of time's passage and duration. In a lecture on, among other things, entomology from 1860--and thus too soon to take on board the Darwinian revolution--von Baer notes the ineradicable human habit of positing ourselves as the measure of time and space and of using our bodily proportions serving as cosmic measurements, with the result that we can never

get big enough to see everything.<sup>1</sup> A second, he conjectures, was originally a heartbeat, and he thinks that our experience is potentially dividable into six to ten events per second, though he renounces the effort to specify the universal minimal interval for sensory experience.<sup>2</sup> Here he picks up a theme beloved of phenomenologists and psychologists: how long is the now?

From this heuristic of sensory allotment--six to ten impressions per heartbeat—von Baer then goes on to consider rabbits and cows. Here the hypothesis gets a little goofy. Since cows have a pulse that is twice as slow, and rabbits twice as fast, their experience must run slower and faster, respectively, than ours. From this he weaves to the general point that any organism's experience of nature is a function of its physiology and lifespan. Thus creatures with different life spans would have a very different physics and astronomy than ours: a person with a thousand-fold acceleration of experience (and thus consequent shortening of life) would live through one phase of the moon; nights would stretch out into seasons enduring almost a year; trees (if in summer) would never lose their leaves and water never grow firm into an icy solid. A person with an even shorter lifespan of 42 minutes would never know that grass and flowers were not everlasting, and the "entire organic world would appear to be lifeless" (262). Von Baer is interested in varying the axis of temporal perception such that our eyes, and especially our ears, could stretch in their powers of discernment. (I needn't tell any of you how resonant his time-lapse and slow-motion fantasy is for the pre-history of cinema.) If our life were short enough--that is, if our perception of fine slices of time were acute enough--we might even be able to hear light, though of course we would no longer be able to hear what we now hear. (He seems to assume that sensory acuity co-varies with temporal perception; he doesn't live in a world like ours, in which music software allows pitch-shifting while holding the time axis invariant.) A universe of vibrations currently inaccessible to us would appear if the temporal structure of our organisms changed: we might see sound, hear heat, or even listen to the music of the spheres as the planets oscillate (263).

Von Baer not only speeds up the elementary unit of perception but also slows it down. What sort of universe would a person live in who had a pulse a thousand times slower than ours--i.e. someone destined to live not 80 but 80,000 years? Von Baer notes that an 80,000 thousand-year

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<sup>1</sup> "Welche Auffassung der lebenden Natur ist die richtige? und wie ist diese Auffassung auf die Entomologie anzuwenden?" (1860), *Reden gehalten in wissenschaftlichen Versammlungen und kleinere Aufsätze vermischten Inhalts* (St. Petersburg: Verlag der Kaiserlichen Hofbuchhandlung H. Schmitzdorff, 1864), 3 vols. Facsimile reprint 2 vols. (New York: Arno, 1978), 1:239-284

<sup>2</sup> He was in tune with the later nineteenth-century interest in the tenth of a second as an interval of perception: see Jimena Canales, *A Tenth of a Second* (Chicago: University of Chicago Press, 2009).

person would barely perceive the shuttling between day and night and might never recognize that it gets completely dark, since an entire year would take place within “31 1/2” heart beats (you have to love the precision). The rumbling bass tones that move the universe along would finally become audible, perhaps like the gravitational waves formed by two black holes colliding, recently heard as a “chirp” in February 2016. In his Principles of Psychology (1890) William James riffs on the time-lapse effects of von Baer’s speculations about the slow-pulse person: “mushrooms and the swifter-growing plants will shoot into creation so rapidly as to appear instantaneous creations; annual shrubs will rise and fall from the earth like restlessly boiling water springs; the motions of animals will be as invisible as are to us the movements of bullets and cannon- balls; the sun will scour through the sky like a meteor . . .”<sup>3</sup>

The punch-line of von Baer’s speculations is that such varieties of temporal experience are not merely hypothetical but probably already exist in the animal kingdom of protozoa and insects, pigeons and bees. Just as there are huge ranges in spatial perception--a microscope can transform a puddle into a universal ocean--so there are radically varying scales of temporal experience. The best standard, says von Baer, is the biggest--everything is always too small. In some ways our knowledge is bound by our temporal mode.

George Eliot (Mary Anne Evans) clearly knew of von Baer as both an acquaintance of one of his most dogged disciples (Herbert Spencer) and as one of the best informed people about German thought in nineteenth-century England. In her masterwork *Middlemarch* (1871-2) she describes the insulation of our self-knowledge as a kind of existential comfort. “If we had a keen vision and feeling of all ordinary human life, it would be like hearing the grass grow and the squirrel’s heart beat, and we should die of that roar which lies on the other side of silence. As it is, the quickest of us walk about well-wadded with stupidity.”<sup>4</sup> In contrast to von Baer’s discontent with our inevitably puny point of view, she found something to commend: sensory dullness saves us from a fatal cosmic roar. Charles Sanders Peirce took the same lesson, that a relatively short lifespan provides us with narrative materials for meaning-making, such as beginnings and endings, and prevents us from the wreckage that infinity would inevitably bring. “If man were immortal he could be perfectly sure of seeing the day when everything in which he trusted should betray his trust, and, in short, of coming eventually to hopeless misery. He would break

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<sup>3</sup> *The Principles of Psychology* (1890; New York: Dover, 1950), 1:639.

<sup>4</sup> *Middlemarch* (1871-2; New York: Penguin, 1994), 194.

down, at last, as every good fortune, as every dynasty, as every civilization does. In place of this we have death.”<sup>5</sup> If we weren’t mortal, the universe might not make sense.

Such embedment in the finite may be a fine thing or it may be making a virtue of a necessity but it definitely makes it hard to get a fix on the historical strangeness of the world that we live in today in comparison with the past. We have a necessarily myopic historical sense. As James said of a human life accelerated into a duration lasting less than an hour, “if born in winter, we should believe in the summer as we now believe in the heats of the Carboniferous era.” A day blurs into a season blurs into an epoch depending on your quotient of mortality. This scale-dependent perception describes our historical near-sightedness quite well. We live within a rare geological moment within a rare geological moment, the upper holocene boundary. A pleasant spell of nice weather, known as the holocene, has enabled civilization as we know it, by providing cooperative natural conditions for settlement, agriculture, and large populations over the past ten thousand or so years. Since around 1800, human population, capacity, wealth and carbon have exploded. From 1900 to 2000, cropland doubled, the human population quadrupled, the pig population went up ninefold, energy use went up sixteen times, and industrial output went up forty times.<sup>6</sup> To von Baer’s 80,000-year person, the industrial era would spring into being almost like a spontaneous creation, and to people born in the middle of it like us, it might seem second nature.

We live in THE moment, the human apex of planetary domination. The fact that we are alive is a tribute to the favorable natural and anthropogenic conditions for the flourishing of large human populations. If you were to roll the dice, chances are you would be born when you were. Somewhere between 5 and 10% of all human beings who have ever lived are alive right now, depending on your estimate of the total number of humans who’ve lived on earth (here I am using 107 billion as a standard estimate). In his novel 2001, which parallels the film, Arthur C. Clarke suggested that there were thirty dead people who had once lived for every person alive: “Behind every man now alive stand thirty ghosts.” He was writing in 1968, when the human population was under 4 billion. If he were writing today when it is about 7.5 billion, he’d have to change it to fifteen ghosts. In five decades, the odds of being born in this moment have doubled.

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<sup>5</sup> Charles Sanders Peirce, “The Doctrine of Chances,” in *Chance, Love, and Logic*, ed. Morris R. Cohen (Lincoln: University of Nebraska Press, 1998), 72.

<sup>6</sup> John R. McNeill, *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (New York: Norton, 2000), 360-361 and passim.

This fact has subtle warping effects on our perceptions. Our lives, our bodies, our minds, our visions of the world have all been shaped by time on a planet when there is a vast herd of domesticated human beings—who weigh, get this, about one third of the total vertebrate matter on earth, the other two thirds being accounted for almost entirely by animals that humans keep in order to eat.<sup>7</sup> Those birds chirping outside, the whales in the sea, the feral dogs of Athens are all only a tiny fraction of vertebrate biomass compared with the anthropocentric part. Never has the planet been arranged like this. To us it seems as natural and eternal as daylight or dandelions would be to a 42-minute human.

Let's try a puzzler. Why is it that when you are sitting in traffic, you feel like you are always in the slowest moving of all the lanes? You feel that way in part because you probably *are* in the slowest moving lane. This perception is not a result of egocentric woe-is-me bias; the odds are that it is highly accurate. (In the famous words, being precedes consciousness.) The slowest lane is the lane with the most cars in it. The odds are that you will be in the lane with the most cars. What you think of as your private perception or a spell of bad luck is in fact the infrastructural fact of your connection to larger populations and conditions than you can perceive. Extraordinary geological conditions profoundly shape our everyday perceptions but our lives are too short to take those conditions as anything but normal. Our moment is both unique in human history, since for only a couple centuries has anything like this been possible, but also widely shared by billions. We have lots of synchronic, but little diachronic solidarity.

Media theory has a mixed mission. Partly, it aims to make the unconscious conscious, to bring out the thisness of a that and the thatness of a this (as Kenneth Burke said). But media theory also aims to defy any strong split of subject and object. Our consciousness converges with our conditions. The frustrated driver in the slow lane's view of the traffic is a function of where they are in it in the same way that our view of history, and even more, our view of the universe is a product of the history of the universe. The anthropic principle, and I am simplifying here, suggests that the conditions necessary to produce an observer predestine the kind of observable universe there could be.<sup>8</sup> What we can know is deeply tied up with the history of the universe we find ourselves observing and in the processes that have produced us as observers. (Those interested in the history of philosophy will note that this argument updates the German idealist claim found especially in Hegel and Schelling that history enables the collusion of subject and object since they are its common progeny.) The only universe in which we could exist, and

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<sup>7</sup> Vaclav Smil, *Harvesting the Biosphere* (Cambridge, MA: MIT Press, 2013).

<sup>8</sup> John D. Barrow, *The Constants of Nature* (New York: Vintage, 2002), chapter 8.

period of the universe in which we could exist, is one that is biased--to invoke the ever-useful term from Harold Innis--in systematic ways. It would have to be old, spread out, and cold, but not too much. It would have to have a certain kind of chemistry, in our case, organic, which presupposes supernovas, the cosmic furnaces that forged by nucleosynthesis every element more complex than hydrogen and helium. The size and scale of the cosmos are in some way complicit or at least correlated with our ability to know them. Or, maybe better put, our minds are shaped by the same conditions that we are trying to observe.

On a cosmic scale, we live in a relatively brief moment in the history of the universe, and a brief corner of its diaspora, in which things stick together, in which houses cohere and trees thrive, on an earth in which matter is ten to the 30<sup>th</sup> times more concentrated than the cosmic average. In the eons, the cosmos will degrade into diffuse boring nothingness, unable to stick together in any way. When the universe is 10 to the 18<sup>th</sup> seconds old, as it is now, a certain kind of knowledge is possible. The entropic cost of observation is not prohibitive. It is possible to discern causal chains. By the time the universe is 10 to 10<sup>7</sup><sup>th</sup> seconds old, it will be out of thermodynamic and cognitive gas: assuming continued expansion (against a possible Big Crunch) each particle will be as far from every other as the current universe is wide.<sup>9</sup> Maybe von Baer should have applied his sliding time scale not to organisms but to the cosmos. If you imagine yourself with a millennial, million- or billion-year heartbeat, you can feel the future pulling the universe apart, and even your body; some of us, indeed, can already feel that. If we lived in a much later era of the universe, the nature of things would have changed enough to require a different kind of knowledge and mode of observation. The physical limits of the knowers are shared in some ways by the physical limits of the things to be known.

I have always been puzzled and fascinated by the link between thermodynamics and intelligence that has been such an important part of our intellectual and technical inheritance since the later nineteenth century. Does order belong to the arrangement of things or to mind? The point of the famous thought experiment of Maxwell's demon was to turn entropy uphill by sorting out gas molecules into fast and slow. Maxwell's demon somehow knew where all the molecules were without exerting any effect on their behavior like some strange etheric deity. Mind was invisible, aloof and yet somehow everywhere without interfering--rather like a parody of the god of mathematicians or of Descartes' thinking substance without extension, a point without

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<sup>9</sup> William Poundstone, The Recursive Universe: Cosmic Complexity and the Limits of Scientific Knowledge (1985; Mineola, NY, 2013), 163.

materiality.<sup>10</sup> The stakes were that this smart but physically non-intervening being could push entropy uphill and thus save the universe from the inevitable “heat death” of universal degradation that so terrorized the later nineteenth century. Clearly there was a cultural element here: the morality of husbanding energy well, masculinity under threat (as it chronically is), the waning coal supply, etc. for worried Victorians.<sup>11</sup>

Quantum physics put an end to the dream of a noninterventional omniscience. Knowledge and the behavior of subatomic particles turned out to be woven from the same fabric. How an electron behaves depends on how we look at it. As John von Neumann said, “An observation is an irreversible process.”<sup>12</sup> The more a system is monitored, the more it is tampered with. You can distort the behavior of a system by watching it—a fact that is not only true in culture, as Stanley Milgram, Michel Foucault and many others have shown, but in nature as well. The particles in the quantum panopticon monitor their monitors. There is no representing without intervening, to quote another Canadian, Ian Hacking.<sup>13</sup> Knowledge is physical. As Norbert Wiener, who must count as one of the great thinkers of hardwired temporality, noted: “In nineteenth century physics, it seemed to cost nothing to get information.”<sup>14</sup> We know now just how expensive information is, both thermodynamically and in a more ordinary sense in our digitally-scraped lives.

I offer an elementary-school joke as a brief interlude in this dense material. The past, the present, and the future walk into a bar. It was tense! Time, of course, is just as mysterious an entity as information. Is it a feature of the subject--time flies while you're having fun, or while your heart beat is faster, as von Baer thought--or of the object--relentless clock time? Is time's arrow, its irreversible flow, just a function of entropy, of the fact that everything in the universe tends to move from a more ordered to a less ordered state? Is time the medium of entropy or its expression, its element or its symptom? Is time's irreversible flow necessary or just highly probable? There is no physical law, in fact, saying that you cannot scoop up the precise same moles of water molecules that your cup just poured into the sea, but the odds are crushingly minute that you will. You could reconstruct the house that burnt down in the fire from its ashes:

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<sup>10</sup> See James Gleick, *The Information: A History, A Theory, A Flood* (New York: Pantheon, 2011), chap. 9.

<sup>11</sup> Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge: Cambridge University Press, 1989).

<sup>12</sup> In Poundstone, *Recursive Universe*, 67.

<sup>13</sup> *Representing and Intervening* (Cambridge: Cambridge University Press, 1983).

<sup>14</sup> *The Human Use of Human Beings: Cybernetics and Society*, 2<sup>nd</sup> ed. (Boston: Houghton Mifflin, 1954), 29.

there is no dictatorial law saying it is impossible, only absurdly slight in probability. Even in the sequence of pi's decimals there is a stretch of six 9s in a row (at the 762<sup>nd</sup> decimal place)—push hard enough in the realm of the irrational and pattern will poke up again. (Genuinely random numbers are one of the rarest substances in the universe.) Maybe tables really do occasionally rise in the air due to fortuitous conjunctions of Brownian motion and maybe time occasionally, in coincidental convergences, lurches backwards or hovers briefly in slight hiccups. Who knows! I don't.

I once wrote of the historical co-emergence of thermodynamics and analog media: “Ironically enough, just as physics was discovering irreversibility media engineered reversibility” but I no longer think it ironic.<sup>15</sup> Time-reversibility in media shows the time-irreversibility of life. The great analog media of time-axis manipulation, phonography and film, showed that optical and acoustic data, once arranged into series, could be sped up, slowed down, or reversed in playback, but they also showed with fresh clarity that some natural processes cannot be reversed. It is remarkable how often cinema and sound-recording pop up in discussions of irreversibility. Wiener, for instance, in the famous opening chapter to *Cybernetics* on Newtonian and Bergsonian time, uses a nice film metaphor. He argues that astronomy is reversible: “The music of the spheres is a palindrome, and the book of astronomy reads the same forward as backward” (31). That is, a film of the planets, played backwards, would be possible according to Newtonian mechanics. “On the other hand, if we were to take a motion-picture photograph of the turbulence of the clouds in a thunderhead and reverse it, it would look altogether wrong. We should see downdrafts where we should expect updrafts, turbulence growing coarser in texture, lightning preceding instead of following the changes of cloud which usually precede it . . .” (32).

A few years later, Karl Popper objected, saying that Newtonian physics also allows irreversible processes, using the example of “a film taken of a large surface of water initially at rest into which a stone is dropped.” The reversed film will show the waves increasing instead of dissipating, flowing in rather than out, and culminating in the sudden appearance of a placid surface. As he drily notes, “This cannot be regarded as a possible classical process.”<sup>16</sup> I have not yet fully sorted out Popper's ideas, but the point seems to be that entropy is not necessary, only highly probable, in keeping with Popper's insistence on an indeterminate universe. Under some highly special or bizarre conditions, a stone might be able to spring out of a turbulent body of water, leaving it completely smooth: it is possible, only extremely improbable. Whatever their

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<sup>15</sup> *The Marvelous Clouds* (Chicago: University of Chicago Press, 2015), 310.

<sup>16</sup> K. R. Popper, “The Arrow of Time” (Letter), *Nature* 177 (17 March 1956): 538.

arguments, film is the sine qua non of their imaginary staging of reversibility. (Perhaps Newton's use of calculus to slice motion into asymptotically small intervals is already cinema avant la lettre, or its mathematical antecedent at least.)

Fortunately for media scholars, we have a robust tradition of theorizing the relationship between entropy and media, time and mortality that goes back to the middle work of Friedrich Kittler. I would nominate his two incandescent texts on time-axis manipulation and lightning and thunder for the media theory hall of fame. The first, "Real Time Analysis, Time Axis Manipulation" (1990), which is thankfully and finally translated into English in this volume, starts with the observation that the alphabet was the first technology of time-axis manipulation. Kittler notes that nature, unlike writing, does not recognize the co-presence of full and empty slots. There are, that is, no yes-no, i.e. discrete, machines in nature--no place-holders, no decimal points or zeroes, no spaces between words. You can rearrange letters along their syntagmatic axis but you can't do that to natural phenomena. "You can certainly reverse the word LEBEN [life] and logically get the word NEBEL [fog], but not life itself, to say nothing of fog itself." (In English we can think of *golf* and *flog* or *live* and *evil*.) His examples are not by chance the core objects of the entropic imagination: life and weather. Life doesn't regenerate itself once it is dead; thunder does not go before lightning. These are one-way events. In discussing Georges Méliès's pioneering 1895 film on the mechanical butcher that shows a sausage turning into a pig, Kittler heralds: "Und die Auferstehung des Fleisches ward Anschauung." Geoffrey Winthrop-Young translates: "Behold the resurrection of the flesh!" This is an admirable solution to translating a phrase that echoes both the Gospel of John and the *chorus mysticus* from Goethe's *Faust*: "the resurrection of the flesh became perception." Unfortunately for Kittler's argument, no such thing occurs in the film, but as usual in Kittler, we shouldn't let the facts get in the way of an interesting idea: where only theology heretofore has dared contemplate such reversibility, now media theory steps forward. In a historically unprecedented way, analog media in the late nineteenth century "made for the first time contingent time-series events recordable." As with writing and the alphabet before, recording media opened up a realm of reversibility and play that is briefly exempt from the relentless grinding of real time.

In a lecture on "Lightning and Series--Event and Thunder" first published in 2003 Kittler continues in his transcendental way. This is one of the most sublime and baffling texts I know--on any subject. In it he tells a tale of three moments in the history of acoustic media: Zeus's thunder in ancient Greece, Father Mersenne's experimental cannonball blasts in the seventeenth century, and modern computers directly playing with the universe of frequencies thanks to Fourier analysis. (Sometimes it sounds as if Kittler has been reading von Baer.) (The single stroke of the event/lightning cannot be perceived by humans due to the slowness of nervous

propagation in our bodies; we have access only to the rumble of the vibrations, the series/thunder that follows. The gods had lightning, but humans had thunder. But modern computation and mathematics bring together extremes that were separated in antiquity. We can't fly like Icarus into the Olympian range where gods read frequencies, but our computers can. Below the sensitivity of our ears lies thunder's frequencies; above the sensitivity of our eyes lies lightning. If what Kittler calls our "filters (eyes and ears, etc.)" could ascend or descend the ladder, they could play with light as we do with sound, with lightning as we do with thunder. (He gushes about the recent sonification of an earthquake in Kobe, Japan.) Any still image of sound such as a spectrogram necessarily implies a temporal dimension, typically on the x-axis. In contrast, many images appear frozen in time. An image does not necessarily require a time-axis (though images can imply one, such as a blurred photograph). To the gods, however, every image would require a time-axis. If our eyes operated at god-like--computer-like--speeds, we'd know that every still visual image is also a slice of time. Pictures only pretend to freeze time for beings with slow sense organs. The old division of spatial image and temporal sound is just a species-specific result of the speed of our sense organs. Other species would see the time in every image or freeze sound into shape. Such a species, for Kittler, is the computer.

Kittler goes theological, or at least proposes "an analytic of finitude" (Foucault): "as nature has consigned us to a finitely broad spectrum in her immeasurable range of frequencies so the old gods consigned us to a finitely long lives in the time domain." Here human sensory limitation and mortality again become the marks of our condition, defined both thermodynamically and media-theoretically. Note the two sentences that begin the lecture.: "Nothing is denied more to us temporal beings than to know time." The second one--the lecture was given to an audience of graduate students--is practical: "When have you read your sources enough to be confident of them?" Starting from a primal ban on human knowledge--note how the set up reflects the Edenic scenario of knowledge the transgression of whose limits would take us dangerously or excitingly into the realm of the gods--Kittler shifts to wondering when we will ever have the confidence to call our studies done. For him, our finitude in perception and knowledge go together with the irreversibility of nature and reversibility of media. As he concludes, with relevance to both any research project as well as to Heisenberg's uncertainty principle, "Every possible choice between being and time comes at the cost of knowledge."

Sybille Krämer astutely sees in time-axis manipulation the very heart of Kittler's thinking. She offers my thesis in a nutshell: "the most basic experience of human existence--and this is relevant because the human is, after all, a physical being--is the irreversibility of the flow of time. Technology is precisely the attempt to ward off (or charm) this irreversibility. In media

technology, time itself becomes one of several variables that can be manipulated.”<sup>17</sup> In life, time goes in one direction only; in media, time can be stretched, compressed, reversed, yo-yoed, in short, edited. With media we can hopscotch through time, but in our bodies, we get one second older every second. Our techniques allow us parallel processing, but we live according to the strict law of serial processing.

Hartmut Winkler brilliantly builds on Kittler and Krämer as well as Bernard Vief to make the point that temporal reversibility in media owes to spatialization. As he puts it in his recent book on processing, “media in general are machines that transcode space into time and time into space.”<sup>18</sup> Time axis manipulation operates by the transposition of sequentially occurring events into spatially ordered symbols, which then can be rearranged without cost. LEBEN becomes NEBEL without danger or expense. What Winkler calls “the geometry of time” occurs this way in alphabetic writing, in magnetic tape, in a vinyl LP, and internet streaming—in short, in any kind of data storage that enables a temporal playback of serially accessible data. Space here serves time. In the first of these, speech, which is a linear stream in time, is projected onto the space of the writing surface with the divisible corpuscles of letters. This is the fundamentally unnatural act of putting place-holders into a linear system. (Nothing is discrete in nature.) This argument is implicit in Kittler, specifically in his praise—which goes further in his grandiose final books on music and mathematics--of the ancient Greeks for having “placed the time of tones into space.”<sup>19</sup> Kittler was thinking of how on a monochord, an ancient instrument, or Odysseus’s bow, you could point to places--like frets on a guitar--that sounded the octave, fifth, and fourth. Here space marks sound. The only way to jump out of real time is to take advantage of space’s ability to transcend time.

Winkler builds on the Brothers Grimm tale about the hedgehog and the hare who challenge each other to a race. The hare, though faster, always loses. The hedgehog has placed a second hedgehog, his wife who looks just like him, at the end of the furrow in which the race is to occur. It takes no time for the doubled hedgehog to get from one end to the other. The hedgehogs taunt

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<sup>17</sup> Sybille Krämer, “The Cultural Techniques of Time Axis Manipulation: On Friedrich Kittler’s Conception of Media,” trans. Geoffrey Winthrop-Young, *Theory, Culture, and Society* 23 (2006): 93-109, 96, trans. slightly modified.

<sup>18</sup> Hartmut Winkler, *Prozessieren: Die dritte, vernachlässigte Medienfunktion* (Munich: Fink, 2015), 12.

<sup>19</sup> FAK, Blitz, 147.

the hare as the latter runs like lightning toward the finish line, “I am already here.”<sup>20</sup> The hedgehog is the principle of simultaneity, or of multiple copies pre-distributed in space, of parallel processing which costs no time, while the hare is the principle of transmission, or of serial processing, which always costs time. (Marisa Leavitt Cohn has shown this acutely well in her work on the Cassini probe.) The work of past time is recorded and available for instant access without the requirement of scrolling in real time. A nice point clinching Winkler’s discussion is buried in a footnote. A crowd is gathered. Two medics and a doctor are working on a man lying on the ground. You ask someone what happened, and the answer comes: he was dead.<sup>21</sup> Making death past tense is the ultimate in time axis manipulation, and Kittler was right to think about resurrection here. To say that someone was dead is not just a grammatical puzzle, but the essence of TAM. No question, save perhaps the incarnation, is more important to Christian theology--or to Kittler’s media theory.

It’s important to note that we can’t actually manipulate real time. Temporal and spatial fixity are not symmetrical. Playback is still new every time. Time is always mercilessly and blessedly disappearing. This is the point about time-axis manipulation being ultimately futile. You can’t record sound; you can record instructions that allow you generate it anew every time in a form that is functionally but never completely identical. Sound as pressure or vibration will always be slightly different in each new instantiation. Kittler quotes Hegel’s “merciless sentence” that sound exists by disappearing or disappears by existing. Recording media don’t hold sound--they hold scripts that inscribe patterns and sounding-devices that perform them, but that called forth sound will dissipate once more. Sound is dissipation--no way around it. Light is too, but we are too dull to know better.

What would intelligent life look like without the ability to alter the material environment? One possibility, I recently proposed, are cetaceans--dolphins, porpoises, and whales, whose aqueous environment and lack of manipulative limbs consigns their intelligence to nonmaterial expression. They live in matter, but cannot mold it. What matter is to dolphins, time is to us. Dolphins lack three-dimensional modeling; we lack four-dimensional modeling. Unlike such smart marine mammals, whose durable engineering is limited to moving mud around on the ocean floor or pulling things around, humans have developed a vast array of durable media,

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<sup>20</sup> “Der Hase und der Igel,” Die Märchen der Brüder Grimm: Vollständige Ausgabe (Augsburg: Goldmann, 1981), 559-61.

<sup>21</sup> Winkler, *Prozessieren*, 237n356. This brilliant chapter is available in English translation at [homepages.uni-paderborn.de/winkler/hase-e.pdf](http://homepages.uni-paderborn.de/winkler/hase-e.pdf)

material moldables into which we can imprint our schemes. Among the greatest of all human technical achievements is the ability to record the data of happenings in spatial form and then spin them back later into real-time. The play-back of course takes time and occurs in time but we cannot, in the end, capture time. There is no material that catches and molds real time. We can only impose symbols serially onto spatially manipulable media. Any time control erodes just as quickly as the dams the dolphins build. We cannot get anything to stick in real time; at best we use symbolic machines to enable reversibility under special conditions. We have to convert time into space to manage it. We can only “write” events on some lasting spatial substrate that play them back with some kind of fidelity. The best we can do is substitute space for time, and firm for fluid matter. We lack any medium of four-dimensional plasticity.

What if we could mold real time? It might sound like bliss to be able to recall our sweetest moments in all their fullness, and have memories as strong as the experience. It also might be a complete hell, if pain would recur again and again in memory as intensely as it took place in experience. (The name for such repetition is trauma, a psychological fact intimately connected with playback technology.<sup>22</sup>) The lack of four-dimensional manipulability is at once a cursed and handsome condition. That we hurtle forth serially in time, irreversibly, means that we are compelled to choose. Irreversibility is actually tied up with conditions of meaningfulness. (This echoes Peirce’s point that death is our guarantee against complete annihilation.)

Everything we do is completely improbable. It is not that our deeds lack meaning but that it is impossible for us to act in anything but a meaningful way. Every act is a choice against infinitesimal odds. Take the act of writing. At the most minimal, take 26 letters plus a space: 27 options are found for every parking spot on the line of writing (a typical keyboard allows more like 90 characters, if you include the shift key, and then there are all the special characters.) Type 56 characters (=27 to the 56<sup>th</sup> power or about 10 to the 80<sup>th</sup>) and you have already surpassed the number of protons in the universe; type 70 characters (about 10 to the 100<sup>th</sup>, that is, a googol) and you are well beyond the highest estimate of how many elementary particles there are in the universe (10 to the 97<sup>th</sup>). Type 2000 characters, around a double-spaced page, and you have “unimaginably” succeeded the size of the universe. This of course is Borges’s Library of Babel.<sup>23</sup> The possibilities multiply no less staggeringly with speech. With 44 phonemes in English, for

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<sup>22</sup> Amit Pinchevski, *Transferred Wounds: Media and the Mediation of Trauma* (New York: Oxford University Press, 2018).

<sup>23</sup> William Goldbloom Bloch, *The Unimaginable Mathematics of Borges’ Library of Babel* (New York: Oxford University Press, 2008).

instance, as soon as you articulate 61 of them you surpass a googol of possibilities. (There is no grammar for action, but the same vastness prevails.) There are so many options, but each choice narrows the next. If you write the letter Q, odds are that the next letter will be a U. We can write *Iraqi* or *QWERTY* and still make sense, but the possibilities for a meaningful choice shrink to a needle's eye the further you go. Thermodynamics says that there are many more ways that things can be chaotic than organized. Muddle has near infinite versions, tidiness only a few. We can't help but be meaningful. The burden we bear is not, as the pop existentialists thought, the universe's lack of meaning, but the inability to stop making sense. Our symbolic machines--spoken, written, optical and acoustic, digital--lift us out of time's flow at the price of being obedient to their rules.<sup>24</sup> We walk through time unconsciously crushed by the barometric pressure of uncountable possibilities. And we can only say, do, see, or hear anything in the moment between past and future. O tempora, O media!

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<sup>24</sup> The guarantee of encryption in non-quantum computing—i.e. the inability to step sideways out of time for hedgehog like parallel calculations-- is the same as the proof of insincerity in interpersonal ties: finitude, that is, the scarcity of time.