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Interruption and Latency: The *Throbber* Against the Fantasies of Real-time

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In almost every type of experience mediated by digital interfaces – loading images and pages from the World Wide Web, updating social media feeds, streaming videos and multimedia content – we can find an animated icon that appears in a perpetual circular movement on itself, which is commonly referred to as the throbber. Unlike a progress bar, the state of processing progress is unknown. In other words, it is unknown when what we are waiting for will eventually arrive. We only know that something is being processed, loaded or downloaded behind the scenes of the interface, in the circuits of the black box that is beyond the screen. For a moment, we are hostage to a machinic temporality. The throbber corresponds, to use an idea from Friedrich Kittler (1986), to a surface effect, that is, to a way of ensuring entertainment – the production of a humanly symbolized reality – given the abstraction of the formal computing processes in the depth. In this sense, the throbber seeks to hide the discontinuities of the system so that, faced with interruption or delay, the users do not abandon the process, allowing their attention to be hypnotically sustained in a kind of media aesthetics of lag (Starosielski, 2015).

From a theoretical mapping of the throbber as media, we propose a particularisation of this element of digital culture, on the one hand, in relation to the cultural images of the notion of real-time associated with the development of cybernetics in the 1960s and, on the other, in relation to the fallacious nature of these images in what will be questioned from the idea of the throbber as an aesthetic zone of affect.

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The empty time that has to be killed is opposed to the full (or well-filled) time of the busy person who, as we say, does not notice time passing — whereas paradoxically, powerlessness, which breaks the relation of immersion in the imminent, makes one conscious of the passage of time, as when waiting.

Pierre Bourdieu[1]

1. An aesthetic instantiation of waiting

The action is interrupted in an indefinite suspension. An animated icon appears in a perpetual circular movement on itself – an infinite loop or ouroboros formalised in pixels. This is a graphic animation that, in digital culture, has been called a *throbber*. Unlike a progress bar, the cyclical movement of the throbber does not indicate the state of progress of the processing. In other words, the users do not know when what they are waiting for will eventually arrive. All they know is that something is being processed, loaded, or unloaded behind the scenes of the interface, in the circuits of the black box beyond what is sent back to them via the screen. There is a suspicion that the system is struggling or saturated, undergoing intensive calculations or complex processing. Or that the network signal is insufficient to power the operation. Ultimately, there are fears that nothing will arrive or that the system will collapse. In the latency between the user's action and the system's response, the desire is interrupted, not cancelled, but intensified. The user's gaze fixes the cyclical wheel in motion to look beyond the screen, virtually contemplating the imminence of the event that is not there yet. For brief moments – or for delays that, due to the impatience they impose, are felt as a boycott – the users are held hostage by the machine's temporality.

> We know not what to do, so we simply wait, putting our trust in the most literal incarnation of *deus ex machina*. The god, we are hoping, will come from the machine. In fact, in these brief moments of helplessness the god is the machine: an omnipotent, invisible, and unknowable entity whose logic and materiality are not entirely clear to us. Despite this abstraction – and perhaps because of it – we are loyal disciples in the church of cyberspace and "on demand" spectatorship. Is buffering a punishment? And if it is, what sin have we committed?[2]

The throbber can be found in almost all kinds of experiences mediated by digital interfaces: when loading images and pages from the World Wide Web

[1] Pierre Bourdieu, *Pascalian Meditations*, trans. Richard Nice (Stanford University Press, 2000), 224.

[2] Neta Alexander, "Rage against the machine: Buffering, Noise, and Perpetual Anxiety in the Age of Connected Viewing", *Cinema Journal*, Vol. 56, No. 2, (2017): 1, https://doi.org/10.1353/cj.2017.0000

(WWW), when waiting for social media feeds to update, streaming videos and multimedia content.[3] If waiting is tormenting and suggests a loss of control to the point where it can become a source of frustration, the throbber has been designed to occupy that interstitial moment between the command and the effect – to shape that temporality – so that the contact with the system is maintained. The world in which the users were immersed a few seconds ago, and which has since been suspended, will reappear. The throbber is the guarantee that the system is doing its best to make this happen, establishing a relationship of trust with the machine and the network. In the end, it will be fine. In this respect, the throbber's main function is to guarantee the fluidity and continuity of operations – the *seamlessness* of the system. Concealing the system's discontinuities is a condition of the interface design so that, faced with interruption or delay, the users do not abandon the process: the throbber hypnotically holds their attention and invites them to enjoy, through the waiting, their apparent passivity.

However, in another sense, the direct correspondence between waiting and passivity is fallacious.[4] "Wait times are the moments of breakdown when we become aware of time in distinct ways. (...) Waiting is defined by the very fact that we notice it. It pulls us into an experience of time in unique ways. It makes us notice duration."[5] The interruption of the planned action – and it is always the break that reveals the *apparatus*[6] – can become a productive opportunity to distance the users from the automatic uses of the system and from what is unthinkingly assumed about its operation. In this sense, the temporality of the

[3] In the context of the materialities and micro-temporalities of media, Winnie Soon has developed a systematic study of the throbber, as well as artistic production around this figure of software culture (See *Executing liveness – An examination of the live dimension of code inter-actions in software (art) practice*. PhD Dissertation, Aarhus University, 2016). Acknowledging the centrality of Soon's research, our essay proposes a particularization of this topic, on the one hand, in relation to the cultural images of the notion of real-time associated with the development of cybernetics in the 1960s and, on the other, in relation to the fallacious nature of these images in what will be questioned from the idea of the throbber as an aesthetic zone of affect.

[4] As Ghassan Hage says in the introduction to a book he edited with various essays on the problem of waiting, "Is waiting an exercise of agency or a lack of it? At the most immediate and superficial level one can rush too quickly to say that waiting is a passive modality of being where people lack agency: things are beyond our control. (...) Yet there are many cases where agency oozes out of waiting. It is not surprising therefore that the question of agency in relation to waiting is a hotbed of ambivalence, a 'passive activity' that emphasizes that it is something we do, though we can also easily see it as 'active passivity' for a slightly different but meaningful take on what is the same mode of being in the world." *Waiting* (Melbourne University Press, 2009), 2. It is in line with this second sense, beyond the simplistic perspective of pure passivity, that, in the final part of this essay, we try to speculate on the throbber as an *aesthetic zone of affect*.

[5] Jason Farman, *Delayed Response – The Art of Waiting from the Ancient to the Instant World* (Yale University Press, 2018), 14

[6] Martin Heidegger paradigmatically elaborates this aspect in the shift from *ready-to-hand* (*zuhandenheit*) to *unready-to-hand* or *present-at-hand* (*vorhandenheit*). See *Being and Time* (Wiley-Blackwell, 1962), 99.

throbber is not just that of wasted time but of a critical temporality that can question the "contemporary rhetoric around the digital age that argues that digital media users have arrived at the promised era of instant connection."[7] This scenario is more a rhetorical imaginary than an empirical reality. Despite the technical evolution of information transmission or processing capacities, bandwidth limitations, for instance, continue to impose discontinuities and latencies in digital interface experiences. "Delay exists in every computer system."[8] And, despite the positive possibilities of existential individuation recognizable in the experience of waiting,[9] the delay in web interfaces seems to be a problem, both for users (frustration) and for digital media companies (revenues). Concerning users, a study on the effect of different types of buffering icons on the perception of waiting time indicates that "web users begin to lose interest in the current task with just 2 seconds of waiting" and "internet video viewers begin to abandon a website if the loading time exceeds 2 seconds, and about half of them abandon it if the loading time reaches 10 seconds."[10] With regard to digital media companies – aware of users' impatience patterns and dependent on a capitalization of attention paradigm – the problem of waiting translates into a loss of users or customers, with a consequent loss of profits.[11] "Latency matters. Amazon found that every 100 milliseconds of latency cost them 1% in sales. Google found that an extra 0.5 seconds in search page generation time dropped traffic by 20%. A broker could lose $4 million in revenues per millisecond if their electronic trading platform is 5 milliseconds behind the competition."[12] As a result, digital media companies allocate large resources to enhancing the speed of their websites. However, despite the financial and technical efforts invested by companies, "the actual waiting time cannot be reduced in many cases due to technical conflicts."[13]

Faced with these limits, the answer to the problem of waiting and latency in media-based experiences will have to be considered not only in technical terms but also in aesthetic terms. Given the impossibility of reducing the objective waiting time, the question is how to mediate and subjectivize the waiting time, in other words, *how to aestheticize the waiting*. This aestheticization can be understood in two senses: first, in terms of what is materially figurative or sensible, what

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[7] Farman, *Delayed Response – The Art of Waiting from the Ancient to the Instant World*, 8

[8] Woojoo Kim and Shuping Xiong, "The Effect of Video Loading Symbol on Waiting Time Perception", Lecture Notes in Computer Science, May 2017, https://doi.org/10.1007/978-3-319-58640-3_9.

[9] See Harold Schweizer, *On Waiting* (Routledge, 2008)

[10] Kim and Xiong, "The Effect of Video Loading Symbol on Waiting Time Perception", 105

[11] See "Attentional Capitalism" in Yves Citton, *The Ecology of Attention*, trans. Barnaby Norman. (Polity Press, 2017).

[12] Todd Hoff, "Latency Is Everywhere and It Costs You Sales—How to Crush It," High Scalability, July 25, 2009, http://highscalability.com/latency-everywhere-and-it-costs-you-sales-how-crush-it.

[13] Kim and Xiong, "The Effect of Video Loading Symbol on Waiting Time Perception", 105

appears during the wait for the system's response – a kind of iconography that digital culture has developed specifically to be seen in moments of interruption, latency and other system dysfunctions; second, in terms of the subjective perception of (true) waiting (time). In any case, both are ways of shaping an experience of waiting that can be more tolerable and, ultimately, more enjoyable. "Perceived waiting time may be more relevant and important than true waiting time." [14] Based on this hypothesis,[15] and in the particular case of media-based experiences, it is decisive how this interstitial moment of interruption is temporally shaped by aesthetic elements that are apprehensible to the users, in other words, by elements designed to capture their attention and manage their impatience.[16] In this respect, buffering icons, such as the throbber, are a kind of a *medium-in-between*[17] conceived to, above all, convey a simple idea: the technical process has been interrupted, but the system has not collapsed, it is still working and, while the latency is processed, it is able to maintain minimal contact with the user, providing feedback.

That was the role of the first buffering icons to appear on the WWW, such as the throbber in NCSA Mosaic[18] (1993) or Netscape Navigator[19] (1994). In the former, we see an animated icon in which the planet Earth rotates on itself connected to two outer poles which, through two channels forming the letter S, feed it with infinite (information) flows. In the second, we see the capital letter N

[14] Fiona Nah, "A study on tolerable waiting time: how long are Web users willing to wait?", *Behaviour & Information Technology*, Volume 23, 2004, 18 https://doi.org/10.1080/01449290410001669914

[15] In *Delayed Response – The Art of Waiting from the Ancient to the Instant World*, Jason Farman substantiates this hypothesis through various examples that form a (non-exhaustive) history of the mediation of waiting. These examples include the placement of mirrors in the waiting areas of New York skyscraper elevators in the 1960s, so that, given the technical impossibility of altering the elevator's performance, people could see themselves and others while they waited; the time indicators in the queues at Disney parks announcing an overestimated time; or the progress bars of software installers being designed to make progress faster at the end. In these and other cases mentioned by Farman, what is at stake are always ways of subjectivizing the waiting time, essentially by shaping attention/distraction, expectation, and gratification.

[16] These aesthetic elements that mediate waiting are not necessarily figurative. In the first computer interfaces, in the 1980s, they could be sounds or simple flashes of light that indicated that the machine was working. See Felix Raczkowski and Mary Shnayien, "History and Aesthetics of Progress Indicators". *Tekniikan Waiheita* 37, no. 3 /2019: 57-67. https://dx.doi.org/10.33355/tw.86775.

[17] In a flat conception, all media – as intermediaries/metaxy, things in the middle, anything that mediates – are *media-in-between*. (See, for instance, John Durham Peters, 'What is Not a Medium?,' communication +1 9, no. 1 (2022): Article 4, https://doi.org/10.7275/epdv-p307.) We have adopted this formulation, in this context, because, in a way, the throbber can be understood as a radicalization of that condition.

[18] See https://www.ncsa.illinois.edu/about/history/

[19] See https://remino.net/bits/throbbing-memories/netscape.gif

above the earth's surface, immersed in an infinite rain of shooting stars.[20] Other famous animated throbbers followed, such as Microsoft's hourglass or the 'spinning beach ball' in black and white on the Linux operating system and in color on Apple. Finally, the shape of the throbber would be standardized and universalized in the circular spinning wheel, moving in a clockwise direction, which, despite a few variations, we see in most of today's digital interfaces. Regardless of this evolution and the variations in the appearance of the throbber, what is common to all of them is the fact that these icons are animated and cyclical (in a loop), creating the effect of a pulse – or a *throb* –, creating the effect of a *life indicator*,[21] a heartbeat which, metaphorically and literally, represents the very life of the machine in the face of the user's indecision.

From here, can we consider the throbber's (aesthetic) specificity? As we mentioned, unlike a progress bar, the throbber doesn't measure progress; it only denotes it. To put it another way, the throbber doesn't translate into measurable information, but, due to its indeterminacy, it translates into a perception effect. This may precisely be its advantage:

> Perhaps adding a loading bar would disrupt the user's attention too much (by allowing a glance away or another momentary tactic) to be permitted by the attention assemblage. If one knew the amount of time to wait, one could leave and do other tasks. A progress bar allows you to slack off or step away. Instead, the sigil eschews even the estimation of an outcome, and the uncertain delay of the throbber tempts the user to keep waiting, as a response could be a moment away.[22]

By being cyclical and indefinite, by being non-metric and non-verbal, by denoting an abstract but affective temporality, the throbber operates in an intensive zone between decision and non-decision, a critical zone that we will call an *aesthetic zone of affect* and which we will elaborate on in the last section of this text. The 'content' of the throbber as a *medium-in-between* is the passage of time itself, appearing as a (temporal) mediator of mediation itself (machinic-time) and of the user's attention (human-time), in a play of sensualities between the inaccessible opacity of the system and the awareness that our experience is being mediated. This is where the throbber's ambivalence lies when it comes to the

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[20] The first web throbbers are symptomatic of a network culture that is testing its conditions of possibility as a media still in formation, an initial phase still based on a certain bricolage, when "slow-loading pages, accompanied by the funky hum of the modem, had their own enigmatic poetics, opening up spaces for experimentation and interpretation. Sometimes this slowness even alerted us to the fact that we were sitting in front of a computer." Evgeny Morozov, "The Death of the Cyberflâneur". *The New York Times* (2012) https://www.nytimes.com/2012/02/05/opinion/sunday/the-death-of-the-cyberflaneur.html

[21] This idea is particularly figurative in the case of the Mosaic throbber, in which we can recognize the configuration of a blood network.

[22] Fenwick McKelvey, "Suffering from Buffering? Affects of Flow Control", in *Internet Daemons - Digital Communications Possessed* (University of Minnesota Press, 2018), 155

system's moments of interruption and latency: waiting is both something that must be eliminated and something that constitutes an opportunity.

2. *More-than-human* materialities of time

From a materialist perspective of media, the throbber corresponds to what Friedrich Kittler, one of its most influential authors, describes as a *surface effect,* that is, a way of ensuring entertainment – the production of a humanly constructed and symbolized reality – after the *post-media* condition. This condition has dissolved all the specificities of the individual and separated channels of technological media into the universal language of the digital. The users no longer understand what truly happens in the depths of the black boxes and abstract processes of the computer processors.[23] This opacity of digital media, which Kittler insists on, signals an ongoing transition, not only in terms of the technical functioning of media but, above all, in terms of its cultural perception in the transition from the 20th to the 21st century. In an almost hyperbolic perspective, or post-historical sense, what is at stake for Kittler is what would correspond to the culmination of the paradigm of inscription systems based on interchangeable patterns, algorithms, codes and signs – *only that which is switchable exists at all*[24] – replacing the old inscription systems (1800), those of the paradigm of literature, of the symbolization of nature, of the human domain of the production of meaning, characteristic of the Enlightenment.[25] In this post-human conception of media, it could be said that these – as devices for selecting, recording, sending, and processing information – are no longer forms of privileged human access to time and space, but are themselves forms of temporalizing and spatializing, beyond the human understanding, what can be extracted from them. From the realm of perception, we have moved on to the realm of the conditions of possibility of experience itself.

Regarding the scope of what we are discussing here, we are particularly interested in the dimension of time. Historically, and determined by the hegemony of writing and the literary culture of interpreting meaning, the cultural understanding of media has tended to reduce them to recording devices or, more specifically, to systems for recording information that prolongs individual and/or collective memory, insofar as it can be consulted later. In other words, media were reduced to a specific fallacy that condemns them to being a mere means for reconstructing history. What we mean by this is that a historiographical

[23] Friedrich Kittler, *Gramophone, Film, Typewriter* (Stanford University Press, 1999), 2

[24] Friedrich Kittler, "Real Time Analysis, Time Axis Manipulation", *Cultural Politics*, Volume 13, Issue 1 (2017): 2, https://doi.org/10.1215/17432197-3755144.

[25] Friedrich Kittler, *Discourse Networks, 1800/1900* (Stanford University Press, 1990), 369.

understanding[26] of *media* as that which "stores" time, and thus makes history, and not so much as that which itself processes time, has dominated.

According to Kittler, the first signs of the crisis of this historiographical model occurred following the revolution of the so-called technological media at the turn of the 19th century into the 20th century. Technological media such as the phonograph, the photographic camera, or the cinematograph made it possible to record events. In other words, unlike written media, which essentially capture and produce the human symbolic, technological media will capture reality itself, the physical and non-subjective processes of nature, including time itself. To that extent, they no longer just give back a human perception of information. They subvert and simulate human perception itself, as well as transforming the very contingent materiality of reality – the temporality of sound or the moving images of the cinematograph – into a code of discrete data that can be manipulated, reversed, accelerated, and decelerated. Wolfgang Ernst, following Kittler's footsteps, describes this turn:

> In the nineteenth century, measuring rather than representational media revealed a world in which the smallest temporal processes played a decisive role in perception without themselves being perceived – a time-related variant of the *petites perceptions* identified by Leibniz. Media technology here lies in acts of measuring, with which the human constitutes an empirical-transcendental object not of self-observation, but rather of the machinic observation of others. The humanities and natural sciences converge not in anthropology but rather in the practices of engineers and mathematicians. [27]

Ernst emphasizes that technological media *reveal* a temporality in the physical processes of the real that cannot be captured by natural human perception. Beyond this, Ernst emphasizes that technological media themselves produce, and operate according to, what we can call a machinic temporality of their own, an *alien temporality* embodied in electrophysical signs, which is not reducible to the study of media from the point of view of the analysis of cultural signs or a general semiotics. It is about recognizing the technological media as temporal beings endowed with a *chronopoetic aesthetics*, something that reveals a "genuine event-like nature of media", with "minimal time processes that represent

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[26] "Media do not emerge independently and outside of specific historical practices. Yet at the same time history is itself a system of meaning that operates across a media-technological abyss of non-meaning that must remain hidden. The insistence on these *media* reference systems, designed as an attack on the reason – or mind-based humanist reference systems – was guided by a deeply anti-humanist rejection of the tradition of the Enlightenment and the established discursive rules of hermeneutic interpretation." Bernhard Siegert, "Cultural techniques: or the end of the intellectual Postwar era in German media theory", *Theory, Culture & Society*, 30(6), 2013, 52

[27] Wolfgang Ernst, *Chronopoetics – The Temporal Being and Operativity of Technological Media* (Rowmand & Littlefield, 2017), 41

a critical and thus decisive criterion of medial operativity itself."[28] After the conception of what Ernst considers *time-critical media*, we can no longer consider a temporality that is only narrative or historical, linear and continuous, when it comes to analyzing media operativity. The temporality that is inscribed and processed by magnetic tapes or computer hard discs is discrete, divided into units that allow reversibility, ellipses, jumps and clicks within their operative architecture. This is the generalized grammatisation and formalization on which the language of the digital is based, in other words, the transformation of the temporal continuum – human, historical, analogue – into spatial discretization, or, to put it more radically, into the spatial discretization of time, which divides everything into minimal units that can therefore be exchanged – that do not have to follow one another – and, above all, are arranged and operated by a logic of cutting and assembly.

Returning to the iconography associated with the throbber, its continuous, apparent linear and regular rotation, always with the same rhythm, contrasts with the non-linearity and discretization or grammatisation of the processes taking place in the black boxes of computer architectures. In a paradoxical effect, the aesthetic dimension of the throbber creates an illusion of *real-time* over what is, in fact, the time of the real that is inscribed in machine processing. As Sybille Krämer points out, analyzing Kittler:

> The so-called 'real time reactions' can only emerge as a consequence of skipping over human perception. Real time analysis does not exist. Every step in computer processing takes time, albeit a span of time that is less than the smallest unit of time that can still be captured by the human senses.[29]

Krämer underlines the discontinuities between experienced human flows and operative machine flows, adding that "while writing makes the things that are already given as a symbolic structure operable as a syntactical linear stream, technological media record, encode and produce the material real itself which is laden with contingency."[30] There is a non-coincidence, or even an incompatibility, between the cultural perception of information flows and their operative functioning constituted by micro-temporalities that are not those of the human scale. In its aesthetic dimension, the throbber is a figure that visually narrativises these gaps in terms of a paradox: on the one hand, it exposes this incompatibility, reveals it by interrupting the user's action and opening up a temporality of indefiniteness; on the other hand, it camouflages this incompatibility by producing an effect of anticipation through which the user's attention is

[28] *Ibid.*, 10.

[29] Sybille Krämer, "The Cultural Techniques of Time Axis Manipulation: On Friedrich Kittler's Conception of Media". *Theory, Culture & Society*, Volume 23 Issue 7 -8, (December 2006), 11

[30] *Ibid.*, 15

maintained. Adapting a formulation by Wendy Chun, the throbber as a medium creates a system of visibility by obfuscating certain structures while revealing others.[31]

3. *Store-and-forward*

"An ideal electrical communications system can be defined as one that permits any person or machine to reliably and instantaneously communicate with any combination of other people or machines, anywhere, anytime, and at zero cost".[32] These words, written by the engineer Paul Baran in 1964, proclaimed a new paradigm for technical communication networks. They appeared in the summary of "On Distributed Networks", one of the papers written by Baran as part of the research project carried out by the United States Department of Defense's RAND Corporation, a project which, faced with the latent threat of the use of the atomic bomb in the context of the Cold War, sought to demonstrate that any centralised network model would be too vulnerable. As an alternative, any network system must be decentralised and, ideally, distributed. As a rhizomatic model – which technically tested the general equivalence, a perfect level of redundancy, between all the nodes/stations in the network, thus overcoming the paradigm of central nodes and peripheral nodes, of main transmitters and secondary receivers – Baran proposed a model that could be generalized to any information transmission system, with profound consequences in terms of conceptions of space and time: it would be a ubiquitous network model and, apparently, based on instantaneity. At least, and in the context of the Cold War and the growing developments in cybernetics, this was the cultural reading of this reticular model: the promise of universal connectivity which, in the meantime, could be fully operationalized by the digital. In this cultural reading, what was at stake was a technological revolution that would acquire eschatological contours, relating to various dimensions, some almost mythologized, about the possibility of the political imagination of universal synchronization – without breaks, from all points of the globe –, a dematerialized economy sustained by instantaneity, that was also universal, in which there would be no physical limits to the human imagination. At the base of these and other promises would always be the same assumption of a continuous flow with possible interruptions or latencies reduced to a minimum or even cancelled out.

However, at a specifically technical level, the scenario was different and, despite what has been said, Paul Baran himself was the first to point this out.

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[31] Wendy Hui Kyong Chun, "On Software, or the Persistence of Visual Knowledge." *Grey Room* 18 (Winter 2004): 28

[32] Paul Baran, "On Distributed Communications. XI. Summary Overview." *NSA Archive*, 1964. https://nsarchive.gwu.edu/media/22942/ocr

Instead of instantaneity or the idea of continuous flow, what was at stake in the distributed network model was precisely an operating architecture of discontinuities. Baran's model depended on what, together with Donald Davies, was technically developed as packet-switching and which consisted of a method for grouping data into packets which, between the initial sender and the final receiver, fragmented the information and distributed it through different sub-channels, passing through different nodes before reaching the final recipient, without a linear sequence. This model implied, therefore, that any message transmitted would not be sent directly, in its entirety, from point A to point B, but, as it passed through different stations, it would be fragmented and stored (micro)temporally in each of the stations (store-and-forward), thus being received, buffered, queued and retransmitted, according to the variable latencies and traffic capacity of the network channels. Almost paradoxically, this was the best technical solution to ensure greater transmission speed. But, at the same time, it was this same logic that, due to the fragmentation imposed, meant that at each mediation node/station, the flow of information was irremediably interrupted.

> What was novel about Baran's design was its combination of digitisation, packets, and variable paths, which enabled a message to be fragmented into strictly delineated components that are redundant, that can each take its own path, and that can arrive in an arbitrary sequence. The basis of this process was its introduction of constant interruptions.[33]

In short, Baran's model of distributed networks, despite the time that separates us from it, is still symptomatic of the fact that, against the fantasy of the immediacy of information transmission, there is, in truth, *no direct communication.* Any flow is discontinuous to the extent that it is fragmented and processed – mediated – by each of the network's stations, which in turn implies micro-interruptions in terms of buffering processes that translate into non-coincidences, delays, latencies, and intervals between what is being sent, processed, sent back, and finally received.[34] Returning to the framework of media theory, we find here another of its basic premises: if there is mediation – and there is nothing that does not involve it – there is nothing that we can consider immediate.

Paul Baran was perfectly aware of this. As he writes about the distributed network model, "we are beginning to understand, or at least to appreciate, the cause of time delays and overloading phenomena in communication systems handling

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[33] Florian Sprenger, *The Politics of Micro-Decisions: Edward Snowden, Net Neutrality, and the Architectures of the Internet*. (meson press, 2015), 85 – 86

[34] "The network structure of today's communication channels and of their information stream is often understood as providing a direct connection between users and services or between two communication partners, even though there cannot be any direct connections on digital networks. The metaphor of the flow conceals the fact that, technically, what is taking place is quite the opposite. There is no stream in digital networks." *Ibid.*, 88 – 89.

competing users with different levels of importance."[35] What needed to be resolved was becoming clear: the reticular system, despite operating on a store-and-forward logic, had to be perceived as a continuous real-time system. Baran emphasizes this distinction between how the system works and how it is perceived by the user.

> We shall explore the possibilities of building a 'real- time' data transmission system using store-and-forward techniques. The high data rates of the future carry us into a hybrid zone between store-and-forward and circuit switching. (...) But, the network user who has called up a 'virtual connection' to an end station and has transmitted messages across the United States in a fraction of a second might also view the system as a black box providing an apparent circuit connection across the country.[36]

Following on from this, any reticular model could only be seen as a quasi-real-time system, as Baran himself recognises. In this sense, there is no such thing as direct communication, either in the early days of the Internet, when Baran was writing, or in today's digital networks. However, it could also be said that the fantasy of effective *real-time* has taken hold as the technical and political imaginary of the West,[37] an imaginary that is intertwined with the narratives of globalization based on the idealization of a synchronous, continuous, uninterrupted, and universal temporality of information networks, a temporality that could demonstrate that machines are interruptible, just like the symbolic and material flows they convey. It is this stable temporality without contingencies that, ideally, must be presented to the users, that must capture their attention, even if the discontinuities are happening in the background, as happens when the throbber's spinning wheel appears on an interface, or, to put it another way, even if the category of 'real-time' is a relative, rather than absolute, characterisation of temporality.

4. Fantasies of *real-time*

In the operative language of computer engineering or reticular architectures, we often find the expression real-time to describe the effective time over which an information process or event takes place. This "real-time" is predefined in each system by temporal constraints that must define the system's response time, according to operating principles in which certain actions are already predefined as events. Beyond the technical specificities that go beyond the scope of the approach presented here, this is a notion that understands that, on the one hand, computer operations are supported by feedback machines whose response speed

[35] Paul Baran, "On Distributed Communications. XI. Summary Overview"

[36] *Ibid.*

[37] In this regard, see the opening part of Ronald Reagan's 1988 speech at Moscow State University on the "technological revolution": https://www.youtube.com/watch?v=1lutYGxMWeA&t=381s

is largely based on action-reaction automatisms and, on the other hand, that there will be a machine temporality, internal and at the level of computer processing, which does not coincide with the user's so-called temporality and which, moreover, is not completely accessible to them. The notion of real-time concerns the duration of computer processing rather than the time experienced by the user. In any case, the notion of real-time has acquired, above all, a more cultural than technical understanding:

> Real-time operating systems transform the computer from a pre-programmed machine run by human operators in batch-mode to 'alive' personal machines, which respond to users' commands. Real time content, stock quotes, breaking news and streaming video similarly transform personal computers into personal *media* machines. What is real is what unfolds in real time. (...) Real-time is never real time – it is deferred and mediated.[38]

In a culture of speed[39] and "time-space compression"[40], in which the proclaimed instantaneity and immediacy of the networks are under discussion, [41] the suspended and undecided temporality of the throbber emphasizes that the imaginary of a real-time system is more of a cultural promise – or fantasy – than a technical reality.[42] Despite the so-called quantitative discretization of machinic time, the image of a universally distributed speed is still permeated by all types of disruptions and latencies that expose the intensive nature of mediated processes. Faced with cultural projections such as a "real-time Web in which every tweet and status update is instantaneously indexed, updated and responded to"[43] or a hypothetical "paradigm of total coherence in which events are instantly known to all agents in a network"[44], the throbber, despite its omnipresence, is a paradoxical digital object in the sense that it represents a rupture in the supposed

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[38] Wendy Hui Kyong Chun, "Crisis, Crisis, Crisis, or Sovereignty and Networks" *Theory, Culture & Society* Vol. 28(6), 2011, 96 – 98. In the case of the throbber, what is at stake in the mediation of time is what Winnie Soon describes as follows: "The viewer is not watching the content as data arrives, instead, the viewer is watching the processed data that has arrived and stored in the buffer. This process of temporal storage and playback gives us an understanding of the relation between buffer and streams, in which there is latency between data arrival (from the network), data storage (within internal memory) and data processing (inside a machine) at micro-time intervals." Winnie Soon, "Throbber: Executing Micro-temporal Streams", *Computational Culture* 7 (October, 2019)

[39] Paul Virilio, *Speed and Politics*, trans. Mark Polizzotti (Semiotext(e), 1986)

[40] David Harvey, *The Condition of Postmodernity* (Blackwell, 1991).

[41] John Tomlinson, *The Culture of Speed: The Coming of Immediacy* (Sage, 2007).

[42] Or even, according to Virilio, in terms of a tyranny of real-time.: "Real-time is not very different from classical tyranny, because it tends to destroy the reflection of the citizen in favor of a reflex action." *Politics of the Very Worst* (Semiotext(e), 1999), 87.

[43] Evgeny Morozov. "The Death of the Cyberflâneur".

[44] Jack Self, "Beyond the self", in *Superhumanity: Design of the Self* (E-flux Architecture/University of Minnesota Press, 2016), 249

instantaneity. The throbber will not combine with the narratives of chronotopia[45] or the digital sublime[46], utopian narratives that seek to realize the "promise of the internet to annihilate time and space by being fast enough to put the whole world in instant contact"[47]. It also does not sit well with the imperatives of performance, acceleration, optimization, and productivity, or the "growth of high-frequency or algorithmic trading that depends on near-zero latency."[48] The presence of the throbber, even if inconspicuous under the habit of its generalization, is the surreptitious mark that the hypothesis of the real-time network is, after all, a fallacious narrative, and that there are "asynchronous mismatches, or misalignments, between the space of our bodies and the infinite atopic fluidity of the digital world"[49]. Ultimately, it is about the impossibility of an ideal functionality or, more specifically, it is about the recognition that the myth of universally distributed speed is not without all kinds of fractures and contradictions.

Strictly speaking, every user is familiar with the experience of buffering, which means that waiting persists and is still part of the current Internet experience. This is caused by both the media processing conditions and the different geographic and socioeconomic conditions of users. The network is not neutral, contrary to the narratives that claim that it is fully decentralized and horizontal. "Infrastructures are not simply tools or means of production. They are political because at their level micro-decisions are made about who can communicate and who cannot, what can be transmitted and what cannot, who is connected and who is kept apart."[50] Against the idea of the universalism of network distribution, it can be considered that, technically, not all geographies have the same coverage, that, politically, there are different ways of controlling and monitoring traffic, or that, socio-economically, not everyone has the same ability to access the fastest commercial packages.

In Paul Virilio's political reading of *dromology*, speed is inseparable from inequality, and the categorization of the less fast is essential for the affirmation of the fastest. In the end, speed functions as a new type of class[51]. Jonathan Crary radicalizes this idea when he writes: "One of the superficial but piercing truisms

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[45] "The fundamental correlation between speed and utopia that is manifest in the 'social imaginary' of popular contemporary business literature broadly centred on cyberspace and the particular social imaginary of the chronotopia found in cyber society." John Armitage & Joanne Roberts, "Chronotopia", in *Living with Cyberspace: Technology and Society in the 21st Century,* edited by J. Armitage & J. Roberts, 43 - 56 (Continuum, 2002).

[46] See Vincent Mosco, *The Digital Sublime: Myth, Power, and Cyberspace* (The MIT Press, 2004)

[47] McKelvey, "Suffering from Buffering? Affects of Flow Control", 141

[48] *Ibid.*, 140

[49] Self, "Beyond the self", 249

[50] Sprenger, *The Politics of Micro-Decisions: Edward Snowden, Net Neutrality, and the Architectures of the Internet*, 76

[51] Virilio, *Speed & Politics*, 33

about class society is that the rich never have to wait, and this feeds the desire to emulate wherever possible this particular privilege of the elite."[52] Virilio's and Crary's positions are certainly symptomatic of a critical politics of time. But at the same time, they reflect a certain polarization, perhaps simplistic, between the fast and the slow classes, as well as a certain *abstraction* of time and space ("as we know it") that "unintentionally join the chorus of marketers and multi-national corporations who want us all to believe that the world is speeding up."[53] Alternatively, the complexification of this polarization can be done through a critical perspective of time that comprehends, as Sarah Sharma insists, "an uneven multiplicity of temporalities that is complicated by the labor arrangements, cultural practices, technological environments, and social spaces that respond to this so-called globalized, speedy world."[54] From this perspective, the notion of temporality does not coincide with the transcendent notion of time that can be homogeneously universalized. It is a question of assuming that various temporalities co-exist at once, relationally and asymmetrically, being *calibrated* – synchronized or desynchronized – by factors external to individuals, but which, at the same time, are lived temporalities with their nuances and particularities. A critical perspective on time should, therefore, more than simply opposing speed to slowness, seek temporal awareness in the contingency of those multiple forms of time calibration or, in other words, point to ways of becoming temporally attuned to the specific conditions of a given (mediated) experience.[55]

As we suggested before, waiting draws attention to itself, configuring a particular temporality. "Waiting forces time to be visible, as loosely stitched and seemingly inefficient. We are able to see the cultural assumptions around what our society assumes to be good or wasteful uses of time."[56] The throbber, as a temporal fracture, appears as a subversive and anti-operative instance. As a moment of

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[52] Jonathan Crary, *24/7 - Late Capitalism and the Ends of Sleep* (Verso, 2013), 124.

[53] Sarah Sharma, "Critical Time". *Communication and Critical/Cultural Studies*, 10:2-3, 312-318, 2013, https://doi.org/10.1080/14791420.2013.812600

[54] Sarah Sharma, *In the Meantime – Temporality and Cultural Politics* (Duke University Press, 2014), 9. Never detaching the multiplicity of specific temporalities from inequitable relations in social, economic, and geographical terms, the examples given by Sarah Sharma, to complexify the polarization of speed and slowness, sometimes invert the dominant assumptions of speed theory. For example, the privileged classes will not only have the advantage of not waiting (health care, for example), but also, if they wish, have the advantage of waiting, either in popular trends such as slow-food, which Sharma elaborates on, or because, in other contexts, they are not pressurized by economic and financial constraints.

[55] "It is to experience ourselves as capably and sensitively attuned to our fast-moving environment and so as existentially flexible, responsive and resilient." Tomlinson, *The Culture of Speed: The Coming of Immediacy*, 159.

[56] Farman, *Delayed Response – The Art of Waiting from the Ancient to the Instant World*, 187. This passage can be complemented by another that appears before it: "An embrace of the moments when waiting becomes visible can remind us not of the time we are losing but of the ways we can demystify the mythology of instantaneous culture and ever-accelerating paces of 'real-time'", 75

hesitation, a privileged space is created for feared uselessness. If, to quote Yves Citton, "our current socio-political regimes do not grant us *the time of waiting*, the time of *anticipation* – which is the time in which our attention is formed"[57], the interruption shaped by the throbber represents the opportunity for a *meta-attentional engagement or reflection*, a certain "oscillation between immersion and critique"[58], in other words, an oscillation between the immersion that captures us and the awareness of the conditions from which that immersion arises. For Citton, that is a moment of subjectivation or individuation of attention. In the correlation between waiting, anticipation, and attention, the throbber corresponds to a time of exception, a time that configures what Bergson calls *la durée*, a type of temporality that resists measurement and that corresponds to an intensive magnitude, not extensive, that resists the reduction of time to a homogeneous medium.[59] This kind of intensive temporality has a strong relation with what Bergson also calls *attention*: "a suspension of normal motor activity which in itself allows other 'planes' of reality to be perceivable (an opening up to the world beyond utilitarian interests)".[60] The throbber, despite being generalized and tending to be trivialized, can appear as an *aesthetic zone of affect*, in the sense of an instantiation which, due to its sensitive appearance, corresponds, to use an expression by Brian Massumi, to a particular *moment of intensity*.[61] Rather than translating into codification – verbal or technical, for example – this moment of impasse during which the user's attention is aesthetically affected corresponds to a friction that establishes an indeterminacy that disturbs the planned action. If the category of real-time is, after all, a contingent characterisation of mediated temporality, the aesthetic zone of affect is an expression of that contingency.

Against the invisibility of the medium – and its optimised functionality – the instances of inaccessibility and breakdown of digital interfaces, such as the throbber, challenge their supposed seamlessness to expose the conditional human and non-human assemblages within which interactions are possible. Nicole Starosielski refers to this aspect in terms of an *aesthetics of lag*, that is, an experience through which "media consumers come into contact with the infrastructure."[62] This kind of aesthetic experience, or affect provoked by the idea of delay, implies in itself a possible visceral, emotional, and even physical reaction of deceleration

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[57] Citton, *The Ecology of Attention*, 178

[58] *Ibid.* 163

[59] See Henri Bergson, *Matter and Memory* (Zone Books, 1991)

[60] Henri Bergson, *Ibid.*, *apud.* Simon O'Sullivan, "The Aesthetics of Affect" *ANGELAKI – Journal of the Theoretical Humanities*, volume 6, number 3, December 2001, 127

[61] Brian Massumi, "The Autonomy of Affect", in *Deleuze: A Critical Reader*, edited by P. Patton. (Blackwell, 1996)

[62] Nicole Starosielski, "Fixed Flow – Undersea Cables as Media Infrastructure", in *Signal Traffic: Critical Studies of Media Infrastructures*, edited by L. Parks & N. Starosielski (University of Illinois Press, 2015), 62.

that eventually confronts users with the seams and the bricolage of the networks themselves.[63]

As an aesthetic zone of affect, the *chronopoetics* of the throbber compels users to focus on what typically escapes their attention during the automatic use of media – namely, the very processes of mediation, not just the content, that shape their experience. As an interruption, the throbber signals that if everything were immediate, action itself would become impossible.

> If everything were to be immediately connected to everything else, our potential courses of action would radically change – and certainly not in our favour. For if immediate communication were the case, all decisions would already be made in advance, there would be neither a time nor a place for interruptions, and thus there would be no way to change communication itself. [64]

Instead of hoping to eliminate waiting – or mediation – we can recognize its aesthetic and operative, rather than inoperative, potential. It is through waiting that liberating deviations and temporalities with alternative rhythms to the demands of acceleration and speed can arise. Additionally, it is through waiting that we can reimagine our condition as believers, networked in a general *erotica* that compulsively puts us in touch with absences and latent needs to be fulfilled or with a future that we anticipate but which is not yet available to us. Producing desire to produce more desire.[65] Or, as Wendy Chun (2016) asserts, making dissatisfaction the driving force behind a search that is self-sufficient, regardless of what is discovered – *always searching, never finding*.[66]

The throbber's pixelated wheel continues to spin, feeding itself and projecting us into an economy of hope that, while keeping us in the expectation that *the best is yet to come*,[67] challenges us to embrace the significance of waiting—not as a means to reach a point in the future, but simply for what it is.

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[63] *Ibid.*, 61

[64] Sprenger, *The Politics of Micro-Decisions: Edward Snowden, Net Neutrality, and the Architectures of the Internet*, 75

[65] "The network initially corresponds to the idea that everything is connected and, as such, is the product of a belief system. (...) But reality can never correspond to this belief system, because, in fact, not everything is connected – the network exists primarily as a state of desire." Tung-Hui Hu, *A Prehistory of the Cloud*, (The MIT Press, 2015), 10

[66] Wendy Hui Kyong Chun, "Always Searching, Never Finding - Habitual Connections, or Network Maps: Belatedly Too Early", in *Updating to Remain the Same - Habitual New Media* (The MIT Press, 2016).

[67] This is an expression we have appropriated from a net.art piece, of the same name, by Italian writer, artist and designer Silvio Lorusso about the throbber. https://silviolorusso.com/thebestisyettocome/

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