5. Infrastructuring Leap Seconds: The Regime of Temporal Plurality in Digitally Networked Media

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Abstract

The chapter pursues the hypothesis that the plurality of time in an age of digital interconnectivity imposes itself as a time regime to human and nonhuman entities. By looking at user practices, conventions of time measurement, and temporal operations of digital technologies it is argued that an infrastructural/infrastructuring process consists of the continuous weaving of a relational assemblage between different temporalities, which does not harmonize them, but makes them relevant to each other in their heterogeneity. Thus, the time regime of digitally networked media does not consist of the power constellation of an absolute, "true," measurable time, but of a fundamental plurality, which becomes visible on the basis of invisible processes and by that challenges all practices of temporal ordering.

Keywords: time regime, time measurement, temporal ordering, interfacing, practices, leap second

"Enjoy the moments of your life." With this slogan, the video app Leap Second promises to keep a special kind of diary: App users are invited to create one-second videos, select the best second for each day, and compile the individual seconds of the day into video diaries. This way they are able to review the days of a month or a whole year in seconds, and finally share these quotidian, yet outstanding moments of their lives via social media. On Instagram the app is advertised with small example videos: In seconds, outdoor and indoor shots alternate, slower and more eventful

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images, landscapes and portraits; shots of people toasting to each other at dinner are replaced by video snaps from an airplane; streets and houses abruptly change to shots of a workplace at home. The videos present a colorful and varied mixture of lived time.[1]

I would like to follow up this example with observations on three aspects that will interest me in the following chapter. First, the one-second videos refer to the *relativity of human perception of time*. The "second-days" seem to take different lengths. The moving image to which they are compiled appears homogeneous and clocked, but at the same time discontinuous, depending on the very different processes and situations in the individual videos, such as movement, actors, sound, color, light, and weather conditions. The homogeneous timing results from the technical settings of the app: The moments of the day are fitted into the almost imperceptibly fast succession of 100 centiseconds. In relation to the discontinuous moving images, the second appears as a reliable, inexorable, even absolute measure of a technically clocked time that forms and orders human perception of time.

But the app's name, Leap Second, probably quite unintentionally, indicates that such a dichotomous juxtaposition does not meet in any way the socio-technical and infrastructured temporalities under the conditions of digitally networked media. This is my second observation: the leap second is a phenomenon that not only emphasizes the meaning of a second, but also reveals the *relativity of all systems of chronology and time measurement*. As I will explain in more detail below, the pluralization of time measurement systems, which inevitably goes hand in hand with this relativity, becomes particularly precarious under the digital condition of temporality.

Thirdly, as Leap Second shows, all this has to do with the *temporality of infrastructures* and the *infrastructures of temporality*. The visual interface of the app bundles disparate and diverse processes of an ordering reference to temporality. The videos refer to natural time cycles, in which people are involved, when they picture the change from day to night or from season to season. The seconds (or centiseconds), on the other hand, refer to the socio-technical timing of clock time. Below these visible processes, however, the fabrication of different temporalities takes place on an infrastructural level, on the basis of micro-temporal and time-critical software processes.[2] Beyond the displayed encounters of temporalities, an "inter-facing" between human users and nonhuman software and hardware components is taking place.[3]

An interfacing in this sense is less a spatial and temporal intersection, less a fixed thing in between than a process that fabricates the togetherness

of disparate entities, or precisely: the being together "in time" (and "in permanence") of entities, each with its own proper time. This infrastructural and infrastructuring process consists of the continuous weaving of a relational assemblage between disparate entities and their different temporalities, which does not harmonize them, but makes them relevant to each other in their heterogeneity and plurality, in the first place.[4] Apps such as Leap Second thus indicate a problem which they equally offer to solve.

With these preliminary considerations in mind, I would like to pursue the following questions: How are human, natural, and technical temporalities confronted with each other under the condition of digital technologies? And how are they becoming identifiable and problematic for each other in a processual temporality of infrastructuring? I pursue the hypothesis that the plurality of time in an age of digital interconnectivity imposes itself as a time regime to human and nonhuman entities. It is not only human and social temporalities that are plural. We can find a similar plurality in all orders of measured time. In a first step I would like to look at the plurality of digitally conditioned temporality from the perspective of user practices.

Demands of Digitally Infrastructured Temporalities and Resistant Tactics

In his critical reckoning with the early utopias of the net culture in *Zero Comments*, Geert Lovink sketches a differentiated picture of so-called "Internet time." On the one hand, he states, there are the practices of internet users who ideally behave "indifferent to time," when they spend time online or rather surrender themselves to the "luxury to get lost" and losing time as "data dandies" strolling through the net, contradicting all imperatives of effectiveness. On the other hand, Lovink observes the work processes of the IT industry, whose cooperation extends to different time zones. Global cooperation shows most clearly that there is "no simple synthesis of the local with the global."[5] An "enhanced global time awareness" is necessary, "an awareness of other times."[6] Lovink proposes to examine the requirement or even the demand to be confronted with a plurality of different times under the condition of digitally networked work as "time regimes under which today's Internet user are actually operating."[7] This temporal plurality not only arises in the cooperation across time zones and in the spatiotemporal delimitation of work, which the internet makes

possible and demands, but is also evident in the everyday practices of digital networking:

> The online session is perhaps the best time unit to express what time on the Internet could look like. Think of more sessions happening simultaneously, such as chatting, talking on Skype, surfing MySpace, watching videos, following blog links, reading and answering incoming e-mails, and conducting a search. When you are online all the time (with a DSL broadband Internet connection), it is the bundle of these never-ending sessions that defines the Internet experience.[8]

Lovink believes, in 2008, that digitally networked time can be limited to time units of being online. Digital time in this perspective is confined to a temporal refugium of the internet in which different proceedings run simultaneously but are separated from the "offline-world." However, he designs the scenario of "never-ending sessions," which is more appropriate for the current situation, because the technological condition of digital interconnectivity allows users to be online all the time.

It is exactly this state that current countermeasures of various "digital detox" movements want to deal with. "Participants gain insight into personal lifestyle techniques and practices that keep them grounded and connected even in the most stressed, overwhelming and technologically driven times," says the invitation of a digital detox organization, which has dedicated itself to the goal of (re)establishing some sort of balance in the digital age and offers device-free events, workshops, and retreats in nature, with the slogan "Disconnect to Reconnect." A recreational holiday at a California camp promises, according to its rules, a withdrawal on several levels: "No Digital Technology—No Networking—No Phones, Internet or Screens—No Work-Talk—No Clocks—No Boss—No Stress—No Anxiety—No Fomo (fear of missing out)."[9]

It is striking how much the digital detox movement refers to temporal aspects in its diagnosis of the current situation: We suffer from the compulsion to have to respond *immediately* to messages, to *constantly* check the input of new messages; we have to keep pace with the *speed of* networked communication *without finding time* to draw breath. The plurality of constant, simultaneous, and far-too-fast processes is, according to these diagnoses, a characteristic of a new time regime of digitally networked media. There is no doubt that digital detox does not offer the prospect of a renunciation and definitive liberation from a digitally networked life. Disconnection is carried out for the purpose of better reconnecting afterwards. The temporary

voluntary exclusion from a networked community follows the logic of permanent connectivity and affirms it, as Urs Stäheli has shown.[10] "Digital detox" aims at the formation of subjects who can better adapt themselves to the demands of a "hardwired time" of digital networks and meet them in a self-regulatory way.

The same can be seen in the advice literature on self- and time-management. Typical here is the recommended way of dealing with the synchronous and asynchronous forms of communication that characterize a digitally networked workplace and that time management literature wants to optimize. This is where the plurality of diverse temporalities becomes apparent—especially in the description of badly handling emails and instructions for a correct way to do so. The time management literature suggests strategies for getting a grip on the "flood of e-mails" that characterizes every workplace. "Why am I not able to work because of all these e-mails?" A first answer to this question comes from a time-management guide using the Microsoft Office Outlook mail and calendar program, which argues for protecting the worker's proper time: "Don't be distracted all the time. Answer consciously and deliberately, instead of always reacting immediately to every message."[11]

The educational program of time-management literature is not about a complete correction of a work situation characterized by too many temporally diverging and accelerated processes, disturbances, and interruptions, but about a better adaptation of the working subject to new technological (work) environments. The addressing of the subject is neoliberal and governmental: the aim that the subject voluntarily concerns itself with a safeguarding of proper relaxation and recovery times, which guarantee a better integration into a technological-economic power constellation. The supposed resistance strategies of digital detox and time-management are rather strategies of regulation, which refer to a techno-environmental condition without being able or wanting to change it. But how is the "ecology" of these practices to be characterized,[12] the environment of human and nonhuman, natural and technological procedures that surround the practices and are regulated to govern subjects or enable self-government? What processes and constellations of power are inscribed in the regime of plurality? What are the conditions of possibility for the regime of plurality?

To determine this more precisely, a software developer is assumed whose practices of digitally networked collaboration across time zones could be directed by self-governmental regulation, such as digital detox or time management. In the course of a working day, when she not only writes the code for a new application, she communicates with designers, customers,

fellow developers, and hardware companies scattered around the planet in different time zones. She not only has her own physical temporality and energy phases to consider, as Lovink cites an observer of working in the IT outsourcing industry, the "diurnal cycle of the human animal,"[13] but also has to develop an increased awareness of the temporalities of her colleagues. The plurality of time is also conveyed by the parallel processes of synchronous and asynchronous processes of analogue and digital working communication through email, video chat, letter post, inhouse messaging, memo, meetings or telephone calls, in which different analogue and digitally networked devices (computers, smartphones, tablets, watches) are included. Finally, temporal plurality is conveyed to her in the practices of programming, which have to be oriented toward the different simultaneous processes of the computer.

The multiplicity of time is not necessarily tied to digitally networked media and could also be described from the sociological perspective of Barbara Adams, who sees a variety of other times included in the shaping of social time, "a multitude of times which interpenetrate and permeate our daily lives," including memories, anticipations, travel, and mobile working hours, as well as weather conditions and temporalities of the involved media.[14] This multiplicity confronts the software developer just as it did an accountant around 1900. But I want to argue, following Lovink's observations, that under the condition of digitally networked media the plurality of time becomes a time regime on which regulating strategies of the adaptation of subjects orientate themselves, because of a specific relationship of visibility and invisibility that characterizes the temporal ordering of human subjects confronted with the temporalities of digital infrastructures. This means that digital time cannot be realized at all as a liberation from the dictate of time measurement, as imagined in visions of "network time."[15] Instead, social temporalities are structured and challenged by the (micro-)temporalities of digital infrastructures. Additionally, there can just as little be a new standard time established that tames this plurality of time. The plurality of time cannot be suspended.

We are dealing with a specific form of (in)visibility of plural space-time systems: The time regime of digitally networked media consists in a visibility of different spatiotemporal orders that run simultaneously but independently of each other and that are perceptible for human users in processes of interfacing. This visibility, which is by no means limited to visuality and thus to graphical user interfaces, is conditioned and made possible by the constitutive invisibility of digital processes that take place in discontinuous pulsing below the threshold of human perception

and thus evoke the impression of "real time" without identifying the synchronization and coordination necessary for producing visibility and continuity.[16] In digital processes, the transmission time of a time signal that connects two independently running space-time systems is (for human observers) imperceptibly short. This is precisely the basis of the universal time fictions from the early internet era. For example, Swatch has for some time pursued the goal of establishing a globally uniform time order measured in beats. But the time regime of the digital does not consist of a standard time.

Digital interconnectivity brings independently running time orders into a relationship of mutual visibility and disturbability. In this way, the relativity and contingency of any time system become recognizable. The time regime of digitally networked media does not consist of the power constellation of an absolute, "true," measurable time,[17] but of a fundamental plurality, which becomes visible on the basis of invisible processes and by that challenges all practices of temporal ordering and synchronization. In this sense, the time of digital media is not characterized by a multiplicity of time, which enables new creative developments, but by a time regime that requires an increased sensitivity for the relativity and plurality of time.

Our imagined software developer, based in Vienna, who works under the condition of digital networked working environments, knows that for her colleague in Australia, with whom she is having a Skype call, different space-time conditions prevail than for herself. Daytime and season are completely different. But the imperceptible processes enabled and conditioned by the infrastructures of digital networks are what make this other time visible and audible on her device in a process of interfacing, a space-time system that appears simultaneous to her own spatio-temporality, but nevertheless is perceptibly different. This demands a temporal plurality from her and challenges her to adapt her practices—perhaps when her meeting is in the morning of Sydney local time and she has to fight tiredness because for her it is 11 p.m. Simultaneous temporal orders are no longer independent of each other under the condition of digital interconnectivity, but become visible and relevant to each other. The relativity and contingency of temporal orders become apparent, the locally and diurnally different observations and experiences of time. As will still be seen, this applies not only to human perceptions of time and practices of temporal order, but also to the technical processes of digital connectivity. However, it is fundamental that relativity and contingency are inscribed in every measurement of time. I will further explore this point using the example of the measurement of the second in the next step of my argumentation.

The Measurement of the Second and the Fleeting Stability of Time Orders

Social time orders in the form of clocks, work plans, and calendars form time regimes that demand self-regulating adaptation of subjects to economic structures.[18] However, the clock is not a once and for all stable technical timepiece that regulates the social realm, a determining, inanimate time technique that threatens and destroys living, subjective times. Rather, each time measurement is based on a "technicity" in the sense of Gilbert Simondon as the "degree of the object's concretization,"[19] which stabilizes a spatiotemporal coordination of socio-technical collectives, but also constantly keeps them open for restructuring and, despite an increasing precision of technical time measurement and standardization, can only establish a temporarily stable structure.[20] The fact that the continuous restructuring of time regimes is taking place on the basis of a changing technological condition becomes particularly clear in the current debate on the leap second.

Since 1972, an additional second has been inserted at irregular intervals into the Coordinated Universal Time (UTC) to compensate for fluctuations and a gradual slowdown in the earth's rotation. Due to its relation to the sun's position, UTC is still regarded as "natural" and "appropriate" for living beings on earth. Measured on the basis of atomic clocks, UTC is slowed down by the leap second in such a way that it never deviates by more than 0.9 seconds from a time measurement oriented at the position of the sun, the rotation of the earth, or the orbit of the earth. This deviation is determined by the International Earth Rotation and Reference System Service by constant observation or measurement. The service then decides whether the day is one second longer at the end of June or December, i.e., a 61st second—23h 59m 60s—is inserted into the UTC at the end of the day. Without the irregular insertion of leap seconds, according to a fear of the unpredictable development of the difference between the Earth's rotation and atomic clocks, the deviation could be four hours in 2000 years. Even further in the future, the clocks might indicate noon when it is in the middle of the night.[21]

It is important to recognize that the leap second problem has arisen only from timekeeping practices that are part of a continuous restructuring of clock time and its basal unit of measurement, the second. The leap second is a metastable remnant that results in a "supersaturation" of the current standard time system and requires its restructuring.[22] The leap second thus arises in the course of a technicity of measured time, which inscribes into each time regime an openness to restructuring: With the beginning

of time measurement by atomic clocks, the "power/knowledge" regime of clock time, the political and institutional competence shifts as well as the expertise between astronomy and atom physics.[23] A decisive aspect of this shift is the refinement and stabilization of time measurement by atomic clocks. From the mid-1950s onwards, the physical determination of time by measuring the transitions between levels of the atom's ground state was a new way of separating the temporal order from planetary constellations. Until 1956, the second was determined by the Earth's rotation around its own axis, i.e., as a fraction of the mean solar day, and was then replaced by the ephemeris second, which is oriented at the Earth's orbit around the sun and which was considered to be more stable, then. Quite in contrast to the irregularities of astronomical time measurement, the period duration of an electromagnetic radiation absorption or emission in the transitions in the ground states of an atom, proves to be—at least in principle—constant. Physicists in the middle of the twentieth century, using the cesium atom, determined the length of a second that remains valid until today, defined by the Bureau International des Poids et Mesures (BIPM): "The effect of this definition is that the second is equal to the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the unperturbed ground state of the ^{133}Cs atom."[24]

The new precision of time measurement entails some consequential problems because the accuracy of the measurement makes it obvious that every time measurement is relative and situational. In the atomic age of time measurement the irregularities of universal world time become visible: not only the relativity of time, but also the irregularities of each time measurement that is oriented at the position of the sun, the rotation of the earth, or the orbit of the earth. Basically, inaccuracy also applies to atomic time measurement. However, the determination of the second, which is nevertheless accurate to microseconds, can show that the mean solar day of the astronomically calculated UT1 (the current equivalent of Greenwich Mean Time) is 2 milliseconds longer than the day calculated from atomic seconds: it comprises 86,400.002 instead of exactly 86,400 seconds. The atomic clock thus becomes a (temporarily) more stable and precise clock only in comparison with other clocks, which can represent the course of time less constantly. This difference between the atomic and astronomical time scales, visible in the precision of atomic time, gives rise to the UTC regime and, with it, the need to introduce leap seconds that keep this difference within a tolerance range in practices of continuous balancing. In favor of a uniform time order, the leap second prevents two time scales from drifting apart, but at the same time it inscribes a discontinuity into this uniform time order, which

in the case of digital networking is clearly recognizable as a problematic uncertainty. As a sign of its technicity, the leap second keeps universal time open and changeable. Its potential to interconnect the macro-cosmological environment of the astronomical and the micro-cosmological environment of atomic time measurement can thus only temporarily lead to a stable order of time. A stability that, under the condition of digitally networked media, is currently about to turn into instability. While the leap second has guaranteed a coordination with, or adaptation of, socio-technical to planetary-organic processes for more than 40 years, thus enabling a collective of human and nonhuman entities to be together "in time," it now fails in the confrontation with digital media and processes that are not only time-dependent, but time-critical.[25] A restructuring of the time regime of a universal world time is necessary, which in the interaction of political, economic, and scientific interests will probably find a new, but just as temporary answer to this problem. In the third step of this chapter I will argue, that the plurality of time not only challenges social practices of time ordering but also digital devices and systems.

Leaping Seconds and Digital Interconnectivity

The plurality of the now coexisting different orders of time measurement is particularly visible in the problems of networked computer systems. One of the oldest internet protocols was developed by David L. Mills, who calls himself an "Internet timekeeper."[26] To this day, the so-called Network Time Protocol is used and ensures clock synchronization on the internet. It is based on the coordinated world time and inserts leap seconds. The Network Time Protocol is part of the decentralized power structures of the internet as described by Alexander Galloway.[27] It can be described as a kind of time management guide for digital devices because it allows computers to cope with the requirement of time plurality.

The protocol provides for a tree-like structuring from servers to clients, based on computer servers whose clocks are synchronized via precise atomic clocks. These in turn can be used as a reference for the coordinated world time. When a leap second is introduced, the time elapsing according to the Network Time Protocol is frozen for one second. Immediately after the introduction of the leap second, the system clock continues to run as if nothing had happened. It "forgets" the introduction of the leap second as well as the introduction of all previous leap seconds. Each new leap second generates a new time scale and thus pluralizes internet time successively.

There are as many Network Time Protocol time scales as leap seconds historically introduced since 1972; therefore, each time the system's past is accessed, the time scale must change and the corresponding leap seconds must be subtracted again.[28] The discontinuity of the coordinated world time thus multiplies in the historical course of the internet time based on the Network Time Protocol, which adapts to UTC again and again.[29] The question arises as to what happens to computer processes within the "paused time" of the leap second, whether the processuality of computational time, which is based on discontinuities and caesuras,[30] but is nevertheless constantly ongoing, can be stopped at all for one second. This is hard to imagine for complex, digitally networked systems, according to the argumentation of developers of the company Google:

> Very large-scale distributed systems, like ours, demand that time be well-synchronized and expect that time always moves forwards. Computers traditionally accommodate leap seconds by setting their clock backwards by one second at the very end of the day. But this "repeated" second can be a problem. For example, what happens to write operations that happen during that second? Does email that comes in during that second get stored correctly? What about all the unforeseen problems that may come up with the massive number of systems and servers that we run? Our systems are engineered for data integrity, and some will refuse to work if their time is sufficiently "wrong." We saw some of our clustered systems stop accepting work on a small scale during the leap second in 2005, and while it didn't affect the site or any of our data, we wanted to fix such issues once and for all.[31]

The solution for Google is to "smear" the leap second: an adjustment by milliseconds over a day. But would it not be desirable to abolish the leap second and move on to a continuous time measurement that completely detaches itself from the sun as the central timer? This question has been increasingly discussed since the beginning of the 2000s. As a trigger, an increased time sensitivity due to the (feared) "Millennium Bug" of numerous computer systems is very likely. The camp of supporters is growing steadily. In view of the changing technological conditions, a collective of authors that brings together the physical, astronomical, and geopolitical expertise of different institutions concludes that we should not hesitate to establish a binding time system that adapts to the modern technologies and needs of accurate time measurement in space travel, satellite navigation, metrology, telecommunications, and synchronization of networked computers.[32]

The fact that the International Telecommunication Union took up the debate and examined the feasibility of a continuous time scale at the World Radiocommunication Conference in 2015 is a clear signal for the shift in the time regime resulting from the current technological condition. Judah Levine, of the US National Institute of Standards and Technology (NIST), clearly voted as early as 2013 to refrain from inserting leap seconds in the future. Keeping the difference between coordinated world time and astronomically measured time as small as possible is too high a price to pay, given the massive difficulties that leap seconds entail for digitally networked systems:

> The problems of time-ordering, causality and the ambiguity of time intervals in the vicinity of a leap second are not easily remedied because they arise in a fundamental way from the interaction of the binary representation used for time stamps and the occurrence of a positive leap second. During a leap-second correction, the time servers operated by NIST will receive approximately 150 000 time requests when the time transmitted by the server is 23:59:59, and the increasing number of financial transactions that depend on millisecond-level timing are sure to be affected.[33]

However, no decision was made at the 2015 World Radiocommunication Conference. The evaluation of further studies and the consideration of a new time order were postponed until 2023. The abolition of the leap second could be identified as a subjection to a "regime of technology," as a "harder hardwiring" of temporality, that now dominates all natural and social processes; as an overhand gain of techno-economic processes that sets the pace and the need for precision for a binding world time. A world time without leap seconds—would that be an order of time that makes a (planetary, organic) outside of technological processes irrelevant? A closer look at the ecology of the leap second, its integration into a network of atomic, planetary, organic, social, and technological relations, has shown, however, that this description would be too short-sighted. In a final step I would now like to specify my thesis of temporal plurality.

The Time Regime of Plurality

What the perception of different temporalities in (work-)processes of global interconnectivity makes just as clear as the drifting apart of astronomical

and atomic orders of time, is the fundamental relativity of each regularity of time. Influenced by the theory of relativity, which he received as a "new theory" in 1920, Alfred North Whitehead already clearly summed up this fact at the beginning of the twentieth century in his natural philosophic work *Concepts of Nature* and warned against a confusion:

> According to the new theory, there are an indefinite number of discordant time-series and an indefinite number of distinct spaces. Any correlated pair, a time-system and a space-system, will do in which to fit our description of the Universe. We find that under given conditions our measurements are necessarily made in some one pair which together form our natural measure-system. The difficulty as to discordant time-systems is partly solved by distinguishing between what I call the creative advance of nature, which is not properly serial at all, and any one time-series. We habitually muddle together this creative advance, which we experience and know as the perpetual transition of nature into novelty, with the single-time series which we naturally employ for measurement.[34]

If one avoids this misunderstanding and distinguishes between process—as the term Whitehead uses in his major work *Process and Reality*, instead of "creative advance of nature"[35]—and (measured) time, one can thus doubt that two observers mean the same thing when they determine space and time from their own perspectives. Each measurement of time must therefore produce a different order of time. If one assumes, with Whitehead, that space and time (in the measurable sense) are only possibilities to express certain truths about the relations between constantly becoming entities within the basic process of all existing things, but that there are numerous truths corresponding to the numerous space-time systems, time orders such as clock time or coordinated world time must be particularly powerful and momentous orders that are temporarily capable of forming regular time regimes, time regimes that combine chronopolitical with geopolitical interests and form and sustain cultural or social sequences and practices.[366]

However, the technicity of time measurement, which becomes recognizable by the leap second, introduces time as a fundamental process of becoming and passing into every order of time and prevents its complete fixation. It thus focuses on the condition of power relations and normalization processes of a unified temporal order. Each practice of time ordering is to be viewed in the context of its "ecology of practices"[377] and develops its own truth there, which is always only one within a plurality of other "true" time orders taking place in parallel, which this practice must blank out and from which it must

detach itself in order to justify itself as "true." A critique of power in the sense of a "cosmopolitan politics" has to return the practices of time measurement to their situational interdependencies of human and nonhuman processes and their mutual dependencies, relations and affiliations.[388] Those who want to secure access to time "in itself" through operations of measurement must make productive what Whitehead characterizes as a misunderstanding: the identification of time as a temporal regularity that is temporarily stabilized, and time as a fundamental processuality that permeates every stabilization. The implementation of a standard time with a universal claim can thus be described as a gesture of power, as a power/knowledge regime in the sense of Michel Foucault, which helps a temporal order to gain hegemony and which—as in the case of clock time and its standardization in a universal world time since the end of the nineteenth century—represents the condition for a normalization and naturalization of this one possibility of temporal order, detached from its situational contexts of measurement. This procedure is, however, supported by the socio-technical production of a measuring and abstracting-calculating access to time itself, which changes on the basis of the changing technological condition, but which must suppress this change in favor of a universalization of time. "Physicists feel weak and they protect themselves with the weapons of power, equating their practice with claims of rational universality."[39]

Digital infrastructures provide a constellation in which the relativity of temporal regularity becomes visible and the assertion of an identity between time order and "natural" time "in itself" is no longer a necessary argument for establishing a binding standard time. The coupling of power and truth is replaced by a combination of power and neoliberal economic expediency that knows about its contingency. The abolition of the leap second and the introduction of a universal time running constantly over atomic seconds would not be a final solution, not an order of time that would be adequate for a digital temporality once and for all, but only a temporary stabilization, another time regime that has emerged from an ecology of atomic physics, astronomy, and IT practices and that differs from previous regimes (e.g., Greenwich Mean Time) by a clear reference to the relativity of time and to the plurality of possible time measurements. However, the debate about the leap second shows a circumstance that is of highest relevance for the investigation of a temporality of infrastructures: The temporal processes in systems of digital data transmission do not take place in a refugium that completely excludes them from their cosmological environment—the radiation emissions of the cesium atom or the gravitational fields and rotations of the earth. Rather, digital processes are part of this environment,

they are infiltrated into it, shape and alter it, and determine the orders of time that can temporarily stabilize on its basis.[400] In a time of digital interconnectivity, temporality is conditioned by a technologically shaped environment, by a media ecology from which users, technical objects, and data networks emerge with their respective orders of time, by a web of relations that runs through and crosses every socio-technical order of time.

The discrete processuality of digital infrastructures as a condition of possibility for the simulation of perceptible digital objects justifies speaking of a specificity of a digital time that characterizes our present condition through digitally networked media that permeate all areas of life. This characteristic is insufficiently captured with a reference to the multiplicity of digital time. For the description of an experiencability of manifold inherent times—of the user, the device, the software, the network—all of which are related to one another and perceived as a multi-temporal web, leaves open why this should be new or special under the condition of the digital. The differentiation of a time of digital interconnectivity within the fundamental plurality of time, according to my thesis, lies in a specific visibility of or disturbability by the plurality of time at the level of technical operations und user practices. The digital process causes the perceptible appearance of a symbolized time, i.e., the perceptibility of images, sounds, or text elements on displays, in a way that is imperceptible to human beings, and thus undermines the difference in their spatial-temporal orders by the speed of digital processing undermining the perceptible low-frequency range. However, this happens without cancelling the difference of spatiotemporal orders. It is rather reduced to an imperceptibly small "in-between." Thus, time orders are confronted with each other that would otherwise run independently of and undisturbed by each other.

The time of digital networks thus does not multiply the temporalities themselves but the constellations in which different times are confronted with each other. A webcam image during a Skype call shows a different spatiotemporal situation, but it shows (simulates) it here and now as simultaneous and relevant to the practices of the user viewing it. This becoming visible for each other—or better: the becoming relevant of different time orders—takes place on the level of not only human perceptibility but also the infrastructure: the manifold hardware and software processes and system times. The relevance of temporal plurality is particularly apparent in the change of uniform time orders, such as the coordinated world time, or in the coordination of human and technical proper times. The confrontation with the plurality of different temporalities does not lead to a (harmonious) temporal fabric. Rather, the plurality of time under the condition of digitally

networked media requires a constant sensitivity to the relativity of time and results in an increased necessity for coordination or (re-)ordering. This can be seen in the debate about the leap second as well as in the possibilities of the records of lifetime as promised by the app Leap Second. The diversity of time, visible in its manifold confluence, becomes a regime of plurality that constantly challenges the practices of ordering time anew.

Notes

1. See Jon Andersen @leapsecond, Instagram, https://www.instagram.com/leapsecond/?hl=de, October 22, 2019.
2. Wolfgang Ernst, *Chronopoetics: The Temporal Being and Operativity of Technological Media*, trans. Anthony Enns (London and New York: Rowman & Littlefield, 2016).
3. Alexander Galloway, *The Interface Effect* (Cambridge and Malden, MA: Polity Press, 2012).
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