On the Politics of Chrono-Design: Capture, Time and the Interface

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Despite commercial promise of instant connectivity, the internet remains a heterochronic assemblage. 'Excessive' browser rendering times, connection dropouts, a lack of mobile coverage and buffer overload are regular perturbations that still characterize, even in a banal way, the everyday experiences of distributed networking. Between a user's expectations at the interface, and how information is processed, queued and technically resolved across globally dispersed communication infrastructures, there exists an intractable experiential lag or gap. This can often be subtly sensed through the 'doubled future-present' of anticipation and tedium while waiting for something to load and become usable, a waiting period most recognizably compensated by "visually present rotating, animated cogs and steadily progressing blue and green lines" (Munster, 2013: 19). The spinning wheels, loading bars and 'throbbers' we regularly encounter are important cultural icons for how time is treated and managed today; taken critically, such whirling animations provide us with a "space for understanding how the *now* is being made operative" (Soon, 2017: 100). Beyond the interface lies a vast domain of automated decision-making infrastructure – an array of systems geared for queuing, error-checking, routing and packet switching procedures – or, in the historical and political sense of Alexander Galloway (2004), protocological power. Grasping how experience is modulated through the temporalities of these systems, we argue, is essential for understanding how processes of individuation are enabled or hindered by interface design, especially in the coordination of cognitive and affective intensities that bring end-user populations to bay.

User experience design (UX) is an interdisciplinary field of practice that tackles these challenges by mediating between signals, signs, behavior and cognition. Progress bars and throbbers, in this respect, are part of a much wider array of techniques and technologies for tempering the materialities of information. Between inputting a URL into a browser and the appearance of content, when a data packet is sent to initiate the first connection with a given server until the last byte is read from the client's TCP buffer and interpreted by the browser, a series of *zeitkritische* or time-critical (Ernst, 2013) mechanisms are triggered and executed. Designing for user experience requires a hypervigilant stance toward how these micro-temporal events and cascading forces unfold. A tenet of the commercial literature on performance optimization, for instance, claims the average time to capture the attention and activity of an end-user is around three seconds (Hogan, 2015), a measure that roughly corresponds with what William James famously discussed in the *Principles of Psychology* [1890] as the 'specious present,' or the punctuate duration of *nowness*. After this point, conversion rates drop due to excessive loading times as shifts occur in the 'mental context' of the user; for instance, as people start daydreaming or simply abandon a task for a new browser tab or application. While James would describe the specious present as a kind of 'saddle-back' or vessel "on which we sit perched, and from which we look in two directions into time" (2014: 12), we might today more accurately think of a closed contraption, a cybernetic trap to suspend or captivate the wandering mind.

There are diverse metrics to assist with handling temporal performance for end-users. Conversions, for example, typically refer to measureable events facilitated by key performance indicators within a scripted or planned funnel of interaction. The goal of performance optimization is to monitor the rates of conversion by effectively mediating the gaps between the database, interface and user. This can be achieved by stimulating interactions, events and affects in order to maintain a context for informational productivity, essentially reducing the possibilities for depreciated engagement or slack. For designers and developers engaged with user experience, the affordances of network delays, the technicity of the browser and capacity of monitoring patterns of

behavior become increasingly important means for the pursuit of efficiencies. This often means dealing with temporal processes that contain diverse, overlapping and asynchronous firings. It is crucial to recognize, in this respect, the extent to which the web no longer consists simply of documents or pages, but following the AJAX paradigm ('asynchronous JavaScript and XML'), applications that continually respond to input and work through interrelated scripts, style-sheets and markup. In their geographically dispersed operations, these applications do not resolve into a uniform, mechanical rhythm, but propagate a fluctuating momentum based on highly dispersed 'data-pours' that support larger trends toward platformization (Helmond, 2015). The instabilities and dynamism of these technical processes, therefore, have notable political economic consequences, and these impact on forms of cultural production and social interactions as these complex ensembles are shaped by interface design and related forms of technical cunning.

In what follows, we consider how temporal indeterminacy, incompleteness and contingency are handled by an array of techniques and technologies we call *chrono-design*. In particular, we focus on time deferral and latency: the interim through which specific causal relations vanish beyond a horizon of legibility and intelligibility as a potential yet to be fulfilled. We conceive of this interim as a 'transactive' space or logistical zone where divergent temporal regimes collide, drift and co-ordinate, yielding time differentials that are measured and weighed against one another. Here, the browser becomes a conjugation device where micro-temporal regimes of network signals are coupled with phenomenal renderings on screen and the actions of 'direct manipulation' from users. Taking these dynamic relations into account, we address how network delays, stoppages and arrivals are technically resolved with the algorithmic operations of the browser; how user experience design grapples with this resolution through an array of specialized techniques; and how these temporal reconfigurations finally give way to new entanglements of power.

One ambition of this piece is to extend proposals for *interface criticism* (Anderson and Pold, 2011) and *interface critique* (Hadler and Haupt, 2016) to consider a set of conceptual concerns and empirical practices that relate to micro-temporal machine processing, where information is not yet

fully composed, but operationally active in fulfilling the *promise* of a sensory address. While recent interdisciplinary work on software interfaces has emphasized how latency is a widespread problem that is compensated for by programmers and engineers (Ash, 2015; Bucher, 2012; Mackenzie, 2002), a key aspect of our account is to understand how specific design techniques are enacted to pursue the captivation and valorization of attention by delivering inattention or 'nonknowledge' to end-users, and how this, in turn, relies on unique forms of cunning and subterfuge.

Recent work by N. Katherine Hayles (2014; 2016a; 2016b) on cognitive assemblages assists in developing our argument, particularly her notion of 'nonconscious cognition' as a kind of thinking that occurs beyond human consciousness. Taking into consideration research in cognitive science and neuroscience, she draws attention to subtle modes of decision-making that might not be fully appreciated or apprehended within classic philosophical and critical categories of thought. These include processes of accelerated pattern recognition, the synthesis of sensory inputs, and the capacity to draw inferences to promote certain kinds of behavior, among others. Hayles' ultimate aim is to gain a more complete view of cognitive ecology applicable to 'nonhuman cognizers' such as animals, plants and complex technological systems. In this article, we advance an analogous framework that also draws on related work by Mark B. N. Hansen (2012; 2015) to focus on how web-based user experience design engages with time and the political economy of profiling. This emphasis allows us to explore how conceptions of a self-deliberative actor are complicated by accelerated cognitive assemblages in terms of power, time and design. Here, we are especially interested in foregrounding a series of tools and methods used to manage the web as a complex logistical domain of transaction at high speed. This is a kind of diagnostic interfacing with nonconscious cognition that allows for experiences of instantaneity to be staged for the end-user, while importantly still enacting modes of decision-making and exchange that evade conscious detection. We reflect on these dynamics of planning and timing within cognitive assemblages through concepts of *traps*, *captivation* and *capture*, and demonstrate how these techniques and

technologies might be repurposed to pursue new forms of critical inquiry into the micro-temporalities of digital infrastructure.

Tertium Quid: Zones of Transaction

As a central influence in the shaping of contemporary software interfaces, user experience design holds suggestive insights for any theory of cognitive assemblages. As we will discuss, interfaces *conduct cognition* by channeling *tertium quid* – an in-between of subterranean communication, of parasitic relations in the terms of Michel Serres (1982) or design-as-trapping as theorized by Vilém Flusser (1999). With efforts to optimize performance also comes novel opportunities to shape end-user behaviors. Such techniques indeed resemble a mode of control that targets cognitive and perceptual limits by engaging with affect, memory and 'not yet experienced' (Parisi and Goodman, 2011). Performance optimization, in particular, works with preindividual intensities and technical incompleteness in ways that undo any easy conception of the user as an autonomous subject. Hayles' proposition for an expanded ecology of cognition calls out for considerations of such revised conceptions of power and politics, particularly as they manifest themselves through the complexities of trapping human behavior at the intersections of information exchange.[1]

A sustained theme in software studies has been to problematize any notion that user interfaces yield characteristic forms of critical, introspective and reflexive knowledge. There are accounts of how interfaces continually simulate revelatory insight and cognitive mapping in "an invisible system of visibility" (Chun, 2011: 22), or the "unworkable" conditions introduced by interfaces for hermeneutics more generally (Galloway, 2012). Consumer devices like the Apple iPad have been obvious targets of scrutiny as inaccessible, opaque systems (Emerson, 2015); such black-boxed devices are linked to design paradigms that advocate transparency through the foreclosure of the system's technical programmability and its site of execution. In doing so, they

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[1] Within the limits of this article, we can only gesture to connections with concepts like noopolitics (Lazzarato 2006), neuropower (Hauptmann and Neidich 2010) and psychopolitics (Han 2017).

essentially confuse, as artist and theorist Olia Lialina (2015) observes, *Erfahrung* with *Erlebnis*. That is, rather than experiences embedded in symbolic forms of life, they deliver us disintegrated impressions at speed. Users are typically taken in existential terms by these regimes, marking a shift from an interpretative episteme of deep subjectivity to the 'surface metaphors' of an *affective dispositif* (Angerer, 2014). Indeed, this shift can be formally observed as increasingly ubiquitious computational infrastructures hold an intricate, engineered depth based on layering and nesting schema (Cramer and Fuller, 2008), while end-user interfaces are increasingly based on post-skeuomorphic regimes of 'flatness.'

While upsetting convention modes of critical thinking, the interface has nevertheless become a central device for pervasive labor to such a degree that scrutinizing its historical constitution and operations is something of an urgent task. Tracing a lineage from fluid dynamics to the design of aircraft cockpits and cybernetics, Branden Hookway (2014) has provided a useful genealogy that considers how various philosophies of play, politics and technology that depend on a conceptual conceit of partitioning are thrown into question by the machinations of human-machine control. His study of thresholds and liminality, of relations that simultaneously separate and hold together disparate entities, makes apparent how any number of trade-offs occur through interfaces so that 'interactivity' might just as easily be replaced by 'transaction.' That is, the interface as 'a form of relation' is increasingly mobilized as an "occasion whereby work may be extracted" (65). The integrative techno-economic dynamics of interfaces, in other words, generate unique forms of value within cognitive assemblages. As transactive portals, this occurs in the back and forth of signals and signs to inaugurate a median trading zone, one that is predominantly led by corporate services premised on the capture of personal data. These conduits of cognitive labor, moreover, call into question categories of self-knowledge and deliberation to the extent that boundaries for decision-making are continually transfigured by the asymmetrical optimization of transactions. While Hookway's approach is largely concerned with the interface as a milieu for subjectivation,

we additionally claim this threshold is a third space or interim in which design techniques become important levers to establish grounds for murky or obscure modes of exchange.

At this point, let's re-consider Hayles' analysis of conscious, unconscious and nonconscious modalities of cognitive assemblages with a focus on how acute feedback loops are marshaled by interface design toward a variety of ends. Interfaces, as we have just observed, are essential to this process by synchronizing informational processes to address the 'costs of consciousness' within a context of transactive work. Interfacing with nonconscious signals is, accordingly, made possible through frameworks of *cognitive translation*; these are epistemologies and devices that function to anticipate and smooth over any contingent events by guiding how cognitive coherence and higher-level reasoning unfolds. Here, we might consider the persistent use of Gestalt theory in contemporary design practice (Johnson, 2013), or lineages of behavioral economics that grapple with cognitive biases following von Neumann-Morgenstern's axioms of game theory (Wendel, 2013). Recall also findings on the apparent slowness of consciousness, evidenced by the 'missing half second,' a phenomenon that arises from conditions where cognition is registered as lagging behind direct experience (Massumi, 1995). It is essential, moreover, to realize the extent to which such knowledges are co-constituted with a carefully calibrated experimental infrastructure (Clough, 2008). That is, these frameworks coincide with a material culture of devices, but also highly specific ways of working with technical ensembles. User experience design as an outgrowth of the field of human-computer interaction draws from these lineages of behavioral, perceptional and sensory experimentation to habituate users into patterns of action, even to the point of compulsion (Schüll, 2012), while nevertheless working to erase its own mediations. This all occurs by binding together signs and signals into reiterative sequences of action, while encouraging *divergent* temporal processes from the *milieu intérieur* of machines.

From this perspective, the peculiar technical operations of cognitive assemblages are foreign from the phenomenological effects they produce and yet, at the same time, are central to the generation of novel experiences and insights they uphold. Recently, Mark B. N. Hansen has

discussed this phenomenon as an "operational split" (2015: 71) between human awareness and technical operations that, he argues, highlights the production of two bifurcating registers, or shall we say regimes, namely the *experiential* and the *operational*. These regimes are distinct since they involve diverging temporal relations, or in other words, they establish two separate temporal domains: the experiential duration of consciousness versus the operational micro-temporality of the apparatus. Importantly, for Hansen, the operational can only be experienced 'after the fact' by *feeding forward* modulated sensation into consciousness. Micro-sensors, computational processors and interpreters, in this way, deliver an unprecedented degree of mediated intervention into experience by environmentally transforming the possibilities for sense and perception itself. For Hansen, as a consequence, these infrastructures "challenge us to construct a relationship with them" (37). Taking up this challenge, user experience design we could say might begin with compensatory gestures for the fact that the vast sensing capacities of twenty-first century media has no direct experiential correlate, but ends in politico-ethical entanglements of behavioral control (Yeung, 2017).

A key difficulty in negotiating between the experiential and operational lies with the centralization of resources in contemporary cognitive capitalism when it comes to the possibilities of enacting relationships with nonconscious agencies. Quite simply, we face a problem of 'unequal deliberation time,' whereby "time itself becomes an agent of surplus value extraction that operates within a system structurally dedicated to exploiting the imbalance between microtemporal, machinic sensibility and human consciousness" (Hansen, 2015: 55). These uneven aspects of distributed cognition are also a major concern for Hayles; namely, throughout informational infrastructures, we can observe how nonconscious agencies are "opening up temporal regimes in which the costs of consciousness become more apparent and more systemically exploitable" (2014: 211). Such conditions become especially clear in her discussions of personal assistant applications that enact "a certain homogenization of behaviour" which depletes cognitive functions associated with spatial navigation and effectively accelerates the channeling of desire through pattern-induced

consumption (Hayles, 2016b). Here, different configurations of awareness emerge throughout a cognitive assemblage based on competing logics embedded within the interface. Indeed, what emerges from both Hansen and Hayles' analyses are considerations of how conscious and nonconscious agencies introduce new complexities for thought, and a demand to cultivate alternative approaches to informational infrastructures in the context of such exploitative incursions into the operational present of sensibility.

The socio-political stakes of interfacing with nonconscious systems become starkly apparent in paradigms of chrono-design where the rallying together of operational and experiential forces seize upon end-user populations in advance. Such techniques become the anticipatory means of conducting cognitive assemblages by mapping out, coordinating and temporally chaining together socio-technological agencies. Indeed, as Flusser reminds us, the etymology of the term 'design' itself is closely associated with connotations of scheming, with 'plots,' 'intent,' and 'aims' ('to have designs on something'); as he succinctly puts it: "the word occurs in contexts associated with cunning and deceit. A designer is a cunning plotter laying his traps" (1999: 17). In his assessment, design connotes how modes of forethought and deliberation are materially projected across an environment. These are operations whereby behaviors are abstracted from a target and cast into contraptions that abduct 'natural' behaviors 'in the wild.' Traps of this sort are central to paradigms of service design and user experience manifested in today's platforms like Facebook, YouTube or Twitter, for instance. Tying 'plot' to the etymology of 'platform' adds yet another angle to consider the ethico-political quandaries of behavioral design manifested in commercial arrangements of informational infrastructures (Singleton, 2014). These are states whereby users *unknowingly*, and even *unwillingly*, participate in operations of abducting value. Emerging behavioral design paradigms, moreover, have advanced conditions where legal frameworks and regulations begin to disintegrate (Rouvroy and Stiegler, 2016). These devices draw on new infrastructural and environmental possibilities for nonconscious sense and perception, and, hence, denote the emergence of a preconscious mode of capitalism. Under these conditions, a typically slick

commercial interface becomes a unique artifact of *métis*; it appears "as a work of magic to those not yet up-to-speed with, yet in the grip of, it's captivating and capturing *kairos* (the real-time of its instantaneity and apparent ubiquity)" (Mellamphy and Mellamphy, 2014: 234).

It is useful to distinguish between notions of 'capture' and 'captivation' for the sake of clarifying our argument here. In an essay entitled 'On Captivation,' Rey Chow and Julian Rohrhuber (2011) develop a notion of captivation based on the work of anthropologist Alfred Gell and his art theoretical concepts of traps and abduction. Chow and Rohrhuber argue that while Gell offers a convincing account of capture and the dynamics that take place between captive and captor, he nonetheless maintains a strict hierarchy between the artist (captor) and the spectator (captive), giving a primary 'intentional' agency to the former and a secondary 'reactive' agency to the latter. According to Chow and Rohrhuber, what is missing from Gell's account is a conceptualisation of the state of *being trapped* – that is, a theorisation of the experience of being held captive from the standpoint of the prey, an experience that exceeds any formal analysis of power relations. For Chow and Rohrhuber, captivation is a type of receptivity that is unassimilable with narratives of freedom that presuppose the existence of autonomous subjects making rational decisions. Rather, they speak of captivation as a process of subjection which is analogous to Louis Althusser's concept of interpellation. What differentiates these two notions, they argue, is that while interpellation emphasises the coherence of the process of identification with an ideological apparatus, captivation emphasises the de-coherence of identity as such; in other words, rather than culminating in identity conforming to a structure of domination, captivation takes the form of an abandonment or losing of the self, a nonproductive process (a distraction or daydream) whereby "politics returns not to government [or governance of the captor] but to anarchy" (64).

In media theory, these questions of captivation are typically articulated within the general problematic of cognitive capitalism for which "all the strategies to capture value basically revolve around the issue of attention time" (Moulier-Boutang, 2012: 75). Here the work of philosopher Bernard Stiegler, whose concepts of psychopower and psychotechniques (Stiegler, 2010) directly

engage with the captivation of human attention by technological means, can be seen as the cornerstone of contemporary critical studies of the attention economy whose motivation is to question and problematise the "commodification of human capacities of attention" (Crogan and Kinsley, 2012: 1). While there have been attempts to update Stiegler's concept of psychopower, specifically in relation to the coupling of the interface and habituation (Ash, 2015), we observe that the main (if not sole) focal point of these studies, as well as Gell's and Chow and Rohrhuber's, is the figure of captive human consciousness imbued with embodied affective and attentive capacities.

However, if we are to develop a theoretical apparatus that addresses the aforementioned split between the experiential and operational regimes of contemporary media, then we must reframe the question of capture in such a way that does not ultimately rest with a suspended form of consciousness. Since there is a conceptual link to follow between the trap, the designer of the trap, and the user who tries to discerns its cunning, rather than focusing on the modalities of the prey's abduction and engagement, our approach is to unearth, identify and repurpose the operational methods, discourses, and infrastructures involved in technically articulating these expressions of cunning or *métis*. In so doing, we focus on mechanisms that do not target human cognition per se, but rather capitalizes on its blindness – a kind of parasitic capture sustained by a well calibrated infrastructure. We believe that contemporary interfaces do indeed feed-forward a type of technological sensibility as a means to captivate or modulate attention, yet we also observe that they do so by concealing what is in fact deployed, executed and precisely *not* fed-forward to the captive.

The captivation of attention, accordingly, *is* a subterfuge or, rather, is part of a double subterfuge. Our notion of chrono-design, rather than directly aligning with Chow and Rohrhuber's or Stiegler's perspectives on captivation, finds closer affinities with Serres' (1982) idea of capture as not simply being a relation or a scenario unravelling between captor-captive, sender-receiver, producer-consumer, artist-spectator, but rather as a meta-relation, a relation to a relation as *tertium quid*, where "[the] exchanged thing travels in a channel that is already parasited. The balance of exchange is always weighted and measured, calculated, taking into account a relation without

exchange, an abusive relation. The term *abusive* is a term of usage. Abuse doesn't prevent use. The abuse value, complete, irrevocable consummation, precedes use- and exchange-value. Quite simply, it is the arrow with only one direction" (80). With chrono-design, this functions by deploying techniques and technologies in ways that leverage bifurcating temporalities between machinic operations and affective registers. To be clear, the goal of such cunning is not to inaugurate a level playing field, nor to increase the capacities of users to sense this difference as such, but to set up an asymmetric zone of transactions. With their evasion of detection from the consciousness of end-user populations, such devices are a common characteristic of the current internet and web as everyday cognitive assemblages.

The Critical Rendering Path

Contemporary web applications are carefully programmed, monitored and optimized for the potentially chaotic unfolding of networked events. Technical heuristics are fed forward *and back into* the nonconscious operativity of protocols and machines as logistical orders, enabling diverse efficiencies, temporalities and applications of 'infrastructural intelligence.' In his material examination of information, Paul Dourish (2015) provides some valuable insights into these material dynamics, especially by emphasizing the need to appreciate the intertwined social and technical aspects of informational infrastructure, a consideration of the specifics of different protocols in terms of weightings and speed, and a close consideration of the relationships between 'internals' and 'externals' of a network for questions of power, what we might call *the heteronomy of networks*. This is an account that inherently questions the techno-libertarian rhetoric surrounding the internet as open, radically democratic and decentralized by foregrounding how the delegation of authority to different network segments (internet as 'internetworking') leads to concentrations of control and local points of centralization. A further aspect relevant to our concerns is how protocols should be considered in relation to their *deployments*, rather than simply taken as abstract plans or instructions. In this way, the internals of protocol design are seen as always explicitly connected to

certain kinds of external management and administrative authority in practice. Dourish's study thus pivots of the question, "what structures or constraints are needed to allow this flexibility?" (201). In a similar way, throughout our discussion, we stress the importance of chrono-design tools and expertise for maintaining specific patterns of use between diversely invested actors, from large-scale monopolistic corporations to casual users to automated agents.

The success of any protocol deployment is never guaranteed. Problems can arise heterochronic agencies interrelate, leading to unexpected conflicts and incongruities that evolve across multiple scales. Intervening in these crises often requires the elaboration of new mechanisms of control which can redistribute agencies and consolidate particular power relations. One might consider, for instance, the introduction of TCP/IP flow control mechanisms in the 1980s after problems with asymmetrical bandwidths across networks dragged transmissions to a standstill; a phenomenon known as *congestion collapse* (Ragle, 1984). Algorithms like 'slow-start' and 'fast retransmit' written by Van Jacobson and Michael J. Karels (1988) were devised during this crisis to facilitate efficient internetworking by focusing on issues of timing from end-to-end, innovations which would be crucial for the rapid expansion of the web during the 1990s. More recently, the recognition of latency as a key limit of platformization by Google engineers (Belshie, 2010) has led to the development of the SPDY protocol to reduce the round-trip time (RTT) of data packets, an initiative since folded into the upgrade of hypertext transfer protocol (HTTP/2). We might also consider here the controversial proposals for Accelerated Mobile Pages (AMP) that aim to improve user experience for smartphones, but arguably further reinforce Google's ad-based influence over the web (Google, 2017; ampletter.org, 2018). Such responses to increased traffic and overcrowded buffers are important since they propel specific arrangements of infrastructural influence, while embedding *problems of speed* as features of protocological power itself. Taken together, they add credence to Paul Virilio's axiomatic claim: "if time is money, as they say, then speed is pure power" (2001: 26). And indeed, these initiatives have occurred with significant economic investment in geographically situating and configuring servers to form content distribution

networks (CDNs) (Sandvig, 2015), while laying out new fiber optic cables across 'the last mile' to homes and businesses, all within the context of rising debates over 'net neutrality.'

Problems of speed, accordingly, manifest themselves throughout the entirety of internet engineering, web development and interface design, including the preparation of content for delivery. For example, the notion of CSS sprites is one well-established technique used for rendering recurring patterns of graphics (Shea, 2004). Inspired by old school videogames, the idea involves loading a single blueprint image into the browser that is repeatedly resourced to reduce the overall HTTP requests; while the page weight increases, duration or time spent rendering drops by drawing from a single file. Sprites of iconic buttons and logos for major commercial websites like Amazon, Twitter, Google or Facebook are often openly accessible on CDNs, and remain one of the most pervasive and accessed digital objects on the web. As artifacts of protocological power, corporate culture and the limits of human attention, they are resources for micro-temporal processing and nonconscious operations that support the optimization mantra: 'the fastest request is a request not made'.

Fig. 1. Artist researcher Roel Roscam Abbing's collection of found cloud sprites.

Interfaces most assuredly deliver more than meets the eye. For designers and developers working with the temporalities of cognition, sense and perception, the *critical rendering path* is a crucial measure for trapping technical delays and waiting times within tolerable limits and optimization benchmarks. Here, the rendering path, generated by the written HTML markup script of a given page, becomes a line of constraint that follows the order in which a browser is instructed to read, including how and when to interpret the various elements of a site (HTML elements, CSS and JavaScript).[2] A wide variety of browser-based tools and methods allow for critical rendering paths to be diagnosed and tuned. 'Empathetic mediations,' for instance, perform the visual presencing of a site through filmstrips of graphic rendering and load states in slow motion (Viscomi et al., 2016). Such approaches implicate interface chrono-design with genealogies of media attention that reach back to early nineteenth century experiments with perception (Crary, 2001), particularly as these dovetail with innovations in scientific management that stem from the 'crises of control' that plagued industrialization (Beniger, 1986). In the twenty-first century, these techniques manifest themselves as frameworks to manage the modulation of global attention coupled with systems of automatic sensing and decision-making beyond consciousness.

For chrono-design, another seminal logistical method consists of Gantt charts presented as 'resource waterfall' visualizations of network activity within a given browser's debugger panel. The overlapping HTTP transfers arranged in sequence on these charts form the rendering path, where the slope provides an impression of the site load, so that key problems or 'anti-patterns' can be identified and treated in turn (see fig. 2). Historically, the Gantt charts on which these waterfall diagrams are based were introduced during the Taylorist era of scientific management as deliberation devices for keeping track of multiple machine operations and labor processes during industrial manufacturing (Wilson, 2003). The later inclusion of the 'critical path method' (CPM)

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[2] For a comprehensive exposition of the notion of the critical rendering path, and how it mitigates a given web page loading speed, see Grigorik (2018).

paved the way for enhanced optimization techniques for timing and sequencing a project during the post-War period. If current interfaces disclose a 'logistical imaginary' (Bratton, 2016: 230), then it develops through these historical lineages of planning and control. Yet where Gantt charts once referred to the assembly of an industrial product or post-Fordist knowledge work, following the micro-temporal processing of networked applications, the critical path now tracks a state of deferral between network requests and on-screen visual renderings so that user populations can be captivated just long enough while their computational requests are resolved.
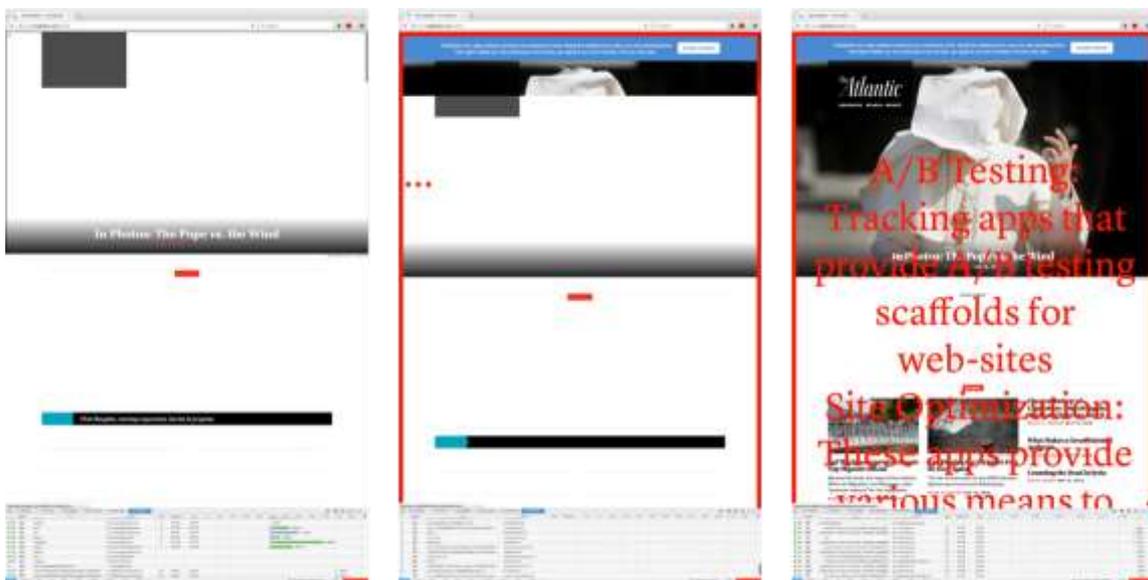
Fig. 2. Experiments with Browser & Debugger Plugins: *Loading… 800% Slower* (Gauthier, 2017)

The rendering path as an interface chrono-design technique mediates the split between the conscious and nonconscious, or what Hansen refers to as the experiential and operational regimes of contemporary media. Structurally, web browsers decouple two principal system components in their operation: a graphical rendering engine and a script interpreter. This decoupling facilitates a parallelization of the experiential regime of the human gaze and the operational regime of the machine. As a result, the execution of scripts runs independent of the graphical rendering routines; in short, rendering routines and script interpretation are separated and executed asynchronously. This temporal parallelization leads to a bifurcation of background and foreground, which user

experience design has the task of conjugating. Web interface designers and application developers typically write scripts to programmatically capture specific user interactions and instruct the browser's rendering engine how to alter the layout of a given page or, for instance, when to make network requests for new data. As networks evolve and become faster, not only can more data be transferred back and forth between client and servers, but more substantial scripts can be written and sent to browsers to be interpreted 'just-in-time' without having the graphical interface itself impaired by such parallel, nonconscious transactions and executions.

In terms of the programmatic formulation of networked applications, requests and callbacks, and promises and futures, are salient chrono-designed constructs that are integral parts of contemporary programming language vernaculars (ISO/IEC 14882, 2011; ECMA-262, 2015). By relying on the programmatic constructs of design patterns, current notions of "reactive design" (Kuhn et al., 2017) uphold this tendency of planning for and working with asynchrony (Bonér et al., 2014). These constructs express an applications' logical development and temporal unfolding, their ontogenetic dimension, how asynchronous and concurrent events inscribe their own becoming. It is important to note that networked applications are necessarily incomplete or dormant within a time interval as they wait for given requested potentials to be fulfilled. Coded promises and futures are emblematic artifacts of incompleteness; within the temporal deferral of completeness, they allow for asynchronous articulations to be expressed programmatically. As constructs, both promises and futures are, technically speaking, proxies: a reference or a variable which is *yet to be* produced, and an assurance that stands for computation *yet to be* executed. As proxies for the postponement of data resolution and computation, they allow application and interface designers to articulate their written asynchronous program (scripts' source code) in a sequential or direct style, rather than a continuation-passing style. More importantly, these proxies allow for their designed application not to halt execution while waiting for futures and promises to be resolved. This is how the unfolding of micro-temporal computational events is shaped and plotted in advance.

It is worth highlighting how these programmatic constructs underlie the type of temporal and logical relation that a chrono-designed 'present' entertains with its contingent 'future.' Here, the asynchronous future does not unfold homogeneously, regularly or mechanically as one logical moment after another. Rather, delegates and empty placeholders mark out a state of incompleteness awaiting execution that potentially takes place through variable temporalities. In practice, the time-critical interval between browser input and output can have diverse durations: from milliseconds for a promised computation to be scheduled for execution by given JavaScript interpreter to tens of seconds for a large file to be requested and fetched from a distant server. Anyone who browses the web most certainly experiences this state of incompleteness on a daily basis; one only has to observe how site content is disparately loaded fragment-by-fragment and continuously updated on the status bar of the browser. This experience of asynchrony may appear mundane on an infrastructural level, especially when running smoothly, but its effects can broadly be perceived as an increasingly ubiquitous mode of socio-political organization. Asynchronous systems, for instance, are central to emergent multisided platforms by allowing new ways of ordering flexible and precarious regimes of digital labor between groups as a 'sublime administration of the everyday' (Pepi, 2016).

Yet there is more to contemporary scripts than simply catering to the experiential regime of human attention and interaction. Since they can read and write information to and from certain internal registers of browsers and make HTTP requests on their own, scripts have become the cornerstone of new economies around user tracking and profiling. Between browsers and third-party web servers, these tracking scripts instantiate a type of transaction that operates through latent causalities beyond consciousness. In doing so, they leverage the parallel decoupling of background and foreground to automate the capture of data without any direct recourse, let alone signaling, to human sense and perception. This background can be understood as a dynamic "protected mode" memory (Ernst, 2010; Kittler, 2014) where special browser registers are written to and read from at micro-temporal speeds to allow for a certain ephemerality to endure (Chun, 2011) from one

browsing session to another. Here, the agency of the web browser and third-party scripts supersedes the attentive actions of end-users, deriving value by precisely not addressing consciousness directly, but rather indirectly, *by proxy*, in tracking the browser's memory itself. Script interpreters thus become sites of friction and enmity as they are operationalized not only to sustain browsers' core functionality, but also to inject obfuscated code to harvest and leak user behavior for profit. There is a pressing need to engage critically with these tools and techniques, we want to suggest; to adapt and redeploy them not simply for the revelatory insight of collecting and visualizing micro-temporal data, but to actively experiment with nonconscious problems of speed, captivation and capture in the pursuit of alternative infrastructural arrangements.

Diagnosing the Present

Throughout this article, we have shown how various temporal aspects of network transactions demand that media and cultural theories begin to critically address nonconscious designs that operate below the threshold of experiential registers, particularly how to deliberate with these agencies, or how to connect differently with their unfolding trajectories. A central aspect of our argument has been to place an emphasis on the need to repurpose these chrono-design techniques that sit at the interstice between the operational and the experiential present of our contemporary informational infrastructures. Most of our theoretical insights in this article have been informed by such an engagement, including network diagnosis, which we undertook as part of a project focusing on the notion of critical rendering path discussed above. What follows is a short demonstration of this empirical research.

In a series of experiments, we measured the micro-temporal rendering of news websites and devised a method for diagnosing how and when HTTP requests are made to load and execute third-party scripts or co-called 'bugs' within a browser as a given page loads.[3] Although there exists extensive research on these aspects of web economies, including studies of social media buttons

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[3] Where bugs are categorized as advertisements, analytics, trackers, widgets or privacy devices.

using digital methods (Gerlitz and Helmond, 2013), studies of real-time patterns on web platforms (Weltevrede et al., 2014) and web tracking as such (Elmer, 2004; Howe and Nissenbaum, 2009; Share Lab, 2015; van der Velden, 2014), the uniqueness of our approach is to recognize not simply the *presence* of questionable third-party bugs, but also their *presencing* as temporal and logistical dynamics worthy of investigation. We align this work with the notion of 'technical time critique'; that is, an approach that "reveals a microcosm of time figures that are usually concealed in media apparatuses; it is assisted by a phenomenology of the temporal affects that media induce in people" (Ernst, 2016: 4). In doing so, we utilized some of the performance analysis tools already discussed to trace the processing of third-party scripts as a design logic that unfolds with the "operational blindness" (Hansen, 2012: 33-34) of end-user populations. This is because some scripts acquire data from users in ways that do not address sense and perception per se after execution (unlike content such as buttons, images, text and so on). These scripts contribute to the temporal resolution or pacing of web applications, but through means that are construed to precisely evade detection. Our aim was to investigate these 'hidden' dynamics by redeploying chrono-design techniques for purposes of interface time critique.

Using performance optimization techniques along with the debugging functionality of browsers, we measured the critical rendering paths of the top 100 popular news websites according to Alexa.[4] Temporal signatures for each site were visualized by focusing on page load time, or the period of time between when a network request is made and when the browser fires events that render a page. This is the timeframe during which a site becomes usable, when the Document Object Model (DOM) is produced, and text and images are downloaded and displayed. To provide a baseline indication of loading patterns, we aimed for a consistency based on geographic location, browser type and connection using artificial testing (rather than, for instance, real-time, streaming data or real user metrics). Tests were run on a 'cold' cache, as if the user were loading the page for

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[4] A complete report from our research can be found online (Dieter et al., 2015). Of interest are the various 'analytic cards' on each website, see Fig. 7.

the first time. The approach was, therefore, synthetic, but still suggestive in providing a consistent comparative indication of the overall temporal signatures and design patterns that constitute online news.
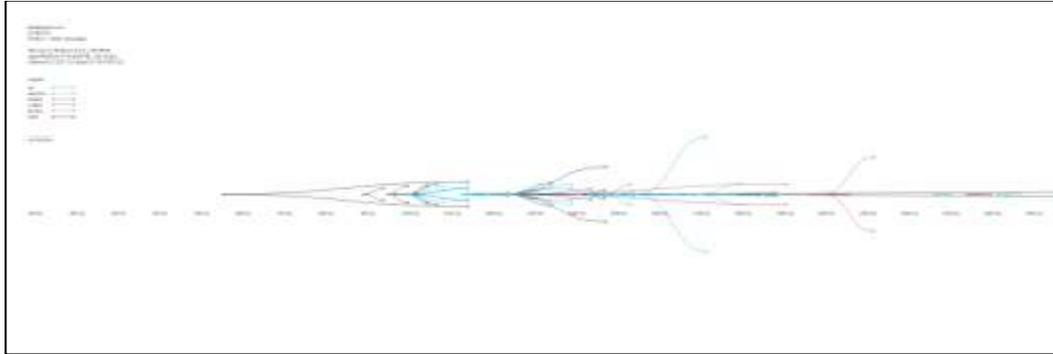
Fig. 3. The Drudge Report
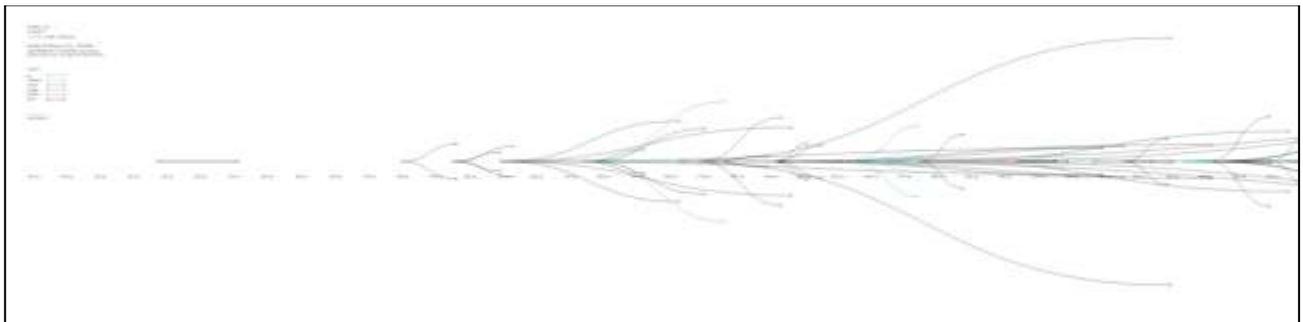
Fig. 4. Breitbart

In order to identify bugs in the sequence of requests, we relied on Ghostery's database (Ghostery, 2015). This enabled us to highlight which requests to third-party scripts were made during the resolution of a given page; to identify how many requests were made; when these were made; how long it took to load these scripts in the browser; and finally to the measure the weight of the scripts' content in bytes. Our approach was less concerned with separating out and stratifying the network connections in search of a Gantt-style waterfall slope, than with integrating signal-based patterns to foreground the cumulative and concurrent presencing of bugs.

Our experiments demonstrate that for some sites requests to third-party scripts far outnumbered the amount of requests made for first-party content (news images, text, etc.). Indeed, the amount of bytes these scripts weighed was at times larger than the total pages' content, and cumulatively took more time to request and load all third-party scripts than it took to load the actual page and all its content. A site worth mentioning here is *The Drudge Report*. Despite its minimalist graphical interface, we found that 81% of its requests were made to third-party servers, amounting to a total script weight of 56%, which took 60% of the gross loading time of the entire page. What is most striking in the case of *The Drudge Report* is the sharp contrast between its visible interface, composed mainly of 'Web 1.0' text and hyperlinks with few images, and its invisible scripted counterpart, composed of mainly of third-party text-based scripts. Similarly, *Breitbart*, the notorious platform for the 'alt-right' can be seen as following a comparable loading pattern (which is perhaps unsurprising given the shared history between them), raising questions of the intersections and embeddedness of surveillance capitalism and political ideologies along nonconscious, infrastructural domains.

A second finding worth mentioning is how early these dubious scripts can be requested and loaded into the browser compared to other first-party elements. For instance, the third request of the site *The Atlantic* is for a tracking script, occurring 700 milliseconds after the start of the overall page load (see fig. 5). The design rationale behind such an operation can be explained by the aforementioned three seconds user engagement time limit of the specious present: the faster a tracker script can be loaded into the browser without users ever closing the page, the greater the chance a site has of producing and disclosing personal user information from the very start. Significantly, monitoring conversion rates alongside the critical rendering path assists with tuning this complex array of trackers and scripts loaded into the browser so that the constantly modulating boundaries of collective consciousness are folded into a wider assemblage of optimization and profit-seeking. A tracker that interferes too much with the critical rendering path so that conversion

rates are undermined, in other words, would be at risk of being adjusted or eliminated from the site altogether.
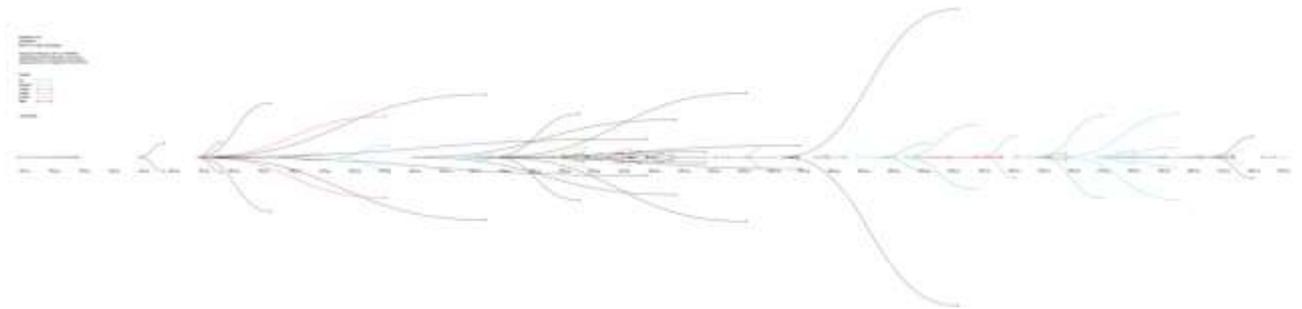
Fig. 5 The Atlantic

We thus see how the critical rendering path in focusing on the temporal sequencing of visual/perceptual appearances for conscious attention, necessarily opens up, in parallel, the possibility of exactly its reverse. That is, a temporal sequencing of non-visual/non-perceptual operations occurring between such appearances. As exemplified by this brief diagnostic study of some third-party scripts and bugs, the inherent duality of the critical rendering path can be used as the basis for practices of parasitic concealment where operational combinations are formulated, engineered, designed and deployed at large within existing networked infrastructures, meticulously bypassing the dynamic and composite attention thresholds of end-user populations by lurking in the technical obscurities of script interpreters. Here, we are faced with a form of programmed 'consent' that does away with direct deliberation. Indeed, what our study foregrounds is how "deliberation shifts from being an activity that happens at the moment of reception, or in its incalculable aftermath […] to an activity that happens — that can *only* happen — in a fundamentally anticipatory mode, *before* any encounter with a cultural object or media network" (Hansen, 2015: 74).

01
reddit.com
07/07/2015
12:59:22 CEST

Page Http Request Elements

ads:	7	15%
analytics:	2	4%
trackers:	0	0%
widgets:	0	0%
other:	36	80%

Objects Size (bytes)

ads:	111718	21%
analytics:	27168	5%
trackers:	0	0%
widgets:	0	0%
other:	369285	72%

(Micro) Timing (ms)

ads:	858	16%
analytics:	169	3%
trackers:	0	0%
widgets:	0	0%
other:	4166	80%

View/Listen

02
news.yahoo.com
07/07/2015
13:00:28 CEST

Page Http Request Elements

ads:	4	3%
analytics:	11	8%
trackers:	4	3%
widgets:	0	0%
other:	112	85%

Objects Size (bytes)

ads:	0	0%
analytics:	1182	0%
trackers:	86	0%
widgets:	0	0%
other:	3768030	99%

(Micro) Timing (ms)

ads:	628	2%
analytics:	2000	7%
trackers:	197	0%
widgets:	0	0%
other:	24806	89%

View/Listen

03
cnn.com
07/07/2015
13:27:18 CEST

Page Http Request Elements

ads:	18	12%
analytics:	10	7%
trackers:	13	9%
widgets:	8	5%
other:	88	63%

Objects Size (bytes)

ads:	161989	7%
analytics:	54449	2%
trackers:	90039	4%
widgets:	99410	4%
other:	1808995	81%

(Micro) Timing (ms)

ads:	2123	7%
analytics:	3343	11%
trackers:	2108	7%
widgets:	1247	4%
other:	19364	66%

View/Listen

04
www.huffingtonpost.com
07/08/2015
12:23:04 CEST

Page Http Request Elements

ads:	38	19%
analytics:	9	4%
trackers:	6	3%
widgets:	12	6%
other:	135	67%

Objects Size (bytes)

ads:	122123	5%
analytics:	25061	1%
trackers:	35706	1%
widgets:	128555	5%
other:	2045560	86%

(Micro) Timing (ms)

ads:	5738	11%
analytics:	1637	3%
trackers:	943	1%
widgets:	2502	4%
other:	41004	79%

View/Listen

05
www.nytimes.com
07/08/2015
12:22:17 CEST

Page Http Request Elements

ads:	15	6%
analytics:	7	2%
trackers:	22	8%
widgets:	0	0%
other:	205	82%

Objects Size (bytes)

ads:	99372	3%
analytics:	30351	1%
trackers:	71368	2%
widgets:	0	0%
other:	2815003	93%

(Micro) Timing (ms)

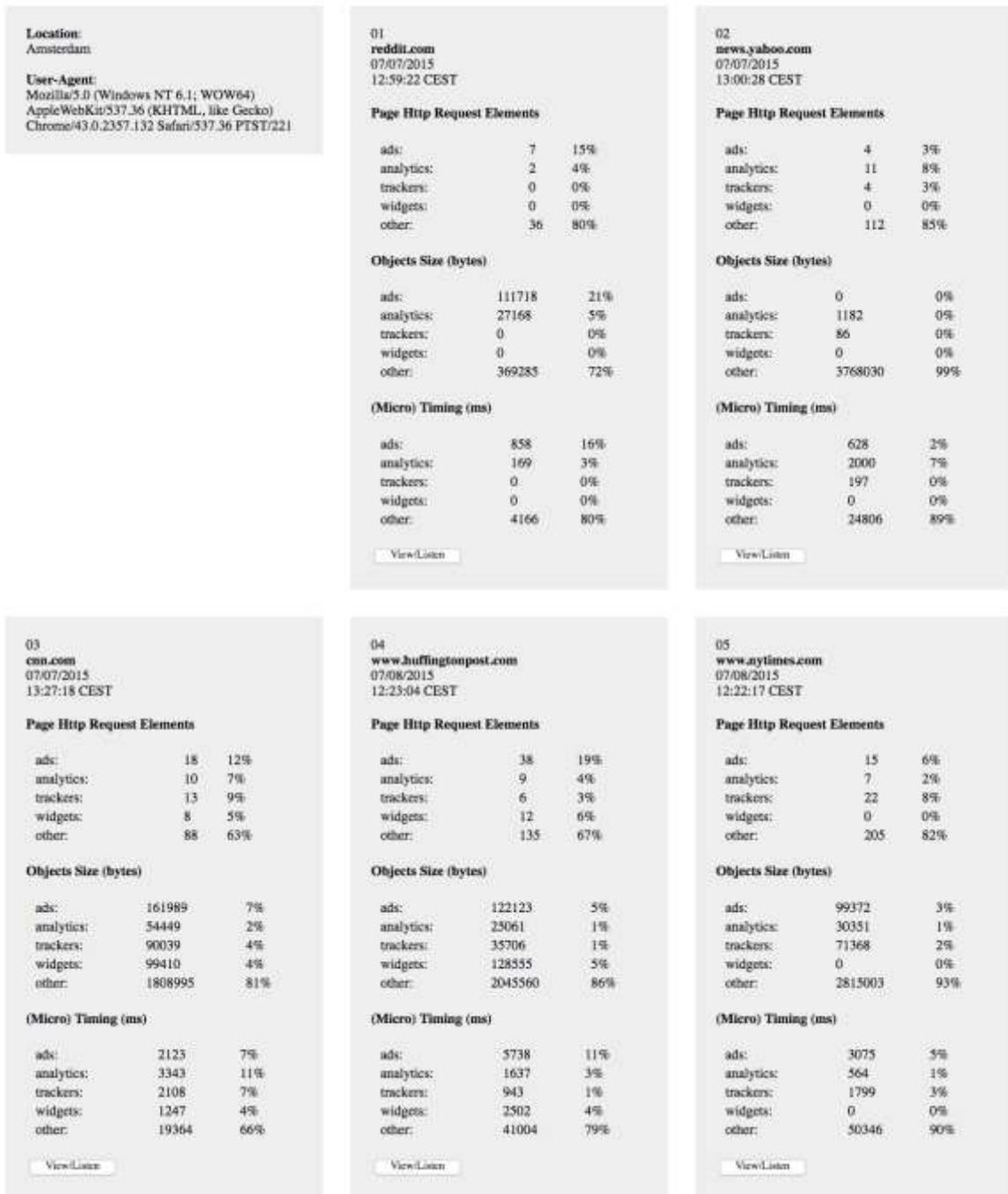|		
ads:	3075	5%
analytics:	564	1%
trackers:	1799	3%
widgets:	0	0%
other:	50346	90%

View/Listen

Fig. 7 Analytic Cards

We should note by way of conclusion that a contemporary technical component of media that equally speaks to this necessarily anticipatory mode of deliberation is the adblocker. Currently, adblocking is a major operational tactic that end-users have to intentionally modulate their proxied consent for executing dubious scripts from unknown third parties. Because the Do Not Track (DNT) standard (W3C, 2017) has not been appropriately followed by industry (and arguably will

not be in the near future) (EFF, 2012; EFF, 2015), the only recourse for intervening in the parasitic economy of tracking and bugging is to hinder the execution of scripts at the browser level, as opposed to the server level advocated by Do Not Track. While browser manufacturers, such as Microsoft, Google and Mozilla, have already directly integrated script-blocking functionality in their respective browsers (Microsoft 2010; Mozilla Foundation, 2016; Google, 2017), these features have consequently opened up a space of contention with the growing third-party ad industry. Future maneuvers might perpetuate a tactics of obfuscation (Brunton and Nissenbaum, 2015), however, there is a need to think and act across multiple political, institutional and regulatory levels to achieve an informational infrastructure that can deal more equitably with the trappings of data capture.

What this disagreement highlights, and what our research foregrounds, is how the micro-temporal aspects of technical media require types of diagnostics that stand as moments of deliberation as such. If current media apparatuses promulgate processes that strategically bypass the perceptive ability of users to detect them – and thus cultivated abilities to deliberate about their aims, presence and constituencies at the moment of reception – then modes of critique must become less hermeneutic and more clinical, that is, more diagnostically-driven. By using similar techniques that allow for such artifices to be programmed and articulated in the first place, interface critique can thus move from being an activity centered on the phenomenology of reception, or an aesthetic that explores historical tendencies, towards a collective project of material negotiation and participation with agencies of nonconscious cognition.

Conclusion

While user experience design strives to obliterate all traces of latency, we aim to zero in on timings at the smallest scales. The diversity of infrastructural micro-temporalities needs to be understood as more than a technical problem of efficiency, these are dynamics of significant social, political and economic consequence. They are undercurrents occurring at pre-perceptual dimensions, yet involve

settings for logistical decision-making, data exchange and the capture of behavioral traces that simultaneously integrate and separate human consciousness from nonconscious processes. As we have argued, there is a need to experiment with these mechanisms beyond the sheer optimization of corporate interest. Part of this involves reconsidering the stakes of cognitive assemblages as targets of deliberate intervention. The interface is a considerable domain of transactive power; it is a *tertium quid* – a zone of exchange between systems, a device and situation now imbued with evasive asymmetries by design. Practicing chrono-design techniques means initiating a capacity to forge different kinds of transaction, including the possibilities to hybridize modes of nonconscious decision-making with new conceptual, aesthetic and political orientations. In this article, we have suggested some problematizations for the analysis of protocols and speed, along with the plotting of asynchronous scripts, and how diagnostics might be utilized as a point of entry into the operations of nonconscious infrastructures.

Chrono-design is a significant aspect that shapes informational infrastructures like the web and the internet. Testing these tools and techniques relies on nurturing a concerted temporal elasticity across cognitive assemblages to support diverse processes of individuation. Our explorations have also led us to sonifications of tracker data and experiments using real-time plugins to experience the micro-temporal political economy of tracking in deconstructive states. These timings are a 'fallen time' not simply of hyper-exploitation, but for an alternative sensing with artefactual temporalities of cognitive assemblages (Murphie, 2007). Yet how do we engage with methods of user experience design in ways that are neither overly instrumental or simply superficial? How can they be hybridized in interdisciplinary directions and how might they be co-developed or connect meaningfully with a diversity of critical collectives? These remain central concerns as we develop an interface critique that engages with contemporary dilemmas of capture and captivation, an approach that supports an attachment to the apparatus from the position of a politicized subject.

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