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Re-mediating the Human:

Habits in the Age of Computational Media

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In the midst of the Fourth Industrial Revolution, networked and computational media, it is claimed, may be fundamentally transforming what it means to be human. Tech industry visions are predictably celebratory: for Microsoft, cloud computing has 'made us smarter' and 'more productive', while artificial intelligence augments 'humankind's innate ingenuity' (Smith and Shum, 2018: 6, 35). By enhancing human capabilities with the ability of computational technologies 'to analyze huge amounts of data and find patterns that would otherwise be impossible to detect', the corporation aims to create 'a better future for all' (2018: 138, 137). Prominent scholarly accounts tend to be more critical. Yet whether they observe the birth of a 'new human' programmed in 'algorithmic thought' (Serres, 2015), or aim to move 'beyond the human' given the increasing autonomy of machine learning technologies (Parisi, 2019), many view our entanglement with digital media as re-shaping more-than-human senses, habits and capacities in significant ways. As the late French philosopher Michel Serres remarked of millennials – the first generation to experience the Internet and associated technologies in their adolescence – their cognitive and affective habits

have been comprehensively '[re]-formatted': they 'no longer have the same body or behavior' as previous generations; they 'no longer have the same head' (2015: 5-6).

Alongside these emergent techno-social developments, a critical return to the concept of habit is gaining momentum across the humanities and social sciences. Scholars are drawing on a range of interdisciplinary fields to address the significance of habit to changing configurations of sociality, (im)materiality, temporality and agency – from the patterned dynamics of biopolitical governance (Bennett, 2013, 2015; Blackman, 2013, 2019) to the digital routines and possibilities of algorithmic life (Chung, 2016; Pedwell, 2019, 2021). Following pragmatist philosophy, we can understand habit as an acquired predisposition to particular modes of responsivity and action. While habits work by adapting to an environment (*taking aspects of it in*), they also function to *affect and reconfigure* environments – and because 'environment' is always multiple, human nature too 'is plural' (Dewey, [1922]2012: 24; Sullivan, 2006). As I have argued elsewhere,[i] what makes habit a particularly useful lens for theorising social transformation is not only its more-than-human qualities but also its double nature: it attunes us simultaneously to the automated processes underlying the persistence of existing patterns *and* the necessary, yet counterintuitive, role of habituation in enabling meaningful change.

While philosophies of habit date back at least as far as Aristotle, significant developments occurred in the nineteenth and early twentieth centuries through the work of the French philosopher and archaeologist Felix Ravaisson and the American pragmatist thinkers John Dewey and William James. For Dewey ([1922]2012) and James ([1890]2014), pragmatism sought to engage the changing nature of human experience *as it unfolds* with a focus on the productive role of habituation, whereas for Ravaisson ([1838]2008) – who would influence

the continental philosophies of Henri Bergson and Gilles Deleuze – habit offered a philosophical and theological lens for interpreting the dynamism of the natural world. Notwithstanding their (sometimes significant) differences,[ii] these thinkers all move beyond the Kantian association of habit with the reproduction of sameness, emphasising instead its generative role in processes of being and becoming (Malabou, 2008; Carlisle, 2014). They also re-think the dynamics of consciousness, thought and will beyond the individual organism (Bissell, 2013; Grosz, 2013), and signal the need for a more processual and ecological approach to theorising social and biological change – with Dewey, in particular, figuring habit as the product of unfolding mind-body-environment interactions (Bennett et al., 2013). Together, then, these philosophers foreground habit as vital to understanding what it means to be human within more-than-human ecologies.

This chapter considers the extent to which we can apply the insights of these classical thinkers to understand the dynamics of twenty-first century media and how they may be radically re-mediating 'the human'.[iii] There is, of course, a long history of intellectual engagement concerning the relationship between media technologies and human habits and capacities. Critical thinkers from Marshall McLuhan and Friedrich Kittler to Bruno Latour and Donna Haraway have explored how various 'new' technologies act as 'extensions[s] of ourselves', functioning to shape 'not only habits of life, but patterns of thought and valuation' (McLuhan, [1964]1994: 1, 12). Yet concerns regarding how particular communications technologies – from the practice of writing, to the printing press, to smart phones – might alter the workings of human thought and memory (by, for instance, making the need to mentally store large amounts of information redundant) date back to ancient civilizations (Malin, 2015; Serres, 2015). Extending this scholarship, I am interested in what is distinctive about human-technology entanglements within an age in which 'cultural experiences, social

interactions, and decision-making are governed by large-scale software systems' that operate via algorithmic procedures (Manovich, 2013: online). If the growing ubiquity of media analytics is key to 'the production of a data-driven human subject' (Clough et al., 2015: 98), how might philosophies of habit help us grapple with the nature and implications of these (im)material processes?

An algorithm is 'a finite set of instructive steps that can be followed mechanically, without comprehension, and that is used to organise, calculate, control, shape and sometimes predict outcomes' (Coleman et al., 2018: 8).[iv] Whether via the aggregative nature of social media, the filtering of results on search engines, or the dynamics of contextual advertising and automatic news production, algorithms now play central role in everyday life. These computational procedures work by extracting ongoing data about preferences, sentiments, routines and habits and feeding this information forward into the production of new choices and tendencies with respect to movement, consumption and knowledge production. What is distinctive about contemporary machine learning algorithms is 'their capacity to learn something in excess of taught rules'; to continually adapt in response to the features they encounter in their 'data environments' (Amoore, 2020: 65). In exploring how media analytics are (re)shaping our social existence, critical scholars argue that the 'algorithmic condition' has produced a logic which 'alters the cultural and social reality it organises, through its procedural dynamics' (Coleman et al., 2018: 9) – as evident, for instance, in how data-oriented media platforms 'pre-compute' the nature of 'our' future habits before they actually come into being (Hansen, 2015; Amoore, 2020). If habit is central to processes of social transformation, how, I ask, does it figure in algorithmic dynamics that are altering the very meaning of 'the social' – and at what point might the logics of habit meet the limit of their analytical purchase?

The first part of the chapter examines how classical philosophies of habit offer an approach to 'assemblage thinking' that resonates with current theories of digital media, and considers three key ways that this pragmatist and continental scholarship might enhance current analysis of mediated social life. The second part complicates the discussion by addressing how adaptive algorithmic architectures – which operate largely without regard for human processes, temporalities and spatialities – refigure the very categories of 'mind', 'body' and 'environment' central to habit philosophies. Pulling together these conceptual strands, I argue that attention to habit assemblages remains salient to understanding the changing nature of 'the human' within emergent media ecologies, but only if we reassess what constitutes 'habit' in a social field increasingly organised by media analytics – and, in turn, what implications arise for understanding more-than-human sensibility, cognition, agency and experience.

Thinking with assemblages: habit philosophies and media ecologies

Offering one of the first and most generative accounts of habit as a more-than-human mechanism, classical pragmatist philosophy compels us to understand the fundamental contingency of human nature via what might be called 'assemblage thinking'. Dewey's *Human Nature and Conduct: An Introduction to Social Psychology*, in particular, focuses on how habits are produced through the 'cooperation of an organism and an environment' ([1922]2012: 10) – and thus constitutively *imbricate* bodies and physical, social, political, economic and affective conditions. From physiological habits and respiration and digestion, to patterned modes of sensation and perception, to everyday styles of walking and talking, Dewey suggests that we are composed as human in and through 'our' habits – which are, in

fact, never simply *ours*, but rather 'working adaptions of personal capacities with environing forces' (11; Sullivan, 2006; Bissell, 2013). Dewey's pragmatism thus demands we move away from a focus on 'individual' habits and attend to moving *habit assemblages* that constitutively link organisms, objects, (infra)structures and atmospheres. In this view, habits always exceed the boundaries of human subjectivity – and transformation, in turn, arises through processes that refigure transactions among the emergent components of wider ecological relations, whether with respect to social conflict, political democracy or progressive education.

Although composed nearly a century earlier, this pragmatist ecological vision resonates with contemporary media theories which view embodied capacities and digital technologies as immanently intertwined. Recent work on 'media ecologies' (Fuller, 2005; Durham Peters, 2015) and 'media habitus' (Papacharissi and Easton, 2013), for instance, figures everyday habits of seeing, thinking and feeling as re-mediated via unfolding transactions among digital infrastructures, platforms, devices, algorithms, data and users – such that alterations to one element of the assemblage can reverberate through the entire network, affecting both human and non-human actions and tendencies. Following Deleuze and Felix Guattari ([1980]1987), an assemblage is a contingent ensemble of things, practices and relations that, although appearing as a functioning whole, is not reducible to a single logic. With respect to temporality, assemblages are always in-process; they involve 'forms that are shifting, in formation, or at stake' (Collier and Ong, 2005: 13). Assemblage thinking is, in this vein, particularly suited to conceptualising media ecologies because it appreciates that 'the configurations in which systems operate are always in transition, constantly adding and dropping components and rearranging connections' (Hayles, 2017: 2). Habit, in turn, is crucial to digital systems because the connections that comprise virtual networks are, in fact,

'projected links based on frequent and potential repetition' (Chun, 2016: 53). As Wendy Hui Kyong Chun observes, habituation not only enables us to 'imagine and elucidate a connection', it also links 'humans and machines together as beings that repeat' (2016: 53).

If pragmatist philosophies understand habits as (re)produced via mind-body-environment assemblages that transform both organisms and their milieus, contemporary theorists of media ecologies explore how *media themselves* are vital environments that both anchor and animate our existence. In this vein, John Durham Peters considers how networked technologies function less vitally as transmitters of 'messages' than they do as elemental 'habitats': 'the taken-for-granted base of our habits' (2015: 1) – thus re-inventing the logistical role of ancient media in the present. Extending Dewey's account of 'environment' as constituting the 'whole biosociocultural context of this or that experience' (Fesmire, 2015: 51), this emergent scholarship advances the pragmatist speculation that the core of both being and becoming is found within 'everyday practices, algorithms and programmes' (Durham Peters, 2015: 44). While philosophies of habit argue that there is no 'true self' apart from habitual modes of conduct (Dewey, [1922]2012: 14), these scholars ask what *kinds* of habits are preserved, disrupted or generated via computational media which operate primarily to 'organize and orient, to arrange people and property' (Durham Peters, 2015: 37) – and how we might understand their implications for more-than-human life.

Engaging these concerns in *Thumbelina: The Culture and Technology of Millennials,* Serres argues that recent techno-social dynamics – and particularly how we increasingly delegate habits of mental synthesising and processing to networked media – have produced a generation of digital humans programmed in an 'algorithmic mode of thought'. Millennials do not have to work hard to gain or memorise knowledge, he suggests, because 'it is already

in front of [them], objective, collected, collective, connected, accessible at [their] leisure, already reviewed and edited' (2015: 19-20). What this generation may sacrifice in memory and attention span, Serres argues they gain in a technologically-enhanced capacity for thinking that is procedural, technical, calculative and data-oriented. Or, as Chun puts it in *Updating to Remain the Same: Habitual New Media,* 'through habits users become their machines: they stream, update, capture, upload, grind, link, save, trash, and troll' (2016: 1). The term 'algorithmic thought' here signals not only how we experience, think or talk *about* algorithms in everyday life, but also a more profound 'practice-based shift in knowledge production and acquisition' (Coleman et al., 2018: 9) that is changing the nature of cognition itself. Through our growing entanglement with computational media, these scholars suggest that we are becoming different *kinds* of humans – ones who think, feel, remember, respond and move differently. If millennials do not rely on the same cognitive habits and capacities as their parents or grandparents, this, Serres contends, is because *they do not need them*: 'With their cell phone, they have access to all people; with GPS, to all places; with the internet, to all knowledge' (2015: 6).

In these ways, both classical habit philosophies and contemporary work on media ecologies figure habit and habitat as vital to the logics of transformation, and advocate thinking with assemblages to grapple with changing forms of human, infra-human and post-human life. In following the embodied afterlives of 'new' technologies, digital media scholars consider how, as Chun puts it, 'our media matter most when they seem to not matter at all'; that is, when they *become habitual* – how, for instance, 'search engines are hardly new or exciting, but they have become the default of knowledge acquisition' (2016: 1). Yet because digital networks are always in process and global media corporations trade on technological obsolescence, we are continuously compelled to update 'our' techno-social habits 'to remain

(close to) the same' (2016: 1). Humans thus participate in networked assemblages in which multiple 'actors are in a state of constant interaction, learning and becoming' (Hillis et al., 2015: 10) and, in turn, 'a continuous modification of habits by one another is constantly going on' (Dewey, [1922]2012: 19). What, then, do we stand to gain from returning to classical philosophies of habit in a context characterised by ubiquitous media analytics, and what might these thinkers have yet to teach us concerning the role of habit in the unfolding constitution of human nature?

Firstly, when read together, pragmatist and continental philosophies, I argue, offer a more robust, fine-tuned and yet open-facing account of habit than many contemporary discussions of networked media, which either reference 'habits' fleetingly, without unpacking their complex logics, or reduce habit to 'bad habits' (Malabou, 2008). As mentioned earlier, for these philosophers, habituation operates via a double logic. In Ravaisson's ([1838]2008) words, habits enable both 'addiction' and 'grace': it is one and the same force that produces habit as machinic repetition *and as* ease, facility and power. Or, as James puts it, 'our virtues are habits as much as our vices' (1899: 64). From this perspective, popular and scholarly discourses that reduce young people's social media habits to a growing crisis of mental health (Twenge, 2017), for example, tell only half of habit's story. They associate digital habituation with a rise in social isolation, damaging addictions and exposure to harm, without exploring how young people *live through* networked media in ways that can also 'widen the[ir] horizons' and 'give them command of their own powers' (Dewey, [1922]2012), 115). Relatedly, critical engagements that interpret our habitual online activity as (re)producing passive forms of being 'made aware' that impede 'real' political action (Dean, 2015) elide the generative forms of becoming that networked participation can entail – how practices of digital meme-making, for instance, cultivate 'a learned and socially habituated way of doing

things with machines, tools, interfaces, instruments, and media' that can transform the material of both bodies and cultures (Rentschler and Thrift, 2015: 242).[v] As our entanglements with networked media deepen and develop, then, these philosophies attune us not only to the potentially stultifying or dangerous effects of digital habituation, but also to the more affirmative capacities and forms of co-operation that techno-social habits can activate and sustain.

Secondly, thinking with habit assemblages has implications for theorising more-than-human agency and cognition that align with the dynamics of contemporary media ecologies. As the foil for Enlightenment accounts of reason, habit has long been reduced to 'unwilled repetition' (Malabou, 2008). Yet, as pragmatist and continental philosophers observe, without a mind/body split that attributes intentionality to rational thought against the 'dumb' automaticity of habituation, habits can no longer be conceived as oppositional to will. Rather, 'in any intelligible sense of the word will, habits *are* will' (Dewey, [1922]2012: 14); however, as Ravaisson ([1838]2008) notes, they exercise an intelligence 'dispersed throughout the body, and indeed throughout nature as a whole' (Carlisle and Sinclair, 2008: 11–12). Significantly, what is vital to the 'intelligence' of habits is their capacity to anticipate the future.[vi] Pre-figuring the contributions of actor-network-theories, ecological thinking and various 'new' materialisms, these philosophies offer an account of what might be termed *distributed agency via habit* – a range of capacities for 'intelligent' action made possible not through disembodied reason but rather via ongoing interactions of bodily processes, cognitive functions and environmental conditions. This view of will and anticipation as the product of dynamic habit assemblages, I suggest, sheds light on the extra-human nature of intentionality and action in the midst of data analytics. Agency, that is, must be conceived as a composite of human-machine relations given how information is now

increasingly stored outside of human memory (Steigler, 2012; Hayles, 2017), algorithms shape a multitude of everyday choices (Manovich, 2013; Clough et al., 2015), and machine learning technologies practice their 'own' forms of cognition (Parisi, 2013, 2019). In this context, classical philosophies of habit remind us that we have never been 'intentional, volitional subject(s), who determin[e] what comes to be' (Manning, 2016: 3). They also foreground habit's role as an (im)material hinge suturing 'technology' and 'culture', 'the organism' and 'the milieu', and 'the human' and 'the non-human'.

Thirdly, classical philosophies of habit hone a sensory empiricism resonant with the increasingly affective and speculative nature of networked mediation. As habit assemblages are continually evolving, pragmatist and continental thinkers suggest that we require intuitive modes of inhabiting these relationalities as they unfold across time and space. Recognising there is always much more to 'experience' than what is intellectually known, Dewey ([1922]2012; [1925]2015) suggests that we can gain greater access to the processual and felt qualities of social existence by learning to inhabit everyday encounters *as they happen*. Dewey's pragmatism thus resonates with what Bergson ([1903]1999) called 'intuition' – an immersive form of sensorial engagement with the richness and flux of material life, which operates before, or in excess of, analytical thought. Focusing on processuality allows these thinkers to hone a speculative approach to everyday life; that is, one oriented towards the latent possibilities for becoming otherwise in *the present*.[vii] The speculative methods of attending to emergent properties these thinkers advocate, I suggest, feel ever-more relevant in a digitally-organised world that is *itself becoming increasingly speculative* – whether via the production of 'affective facts' within the political-media 'resonance machine' (Connolly 2005; Massumi, 2015), the role of derivatives trading in financial markets (Clough et al., 2015, Clough 2018), or the intuitive modes of pre-emption employed within the post-9/11

international security apparatus (Amoore 2013, 2018). Across these and other algorithmic procedures, the focus is on possibility rather than probability; on the potentiality of that which 'has not yet come' (Williams, 1977: 130). In such conditions, these philosophies offer a generative lens to explore the immanent nature of mediated ecologies with 'the prudence of an experimenter' (Manning, 2016: 7) – in ways attuned to *process*, and hence to the virtual within the actual.

In considering the implications of these networked dynamics for 'the human', we might ask whether the emphasis on emergence, sensation and felt qualities central to pragmatist and continental philosophies conflicts with the more mechanistic and procedural habits media scholars attribute to emergent digital subjects. It bears emphasising, however, that 'the algorithmic' and 'the affective' are not oppositional; rather, they continually feed into one another. Indeed, as Louise Amoore notes, central to the shift from probability to possibility characterising the changes in algorithmic decision-making at the turn of the new millennium are processes through which 'scientific data begins to incorporate the emotional, affective and speculative domains'. Consequently, 'data-led algorithms that model the movement of bodies across space coalesce with intuitive and speculative knowledges that imagine future scenarios' (2013: 10; 2018, 2020). In this vein, it is notable that Serres's 'digital human' combines algorithmic thinking with 'an innovative and enduring intuition' (2015: 19). Precisely because they no longer have to dedicate so much mental energy and neural capacity to gathering, storing and organising information, young people, he argues, may cultivate a more intuitive mode of engagement attuned to the visceral experience and flow of everyday life (2015: 72). While her enhanced capacity for intuition attunes Serres's 'millennial' to connect with moving events as they unfold, her algorithmic aptitude allows for a more precise 'arraying of possibilities such that they can be acted on in the future' (Amoore, 2013:

23). As networked media transform everyday habits and habitats, then, we can consider how the emergence of an 'authentic cognitive subjectivity' (Serres, 2015: 19) – which sutures human and machine modes of sensibility, perception and thought – raises questions concerning what 'human nature' can now be said to entail.

Mediation beyond 'the human': noise, novelty and incomputable data

Yet if the above conversation explores how networked technologies are re-mediating 'the human', other scholars argue that what is most distinctive about computational media is their disregard for anthropocentric categories, processes and experiences. For Mark Hansen, what distinguishes twenty-first-century media – including everything 'from social media and data-mining to passive sensing and micro-sensors' – from previous technologies is a shift from 'a direct to an indirect modality' (2015: 4-5). In this view, older media forms, such as radio, television and early Internet, are 'human-addressed' in that they 'correlate *directly* to human modes of sensory experience and cognitive processing', whereas computational media are 'only *indirectly* correlated to human modes of experience' and carry out technical processes to which humans have no direct access (4-5). This distinction emerges from the embedding of adaptive algorithmic architectures within digital media technologies, which enable a transition from 'a past-directed recording platform to a data-driven anticipation of the future' (4). While computational media collect ongoing data about human sensibility which is used to produce new (or amplify existing) affects, habits and atmospheres, these processes do not coincide with human time, space or sense perception; rather, they involve 'inexperiencable experience' (Chun, 2016: 55).

Appreciating the significance of these technological shifts for more-than-human life, I suggest, requires addressing how contemporary algorithmic dynamics operate in a post-probabalistic mode – such that the logics of habit may appear less relevant than randomness and incomputable data. Following the events of September 11, 2001, the international security community became increasingly focused on the anticipation of 'low probability, high consequence' events – on how, as Amoore puts it, 'uncertain futures – however probabilistically unlikely – [could] be mapped and acted upon as *possibilities* (2013: 1). This led to a change in emphasis from statistical probability to algorithmic possibility enabled by 'the coupling of large-scale databases and adaptive algorithms' (Clough et al., 2015: 95). The model of risk that emerged is animated by an anticipatory logic that 'seeks not to forestall future events via calculation but to incorporate the very unknowability and profound uncertainty of the future into imminent decisions' (Amoore, 2013: 8; 2018). Significantly, the new algorithmic practices that inform risk-management in international security and political governance are simultaneously employed to maximise opportunity in the commercial world, including the information and technology industries. If the state seeks means of identifying 'unanticipated threats yet to come', commercial enterprises seek knowledge of the 'unexpected habits of a consumer yet to come' (Amoore, 2013: 41). Across these overlapping political, economic and social realms, the focus is less on tracking past patterns that can be projected into the future and more on identifying emergence, potentiality and 'the merely possible' – an imperative enabled by data mining practices that employ 'association rules' between transactions across databases (2013: 43). These algorithmic processes allow 'instant geospatial realization of histories of environmental, consumer, criminal, domestic and municipal datasets to be reconciled in real time' (Clough et al., 2015: 7), such that the focus is neither 'individuals' or 'populations' but rather massive quantities of disembodied data.

For our purposes, what is significant about adaptive algorithmic architectures is how they alter the relationship between media technologies and everyday habits and refigure the categories of 'mind', 'body' and 'environment' central to pragmatist and continental philosophies. For data-driven media platforms, the objective is to *produce novelty* though processing information that would usually be discarded as noise; that is, to incorporate within algorithmic procedures 'patternless quantities of data that allow parameters to change in real time' (Clough et al., 2015: 104; Amoore, 2020). Consequently, although computational media collect endless information about quotidian behaviours – 'making a call from a cell-phone, using a mobile device to access the internet, clicking through web links, swiping a credit card to make a purchase' – it is not the personal, embodied, habitual qualities of such activities that matter; rather 'the emergent attributes of digital trails en masse' are what produce value (103-4). As such, durable habits and patterns appear less significant to adaptive algorithmic architectures than noise and novelty.[viii] The visceral body of habit philosophies is, in turn, replaced by 'data fields [that] pass in and out of bodies' (103) and processes of 'intelligent' habit cultivation (Dewey, [1922]2012) give way to machines who 'think' at scales and speeds that are not our own. In the midst of networked media that operate almost entirely outside of human awareness, the ontological entanglement of 'mind' and 'body' or 'thinking' and 'sensing' vital to philosophical accounts of habit may thus appear inconsequential. Moreover, the fact that these algorithmic procedures operate with no causal relationship between inputs and outputs and without a distinction between inside and outside 'the system' (Clough et al., 2015) raises the question of what constitutes 'the environment' in social worlds increasingly ordered by computational technologies. If the very idea of mind-body-environment interactions requires 'the operational logic of closed

systems' (95), then the rise of data analytics arguably undermines the continuing viability of this model for interpreting the mediated nature of our existence.

How, then, should we understand the status of 'the human' within contemporary digital assemblages? For Serres (2015) and Chun (2016), 'algorithmic thought' arises from changing human-technology entanglements that prompt humans to develop particular machine-like qualities, alongside other cognitive, perceptual and sensorial capacities. By contrast, Luciana Parisi (2013) conceptualises 'soft(ware) thought' as a form of algorithmic cognition that does not exist in direct relation to human habits, affects or aptitudes. Emerging from the infiltration of randomness into programming culture, soft(ware) thought, Parisi argues, is not what 'affords the mind new capacities in order to order and calculate' or what 'gives the body new abilities to navigate space' (2013: xviii). Instead, it involves the 'automated prehension' of infinite data that cannot be fully compressed, comprehended or sensed by totalities such as 'the mind', 'the machine' or 'the body' (ix). Similarly, for Patricia Clough and colleagues, media analytics enable 'a new prehensive mode of thought that collapses emergence into the changing parameters of computational arrangements' (2015: 108).[ix] From these latter perspectives, the increasing autonomy of machine learning algorithms necessitates a more radical move away from 'the human' within social and media theories. Instead of addressing how computational technologies may be reshaping the habits that make 'us' human, the more urgent task, these interventions imply, is to confront the implications of media (infra)structures that operate without need for human input or regard for anthropocentric modes of organising or interpreting our social worlds.

What is vital to recognise in assessing these varying accounts of algorithmic life, however, is that none of the techno-social shifts addressed above are uniform or all-encompassing, nor do

digital assemblages (or any assemblages) work according to a single logic. As Hansen acknowledges in his account of the transformations associated with twenty-first century media, it is not the case that 'human experience simply and abruptly ceases to be what it has been up to now, or that humans have somehow changed in a way that leaves behind what they have changed from' (2015: 8). It is clear that 'we still live in the world through attentional consciousness and sense perception' and 'we still experience media that address us through these modes' (9). This points to one of the primary ways that the logics of habit – as theorised by pragmatist and continental philosophers – continue to matter to networked societies: they alert us to how 'obsolete' media never simply disappear; rather, *they live on in users' bodies* – in the active traces of past gestures, routines and tendencies – forming the 'productive nonconscious' of mediated social existence (Chun, 2016: ix, 7; see also Clough, 2018). Consequently, what appears technologically 'novel' or 'authentic' is always an ongoing re-mediation of old and new (Bolter and Grusin, 1998) and, in turn, the time of digital media is not as fast-paced or frenetic as it might seem (Chun, 2016). Or, more precisely, contemporary media ecologies involve *multiple* temporalities and spatialities (Coleman, 2017), some of which overlap with human experience and others which operate at radically different speeds and scales – much like habit itself, which, in compressing past, present and future and imbricating organic and non-organic processes, is emphatically non-linear and more-than-human.

In this vein, if 'old' and 'new' media continue to intermingle within networked assemblages, so too do statistical probability and algorithmic possibility. The growing focus on possibility and 'inferential forms of numbers' does not invalidate probability within media analytics; rather, 'multiple forms of probability coexist within a complex of authorized forms of possibilities of knowledge, past frequencies, and personal convictions' (Amoore, 2013: 45).

Consequently, while it is true that 'personal' habits in and of themselves are not of predictive interest to big data, the anticipatory dynamics of habit are not irrelevant to computational media. Indeed, as Chun suggests, the capacity for anticipation within algorithmic architectures emerges from correlating habits (i.e. buying lotion and taking vitamins) across data sets – a 'second-order correlation, which depends not on individual past experience but on collective action' (2016: 56). Probability, in this context, 'expands beyond an individual's experience to draw from your experiences of people "like you"; through data analytics' (2016: 57). Extending habit's anticipatory function to address the multiple relationalities and forms of 'cooperation' that habit assemblages involve (Dewey, [1922]2012) therefore complicates the relationship between causation and correlation, underscoring how probability and possibility work alongside and through one another in processes central to global media and platform capitalism. From this perspective, the kind of assemblage thinking that philosophes of habit employ and media ecologists extend is vital precisely because it allows for the simultaneity of diverse logics, relationalities and temporalities within mediated social life.

Conclusions: environmental sensibility and (much) more-than-human life

Drawing on the above conversation, pragmatist and continental philosophies, I argue, remain salient to discussions of networked and computational media, but we require a concept of habit that exceeds 'the human' more radically than these classical accounts allow – such that it encompasses not only evolving psychic and somatic relationships between bodies and environments but also 'singular actions [that] become indications of collective patterns' within algorithmic procedures (Chun, 2016: 57). In other words, our age of media analytics – in which algorithms iteratively learn and collaborate not only with humans but also with data

and other algorithms (Amoore, 2020) – demands recognition of how habits can assume a life of their own untethered to human bodies, processes or sensibilities. The imperative for media and social theory, however, is not to omit subjective experience – or attention to 'mind', 'body' and 'environment' – from analysis of contemporary media ecologies. Rather, it is to open up such concepts to 'the breadth of the social shift afoot in the computational world' (Clough et al., 2015: 111) through an approach to assemblage thinking in which humans are implicated but do not retain any status as unique or privileged actors and there is no discrete divide between human bodies and other kinds of matter.

This challenge entails theorising what Hayles calls 'a planetary cognitive ecology' in which cognition is engaged in by 'technical systems as well biological life-forms' (2017: 3). Within such an ecology, agency is more-than-human and distributed, in the ways pragmatist and continental philosophers suggest, but also 'punctuated': that is, it involves 'longer periods when human agency is crucial, and shorter intervals when the systems are set in motion and proceed on their own without direct intervention' (32). In turn, human subjectivity is not 'set off against a (media) object world, nor different from the microprocesses that inform it' (Hansen, 2015: 3) and 'environment' is never singular or self-contained. Indeed, in this mode of ecological thinking, 'there is no such thing as an environment in general; there are specific changing objects and events' (Dewey, [1922]2012: 62). What is at stake in our emergent computational world, then, is not only a capacity for habituation that spans the continuum of biological life (Ravaisson, [1838]2008) or the unification of 'human nature and the environment, natural and social' that habits entail (Dewey, [1922]2012: 9), but also a much broader range of (im)material dynamics through which human and technical processes interpenetrate one another to the extent that any human/non-human binary becomes untenable. With the rise of machine learning technologies, there is no human *outside the*

algorithm: 'humans are lodged within algorithms, and algorithms within humans' (Amoore, 2020: 58).

But where does all of this leave the sensory empiricism that philosophers of habit advocate? On one hand, grasping the significant social transformations associated with computational media requires speculative 'attunement to a world pulsing with change' (Clough et al., 2015: 111). On the other hand, the operations undertaken by such technologies are ones to which we have no direct access and that 'correlate to no existent human faculty or capacity' (Hansen, 2015: 4-5). What, then, of the embodied subject of pragmatist thought who gains greater access to the processual qualities of our material existence by affectively inhabiting environmental conditions as they unfold across time and space? Relatedly, what can the enhanced capacity for intuition Serres attributes to his 'digital human' be said to entail in societies increasingly ordered by technological procedures that do not coincide with human consciousness or sense perception? Do such techno-social conditions portend a future reality in which humans become ever more alienated from the very processes that (re)mediate our everyday habits, affects and experiences?

My view is that this need not be the case. Although computational media do not necessarily lend themselves to the kind of sense- or observation-based empiricism that habit philosophers envision, they do enable us to consider the nature of a wider 'environmental sensibility' (Hansen, 2015) that exists beyond the parsing of 'the human' from the world. As Hansen argues, microcomputational sensing and data-gathering technologies gather a wealth of data that 'registers the environmentality of the world itself, prior to, and without any necessary relation with, human affairs' (8). While such data is not available to humans in real-time, it is continuously fed forward into future consciousness, thereby offering us 'digital insight'

into how we are fundamentally *of* 'our' environment in ways that far exceed our ordinary awareness or after-the-fact modes of accounting. We might say, then, that twenty-first century media allow humans to connect with 'a moving world' (Dewey, [1922]2012: 83) (which such media simultaneously constitute) as never before, while also re-grounding 'a non-anthropocentric account of [that] world' (Hansen, 2015: 24). Moreover, if classical accounts of habit underscore how intuition has always been a more-than-human faculty, computational technologies now co-shape the future intuitive gestures of both humans and machines – such that intuition cannot 'meaningfully belon[g] to a unified *I* who thinks' (Amoore, 2020: 67).[x]

From my perspective, the rich modes of sensory attunement and affective inhabitation that pragmatist and continental philosophers advocate remain relevant to grasping the immanent and multi-faceted nature of current media ecologies. Indeed, we still register the sensorial effects of computational procedures in a variety of ways – through, for instance, ongoing awareness of how 'our daily digital life is full of algorithmically selected content' (Eslami et al., 2015 cited in Bucher, 2017: 31). And although '[b]ig data doesn't care about who you are so much as the bits of seemingly random information that bodies generate' (Clough et al., 2015: 105), media analytics nonetheless (re)produce embodied routines, habits and tendencies in ways that we can experience viscerally and affectively. What is vital, however, is that we acknowledge how many elements of contemporary digital assemblages are *not* immediately amenable to human sensibility and that, as such, experience 'simply is not what it used to be' (Hansen, 2015: 23).

While computational media would seem to augment human capacities in some ways and diminish human agency in others, what analysis of the role of habit in their dynamics more

profoundly reiterates is the extent to which 'the human' is, perhaps now more than ever, *so much more-than-human*. We are, ourselves, are technical, networked, algorithmic and enmeshed with data – though what this means, or has the potential to mean, socially, politically or ethically is neither obvious or uncontested; the re-mediation of 'the human' continues to unfold.

Notes

[i] See Pedwell, 2017a, b, c, 2019, 2021.

[ii] See Pedwell, 2017a, 2021.

[iii] I use the term 'the human' in inverted commas to indicate its status as an imagined category that is never simply given, neutral or universal. As feminist, queer, critical race and decolonial thinkers have long argued – and as I discuss elsewhere in relation to the logics of habit (Pedwell, 2021) – the very ways in which 'the human' is defined have long operated via a host of constitutive social contingencies and exclusions.

[iv] The OED defines an algorithm as 'a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer' (2018: online) – for example, the 'promise to be able to identify the relations of AB in association with XY, where W is also present' (Amoore, 2013: 43). As Louise Amoore notes, what is essential to the algorithm is 'the capacity to generate an actionable output from a set of attributes' (2020: 4). Algorithms, however, are extremely diverse. Unlike older rules-based and decision tree algorithms, contemporary machine learning algorithms, such as deep neural networks, have the capacity to modify their parameters in real-time in response to the data they encounter and extract. Rather than operating 'as a finite series of programmable steps', these algorithms are 'perennially adjustable and modifiable in relation to a target output' (13). What is most instructive in the critical study of algorithms, then, is how different algorithms experiment and adapt in practice; 'their empirical profusion and practical existence in the wild' (Seaver, 2017:2 cited in Amoore, 2020: 10).

[v] See Pedwell, 2017b, 2021.

[vi] As Catherine Malabou notes in her reading of Ravaisson, while a habit first emerges as the *effect* of a repeated change, 'it gradually becomes a *cause* of change itself, as it initiates and maintains its repetition' (2008: ix–x). From this perspective, habits are the result of past action but they are also what make possible a range of future

possibilities. Or, as Elizabeth Grosz puts it, habit 'anticipates a possible change … [it is] a potentiality, a possibility, a virtual mode of addressing a future change'. In temporal terms, then, a habit transforms a being 'so that its past experiences act to anticipate what the future may require' (2013: 220).

[vii] As pragmatist philosophy underscores, to work speculatively is to approach the world as composed of unfolding events conceived of as 'moving, as fraught with possibilities, as not ended, final' (Dewey, [1922]2012: 122). It is, as Martin Savransky, Alex Wilkie, and Marsha Rosengarten argue in *Speculative Research*, to develop practices that, 'by engaging inventively with the (im)possibilities latent in the present, can disclose, make available and experiment with possible prospects for becoming of alternative futures' (2017: 10).

[viii] While machine learning algorithms learn via their exposure to vast quantities of data, in which 'noise' may be yield valuable information, what is vital to their operation is the ability 'to make an action achievable amidst clutter and occlusions' (Amoore, 2020: 78).

[ix] The term 'prehension' – which might be defined as a 'pre-epistemic' form of apprehension – derives from the work of Alfred North Whitehead ([1929]1979); another early twentieth century American pragmatist thinker, though one whose account of process and relationality more radically de-centres 'the human' than does either Dewey's or James's philosophy.

[x] Amoore provides an insightful account of intuition as a more-than-human capacity in her discussion of the role of machine learning in surgical robotics, in which 'algorithms are enrolled to recognize surgical gestures and to extract the features of movement, to actively distribute cognition across human surgeons and robots'. For the designers of such algorithms, the objective is to 'model the optimal suturing motion so that future human *and* robotic surgeons have their intuitive movements shaped by the ingenuity of the model (2020: 59).

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