

From Neuro- to Noodiversity: Niche-Constructing the Stupefied City

There has perhaps been a tendency, in general organological circles, to see the hyperstimulation and cognitive demands of digital consumer technologies as inherently negative, the cause of a social pandemic of attentional deficiency. By drawing on the theory of 'neurodiversity', and bringing it into dialogue with our own concept of noodiversity, we can begin to nuance this picture—and in a manner that moreover contributes to debates on both the renewal of our urban environments and the outdated functionality of our ideas of what constitutes intelligence. For neurodiversity theorists, so-called learning disorders like dyslexia, ADHD and autism are elevated to pathological status by a combination of our narrowing cultural tolerance for different kinds of intelligence plus environmental and classroom conditions that prove increasingly maladaptive for certain kinds of Pleistocene brain. They propose to reinvent learning around a tailoring of milieus better accommodated to the flourishing of diverse neurological types, in which the student, afforded the freedom to create their own learning environment, is no longer expected to adapt to the restrictive, anxiogenic, sedentarism of habitual modes of work. Digital technologies present themselves as a significant component in this reinvention—or what we might, following Stiegler and Sen, better call a 'recapabilisation'—,¹ because of the way they increase the variety of environmental cues that serve as a basis for niche construction. Similar claims can be made regarding their potential to overturn a critical narrowing of the cultural-technical modes of intelligence in which noetic vitality consists. To realise this potential, however, we need to understand that the same (technological) ecological conditions that have maladapted the neurodivergent also broadly underlie what amounts to a crisis of noodiversity. The prospect of developing concentration through digital technology enables us to see that technologies hitherto linked to hyperdistraction acquire this characteristic when set against the understimulations of a world that has been increasingly stripped of stimulatory alternatives.

¹ This reworking of Sen is most extensive in Bernard Stiegler (2018) *The Neganthropocene*, edited, introduced and translated by Daniel Ross. London: Open Humanities Press, pp.52-3.

The central question, here, is fundamentally one of *relative* stimulus. The attraction of migrating online and losing ourselves in the oblivion of digital devices is relative to the paucity of analogue forms of stimulus in the high-stress and greenspace-poor environments of contemporary living. Cities have responded to this migration by plying us with ever stronger doses of commercial stimulation designed to lure us back in, recasting their centres as the supply hubs for a range of pharmaka that serve to prop up the exhausted citizens of addictogenic society. These efforts, however, are counterproductive. Far from being drawn to return to a world of shared public spaces, we are plied with the means through which to retreat from it. Much like the drugs given to ADHD sufferers to *simulate*, rather than *stimulate*, learning, contemporary urban living is effectively making us stupid, by narrowing attention around predominantly commercial environmental cues, which in turn creates a vicious circle whereby we only respond to the dopamine hits provided by consumerism. To break out of this circle, we must diversify the modes of urban vitality. Using contributive digital tools of augmented reality to embed learning across the cityscape could be one way to achieve this, but it is not without problems.

Noodiversity

The last few years have seen an increasing number of references to the idea of ‘noodiversity’ in the Digital Studies network. Broadly speaking, the concept serves as an analogue of biodiversity for intermittently not-inhuman, ‘noetic’, or exosomatic life, linking the vitality of technical culture to the variety of individuations coproduced between people and their tools. The ‘noo-’ prefix derives from the Greek νοῦς or νόος, meaning ‘mind’ and ‘intelligence’, or ‘nous’ in British English. The argument goes that ‘nous’ is not natural and infinite, but artefactual, fragile and finite, produced through the interaction of biology, technology and their social organisation. Certain kinds of organisation, most notably that of cognitive capitalism, bring about the depletion of intelligence, through a combination of milieus that inhibit its emergence and an industrial model that exhausts our mental energies.

I first used the term ‘noodiversity’ in November 2014, at the General Organology conference in Canterbury, in a piece that spent several subsequent years languishing in a print queue before seeing daylight. The paper in question, ‘Prolégomènes à un manifeste des études digitales’,² drew on the work of Susan Greenfield to posit that a diminution in the variety and density of our neuronal connections might even lead to a physiological diminution of consciousness. The idea resonates with the biophysicist Stuart Kauffman’s claim that life emerges spontaneously and automatically from diversity, as molecular variety generates multiple possibilities of increasingly complex

² Gerald Moore (2018) ‘Prolégomènes à un manifeste des études digitales’, *Études digitales*, 3: 21-37.

interactions.³ It draws more immediately, however, on work on the biology of the dopamine system, according to which addiction coincides with the narrowing of attention around the addict's object of choice, leading to the electrical silence of synapses and the pruning away of neurons no longer activated by the demands of everyday life. This creates a vicious circle, as the absence of receptivity to countervailing stimuli weakens the brain's ability to focus its attentions elsewhere. This reading of addiction goes against dominant stereotypes of how to treat the addicted brain. Counterintuitively, not to mention counterproductively, abstinence-based models of rehabilitation all-too-often merely strengthen impulsion to consume, by inadvertently reinforcing the neural circuits that keep the source of dopamine-craving in the forefront of the addict's horizons.⁴ An alternative strategy of overcoming addiction would therefore consist in diversifying the the array of stimuli to which the addict is exposed, reorganising the wiring of the brain so as to lessen the hold of the toxic pharmakon. Exposure to alternative possibilities of living, be that through increased social mobility, learning a new musical instrument, language or sport, or even, as Warren Neidich discusses, experimenting with Ayahuasca to reactivate dormant synaptic connections,⁵ would have the effect of reinventing experiential horizons through the creation of 'alternative reinforcers' that counteract attentional narrowing. A politics of noodiversity would entail generating the possibilities for such exposure as an antidote to the monocultural diet that afflicts not just consensually identified addicts, but all of us who internalise the homogeneity of consumer culture beyond the point where it stops yielding pleasure. This politics acquires specific significance in the context of our so-called 'addictogenic society', characterised by growing accounts of screen and device addiction, to say nothing of the pain and opioid crises, and increasing levels of stress-related related illness for which addictions function as a form of therapeutic escape.

It is not just our own society that is addictogenic: we can see cycles of addiction throughout history, coinciding with the periods of disadjustment between what Bertrand Gille described as technical systems and the social support systems that, by organising a society's adoption of technology, serve to integrate its members. Waves of technical disadjustment create addiction by dramatically rewriting the habits of the body and moreover through the creation of what addiction psychologist Bruce Alexander terms 'psychosocial dislocation'.⁶ Organological revolution opens up possibilities of consumption that reorganise both the neuroplastic brain and the institutions of society□

³ See Stuart A. Kauffman (2000) *Investigations*. Oxford, Oxford University Press, pp.10-16.

⁴ Mark Lewis (2015) *The Biology of Desire: Why Addiction Is Not a Disease*

⁵ Warren Neidich (2017) 'The Brain without Organs: Ayahuasca and the Theory of Neural Regression', in *The Psychopathologies of Cognitive Capitalism: Part Three*, ed. Warren Neidich. Berlin: Archive, pp. 223-248.

⁶ See Bruce K. Alexander (2007) *The Globalization of Addiction: A Study in the Poverty of Spirit*. Oxford: Oxford University Press, pp.59-62.

not just forms of employment, but also social norms that hitherto functioned to regulate our use of intoxicating *pharmaka*. Structural unemployment caused by technological change leads to the disintegration of social cohesion and the retreat of the socially marginalised into zones of intoxication offering ‘rational’, ‘adaptive’ respite from the chaos of everyday life.⁷ We saw this in fifth-century Athens, when the conjuncture of writing and the *demos* caused the displacement of the aristocracy into the politically disruptive private drinking clubs of the symposia;⁸ also in early Enlightenment Europe, in the Gin Craze of pre-industrial London and the ‘Leselust’ spawned by the boom of the book industry.⁹ We see it now, too, on the desolate urban high streets of the post-consumerist digital era, where the few stores surviving the onslaught of Amazon tend to be the ones servicing the addictions thrown up by the entrenched dislocation of digital society: shops for betting, vaping, junk food, and mobile phones; the super-discount ‘pound’ outlets, where even the poor can (notionally) spend for the sake of spending; the growing slew of cheap-to-run coffee houses, which, having surrendered their Habermasian role as formenters of enlightened disobedience, now serve primarily to prop up an exhausted, underslept workforce, diligently traipsing to their ‘bullshit jobs’ with little in the way of protest. Consumer capitalism, as Lefebvre pointed out, reinvented the city as a commercial spectacle, a ‘centre de loisirs’ that stages only the ‘formes dégradées de la vie ludique’, where the rigid channelling of stimulation into the identikit semiotics of consumerist junkspace destroys the ‘plasticity’ of society.¹⁰ In its aftermath, the competition-driven race to the bottom means that once-resplendent medieval towns like Durham and Saint Denis come to resemble the kind of ‘city-swallowing’ ‘zones’ of adaptation described by Keller Easterling as ‘the world’s global urban addiction’.¹¹ As businesses flee to warehouses on the periphery, local councils offer only supply-side solutions to revive vitiated community hubs bereft of jobs and residents. But slashing tax and regulations and building more shops to generate commercial activity achieves only the opposite effect of narrowing the varieties of available stimulus. The municipal parks, playing fields and public spaces once deemed a vital, counterstimulatory, tool for keeping the industrial proletariat off alcohol,¹² die off from underfunding. Reworking Stiegler’s Gille slightly, the problem is one of disadjustment between the ever more intense and centrifugal forms of technological

⁷ Alexander, *The Globalization of Addiction*, pp.59-60.

⁸ See Gerald Moore (forthcoming 2020) ‘Automations, Technological and Nervous’, *New Formations*.

⁹ Gerald Moore (2019) ‘Philosophy and Other Addictions’, in *Freedom and the Subject of Theory*, eds. Oliver Davis and Colin Davis. Oxford: Legenda, pp. 180-2.

¹⁰ Henri Lefebvre (2009) *Le Droit à la ville*, 3e édition. Paris: Economica/Anthropos, pp.122-3.

¹¹ Keller Easterling (2014) *Extrastatecraft: The Power of Infrastructure Space*. London Verso, pp.25-6.

¹² See David T. Courtwright (2019) *The Age of Addiction: How Bad Habits Became Big Business*. Cambridge, MA: Belknap, pp.98-9.

stimulation offered up by the market, and the diminishing centripetal power of social support systems to construct an integrated, functional public.

There is a relationship to note between the city as zone for what I have elsewhere termed ‘dopamining’ – the industrial exploitation of our neuroplasticity for the sake of generating compulsive consumption – and the anxiolytic safe spaces of the ‘machine zone’ described by Natasha Dow Schüll in her work of gambling addiction.¹³ Faced with the simultaneous boredom and stress of urban disadjustment, life migrates online, into dopamine-yielding virtual worlds of games, fake news, and celebrity gossip. As we saw in the case of both gin and books, the same technologies that lead to disadjustment become the object of abuse through a combination of the new, more intense, kinds of intoxication they offer, and the absence of norms of use to minimise their toxic potential. In these periods, the attentional narrowing of neuronal diversity in the addicted brain is paralleled in the decreasing variety of social behaviours, as habits converge around the new, hence under-regulated, technical system. The concept of noodiversity covers both aspects of this parallel, its cultivation working as a remedy at the neurological and social levels.

The oral prehistory of noodiversity goes back as far back as the 1990s, where (sadly unverifiable) trace evidence suggests it was first evoked as a concept in the ‘political sociology of technology’ by two Italian researchers now lost to academia.¹⁴ As far as I can tell, Stiegler didn’t use the term before me, though he did most of the groundwork for the idea and has subsequently taken it further. His version of the concept first appears in print in 2017,¹⁵ as a prelude to a much fuller discussion in *The Neganthropocene* (2018). My own earliest work on it developed out of passages in *Constituer l’Europe, 2: Le Motif européen*, where Stiegler describes the negentropic ‘diversification of types’ as being as ‘indispensable to social life as biodiversity is to the growing vitality of organisms’.¹⁶ The same passage describes the ‘homogenisation of types’ and corresponding ‘desertification’ of contemporary culture, with Stiegler alluding to his slightly earlier interest in the mass-production of consumer experience from around the time of *Aimer, s’aimer, nous aimer* (2003). It is in this essay that he first describes how mass-media brings about a narrowing in the diversity of a population’s

¹³ Natasha Dow Schüll (2012) *Addiction by Design: Machine Gambling in Las Vegas*. Princeton: Princeton University Press, p.2.

¹⁴ In an unpublished seminar paper given by F. Ambrogetti and G. Constantini (April 2003) “For a Contribution of Political Sociology to the Study of Technology: The Concept of ‘Noodiversity’”, *Technological Strategies for the New Europe*. Lecce University.

¹⁵ Bernard Stiegler (2017) ‘For a New Conflict of the Faculties and Functions: Quasi-Causality and Serendipity in the Anthropocene’, *Qui parle*, 26(1): 77-99, p.87 onwards.

¹⁶ Bernard Stiegler (2005) *Constituer l’Europe, 2: Le Motif européen*. Paris: Galilée, p.64.

technological habits, ‘synchronising’ the time-consciousness of football spectators.¹⁷ We can chart the shift via the growing numbers of one-time amateur players who surrender their 3D balls for clusters of ball-shaped pixels, which they consume beyond the point where pleasure gives way to compulsion. In so doing, they find themselves subsumed under a spectacle they play no part in producing, but which nonetheless fundamentally reorganises their lives.

At the heart of this mass-production of addicted consciousness is an imbalance between the use of technology for consumption and the restricted ability of consumers to use consumer technologies like televisions to transform both the world and themselves. The loss of noodiversity is thus also what is at stake in Stiegler’s reworking of Marx’s concept of proletarianisation as ‘generalised proletarianisation’, in which not just work, but experience and thought are externalised into machines without any corresponding internalisation of knowledge on the part of the machine user. Even our thought today is homogenised by the standardisation of the tools through which we do our thinking, from the Instagrammability required of aesthetic design, to the Tweet-length strictures of policy formulation, the algorithmic stereotyping of terrorists, and the econometrical schemata that constitute the failing blueprint of global economic growth. The example of Cambridge Analytica, suspected of exploiting big data to manipulate voting in both the US presidential elections and the UK’s referendum on Brexit, shows how digital technologies are being employed with ever greater efficacy to automate decision through the prescription of aesthetic experience. The affair demonstrates just how far that contemporary politics has yet to develop mechanisms for dealing with digital disruption. Among the methods since proposed for the detection and mitigation of fake news are economy of contribution-style techniques for the collective certification of news sources. These speak to the idea of ‘noodiversification’, that is, of creating digital tools to generate decentralised communities with the capacity to establish their own norms for living. Because of the way it runs counter to the algorithmic conditioning of proletarianised thought, Stiegler goes so far as to argue that the cultivation of noodiversity can serve as an antidote to the ecological crisis that is befalling our *artefactual* as much as our natural environments. ‘Noodiversity will be the key issue over the next few decades, and this will require a noopolitics to operate above and below the emerging neuroindustry’.¹⁸

Neurodiversity

There is a striking overlap between this politicisation of noodiversity and that of another, more or less contemporaneous and highly similar, but perhaps deceptively homophonous concept, namely ‘neurodiversity’. The ‘neurodiversity’ movement began life in the late 1990s and, much like noodiversity, with the suggestion that it ‘may be

¹⁷ Bernard Stiegler (2003) *Aimer, s’aimer, nous aimer*. Paris: Galilée, pp.26-30.

¹⁸ Stiegler, *The Neganthropocene*, pp.78, 81.

every bit as crucial for the human race as biodiversity is for life in general'.¹⁹ The central plank of the neurodiversity argument is that contemporary societies are organised in a way that pathologises the 'neurologically different'—people with ADHD, autism, Down Syndrome and Tourette's, among others sometimes suggested to include those with a genetic propensity for addiction-formation. Above all, they are forced to 'adapt' to dominant social and educational norms to which their brains are not suited. This enforced adaptation, proponents argue, is particularly pronounced in the institutional cultures of the West, and has become progressively more problematic since roughly the 1970s, when numerous neurological 'disorders' and 'learning disabilities' first emerged as phenomena of the medical-educational gaze. At the very time when we are supposedly becoming more attuned to the value of intellectual pluralism, and despite plentiful evidence of lip service to the contrary, the result is that we continue to promote a concept of intelligence linked above all to conformity—that is, to the ability to succeed within the dominant, normalised, milieus of society. In this respect, the neurodiversity movement provides yet more evidence for what Stiegler, Virno, and others, have theorised as the ideology of adaptation: the predominant expectation that individuals change themselves to fit whichever circumstances are imposed upon them, and which affords no place to the prospect of our participation in the construction of milieus designed to enable us to flourish.²⁰

In other respects, the movement is marked by subtle elements of difference that need qualification to be reconciled with Stieglerian positions. In dramatic depictions of the attentional shortfalls of consumerist society, the latter has tended to focus on industrially manufactured technologies of distraction and hyperstimulation as decisive causes of what Kate Hayles calls a shift in our 'mean levels of attention'.²¹ By contrast,

¹⁹ Harvey Blume (September 1998) 'Neurodiversity: On the neurological underpinnings of geekdom', *The Atlantic*, quoted in Thomas Armstrong (2011) *The Power of Neurodiversity: Unleashing the Power of Your Differently Wired Brain*. Philadelphia: DaCapa, p.6.

²⁰ On this idea, see Gerald Moore (2013) 'Adapt and Smile or Die! Stiegler Among the Darwinists', in *Stiegler & Technics*, eds. Gerald Moore & Christina Howells. Edinburgh: Edinburgh University Press.

²¹ See chapter 5, 'Thérapeutique et pharmacologie de l'attention', in Bernard Stiegler (2008) *Prendre soin: De la jeunesse et des générations*. Paris: Flammarion; also N. Katherine Hayles (2007) 'On Hyper and Deep Attention: The Generational Divide in Cognitive Modes', *Profession* 13, p.190.

the argument from neurodiversity finds its basis in the genetic disparities that distinguish the 'neurodivergent' from the 'neurotypical', but offers a comparable critique of the socio-ecological changes that have brought these differences to the fore. The growing phenomenon of attentional deficiency becomes less simply about environmental circumstances that cause us to internalise the distractedness of our technological environments, and more about the increasingly obvious maladaptation of Pleistocene brains to the paradoxically understimulating adaptation-demands of late capitalism. 'Much of ADHD may need to be substantially reconceptualized as a symptom of our contemporary society and our modes of regulating children's behaviour, rather than a symptom of any neurological imbalance or disorder.'²²

Pioneering work on the proliferation of attentional disorders questions the effect of educational standardisation, urban transformation and the commodification of time on children's neural development. Research appears to have established a statistical correlation between ADHD and 'abnormalities' in the development of the brain's frontal lobes.²³ These lobes are 'essential for long-term planning', behavioural and emotional inhibition, the internalisation and externalisation of behaviour, and the ability to 'conceptualize more complex psychological perspectives'.²⁴ A decisive factor in their healthy functioning is the dopamine neurotransmitter, which underpins our neuroplastic ability to internalise our environments. Dopamine is vital chemical component in our ability to learn from experience, but it gets depleted the more we struggle to sustain concentration. This is the phenomenon of 'attention fatigue';²⁵ we have already seen it in the above-mentioned example of the addict, whose attempts to abstain ultimately reinscribe the neural pathways that cause craving in the first place. Rat experiments conducted by the Estonian psychobiologist Jaak Panksepp have established a connection between boisterous play, dopamine release and the growth of the frontal lobes. Others have shown that time spent in 'green' environments enables the replenishment of depleted dopamine.²⁶ 'The explosion in the diagnosis of ADHD may largely reflect the fact that more and more of our children no longer have adequate spaces and opportunities to express this biological need□to play with each other, in vigorous rough-and-tumble ways, each and every day'.²⁷ According to Thomas

²² Jaak Panksepp (1998) 'Attention Deficit Hyperactivity Disorders, Psychostimulants, and Intolerance of Childhood Playfulness: A Tragedy in the Making?', *American Psychology Society*, 7(3), pp.91-2.

²³ Russell A. Barkley (1997) *ADHD and the Nature of Self-Control*. New York: The Guildford Press, pp.34-7.

²⁴ Jaak Panksepp, 'Attention Deficit Hyperactivity Disorders', p.91.

²⁵ Armstrong, *The Power of Neurodiversity*, p.43.

²⁶ Frances E. Kuo & Andrea Faber Taylo (2004) 'A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence From a National Study', *American Journal of Public Health*, 94(9): 1580-1586, p.1580.

²⁷ Panksepp, 'Attention Deficit Hyperactivity Disorders', p.91.

Armstrong, writing in the *The Power of Neurodiversity*, the loss of time and space for playing has left children ‘dopamine-starved’ (depleted) and with ‘frontal-lobe dysfunction’ that could ‘benefit tremendously from vigorous free-play experiences.’

The problem is that increasingly we’re seeing a cultural trend toward a more sedentary childhood, where children sit passively watching television, ‘playing’ video games (which is not true play), working at their computers, and being involved in adult-supervised competitive games (also not true play).²⁸

Similar criticisms have also been levelled at a schooling system and regimes of medical-pharmaceutical treatment that place unprecedented levels of pressure on pupils to conform to neurotypical categories of what constitutes ‘smart’. Critical concerns bear, in particular, on the prescription of psychoactive medications like methylphenidate (Ritalin), which becomes the hallmark of the adaptive therapeutic approach, that is, of bending the child to fit the established norm, in place of allowing the interests of the child to shape the learning process.²⁹ The drug gives the impression of success by getting impulsive, fidgety children to sit still, but its impact is now thought to stem more from the inhibition of the search for stimulus than from the enhancement of attentional focus. Ritalin seemingly works by dulling the impulse to play. Despite providing a dopamine shot that should facilitate environmental learning, it merely simulates focus, curbing distractibility by reducing the child’s receptivity to the dopamine cues of the broader environment. In so doing, it blunts our neuroplastic capacity to be shaped by our surroundings.³⁰ The basic problem remains, which is that our surroundings are insufficiently stimulating and getting worse, rendering maladapted people who, for the overwhelming majority of human history, had found a viable cultural niche as physical learners and explorers. The solution, neurodiversity activists argue, lies in embracing the extended evolutionary synthesis, with its emphasis on ‘niche construction’ over a narrow understanding of adaptation. ‘Instead of always having to adapt to a *static, fixed, or “normal”* environment’, neurodiverse learners and their caregivers should be capacitated to construct milieus adequate to the ‘unique needs of their brains’.³¹

The same shift in evolutionary register, away from the ideologically contaminated discourse of natural selection and towards an expanded theory of artificial selection, is already at work in the theory of general organology, with its post-Canguilhemian

²⁸ Armstrong, *The Power of Neurodiversity*, p.45.

²⁹ Thompson, *The Power of Neurodiversity*, p.16.

³⁰ Panksepp, ‘Attention Deficit Hyperactivity Disorders’, p.95.

³¹ Thompson, *The Power of Neurodiversity*, pp.16-17.

insistence on our ability to use tools to reinvent both our milieus and ourselves. Neurodiversity's emphasis on genetics (not to mention its avowed proximity to the positive psychology movement) risks throwing up the perhaps too-easy criticism of ideological complicity in its 'naturalisation' of socially constructed behaviours. But there is a pronounced organological dimension in the niche constructivist therapies the movement proposes—one from which the politicisation of neurodiversity can learn, and which will enable us to situate neuro- and neurodiversity together on the same continuum. Most notably proposed in the wake of work by the evolutionary biologist, Richard Lewontin,³² but strongly anticipated by Jacob von Uexküll, Georges Canguilhem and even the aforementioned Lefebvre, the theory of niche construction posits that life is not simply about adaptation to a pre-given environment. Organisms also participate in the construction of milieus, or ecological niches, in which they can flourish, over and above merely struggling to survive. Lefebvre's resonant claim is that the vitality of a city is proportionate to the role of its *ouvriers* in the creation of a collective *œuvre*—the collective endeavour of niche-constructing animals we now believe to be uniquely capable of collective attention.³³ Off the back of his critique of 'disease model' approaches to the schooling of so-called learning 'deficiencies', Thompson emphasises the role that technology and its social reorganisation can play in integrating those hitherto excluded from the construction process, facilitating the creation of new learning norms by and for the neurodivergent.

Escape—to and from the machine zone

The genetic argument for ADHD points to an allele prevalent among ADHD sufferers that inclines them towards 'novelty seeking'. The D4 dopamine receptor is believed to have evolved around forty thousand years ago, at a time when the enhanced susceptibility to stimulation it confers would have proved adaptively advantageous in the search, for example, of new territories or food sources.³⁴ The same gene that makes for Paleolithic vitality gives rise to frustration and comparative hyperactivity when expressed in an individual who is trapped within the understimulating confines of a

³² See, on this point, John Odling-Smee (2010), 'Niche Construction', in Massimo Pigliucci & Ged B. Müller, eds., *Evolution: The Extended Synthesis*. Cambridge, MA: The MIT Press, pp. 175-8.

³³ Henri Lefebvre, *Le Droit à la ville*, pp.44-6; on collective attention, see Michael Tomasello (2019) *Becoming Human: A Theory of Ontogeny*. Cambridge, MA: Belknap, pp.304-5.

³⁴ Thompson, *The Power of Neurodiversity*, p.36.

standardised classroom microhabitat. But it can be accommodated by integrating the prospect of learning through movement. It is well established that digital culture provides people with autism with possibilities of work and social interaction that circumscribe the difficulties they can face with face-to-face socialisation. It also opens up similar opportunities for other 'neurodivergent attentional styles'. A striking instance of this occurs in what is much debated but increasingly recognised as the elevated levels of 'hyperfocus' often experienced by ADHD sufferers when engaging with the much higher dopamine-yield triggered by stimulation-rich hobbies, including computer games and other modes of 'screen time'.³⁵ The aforementioned Thompson reads this as evidence of the attentionally impulsive merely being out-of-place in environments that stultify and underwhelm the senses. By way of corrective, he recommends that ADHD sufferers be provided with greater real-world stimulus, including the freedom to move around and explore the physical space of the classroom. And he argues in favour of creating digital educational platforms that compensate for the inadequate stimulation of conventional classroom settings.³⁶ The crucial factor, in any case, is that the milieu reflect the specific needs of the learner. Full-blown niche construction□and general organology□would go further still in insisting that individuals play a decisive role in experimenting with and constructing those milieus for themselves.

The argument from genetics can nuance the anti-consumerist argument from social causation, without the two contradicting one another. Roughly 7% of the population carry something like the D4 allele, and they stand out as the extreme end of Hayles's shifting attentional mean. It seems reasonable enough to posit that the environmental changes disproportionately affecting them will impinge upon the rest of us, albeit to a lesser extent. With sufferers of ADHD, it tends to be the norms of classroom that condemn to stupidity: the requirement to sit in one place for long periods, shutting oneself off to competing sources of stimulus. But the same requirements of sedentarism are characteristic of many prevailing forms of deskbound, screen-based employment, where stimulation is moreover systemically channelled to focus on overambitious, anxiogenic, targets; and where the productivity gains of automation are accordingly offset and rendered stagnant by workers' stress, demotivation, and the 'structural stupidities' induced by the workplace.³⁷ It is in this context of restricted stimulation that we resort to the pursuit of dopamine hits via binge sessions in the anxiolytic machine zones of Netflix and mobile phones.

³⁵ See, for example, Kathleen E. Hupfeld, Tessa R Abagis & Priti Shah (September 2018) 'Living in the "zone": Hyperfocus in adult ADHD', *ADHD Attention and Hyperactivity Disorders*, p.42.

³⁶ Thompson, *The Power of Neurodiversity*, pp.41-2.

³⁷ See David Graeber (2015) *The Utopia of Rules: On Technology, Stupidity, and the Secret Joys of Bureaucracy*. Brooklyn: Melville House, pp.94-5.

It is in this context, too, that the task of the ‘real’ smart city must include a rebalancing of available stimulus□by bringing the freedoms and heightened sensations of digital technology to bear on the reconstruction of our depleted learning environments, be they in the classroom, the office, or the city as a whole. Augmented reality technologies are already hinting at ways to reinvent urban landscapes as learning territories, by allowing, for example, the digital overlaying of historical buildings and artefacts for exploration *in situ*. The kind of approach pioneered by Pokemon Go, with 500 million downloads in 2016, is among the most conspicuous successes to date of the purported reintegration of online and offline worlds, projecting the contents of a screen across the physical environment. Its success lies in the gamification of exercise to resituate digital escapism squarely within the analogue world: outside the game, players compete over who has walked furthest in the quest to find and take selfies with digital creatures secreted in far-flung corners of the city, some covering thousands of kilometres in the process. But determinedly onscreen goals ensure that the discovery of one’s locality risks being fleeting and incidental, without generating further affective investment in the places onto which digital avatars are superimposed. The level of online-offline reintegration, in other words, is far from self-evident. Innovation needs to focus on enhancing the varieties of urban stimulus and our capacity to reflect on them critically, not on relegating cityscapes to serve as disposable backdrops for virtual adventures.

It has been argued that addiction is a really only a form of disordered learning, marked by the adaptation and fine-tuning of the neuroplastic brain to the dominant stimuli of its surrounding environments, ‘automatising behaviour’ in the same way that learners acquire mastery through habituation to once-unfamiliar routines.³⁸ The conspicuous ‘interpassivity’ and dopaminergic of Pokemon Go nonetheless falls short of the internalisation of knowledge, the creation of *savoir-vivre*, that Stiegler would equate with learning. More pedagogically substantial alternatives are doubtless in the offing, including at Durham University, where we are working on a contributive platform designed to involve communities in the digital reconstruction of their local heritage (openheritage.community). Even these efforts might be viewed with a note of caution, however. Discussing the possibility of using high-stimulus digital tools to increase dopamine levels and thereby help concentrate the attention of those neurodivergent who require greater stimulus to trigger neuroplastic learning, the aforementioned Susan

³⁸ See, for example, Maia Szalavitz (2016) *Unbroken Brain: A Revolutionary New Way of Understanding Addiction*. New York: St Martin’s Press, p.118; also Barry J. Everitt and Trevor Robbins, ‘From the ventral to the dorsal striatum: Devolving views of their roles in drug addiction’, *Neuroscience and Biobehavioural Reviews*, 37 (2013), 1950.

Greenfield worries about the long-term effects of what ‘would surely not be that different from giving them low doses of amphetamine’.³⁹ Such doses might preserve deep attention, but at the cost of spiralling levels of dependence on technological stimulation, which moreover run the risk of tipping over into the high dopamine levels she associates with regression to ‘childlike’ ‘mindlessness’: over-responsiveness to the external environment, resulting in ‘prefrontal under-function’, nihilism, diminished reflection and waning self-consciousness.⁴⁰ The irony, here, is that these symptoms already prevail in what has elsewhere been described as our ‘hyperdopaminergic society’, set in place by the ultra-competitive, stress-intensive, rat race of neoliberal adaptationism.⁴¹ We have created a biochemically skewed culture, where higher dopamine levels are simultaneously advantageous□affording faster adjustment to the disruptions of rapid social change, also reducing susceptibility to depression, anxiety and a host of other mental and physical, low-dopamine-related, illnesses□and punished by the Skinner cage-like structures of contemporary housing, work and education. Whatever the niche constructive opportunities the digital may offer, they cannot be allowed to substitute for a more thorough engagement with the broader socioeconomic conditions at the root of this imbalance.

Conclusion

The psychologist Fred Previc has theorised the existence ‘hyper-dopaminergic disorders’, diseases including depression and obsession compulsion, schizophrenia, Alzheimer’s and Parkinson’s, whose increasing prevalence he attributes to dopamine disinhibition caused by the competitive, individualistic and community-poor lifestyles that have become normalised and intensified over the history of capitalism. In a correlation that reinforces the impression of our cultural and artefactual ecologies making us ill, the list of hyper-dopaminergic disorders is broadly coextensive with disorders attributed to the hyper- or hypo-reactivity of the nervous system to environmental stimuli, the ‘inability to inhibit irrelevant information’ coming from one’s surroundings.⁴² They map, in

³⁹ Susan Greenfield (2014) *Mind Change: Digital Technologies Are Leaving Their Mark on Our Brains*. London: Random House, p.191.

⁴⁰ Greenfield, *Mind Change*, pp.98-9.

⁴¹ Fred H. Previc (2009) *The Dopaminergic Mind in Human History and Evolution*. Cambridge: Cambridge University Press, p.157; see also Gerald Moore, et al. (forthcoming) ‘The Limbic Capitalocene: Planetary Detox and the Neurobiology of Ecological Collapse.’

⁴² Compare Previc, *The Dopaminergic Mind*, p.157, with Bianca Acevedo et al. (2018) ‘The functional highly sensitive brain: a review of the brain circuits underlying sensory processing sensitivity and seemingly related disorders.’ *Philosophical Transactions of the Royal Society B*, pp.1-5: 2.

turn, onto the kinds of mental illness known to be more prevalent in cities: disorders of mood, anxiety, psychosis and addiction, exacerbated if not caused outright by the effects of stress, poverty and isolation, and which are moreover known to be mitigated by the existence of established social support systems.⁴³ A hyper-reactive nervous system is recognised as a key feature of some kinds of neurodivergence—Autism Spectrum Disorders and ADHD, but not Dyslexia, for example—that are also now recognised as more susceptible to addiction, and to screen-based addictions in particular,⁴⁴ because of the way that withdrawal into ‘zones’ of intoxication works to dampen the deleterious surfeit of stimulus. The stresses of contemporary living thus bring neurodiversity to the fore, pathologising it into visibility, while simultaneously curbing noodiversity, by channelling attention towards heightened dopamine cues that lead us to retreat from shared public space. The hits of dopamine offered up by consumerism become an instrument of adaptation, in this respect, compensating for the constriction, toxicity and under-stimulation of the surrounding environment. The risk of automation and the ‘smart’ city is that they will intensify this predicament, upping stress-levels as we are pushed to compete with robots; inhibiting playful experimentation with constant surveillance, ongoing assessment and new modes of bioregulation; pushing us further to seek respite in machine zones at the margins of life of the city.

In Stieglerian terms, this adaptation to pre-established norms falls short of the learning that takes place when environmental stimuli are internalised and converted into knowledge; when the creation of new vectors of stimulation translate into alternative futures that loosen the narrowing of attention around consumption in the present. Noodiversification will consist in constructing niches defined by quasi-causal points of externality from which to reorientate towards more therapeutic, less anxiogenic, modes of living. ‘Neuro-urbanists’ have already begun to envisage low-stress communities where the neurodivergent and -typical alike would be freed up to work and build lives, and look to digital technology as a means to realise this.⁴⁵ The task of the ‘real smart city’, and for ‘contributive learning territories’ like the one in development at Plaine Commune,⁴⁶ will be to build on these findings to encompass a more pluralistic concept of ‘smart’.

⁴³ Oliver Gruebner et al (2017) ‘Cities and Mental Health’, *Deutsches Ärzteblatt International*, 114, pp.121-7: 122-3.

⁴⁴ See, for example, Greenfield, *Mind Change*, on the idea that ADHD and addiction are ‘two sides of the same mental coin’ p.188.

⁴⁵ Mazda Adli et al (2017) ‘Neurourbanism: Towards a new discipline’, *The Lancet Psychiatry*, 4(3), pp.183-5.

⁴⁶ Stiegler, *The Neganthropocene*, pp.122-5.