

- ARTICLE -

## **Distributed Mimicry: Big Data and Predictive Analytics**

*John Farnsworth*

### **Abstract**

This paper argues that mimicry is a central issue in the development of new practices of predictive analytics and big data. The issue concerns the increasingly precise reproduction of human interactional dynamics and their translation to machine and code worlds. Mimicry, in this sense, allows for predictive analytics to simulate a huge range of individual and collective cross-species behaviours. This includes human practices, particularly at the non-conscious, non-verbal level sometimes with an uncanny appearance of intuitive anticipation. The paper takes up different perspectives on mimesis and simulation to discuss the exploitative and emancipatory tensions these articulate. It investigates these through developments in mimicry algorithms and the distributed mimicry generated through swarm robotics, text mining and recent advances in codifying human synchrony. All of these utilise mimicry as core elements in their development.

### **Introduction**

Mimicry is almost ubiquitous across species, whether it is swarm behaviour amongst bird, insect or fish populations, or as a means of deception or protection on an individual basis. Gabriel Tarde (1903) argued long ago, that imitation is a foundational aspect for the social sciences, precisely because mimicry plays a key role in societies in ways that replicate phenomena in the physical and biological universe. Whilst mimicry has always been central to art and literature (Girard 1987), the rise of 'Big Data' now enables mimicry to be modeled and reproduced in the subtlest ways, often to the global advantage of state and corporate interests.

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John Farnsworth is associated with the Media, Film and Communications Department at the University of Otago. He is also a registered psychotherapist working in private practice. Recent papers include work on new technologies, mobile devices, short-term psychotherapy, ethnography and methodology.

This paper discusses digital mimicry and its implications, by which I mean the expanding distribution of mimicry through digital means. Some of these means, as I illustrate later, are already so sophisticated that their implications become hard to grasp. Mimicry is made possible through mathematical algorithms—code, in effect—which can replicate, or simulate, an extraordinary array of functions. These, as I will describe, operate across human, mammalian and species domains. They also extend from the biological to the finest gestural interactions between human beings that, now, can be microscopically tracked and reproduced. These, in turn, open up potential new forms of assemblage that extend collective human capacities. Nigel Thrift (2014), for example, outlines the rise of a sentient city where human-digital interfaces are increasingly reconfiguring, over time, how we experience or inhabit urban life. As he argues, these re-assemblages begin to raise difficult questions about what we mean about the very idea of sociality. These are questions echoed in the posthuman literature (Hayles 1999; Braidotti 2013).

As I outline below, mimicry, or mimesis, has a long history. Auerbach (1953), for example, describes 3000 years of mimetic Western art and literature. He and others (Gebauer and Wulf 1995; Halliwell 2002) also demonstrate that mimesis or simulation involve dissimulation or deception. Consequently, simulation and dissimulation often go hand in hand. This opens up two broad alternatives for societies: simulation either for cooperative or for exploitative ends. In this context, dissimulation is an aspect of exploitation.

Homi Bhabha (1995) explores exploitation and domination as a key theme in his writing on postcolonial societies, and I draw on it to discuss how his analysis of simulation and colonization can be applied to the realm of digital mimicry. Here, questions of domination are central, along with the shifting terms of that domination as the signifiers and relations of domination alter.

Bhabha's analysis is outlined below; here, it is enough to note that it offers a detailed critique of the strategies of coloniser and colonised which, in terms of simulation and dissimulation, can be translated to the digital sphere. Domination, as in the postcolonial setting, involves the constant struggle around how issues of surveillance, privacy or copyright are negotiated. This may be the deceptive state practices brought to light by the Edward Snowden and Wikileaks controversies. Equally, it is the practices of mimicry and prediction by giant corporations, whether these are Google or Facebook algorithms, consumer simulation by Yahoo, Walmart or eBay (Kullenberg and Palmås 2009, Palmås 2011, Ferguson 2013a), or discrete customer management by numerous conglomerates (Ferguson 2013b).<sup>1</sup>

By contrast, distributed mimicry and predictive analytics can be utilised for democratic or emancipatory ends. This is what the explosion of public good, open source or civic software freely available on the Internet demonstrates (e.g. Braverman 2014, Thomas 2014). This, in turn, opens up questions about what we mean by 'surveillance'.

Surveillance is commonly top-down scrutiny by the powerful, but Ganascia (2010) emphasises *sousveillance*, or watching from below. Yet, digital mimicry opens out the notion of *veillance* beyond a binary opposition towards an array of practices.<sup>2</sup> For instance, Klauser and Albrechtslund (2014) draw on Latour and Foucault to ask how big data organise both public projects and also individual forms of self-surveillance. As they argue, ‘such quantification practices using monitoring technologies become co-producing when individuals constitute themselves as subjects engaging in self-tracking, self-care, and self-governance’ (2014, 275). These cooperative practices are quite different to the usual typification of top-down surveillance and highlight the tensions around how, and to what ends mimicry, let alone surveillance, functions.

The paper, then, develops the idea of mimicry or mimesis as an outgrowth of big data and predictive analytics. It emphasises a dynamic notion of mimicry—one that is interactive and potentially self-learning (Buytendijk and Trepanier 2010). It begins by discussing the concept of mimicry and its roots in the concept of mimesis, and then turns to outline the development of recent applications across a variety of domains.

It picks out two in particular. One is collective: the development of swarming algorithms and robotics. The second moves from the collective to the individual, describing visual and aural technologies that track how humans synchronise their communication in gestural and non-verbal ways. In effect, this work constructs algorithms that mimic empathy and co-relations, often at dynamic, microscopic scales. Yet, both collective and individual digital mimicry involve translation and colonisation and powerful sets of tensions about the uses to which these extremely sensitive, miniaturised practices can be put. This returns us to Bhabha and colonisation. I relate his work to Pentland’s research on sociometric badges in organizations to discuss how subtly shifting parameters of colonization and domination work to corporate advantage.

### **Mimicry – mimesis**

Historically, mimesis has been a key organising trope throughout European history and literature. Eagleton (2003), drawing on Auerbach’s (1953) immense survey, depicts it as the long-running effort to ‘represents the world as it actually is’. Such representation involves the genre of realism, itself ‘one of the most elusive of artistic terms.’ In the gap between ‘reality’ and its representation, Hayden White (1999) argues, lies the domain of the figure. Here, he proposes, even history, that most seemingly ‘realist’ form of writing, is better considered not as a direct access to reality but as a special kind of language use; in other words, a specific kind of figure. Such figures: metaphor, allegory, and rhetorical tropes function, in effect, as translation devices from world to page. White (1999, 7) argues that like metaphoric speech, symbolic language ‘always mean more than it really says, says something other than what it seems to mean, and reveals something about the world only at the cost of concealing something else’. There is always a slippage (Imbert 2003). Such ambiguous figural realism, with its slippage and excess, as these writers argue, is intrinsic to mimesis and imitation.<sup>2</sup>

Homi Bhabha (1995) investigates the implications of this argument for colonial power and resistance in postcolonial theory. He draws, for example, on Lacanian psychoanalysis (1977) for the idea of mimicry as camouflage. Following Lacan, he presents the coloniser as a snake in the grass: one who speaks in 'a tongue that is forked,' creating mimetic representations that emerge 'as one of the most elusive and effective strategies of colonial power and knowledge' (Bhabha 1995, 85). 'The effect of mimicry on the authority of colonial discourse', he suggests, 'is profound and disturbing', as if 'the very emergence of the 'colonial' is dependent for its representation upon some strategic limitation or prohibition within the authoritative itself . . . so that mimicry is at once resemblance and menace' (1995, 122-23).

When translated to the digital realm of state and corporate bodies, the same layered relations of ambiguity and ambivalence can be found. Such bodies stand as colonisers in close and ambiguous relations to the subject Other, either as codified 'dividual' or surveilled subject. They enact mimicry, at the individual or collective level, through utilising big data patterns to anticipate and replicate the desire of desiring subjects through the predictive capacity of algorithms and code. Conversely, colonised subjects deploy mimicry, too, in order to subvert 'the narratives of colonial power and dominant cultures' (Kumar 2011, 121). Yet both coloniser and colonised are subject to ambivalences and complex identifications. As Hubbard and Kitchin summarise it (2011, 71), 'if the coloniser becomes a split, ambivalent figure, then so does the colonised: the latter possesses no authentic self beneath the mask of mimicry bequeathed by the coloniser.' Political resistance to colonization, then, has to be understood as an 'ambiguous process in which that legacy is both refused and desired.' Yet, Imbert (2003, 10) emphasises, in postcolonial, postmodern societies, 'the writing back of oppressed groups' and mimicry becomes 'the efficient art of one who is in the advantageous position of being at least bicultural' (2003, 9). All such strategies, as Bhabha (2004, 85) observes, are a discourse of mimicry 'constructed around an ambivalence; in order to be effective, mimicry must continually produce its slippage, its excess, its difference.'

Yet, such discursive negotiations are far from exhausted by the binary opposition of coloniser / colonised. Maran (2003, 194) applies mimesis to semiotics, arguing that it is 'the essence of mimesis to be dynamic and to include body-related motions, rhythms, gestures and sounds'. In short, mimesis has a protean character in which there is a constant negotiation 'between the mimic and the original' as a sign system (2003, 207). When these become digitised as code they are, in effect, approximations for the dynamic interactions they represent (2003, 206-07). Put another way, it points to the limits of all code and algorithms compared to the complex systems, the excess they're attempting to simulate.

### **Mimicry and the digital**

As a concept, mimicry opens up a diverse array of alternatives. These range from genre studies of mimicry, whether in literature or film to ideas of simulation that imply

practices of deception or substitution (Puschman 2009; Rutherford 2011; Terada 2008). Mimicry also covers the wide field of ethology, where one living system mimics another for the purposes of prey or concealment (Grim 2013). Increasingly, each of these strategies is being studied for their application to digital networks. For example, Moeslinger, Schmickl and Crailsheim (2010) outline how flocking algorithms can be created that resemble swarms in bees, ants, birds or other flocking species (and see boids, below).

In practice, algorithms of all types are now commonplace. Christopher Steiner (2012) details the diversity of applications, including Pandora or Spotify, online trading giants from Walmart to Amazon, dating sites, music composition programs, predictive text, poker sites or trading activity. But the list can be indefinitely extended (Kullenberg and Palmås 2009; Palmås 2010, 2011). The focus, in every case, is on how programs anticipate human choices and decision-making, principally by analysing the patterns implicit in complex, often subtle cues of human behaviour. The accuracy of prediction enables the accuracy of mimicry to the point where human identity is indistinguishable from digital activity. The paradigmatic case is algorithmic trading: here, algorithms replace human activity altogether in cyborg finance or through computer generation and translation of news stories to high speed statistical trading that mimics human sentiment (Bogaisky 2013). By extension, such algorithmic communication is central to the emerging Internet of Things (Dodge and Kitchin 2011).

In a sense, these developments are at the macroscopic level where potentially huge networks can be assembled and mobilised through digital coding. The same, however, applies at the microscopic level where the most subtle human gestural signals can be reproduced by sensors and devices. It is these two scales of algorithm to which I next turn.

### **Simulation and swarming algorithms**

Just as there are classes of apps and software, so there are classes of algorithms. Each of these routinises, in different ways, mathematical calculations, and all of them are open to update and change. While some go by colourful names—knapsack and travelling salesman problem algorithms, greedy algorithms, brute force and others—each tackles different computational problems (Prabhu 2011).

Where predictive analytics and mimesis are concerned algorithms, formally speaking, constitute the mathematical modeling of complex dynamic interactions that take place between variables. In the case of collective interaction, modeling can be at any level of analysis, from microscopic to cross-species. For instance, biochemical algorithms can be stochastic or deterministic and are designed to model reactions within cells (Gillespie 1977). Swarm algorithms work by mimicking the activity of individual swarm members. Ant colony simulation, for example, is related to optimising how ambient networks of intelligent objects interact. It works by calculating how any single ant uses limited

information about its tasks or its location to its closest neighbours, and then extrapolates this data as mathematical rules across swarms or colonies to generate the dynamics of collective interaction. Algorithmic applications such as this are likely to become one basis for the diffuse miniaturised interaction of nanotechnology with applications from the Internet to vehicle routing (Waldner 2008).

Where swarms are concerned, ants are far from the only paradigm that is used: swarm behaviour has been mimicked using flocking birds, schooling fish, bat swarms, penguin flocks and particle behavior. It is used with varieties of mammals (gorillas, deer, cougar), insects (beetles, arachnids), as well as forest growth, marine fouling, bacteria, ecology systems simulation and other more generalised models. This list itself is far from exhaustive (Reynolds 2014). Reynolds himself is one of the originators of algorithmic simulation studies with his seminal work on boids, or artificial life programs that simulate the flocking behavior of birds, which he initiated in 1987 (Reynolds 1987, 2014). This behavioural simulation has been developed in a variety of ways. For instance, Delgado-Mata et al. (2007) extended his basic model to incorporate the effects of fear, modeling how olfaction is used to transmit emotion between animals. This is by depicting pheromones as particles in a free expansion gas and developing algorithms to model the resulting interactions. Boids have also been used with flocking birds and radio simulation (Hartman and Beneš 2006; Lebar Bajec and Heppner 2009; Ibáñez et al 2003).

### **Swarming robotics**

Boids, themselves, imply robotic extensions of mimetic algorithms. Swarming robotics, in particular, is now under intensive development. It includes robotics potential uses in search, foraging tasks or mining but, equally, in constructing flying, autonomous robot swarms. These involve miniature drones equipped with GPS, processors and radios that can fly in tight formations in the same way as gregarious animals do (Chappell 2014). Inevitably, drones are associated with military uses, but there are numerous civil applications, including such mundane inventions as delivering cartons of beer to offshore fishermen (Chappell 2014).

Miniaturization is increasingly central to the creation of swarm robotics, itself a highly active field (Dorigo 2014). This includes the area of swarmanoids. Swarmanoids are aggregations of numerous autonomous robots into clusters. For example, up to 60 bots can function as three types: eye-bots, hand-bots, and foot-bots (Deyle 2011). In short, these bots mimic body parts but do so as collective self-organizing entities. Similarly, the Kilobot Project is a low-cost scalable robot system for demonstrating collective behaviors designed to test collective algorithms on hundreds or thousands ('kilos') of robots. These are already freely available for purchase on the Internet (The Kilobot Project, 2014). It is accessible to robotics researchers to model collective transport, human-swarm interaction, and shape self-assembly. In brief, these emergent fields

demonstrate the rapidly expanding diversity of distributed mimicry, most of them relying on big data, algorithms and sensors.<sup>3</sup>

Clearly, a key question from these developments is how, and by whom, they are exploited. As these applications illustrate, they include collaborative, peer-to-peer assemblages, as their free availability on the Internet suggests. They are also ripe for extensive exploitation by military, commercial and state actors. The film *Minority Report* is a typical dystopian scenario where, for example, swarms of spider bots scan human eyes for telltale signatures of activity against the state.

### **Codes, rapport and mimicking human synchrony**

If mimicking collective behaviour is one end of a spectrum, mimicking the microscopic, momentary cues of individual interaction represents the other. There is extensive, ongoing research designed to develop predictive analytics that replicate every gestural component of human interaction. In short, the subtle human cues that enable matching, coordination and mimicry can increasingly be coded. From these, patterns can be extracted and used to predict behaviour in face-to-face or mediated contexts (Sun et al. 2011). These have been investigated in order to identify the precise, codeable cues of human interaction, whether this is lexical or gestural.

What are these patterns? Where written text is concerned, they involve the precise lexical cues involved in creating attunement between individuals. These cues, often used in a non-conscious way, create a back and forth mimicry that, as Scissors et al. found (2008), enhances trust, outside of the particular content under discussion. His team studied CMC text conversations and demonstrated a relationship between high mimicry and high trust. This was by identifying specific markers that created and secured them. In particular, they pinpointed the repetition of lexical and syntactic phrases ('I'll keep my end around 40 . . . around 40?'), but also marker words, such as motion verbs or matching emoticons, that clarified agreements and supported trust (2008, 279). They also found that the language of deceptive individuals contained fewer such markers (2008, 280). They speculated that the cognitive complexity involved in manipulating such a wide range of subtle cues at speed disturbed precise attunement and signaled potentially deceptive behaviour (2008, 280).

Other studies extend from textual to gestural interaction and the ways these organise synchrony between individuals. For example, Gonzales et al. (2009) examined the way groups coordinate at non-conscious levels. They then codified groups' language to predict the degree of their subliminal interpersonal synchrony. To do this, the research team introduced a mimicry algorithm described as 'linguistic style matching' (LSM). This is designed to calculate the degree to which the mimicry of words between group members predicts key group dynamics such as cohesion and performance. LSM does so by monitoring word count, pronoun patterns, and the verb tenses used by participants.

Because it is an automated syntactical measure, it can be applied across conversational contexts in online or offline conversation in dyadic or group settings.

The LSM metric expands on a large body of established work linking mimicry to social dynamics. Much of this literature focuses on nonverbal and paralinguistic mimicry (Bernieri, et al. 1988; Chartrand & Bargh 1999; Giles et al. 1991; van Swol, 2003). Simulation, however, goes well beyond textual interaction and is often based around multi-agent systems in face-to-face or virtual settings. This has produced an accelerating range of research in social simulation studies (Andrig 2010; SICOSSYS\_Project n.d.). It has also produced military applications where, for example, US marines are exposed to digital simulation of battle scenes or threat scenarios with crowds and citizens (Grace 2009).

These developments involve verbal and visual fields as well as body language: in each case, the focus of interest is in how mimicry and gestural matching take place. Consequently, the significance of such studies is twofold. First, they enable the microscopic tracking of non-verbal cues and responses. Second, this facilitates the coding and computerised replication of human synchrony (Fox, Bailenson and Ricciardi 2013). For instance, Feese et al. (2012) studied how nonverbal communication in groups can be derived from motion sensors on the body which signal precise cueing triggered by slight shifts in head nodding, gesticulating and posture changes. This revealed subtle differences in the ways that participants responded; for example, to the non-verbal cues in two types of leadership style.

Other research investigates degrees of synchrony and how well individuals could detect 'digital chameleons'. These draw on studies produced across decades (Bailenson and Yee 2005). They enable researchers such as Bailenson et al. (2008) to distinguish between explicit or implicit forms of mimicry. Explicit mimicry involves conscious awareness of responsive interactions. Implicit mimicry is often out of awareness; Bailenson et al. (2008) list research, in this context, on laughter, eating habits, mood and verbal behavior. Clearly, the idea of chameleon echoes the arguments raised by Bhabha and Lacan, albeit in a digital context. Here, the phenomena of slippage and excess to which Bhabha points is precisely identified through interactional signals. For example, Sun et al. (2011) describe the way the actions of one member of two interactants, such as 'moving sideways or leaning forward, then the partner may take on a congruent posture' or 'certain mannerism such as rubbing the face, shaking the legs, or foot tapping'.

In other words, it is by automating mimicry that digital chameleons come into play. As Bailenson et al. (2008) demonstrate, 'subjects had difficulty detecting humans from computer agents on communication interactions.' Emphasising this is still early work they argued that the studies:

demonstrate the viability of using algorithmic mimics in computer agents.  
As multimodal input devices—such as voice recognition, expression

recognition, or gesture recognition—increase in prevalence, the ability for computer agents to mimic human behaviors can become very sophisticated and layered. It also creates the potential for computer agents to mimic more complex human traits—such as speech patterns, personality, speech accent, expressiveness and so on. (Bailenson et al 2008, 85).

This holds not just for face-to-face contexts, but also for distant or virtual communication. Recent research suggests not only how verbal and visual cues can be reproduced but also how they can be accurately traced and recreated through the use of accelerometers, gyroscopes and other sensors (Bailenson and Yee 2005; Sun et al. 2011). From here, the potential exists for translation to predictive analytics and algorithms to anticipate behaviour in individual, group, crowd and virtual settings. Extensive modeling has already taken place, for example, in the case of computer-simulated crowd behaviour (Wijermans 2011; Wijermans et al. 2013) or complex interaction through massive multiplayer online games (Yee et al. 2007).

### **Synchrony: exploration or exploitation**

It is important to note synchrony's long historical roots in the social sciences. This is particularly in the work of Gabriel Tarde (1903) who, in the early twentieth century, developed complex ideas around imitation and invention. Imitation is largely identical to mimicry and suggests how (non-conscious) contagious behaviour takes place not only through face-to-face interaction but is distributed across time and space, most commonly by the Internet and social media (Knudsen et al. 2012; Thrift 2004). The related issue, as noted earlier, is that increasing accuracy of prediction with microscopic behaviours raises two questions. One is about the replacement of human functions by social robots (Michelet et al. 2012). Instances include the development of voice recognition systems, either on public transport or GPS systems, or else on mobile devices through Siri or Google voice apps. The other is the perpetual tension between exploitation and emancipation: to what ends are these developments to be put? There are expanding examples of both, from the emancipatory possibilities in teaching (Schneider 2014) or intelligent assistive systems for the disabled (Kraus 2012) to the regulative corporate systems outlined by Kullenberg and Palmas (2014).

Other studies follow how rapport is established and maintained across individuals and groups. Sometimes this is facilitated by using Microsoft's Kinect system which enables a whole range of body movements to be mapped in real time. For instance, Won et al. (2014, 3) discovered that gauging the synchronicity of head movements proved a powerful predictor of creative output. More than that, Kinect refines an understanding of how synchrony, or rapport, takes place in interpersonal interactions (Won 2014, 18). Kieran Snyder (2014) takes up these issues in a different way, asking 'can a child and a chatbot become friends?' She reprogrammed a 1960s bot, ELIZA, to chat to her 2 year-old daughter. As she comments of her daughter (2014, n.p.):

She notes that the ELIZA Mommy character doesn't talk as well as Daddy's car or Mommy's phone or, she assures me, actual Mommy, which I am relieved to hear since actual Mommy is me.

So, even a two year-old is alert to the limitations of the Turing Test, but the general implications for interactive human-digital interaction are clear enough.<sup>4</sup>

Replace this domestic scenario with a corporate one and there is a clear shift across the spectrum from exploration to exploitation. For instance, a MIT research team led by Alex Pentland charted real time office interactions in diverse natural locations using a 'sociometric badge' (Pentland 2014). As Rothman (2014) summarises it, the 'badge' worn on a lanyard is a sensor. It measures:

every sixteen milliseconds, a variety of interpersonal variables, including "the tone of voice used; whether people face one another while talking; how much they gesture; and how much they talk, listen, and interrupt each other." When all this data is combined, it offers something close to a total, continuous picture of office life.

Carr (2014) describes some of the findings:

The devices are able to measure not only the chains of communication and influence within an organization but also "personal energy levels" and traits such as "extraversion and empathy". In one such study of a bank's call center, the researchers discovered that productivity could be increased simply by tweaking the coffee-break schedule.

The reference to increased productivity suggests problematic implications of this kind of research. As Carr (2014, n.p.) observes, 'Replacing politics with programming might sound appealing. . . . But there are good reasons to be nervous about this sort of social engineering.' Amongst them, he lists questions of privacy and surveillance. In fact, such research points precisely to the emergence of a panspectric society where humans become collectively trackable data points on behalf of the organization for which they work. It also indicates the potential emergence of a 'digital Taylorism' that seeks ways to increase efficiency and productivity (Parenti 2001). In short, tracking, mimicry and predictive analytics all raise, again, the tensions inherent in the microscopic, big data approach to collective interaction. As before, it concerns the uses to which such work is put.

### **Implications**

Pentland's research on the office recalls the issues raised by Bhabha about colonization; only here, colonization is now increasingly miniaturised and pervasive. Nonetheless, the same tensions between coloniser and colonised, and the potential issues of dominance by way of new technologies, can be detected. They are translated, in these instances,

from state to corporate governmentality. As Bhabha argues with postcolonial societies, simulation is central yet, in these contexts, it is configured differently through the way predictive analytics works. At root this is through the numericization of gestures and lexical patterns, so that othering is now articulated through code. Other researchers have noted the numerous commercial and marketing applications simulation opens up with avatars and virtual worlds (Ward 2012).

At the same time, it is important to note that a paradigm of colonisation and domination only works where clearly differentiated patterns of social power are evident, as in the postcolonial discourses of mimicry investigated by Bhabha. Where, by contrast, networks of collaboration, exchange or public good practices are involved, then different sociotechnical formations and sociopolitical networks are active (Latour 1990, 2005) and Bhabha's analysis of the relations of domination are better replaced by analyses of the networks of influence (Grabher 2006; Mische 2008; Sheller 2004).

Such research activity appears to recreate, as Manovich (2013) argues, 'the algorithms of our lives'. Yet this is not an entirely accurate metaphor, since there is a continual slippage in how mimicry is produced when there is a shift from analogue to digital reproduction. Equally, where predictive nanotechnologies are concerned, the dividing lines between human and technical interfaces—where one stops and the other starts—undergo constant alteration, as the work on swarming algorithms suggest. In this context, tracking the shifting dynamics of sociotechnical mediators and network assembly through self-generating coding and material bodies provides ways of assessing the implications of distributed mimicry.

Swiping technologies for mobile keyboards are a case in point. If the media are the screen, then the gestural and lexical activity of text-production takes place through the accumulation of word statistics stored and accessed by big data. In these contexts, it makes more sense to think in terms of chains of mediators that constantly assemble the text—and, by extension, the human exchanges—they make possible across time and space. Of course, some swipe technologies are cooperative enterprises of free or open source; others, such as Google, are linked to global corporations.

When voice recognition software and text-to-speech or speech-to-text technologies are included, the boundaries shift again. Here, it becomes increasingly difficult to know whether we are responding to another human or a machine. This aspect of mimicry is closely linked to the fundamental issue of the Turing Test: is it a human or a machine behind the screen? This is one of the questions that recent research raises with the use of agents and digital chameleons (Blascovich and Bailenson 2011).

The problem is further intensified by social simulation studies where the replication of individual, dyadic, group and crowd behaviour becomes increasingly possible through access to massively-generated data sets. Collective behaviours, as discussed, are

orchestrated through subtle forms of synchrony but can increasingly be reproduced via algorithms as resemblances of rapport, empathy and intuitive anticipation. It is hardly surprising that these constitute the material for science fiction dystopias, though often with machine rather than human domination as the central focus. Of course, if this comes into being, it suggests a new way to understand Bhabha's tropes of coloniser-colonised, with software as the simulator-dissimulator in relation to their human counterparts.

Nonetheless, whilst the substantial concerns over panspectric surveillance and societies of control highlight real threats they must, as suggested, always be placed against the exploratory, peer-driven activities described earlier. These are commonly in the interests of participatory, civic, public good or democratic uses, whether in pursuit of education, health or broader emancipatory goals. In short, one could say that such ongoing tensions that have dominated modernism will continue to be a central concern in postmodern, posthuman societies.

## Conclusion

If we return to the original idea of mimesis, Eagleton (2003) summarises it as representing the world 'as it actually is'. But this, as Hayden White (1999) argued, requires mediation by figurative devices in order to translate the world to the page. The development of digital mimicry, however, suggests a reversal has taken place. Whilst algorithms are translation devices, just like figures of speech, they also indicate how the world isn't simply represented but, by virtue of their capacity for precise simulation and prediction, it is actually constructed, and reconstructed, through the processes of figuration. The seamlessness with which increasing parts of the physical and biological universe can be reproduced as boids, bots or algorithmic swarms, is beginning to be matched by the capacity to mimic the most intimate and apparently human-specific aspects of interaction. Mimicry, then, doesn't simply represent the world; rather, the world itself is re-represented through mimicry. As new developments in wearable technologies, the Internet of things and nanotechnologies emerge, this can only expand, and the human-machine interface becomes more closely interwoven. Of course, this is part of the posthuman argument (Hayles 1999), though it is rarely made with respect to mimesis. What mimesis suggests, as Tarde (1903) argued, is that the processes of imitation and invention whether for purposes of competition, domination or cooperation, are likely to be increasingly identical across physical, biological, human and code worlds.

## Notes

1. The argument in each case is about the development of panspectric surveillance. Here, it is no longer 'a human being that "watches" your behaviour, but a computer that predicts your behaviour by searching for patterns across a much broader register of information' (Palmas 2010).

2. Veillance: from Old French veillier, from Latin vigilare, to watch (Merriam-Webster n.d.). And see Mann and Ferenbok (2013) on forms of veillance.
3. There are extremely complex debates around simulation, mimicry and, here, the idea of the figure (e.g. Zohar 2007). These are beyond a single paper. Enough to note, for example, there are alternative approaches to icon, index and symbol (e.g. Krauss 1977). Deleuze and Guattari (1987) also argue that mimicry itself is 'a stationary repetition of the background—be it with other species or immobile objects—while camouflage is a process of becoming' (Zohar 2007, 176-77). One implication for digital mimicry is that mathematical modelling captures, in effect, static moments of fluid processes. Consequently, the full, mobile complexity of human interaction is undetectable to algorithms: it remains, to them, hidden in plain sight.
4. But see the literature on sex bots and flirt bots for other examples of deception (Burton n.d.).

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