Affect and Emotion in digitalSTS

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Emotions and Actors in Digital Systems

"'You can't mess with my emotions. It's like messing with me. It's mind control.'" This sort of public reaction confronted Cornell University's Jeffrey Hancock and the other authors of the now-infamous Facebook "emotional contagion" study (Kramer et al. 2014). Hancock had partnered with researchers from Facebook to determine if changing the frequency of positive or negative emotional keywords in a user's Facebook newsfeed tilted that same user's posting in a more positive or negative direction (Kramer et al. 2014). To test the hypothesis, Hancock and his coauthors had altered the flow of newsfeed posts for two groups of Facebook users simultaneously. This process, in which two possible interfaces are shown to social media users in real time for experimental purposes, is known in Silicon Valley as an A/B test (Cristian 2012). When the research describing the experiment was released, media coverage was highly critical: Facebook, in the words of one headline, had "manipulated emotions for science" (Hill 2014).

Human affect and emotion are simultaneously integral and unsettling to our contemporary experience of digital technologies. The furor around Facebook's "emotional contagion" study was exemplary of a public controversy at the socio-technical intersection of computational media, social and cultural practices, and lived emotional experience (Selinger and Hartzog 2015). Such intersections have proliferated: in April 2017, for instance, Facebook's Australian division was exposed as having worked to target advertising to teenage users based on longitudinal emotional profiles developed out of the company's personal data (Levin 2017). As the computational tools on which we rely to mediate our everyday social lives become increasingly interconnected, pervasive, and sensor-rich, the digitally mediated quantification and expression of human emotions is an increasingly central part of the experience of digitally mediated existence.

As a discipline, science and technology studies (STS) is ideally placed to explore and critique the ways the varied landscape of human emotional experience and expression shifts as a "matter of concern" refracted through diverse digital interfaces, systems, and platforms (Latour 2004). There is strong extant scholarship on the history of emotion as a scientific and technical object. Otniel Dror (1999b, 2001, 2009) has articulated how the development of physiological laboratory cultures of the 19th century was "immanent in the very design of . . . laboratory models of feelings" (2009, 851), while Brenton Malin (2014) describes how new

technological apparatuses such as film shaped the emotional terrain of 20th-century social science. Elizabeth Wilson (2010) argues for the centrality of affective response to early computer science and cybernetics pioneers like Alan Turing, and how "computational logic, the building of mechanical devices, and fantastic anticipation were always intimately allied" (39). And two recent edited volumes (Tettegah and Noble 2016; Hillis et al. 2015) have done much to put historical accounts of affect and emotion into conversation with digital media studies.

A wider scholarly focus on human affect and emotion in the history and contemporary development of digital and computational media is nonetheless long overdue. Attention to these realms of human experience opens the way for a broader explication of the human sciences (Rose 1988; Foucault 1994) and "sciences of subjectivity" (Shapin 2012) as "technical" mechanisms in digitally mediated worlds. The designers of digital media platforms and applications draw on the sciences of emotional tracking, classification, and management to build systems through which everyday acts of emotional expression can be made comprehensible as data, and put to use as components of sophisticated digital profiles of the individual (Haggerty and Ericson 2000; Cheney-Lippold 2011; Pasquale 2015; Stark 2018a). Computer science has been heavily influenced by psychology and the behavioral sciences more broadly (Stark 2016), and Facebook's controversial actions point to the ways techniques for mediated affective and emotional management are already being put to use in the service of digital advertising, surveillance, and profiling (Cadwalladr 2018; Rosenberg et al. 2018). The application of these technologies and techniques has gone hand in hand with the design and spread of neoliberal economic models of individualization, and asymmetries of knowledge and power implicating core aspects of how we understand the emotional and reflective self (Illouz 2007).

Even—and I argue especially—in the world of silicon and bits, human emotions are powerful drivers of agency and action. Here I lay out the range of phenomena encompassed by terms such as *affect*, *emotion*, *feeling*, and *mood*. After providing this overview of definitions around affect and emotion, I suggest an analytic frame to help make the impact of these phenomena more legible: the *emotive actant*. Bruno Latour's well-known notion of an actant, or anything "modifying other actors through a series of . . . actions," has widespread currency in STS (Latour 2004, 2005), and Latour's actor-network theory (ANT) is a well-known lens through which to understand the impacts of sociotechnical apparatuses. I argue *emotive actants* are *actants intensifying the experience and expression of human feelings*, and have an increasingly palpable influence within the contours of digitally mediated culture, politics, and social experience.

Definitions are a challenge for scholarship across the fields studying affect and emotion (and associated terms such as feelings, moods, sentiments, sensations, and passions). As William Reddy (2001, 3) observes, "Emotions have been compared to colors. . . . [Both] have a strong subjective or experiential character [and] in both cases, there is no way for an independent observer to check these 'self- reports.'" Despite the fact, as Reddy notes, the "reported experiential qualities display great constancy from one person to another," the inherently subjective experience of emotions makes systematic comparison both of particular genres of feeling and of generalized emotional states difficult enough in everyday life.

Such polysemy is potentially crippling for STS scholars particularly attuned to ways in which scientific practice and discourse are constitutive of scientific

"facts," with usages shifting depending on the discipline, subfield, or context of conversation. The language used to describe human feelings is therefore as much an object of study for STS as it is a necessary resource. Resisting the temptation to blur definitions together is key, and the taxonomy I present here should be taken as provisional and partial, reliant on similar efforts by sociologists like Arlie Russell Hochschild (2003b) and Deborah Gould (2010), psychologists such as Jerome Kagan (2007) and Rom Harré (2009), and humanities scholars such as Teresa Brennan (2004).

One central definitional distinction cutting across many disciplines separates *emotion* from *affect*. Jerome Kagan summarizes current psychological consensus around *emotion* as fitting within, and simultaneously constituted by, four interrelated human phenomena: *affect* (or in Kagan's terms, "a change in brain activity to select incentives"), *feeling* or *sensation* ("a consciously detected change in feeling that has sensory qualities"), *emotion* proper ("cognitive processes that interpret and/or label the feeling with words"), and *reaction* ("a preparedness for, or display of, a behavioral response") (2007, 23). Deborah Gould defines *affect* as "nonconscious and unnamed, but nonetheless registered, experiences of bodily energy and intensity that arise in response to stimuli" (2010, 26), and *emotion* as "what from the potential of [affective] bodily intensities gets actualized or concretized in the flow of living" (26). For Gould, such actualization might come through linguistic categorization, gestural performance, or both. Teresa Brennan suggests affect is "the physiological shift accompanying a judgment," inasmuch as affects imply a focus of attention and action toward a particular stimulus presumes adjudication between one potential response and another. The bottom line, as Brennan and others reiterate, is "feelings are not the same as affects" (2004, 5).

The links, causal and otherwise, between affect and the wider range of human felt experience are contested within both the human and biological sciences. The *affective turn* resulted in a rise in interest from scholars in the humanities and social sciences over the past two decades in material, nonconscious, bodily, or somatic factors in the experience of human subjectivity (Gregg and Seigworth 2010)—a turn characterized by "an amalgamation, a revisiting, reconsideration and reorientation of different theoretical traditions" (Hillis et al. 2015, 4); with many such scholars self-identifing as "new materialists." Gould's definition of affect is grounded in Brian Massumi's (2002) theorization of affect as a play of intensities and valences, itself based on the work of philosopher Gilles Deleuze (Deleuze and Guattari 1987). Massumi draws on research from neuroscience (Damasio 1994) and cognitive psychology (Ekman and Rosenberg 2005) to assert affect is invariably precognitive, and is thus dispositive in the shaping of emotional experience. This interpretation has been strongly critiqued both on conceptual grounds and for what its critics assert is a misinterpretation of the underlying empirical evidence (Leys 2011). Ruth Leys's (2017) *The Ascent of Affect* strongly contests the science underpinning the affective turn—and even the concept of affect itself. The affective turn has nonetheless influenced a variety of fields including digital media studies, and provides a set of conceptual springboards for work at the intersections of computational media studies and STS (Sengers et al. 2008; Hillis et al. 2015).

Definitions of emotion proper assume a high degree of cultural specificity in how feelings (in Kagan's sense of the term, consciously detected changes in feeling) are perceived and interpreted by the self and others. Sociologists have been interested in human emotion and its cultural specificity for several decades (Lively

and Heise 2004). Contemporary sociological scholarship on emotion grounded in both social psychology (Solomon 2003; Kagan 2007) and affect control theory (ACT) in particular (Lively and Heise 2004; Shank 2010), provides further potential definitional and analytic tools to explore feelings in digital contexts.

Based on her sociological work on gender and labor in the early 1980s, Arlie Russell Hochschild identified two distinct models dominating scholarship on emotion at the time: (1) an *organismic* model formulated in physiology, psychology, and evolutionary biology and (2) an *interactional* model stemming from anthropology and sociology (Hochschild 2003b, 215). These models persist: in general, proponents of an organismic model understand emotions as strongly determined by affective biological processes or drives, and assume by extension basic human emotions are universal across different cultural and sociotechnical contexts. In contrast, interactional models of emotion focus less on underlying affects, and more on the social and cultural factors shaping particular instances of emotive and emotional expression. Psychologist Paul Ekman's research suggesting emotional facial expressions are common across cultures is a well-known example of work grounded in the organismic model (Ekman and Friesen 1971); Lila Abu-Lughod's anthropological work on emotion in the context of North African Bedouin cultures represents an interactional approach (Abu-Lughod and Lutz 1990). The debates between the proponents of each of these models over the degree to which emotions are either universal or culturally specific are a further definitional and sociotechnical variable for STS researchers to keep in view. In *The Managed Heart*, Hochschild argued for an analytic model for emotion synthesizing the organismic and interactional models, what she termed "a new social theory" for emotion. Hochschild suggested emotion is "a biologically given sense, and our most important one . . . unique among the senses [in being] related not only to an orientation toward action but also to an orientation towards cognition" (229). In other words, emotions are more than simply a bridge between physiological and psychological responses to stimuli: they also engage thinking, and by extension purposeful action, in tandem with somatic or instinctual responses.

This capsule introduction to terminological distinctions and controversies around affect and emotion is not meant to slight the extensive and complex debates around how these phenomena are defined and understood across many disciplines. Instead, it is meant to help STS scholars orient themselves amid the thickets of terminological and disciplinary difference, and understand these debates around the vocabulary of affect and emotion as themselves resources for sociotechnical inquiry.

Emotive Actants

Among the language used to describe emotional phenomena is one term, *emotive*, which I argue deserves more prominence in our analyses of digital media. The word *emotive* means, "arousing intense feeling"—whereas the word *emotional*, with which *emotive* is sometimes used synonymously, means "characterized by intense feeling." These terms reflect slightly different models of felt subjective human experience—an emotive response is closer to the aforementioned definitions of *affect* than is a reflexive emotional one, and is characterized by the powerful expression of feelings but not necessarily a fully reflective emotional experience.

In their introduction to *Networked Affect*, Ken Hillis, Susanna Paasonen, and Michael Petit observe, "the need to focus on connections and relations in studies of action and agency" (2015, 10), and how this need is especially acute in the context of digital mediation. Yet affect and emotion, while clearly relational and agentic, have not always been well explicated in relation to ANT approaches (Latour 2005). Hillis and their coauthors stop short at identifying a specific mechanism through which to articulate this relationship—but the term *emotive actant* fits the bill.

I define an emotive actant as an agent intensifying affect, feeling, sensation, and even emotion. Latour observes ANT is interested in tracing the interacting effects of agents; by extension, Latour notes, "if you mention an agent, you have to provide the account of its action, and to do so you need to make more or less explicit which trials have produced which observable traces" (Latour 2005, 53). Emotive actants produce a notable change in expression, a trace explicable by their particular presence, configuration, and influence within a chain of interactions. Latour calls this general process "translation"—a "connection that transports, so to speak, transformations" (2005, 108). Identifying an agent as an emotive actant describes a process, not an end state: many human technologies can be mobilized as emotive actants.[1] Yet in cases such as the Facebook emotional contagion study, a set of digital artifacts—social media classification schemes, algorithmic data analysis, and digitally enabled A/B tests—became mobilized as emotive actants in various deliberate and accidental ways, actively translating and mediating human affective and emotive expressions for particular technoscientific, economic, and political ends.

Explicitly identifying emotive actants as having effects on embodied human mental and physical activity is part of the broader STS project of "rethinking both human and nonhuman actors and how affect is generated and circulated" (Hillis et al. 2015, 10). Emotive actants clarify what Latour describes as the problem of "figuration," proceeding from his observation, "what is doing the action is always provided . . . with some flesh and features that make them have some form or shape, no matter how vague." For Latour, description itself can cloud sociological analysis by limiting the categories of what is considered a legitimate social actor (2005, 53). By focusing on the transformative effects of particular emotive actants in describing agency in the context of digital mediation, I am not diminishing the importance of these actants' figuration—far from it. Instead, the concept of the emotive actant allows a wide range of digital artifacts, and discourses about them, to become comparable within the same category of agency (55).

The notion of an emotive actant also resonates beyond ANT by highlighting the ways human affect and emotion shape the normative value systems underpinning the creation, use, and development of digital media technologies. Values, whether understood as agent-centered or outcome-centered systems of reasoning or activity (Nagel 1979), are central to analyses of sociotechnical systems (Friedman and Nissenbaum 1996). As Deborah Johnson (2007) observes, "Values can be seen as interests, the interests of particular groups struggling over the design or meaning of a technology" (27). Changes in a particular technology's materials, discourses, and practices change the conditions under which values, ranging from individual privacy to transphobia to racial bias, are expressed through it (Nissenbaum 2015; Haimson and Hoffmann 2016; Noble 2018). Notwithstanding the complexity of these questions, scholars in philosophy, information studies, STS, and computer science are increasingly engaged in analyzing the politics of technologies (Winner 1988; Feenberg 1992) through methodological traditions like value sensitive design

(Friedman et al. 2006), reflective design (Sengers et al. 2005), and studying values at play (Flanagan and Nissenbaum 2014). Like ANT, these approaches seek to tease out the mechanisms by which human values influence technologies, and in turn dynamically shape user experiences and sociotechnical milieus.

Digital media's increasingly deleterious effects on democratic processes make interrogating digital systems with an emphasis on affective and emotive values all the more urgent. Digital media manipulation and disinformation within the context of the attention economy (Beller 2006a, 2006b) are enabled by the manipulation of emotive actants. In this societal context, STS scholarship must attend to how affects and emotions—in their presumed salience, their lived experience, and their political resonance—infuse the norms and values of particular digital platforms (Konnikova 2013) and/or shape subjective and social reactions to particular technologies in their myriad transnational and global contexts (Powell 2013; Beer 2016; Stark 2018a).

Emotions in Digital Context

One of the most prescient accounts of computation and its contemporary social contexts comes from Continental philosophy, in the writing of Gilles Deleuze (1990). Deleuze argued the 21st century would be typified by a new form of "control society": one premised on computational media and data analytics as means for powerful institutions to modulate and restrict an individual's smooth flow through and access to social systems. Deleuze's notion of the "control society" describes the broader sociotechnical framework in which data about human emotional expression have been incorporated into systems of algorithmic modulation, management, and control (Crawford et al. 2015; Lee et al. 2015; Hoffmann et al. 2017; Stark 2018a).

Digital media technologies working as emotive actants often convert embodied emotional expression into computationally legible numbers, words, and symbols. Such technologies then reproduce these computational logics as mediating models through which individuals reinterpret and re-present their own subjective feelings, both to themselves and to others. Marisa Brandt (2013), drawing on the work of Jay David Bolter and Richard Grusin (2000), describes this process as *therapeutic remediation*, a cybernetic logic through which computational media can have a transformative effects on the human sense of self. Emotion's entanglement with digital media technologies and platforms has become more and more widespread as these phenomena have been quantified under the purview of clinical psychology, psychiatry, and neuroscience (Damasio 1994). Contemporary quantified models of emotion are grounded in foundational "organismic" works from biology and experimental psychology, including from Charles Darwin's *The Expression of the Emotions in Man and Animals* (Darwin [1872] 2009), in which Darwin postulated emotional expression signaled either the direct action of physiological reflexes, or a habituated response to some external stimuli (Winter 2009; Snyder et al. 2010); and from William James's 1885 "What Is an Emotion?" the basis for what is now known as the James-Lange theory of emotion (James and Lange 1922; Wassmann 2010). The psychoanalytic tradition founded by Sigmund Freud has also influenced contemporary scholarship on emotion and digital media, although in sometimes-oblique ways (Turkle 2004; Liu 2011). Sherry Turkle's work has emphasized the ways in which humans ascribe animation and agency to computa-

tional tools depending on the contours of interaction, findings supported by the work of the late Clifford Nass (Reeves and Nass 2003; Robles et al. 2009).

What Otniel Dror (2001) identifies historically as "emotion-as-number"—a scientific discourse equating the range of human emotional experience to physiologically quantifiable metrics—has been a key technical mechanism enabling human felt experience to be simplified, translated, and incorporated into the structures of digital computing. This discourse influenced the first cyberneticists and artificial intelligence pioneers in the late 1940s and early 1950s. Researchers were interested both in behavior and in the notion of physiological feedback (Orr 2006; Kline 2009; Wilson 2010; Pickering 2010). While explicitly cybernetic research trajectories fell out of favor by the 1970s, interest in the digital quantification of emotional responses continued to percolate, such as in the work of Manfred Clynes, who coined the term "cyborg" (Clynes and Kline 1960) and later developed a system to measure human emotion via haptic feedback (Clynes 1989).

Clynes and others in turn helped inspire the contemporary work of computer scientists such as Rosalind W. Picard, who in her seminal work *Affective Computing* (2000) revived the study of emotions via computational data in human-computer interaction (HCI). HCI had long been grounded solely in cognitive psychology (Card et al. 1983), but Picard suggested classifying and quantifying human emotive signals was a first step in learning how to simulate the experience of emotion in machines. The recent expansion of interest in interaction design, machine learning, and artificial intelligence (AI) has prompted growth in the study of social and emotional aspects of AI and HCI as a byproduct of affective computing utility's in translating expressions of emotional experience into quantifiable and machine-legible data (Höök et al. 2010; Höök et al. 2015).

Social and emotional HCI has seen significant growth in the last decade, due to advances in the speed of hardware, the capacity of software, engagement by masses of users in social media, and the increasing public salience of HCI problems to the general public (Shank 2014). These developments in HCI have their genesis in several distinct phases, from early work in human factors computing in the 1970s and 1980s, and a focus on usability in the 1990s (Bødker 2015), to the contemporary proliferation of academic and design work in the affective computing centered on the concept of the "user experience" (UX) of digital information technology (Dourish 2004; Grudin 2012). The temptation to equate all aspects of human emotional expression with physiological data describing bodily activities—information such as heart rate or the rate of blood flow—has been strong in HCI. In a 2007 paper, Kirsten Boehner and colleagues argued for an alternate *interactionist* model for exploring emotion in the context of digital design practice.

As Boehner and her coauthors write, emotion is "an intersubjective phenomenon, arising in encounters between individuals or between people and society, an aspect of the socially organized lifeworld we both inhabit and reproduce" (280). In contrast to research in affective computing and "emotional AI" interested primarily in quantifying and translating physiological responses as emotional signals (Picard 2000; Scheirer et al. 2002; Picard and Daily 2008), the interactionist research paradigm incorporates alternative forms of experiential data as elements of digital design alongside quantitative data (Leahu et al. 2008; Boehner et al. 2007; Boehner, Sengers, and Warner 2007; Sengers et al. 2008), such as those elicited by Katherine Isbister and Kia Höök's sensual evaluation instrument (Isbister et al. 2006). From an STS perspective, however, both of these schools of HCI research implicitly understand digital technologies as emotive actants and not neutral

agents: not merely passively transmitting emotional signals between individuals, but modifying, intensifying, and prompting new configurations of feelings in users. Just as, in the words of sociologist Arlie Russell Hochschild, "every emotion has a signal function," so too does every digitally mediated human signal have an emotive and by extension social function in the age of computational media.

Emotive Actants at Work: Clicking, Tracking, Expressing, and Parsing

As examples of some of the ways in which emotive actants might shape sociotechnical processes, consider a few broad categories (though needless to say, the artifacts within these categories often interact and overlap as parts of larger networks). The first category consists of artifacts and systems designed to facilitate *clicking*, wherein scholarship from psychology and neuroscience is brought to bear on intensifying the effects of the UX design for social media platforms. The second category is made up of technologies for *tracking*, encompassing a variety of devices deployed by individuals, institutions, or both to detect, collect, and monitor human emotive states. The third category consists of artifacts designed for correlating and *parsing* data produced by user engagement and expression. Finally, a fourth category of technologies have been developed for *expressing* emotion, enabling us to communicate emotional states online via emoji, emoticons, stickers, and animated GIFs—including expressing cultural and political resistance to the status quo. Across this taxonomy, there is broad scope for new digital STS research describing, contextualizing, and troubling the technical definitions, translations, experiences, and expressions of affect and emotion within the broader social contexts of our networked world.

Clicking

Nikolas Rose (1988, 1996, 2013), Anthony Giddens (1991), and Eva Illouz (2008) have all explored the role of the psychological sciences in disciplining and modulating the modern self; new digital technologies both for expressing emotion socially and for experiencing and managing it therapeutically promise to once again shift our understanding of ourselves. Michael Hardt (1999) has suggested pessimistically, "we increasingly think like computers"; Jeanette Wing, coming to a very different conclusion regarding desirability, has extolled the benefits of such "computational thinking" (Wing 2006). David Golumbia describes this discourse as "the cultural logic of computation," a set of social assumptions about the utility of digital media influencing human social and subjective life (Golumbia 2009).

The business models of many social media platforms entail catching and holding human attention (Beller 2006a, 2006b); engaging human affects and emotions, especially high-intensity or negative ones, helps keep and maintain our engagement across space and time. Psychological and behavioral science has shaped technical strategies to keep users engaged from the 1980s onward (Card et al. 1983; Moran and Card 1982; Newell and Card 1985), and affective or emotional blocks to digital media use, such as computer anxiety, were problematized in the same period (Heinssen et al. 1987; Doyle et al. 2005; Powell 2013). Compelling, even "addictive" UX and interaction design are now understood as major components of Silicon

Valley commercial success (Norman 1989; Katz 2015). With concerns on the rise about the amount of time and attention social media users pay to their digital devices, many critics of digital platforms—and those platforms themselves—have also begun to promote hazy notions of "digital wellbeing" (Stark 2018c).

Advances in digital game design are driving new strategies to engage and channel the affective and emotional impulses of users (Juul 2010a). Digital game designers seek to create compelling effects through design decisions regarding game play and narrative. Decisions around viscerally and emotionally compelling game design are examples of what Ian Bogost terms "procedural rhetoric" (Bogost 2006)—the ability to encode particular persuasive elements into the actions required of players, and by extension by digital media users in general. With the more recent rise in popularity of casual and social games, many of which are played primarily on smartphones, designers have sought to incorporate the same kinds of gamic interface strategies (most notably viscerally compelling feedback within interface graphics) into smartphone applications more broadly. Making a digital interface "juicy," in the words of game theorist Jesper Jull, entails bring colors, quasi-organic movements, and digital objects programmed to be mimic the tactility of their physical counterparts (Juul 2010b). UX design guru Donald Norman coined the term "visceral design" in 2005 to describe these design elements (Norman 2005).

Activating and intensifying visceral, emotional, and noncognitive impulses has a long history in advertising, graphic design, and industrial design (McGrath 2008), and a new scholarly vogue in the study and application of behavioral economics and behavioral "nudges (Thaler 1980; Kahneman 2013; Thaler and Sunstein 2008). The standardization and mobilization of human feelings is also a growth industry for many social media companies. Facebook's 2016 move to expand the "Like" button to include a broader range of emotional "Reaction" icons (Goel 2015) is exemplary of the role these platforms have in encouraging their users to tag and organize their own emotional data, and collect them for a variety of purposes including driving increased use of the site and more targeted advertising decisions (Oremus 2013; Boesel 2013).

STS scholarship has the opportunity to expand into analyses of the technologies and practices of these "creative" industries, exploring how they have incorporated concepts, values, and techniques from the psychological and behavioral sciences, engineering, industrial design, and gaming (Holland et al. 2014; Parisi 2018; Stark 2018b). These projects connect with a recent emphasis on making, doing, and critical design in STS work (Pullin 2011; Dunne and Raby 2001; DiSalvo 2012). Other extant projects examining the historical and contextual complexity of emotion to the technical and design community include cases in which design is mobilized to compel and addict (Schüll 2012), and working with designers and technologists themselves to explore novel practices and strategies around emotion and design (Demir et al. 2009; Stark 2014).

Tracking

Technologies for tracking, recording, collecting, and quantifying human emotions are tightly tied to the development of Western technoscience, and to the more recent rise of so-called "surveillance capitalism" (Zuboff 2015). As Otniel Dror argues, physiology and psychology developed discourses and technologies to

produce "emotion-as-number," based on physiological quantification of affects and reactions, as a method of containment for phenomena scientists themselves found unsettling (Dror 1999a, 1992b, 2001, 2009). The 20th century saw increased integration of such quantified data into technoscientific epistemologies of reasoning, experimentation, and evidence. Yet while discourses of emotion-as-number are longstanding, digitally mediated systems of pervasive surveillance are a more recent development. Any external material trace or emanation that can be potentially correlated with an interior affective state is technically traceable (Kerr and McGill 2007): technologies for tracking the physiological expression of affects include facial recognition and movement recognition technologies such as the Facial Action Coding System (FACS; Ekman and Rosenberg 2005); systems gauging affect via vocal tone (Mizroch 2014); mobile monitoring applications for collecting physiological data such as heart rate and skin conductivity (Picard and Klein 2002; Picard and Scheirer 2001); and a range of wearable consumer hardware devices to record movement and sleep patterns, gestures, and gait (Schüll 2016). These technologies are becoming increasingly common both in enterprise applications such as hiring, and in enabling new tools for emotional expression in everyday social media (Stark 2018b).

Digital self-tracking has also increased in popularity over the past decade (Richards and King 2013; Wolf 2010; Nafus and Sherman 2014). Mobile applications such as Mood Panda and MoodScope encourage users to actively track and quantify their mood in the service of self-improvement and sociality. Mood and emotion tracking is just one aspect of the self-tracking ecosystem, with many trackers drawing on techniques from social psychology to assess their feelings longitudinally over time (Carmichael and Barooah 2013). Other devices are pushing techniques of mood management into an ostensibly more direct interface with the body itself, while black boxing the scientific assumptions of their component technologies: such tracking is thus a part of the "neuroscientific turn" (Littlefield and Johnson 2012) connecting brain science to traceable everyday activities.

Parsing

What happens to the data we produce when we click and are tracked? These inadvertent digital traces are parsed and analyzed by institutions ranging from social media platforms and advertising agencies to governmental and security services (Kerr and McGill 2007). Sociologist Ulrich Beck (2009) points to postindustrial societies as framing future decision making within a probability calculus and the language of risk; increasingly, data about emotional reactions and behaviors are included in these calculations. Out of these aggregated patterns of data, personalized profiles of an individual's emotional expressivity (or the set of signals performed by the human body deemed to correspond to it) can be interpreted by the authorities—or the individual herself—as symptomatic of more fundamental aspects of the self: disorder, criminality or culpability, productivity, mindfulness, or well-being (Cheney-Lippold 2011).

Data mining and analytic techniques are often proprietary, opaque, and increasingly incorporated into comprehensive profiles and scores of our online "data doubles" (Haggerty and Ericson 2000; Citron and Pasquale 2014). Such traces can also be linguistic, and thus tracked and analyzed via sentiment analysis tech-

niques counting the number of positive and negative words in a corpus of data (Hu et al. 2013; Andrejevic 2013). Affectiva, a company founded at MIT, promises to deploy a wide range of emotional tracking and monitoring techniques, such as sentiment analysis and facial recognition techniques, to user data in order to assist companies in marketing and advertising (Coldewey 2016).

Parsing human feeling for commercial ends is not new, but digitally mediated parsing can easily be enlisted in the management of labor, consumption, and health (Scholz 2013). Arlie Russell Hochschild (2003a, 2012) explores how flight attendants, retail clerks, nurses, and care workers, often but not exclusively women, are taught to understand, manage, and even shift their own feelings in the service of their jobs. Similar studies on taxi drivers (Facey 2010) and service center workers document how widespread and technologically embedded these practices of emotional self-management have become. For Michael Hardt, the radical challenge of technology's ability to shape our emotional lives for good or ill is posed primarily by this "*affective labor* of human conduct and interaction" (Hardt 1999, 94). By affective labor, Hardt means the energies and passions expended in the service of work—like emotional labor, affective labor relies on human energy, but is more concerned with the constantly renewed drives for sociality and connection humans exhibit online. Affect and emotion also play a particularly central role in the web of contemporary online "knowledge work," and are central to the political stakes around the contemporary experience of digital labor in the so-called "on-demand economy," such as those of Mechanical Turk workers (Irani 2015), Uber drivers (Rosenblat and Stark 2016), and creative workers more broadly (Gregg 2015).

Digital technologies further enable new configurations of surveillance and control across spatial borders. In her ethnographic accounts of call center labor in India and elsewhere, Winifred Poster argues emotional labor is inextricably tied not only to novel shifts in communications technologies (for instance, the adoption of text-based chat programs for customer assistance), but also to already-extant asymmetries of economic power, misogyny, racial and linguistic prejudice, and national chauvinism (Poster 2011, 2013). The digital technologies used by Poster's interlocutors serve to paper over and exacerbate these divisions: by compelling workers to conform to a particular set of linguistic, affective, and stylistic "best practices" around the provision of customer service, these systems and their human proponents promote an invariable standard of human emotional conduct that both suppresses the subtleties of rich human interaction and enlists workers around the world in an forced hermeneutics of monitored, regimented interaction.

Expressing

The parameters for emoting via digital systems are set by those systems' affordances and design; in turn, emoting is a key element of both the computational logics of digitally mediated sociality, and of resistance to hegemonic technoscientific and economic logics. The emoji character set, initially developed as a proprietary feature of Japanese telecom company NTT Docomo's cellular phones, is exemplary of how affective labor is captured through digital mediation, and how these forms of emotional expression are not only social, but also entangled in

questions of personal identity and political economy (Stark and Crawford 2015). The enormous popularity of the characters as a means of social expression ultimately forced Apple to provide functionality for emoji on its devices worldwide. Further clamor from users led to the character set's eventual incorporation into the global Unicode technical standard for interoperable digital symbols. Emoji, emoticons, "sticker" pixel images, animated GIFs, and proprietary animations point to a digitally mediated future in which proprietary logics and interfaces drawn from animation increasingly structure the means through which we communicate socially and emotionally (Silvio 2010; Gershon 2015).

The mechanisms of traditional clinical interventions and therapeutic techniques have also changed with the spread of digitally media systems (Mishna et al. 2016). While digitally mediated or e-therapy has a long history ranging from the famous Rogerian therapeutic chatbot ELIZA (Wilson 2010), its increasing use calls into question how practitioners and patients are reshaping the experience of therapy in conjunction with mediating technologies and new business models designed, in many cases to bring market logics of efficiency and cost-effectiveness to the therapeutic process (Alexander and Tatum 2014; Atkins et al. 2014; Brandt 2013). Both Eva Illouz (2007) and Martijn Konings (2015) have observed therapeutic cultures have an ambivalent relationship with capitalist logics, both teaching self-efficacy and autonomy and equipping and acclimatizing individuals as better adjusted and more productive capitalist subjects. This ambiguity characterizes services like Talkspace, a service offering connection with a therapist via text (Cook 2015; Essig 2015): it is unclear how the relationship formed via this type of remote mediation, while broadening the accessibility of therapy, shapes the long-term experience of the patient or the therapist. The increasing penetration of digital technologies into health care settings, including the provision of mental health, is a core area for future STS research (Brandt and Stark 2018).

The categories described above evidently overlap and enable one another, serving as emotive actants in complex ways: for instance, a smartphone-based mood tracking application like Mood Panda functions as an emotive actant by engaging multiple sets of social and technical linkages, and shaping them and the emotional subjectivity of users in turn (Stark 2016). Future STS work on affect, emotion, and digital media will necessarily rely on a multidisciplinary set of literatures exploring both emotions and digital technologies writ large. Yet the political salience of emotion and affect in the context of increasingly ubiquitous digital networks is incontrovertible (Papacharissi 2014), particularly in light of recent public furor over the psychographic profiling performed by British firm Cambridge Analytica in the service of the Donald Trump presidential campaign (Cadwalladr 2018; Stark 2018a).

This extant work in STS provides templates for more broadly sociotechnical assessments of feelings, values, and technologies. Understanding contemporary digital devices as emotive actants provides a mechanism for exploring the effects of these technologies on human feeling, and by extension on human social life. Perhaps most importantly, the notion of an emotional actant actively translating and mediating human emotional expressions highlights political questions of human sociality, equality, and solidarity within ANT, and STS scholarship more broadly, in new, urgent, and productive ways.

Note

1. Indeed, human language is perhaps the ultimate emotive actant, providing a technical means to translate the affective impulses of the body into culturally specific and reflective emotional responses.

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