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Susi Geiger

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Silicon Valley, disruption, and the end of uncertainty

Susi Geiger

UCD College of Business, University College Dublin, Belfield, Dublin 4, Ireland

ABSTRACT

This paper reflects on the relationship between high-tech disruption narratives and uncertainty. My main argument is that an economic sociology of the future is incomplete without addressing the 'demonic' or rather eschatological elements apparent in the promissory twin rhetoric of disruption and inevitability that a number of contemporary technology firms employ. The conjuring up of liberatory high-tech futures implicates a political-philosophical perspective of the end game. It utilizes at once the productive power of uncertainty to create visions of 'absolute riches' and societal gain but at the same time narrows these futures down to one inevitable alternative to the status quo. Through the examples of two Silicon Valley disruptor firms, I argue that these eschatological narratives need to be opened to social scientific critique in order to examine their potential societal consequences above and beyond the narrow geographic confines of 'the Valley.'

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Introduction

The historian of economics and science Philip Mirowski once said, when talking about the 2008 Recession, that 'In the neoliberal land of make-believe, if you can sell it, then it must a fortiori be legitimate' (Mirowski 2012, p. 290). Indeed, the relationship between fictionality and the economy has been subject to much scrutiny in recent years (e.g. Esposito 2013, 2015, Beckert 2016, Geiger and Finch 2016, Meyers and van Hoyweghen 2018). This literature has, by and large, argued that economic expectations, as projections made under conditions of uncertainty, are necessarily fictional – they have a 'broken relationship to reality' (Beckert 2016, p. 62). Where fictional expectations around future markets or technologies are circulated, these expectations act as cognitive reference points for stakeholders to buy-into the fiction over time (Brown 2003). These expectations can be strongly affectively laden – they can be taken over by 'irrational exuberance' (Shiller 2000, Geiger and Gross 2017). But do expectation-based theories account for the 'demonic' undertones that have been diagnosed in the discourses of disruption found in contemporary technology circles (Beckert 2016, p. 285)?[1]

In this paper, I examine the political-philosophical and quasi-religious colourings of contemporary high-tech disruption narratives, as circulated and perpetuated by many Silicon Valley-type (bio)-technology firms. Where Hogarth (2017) sees these firms suspended in a liminal space between the 'regime of hope' and the 'regime of truth,' I argue that their disruption narratives work as political technologies, conjuring up a 'theological unconscious' (Muniesa 2017), where futures are envisaged as liberatory and essentially faith-based alternatives to the current status quo. Recent works in the sociology of expectations see capitalist futures as multiple and entrepreneurs productively utilizing this multiplicity (Esposito 2013, 2018). In my reading of high-tech disruption narratives, this multiplicity is often paradoxically combined with a narrowing down of all potential futures to one. This

CONTACT Susi Geiger Susi.geiger@ucd.ie UCD College of Business, University College Dublin, Belfield, Dublin 4, Ireland

political or philosophical techno-vision is elevated to be the only possible alternative to the status quo; it signals the necessary destruction of the old and the creation of a world that clearly parts with whatever has preceded it. In other words, I propose that through advocating 'the end of uncertainty' disruption narratives gain an eschatological character.

In its secular usage eschatology signals both the fulfilment of time and the opening up of a new and better future (Pannenberg 2008, Loureiro 2010). In contrast to an expectation-driven rendering of economic futures, eschatologies of disruption thus start with an end state and work backwards, using a metaphorical future perfect rather than the 'future present' (Esposito 2018) of imaginaries and expectations: future worlds are wished into existence in a quasi-messianic manner.

I investigate this proposition by tracing the evolution and narratives of two organizations that, like many other Silicon Valley-type firms, have played heavily on a future-oriented disruptor narrative: the consumer genomics testing firm 23andMe and the blood-testing firm Theranos. My investigation of these two firms' narratives is based on extensive secondary data and complemented with broader insights from an ethnographic study in the Silicon Valley digital health ecosystem. I emphasize that I am not drawing any factual parallels between Theranos' alleged fraudulent behaviour and a firm – 23andMe – that operates in the regulatory sunlight. My interest rather revolves around the political-philosophical narratives which these firms build and the effects these may have in conjuring up future markets-to-be. Overall, then, this paper reflects on the relationship between expectations, uncertainty, and high-tech eschatologies that the omnipresent concept of disruption creates.

Disruption as a high-tech eschatology

For all its ubiquity in contemporary popular and business discourses, there is a surprising lack of theorization of the term 'disruption.' Hogarth (2017, p. 258) calls the term a 'signifier that has floated free of its original conceptual mooring.' The Cambridge English Dictionary tells us that disruption means 'to prevent something, especially a system, process, or event, from continuing as usual or as expected'.[2] When referring to the world of business, the term is said to signal a 'change [in] the traditional way that an industry operates' (Hogarth 2017). Synonyms listed include 'upset,' 'destabilize,' 'dislocate' and 'turn upside down.' Elsewhere, we are informed that the word's etymology points to the Latin *disrumpere*, meaning 'break apart, split, shatter, break to pieces'.[3] Disruption, then, prevents old patterns or business as usual from repeating themselves; it is by definition a thoroughly destructive force.

In management thinking and with a nod to management guru Clayton Christensen, the notion is usually paired with its more upbeat cousin 'innovation.' Extolling the benefits of disruption in the service of creating the new, management scholars and practitioners time and again refer to Schumpeter's 'gale of creative destruction.' In his early work, Schumpeter foresaw industry lifecycles of entrepreneurial disruption and subsequent value creation where 'the process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one.' (Schumpeter 2010/1943). For Schumpeter, the figure of the entrepreneur is central to this process. He has 'a will to found a private kingdom' and 'the will to conquer: the impulse to fight,' but also displays 'the joy of creating' (1968/1934, p. 93). Interestingly, Schumpeter's later writings see this process of 'relentless necessity' as eventually leading to the undermining of capitalism by itself; disruption ultimately brings about the demise of capitalism as we know it.

It has been argued that Schumpeter borrowed the notion of creative destruction from the work of Friedrich Nietzsche, who in turn was said to have been influenced by Hindu mysticism and more precisely the figure of Shiva, the great destroyer of the Hindu cosmos (Reinert and Reinert 2006).[4] Myths of destruction and creation, ushering in a new age, are ubiquitous across many religions and often re-appear in capitalist imaginaries (e.g. Deutschmann 2001, Agamben 2011). Not least in Christian teaching, notions of the end of time and the beginning of a New Kingdom are central to its doctrine and are usually referred to as eschatologies (Cole-Turner 2016). Starting with Kant's 'ethical commonwealth' (*das ethische Gemeinwesen*), the concept of eschatology has slowly

gained a secular philosophical meaning (Pannenberg 2008). In contemporary usage, it has filtered into fields as far removed from religious thought as marketing research (Woodruffe 1997, Schwarzkopf 2011), artificial intelligence (DeLashmutt 2006), and sustainability (Gayá and Phillips 2016).

In these secular contexts, eschatological arguments signal a radical break or rupture with the present state of affairs; a break that is made meaningful to the individual and the collective through its ushering in of a new (and better) beginning (Loureiro 2010). Eschatologies in these contexts are 'frame-breaking' in the sense that they envision the overcoming of an old and frequently hegemonic state through the liberatory revelation of a New Kingdom (Gayá and Phillips 2016). Fukuyama (1989) located the early origins of such liberalist thinking in Hegel's absolute moment, where a fully developed and sublimated rationality would ring in the 'end of history.' Where for Christensen's many followers in management thinking the disruption/innovation dyad is of cyclical and often incremental nature, eschatologies of disruption envisage a narrative end point: the end of time is always the beginning of something radically new and better for all those who believe – but it is the beginning of an end state rather than merely a stage in a never-ending cycle of innovation. In the context of capitalism, Schwarzkopf (2011) argues for instance that the trope of consumer sovereignty is a fundamentally eschatological feature. In the political edifice of neoliberal capitalism, the consumer is King – 'invested with the same destructive moral absolutism that had once characterized pre-modern monarchs' (Schwarzkopf, 2011, p. 124). In this narrative, consumers are 'liberated' from the shackles of state or other institutional powers through their individual consumption choices and given the moral authority over the economy. Once invested with this power, there is no possible return to the former status quo.

In technology circles, these frame-breaking and liberatory notions of disruption are often combined with technological determinism. This is nowhere as tangible as in Silicon Valley's 'Californian ideology,' where an individualistic anti-authoritarianism combines with a 'profound faith in the emancipatory potential of the new information technologies' (Barbrook and Cameron 1996, p. 45). Bio-digital and genomic technologies in particular have been touted as 'instruments of deliverance' from human limitations and sufferings (Graham 2002, p. 71). Combining liberatory discourses of consumer sovereignty and human sublimation through information technologies, disruption in *this* context gains a political-ideological *telos* that significantly exceeds the more benign discourses of cyclical renewal of stagnant industries that management thinkers have put forward since the 1980s. These contemporary high-tech disruption narratives also place themselves in a peculiar and as of yet understudied relationship to the notion of uncertainty.

Disruption and the end of uncertainty

The recent sociology of the future has highlighted that by disrupting the 'normal' workings of the market, the Schumpeterian entrepreneur essentially exploits Knightian uncertainty. Esposito (2013, 2018) for instance claims that entrepreneurs make uncertainty productive by introducing an element of surprise or point of novelty into markets and thus thwarting others' ability to calculate. Beckert (2016) argues that an orientation toward an open, infinite future is a central hallmark of modern capitalism, in contrast to traditional societies who perceived the future as a cyclical repetition of the past. For Beckert, expectations are placeholders that provide conviction and confidence in the face of an open, uncertain future and make this future at least partly calculable. Though future-oriented and open to imagination, these expectations are thus not completely free of the past; they are cognitively and calculatively anchored: 'the scope of credible imagined futures is not limitless. There remains a central role for rational analysis in channelling fictional expectations in credibly feasible directions' (Beckert and Bronk 2018, p. 12). Expectations can fail, of course, as credibility is always discursively and socially constructed, and calculability may itself be largely an 'illusion' (Beckert and Bronk 2018, p. 21). Importantly, expectations can also be subject to deliberate deception and politics in channelling whose narratives come to count. Nonetheless, for Beckert and

Esposito, the range of 'future presents' is both multiple and limited by present decisions and actions: 'the future present depends on the present future, but can deviate from it' (Esposito 2018, p. 232).

Lane and Maxfield (2005, p. 10) discern between three states of future uncertainty, namely truth uncertainty, which can be managed calculatively; semantic uncertainty, which requires discursive interactions among actors interpreting an event; and ontological uncertainty, which 'resists the formation of propositions about relevant future consequences.' In the absence of calculability, ontological uncertainty in particular requires narrative embedding (Lane and Maxfield 2005). This embedding, I argue, can be used to close down future options rather than keeping them open and multiple; the more so the stronger faith-based arguments in the narrative overshadow calculative ones.

In a somewhat paradoxical twist, while ontological uncertainty gives high-tech entrepreneurs a licence to spin a good futuristic tale without much heed to its potential veracity, this future narrative is then elevated to the only narrative that counts. Over 20 years ago, Winner (1998, p. 62) warned against such 'language of inevitability' in technology discourses by observing that:

> For the techno-prophets, the incentives are obvious. Like ancient seers and soothsayers, they can claim special knowledge of the future, … What ordinary folks derive from these future visions is the comfort of believing that the future has already been scripted and that (if they scramble fast enough) they can find agreeable parts in the drama. … Why, these people might wonder, should they waste their energy fighting the inevitable?

An eschatological interpretation of high-tech disruption narratives would thus suggest that they portray the future as simply *becoming;* it is both inescapable and inevitable. In comparison to the 'inevitably unpredictable' future presents that Esposito (2018, p. 228) traces, I argue that eschatological futures, as sketched in certain high-tech disruption narratives, are futures perfect. In these future perfects, ontological uncertainty is resolved through narrative inevitability.

In summary, I propose that where future-based innovation narratives become overlaid with potentially more 'demonic' faith-based ones (Beckert 2016), narratives of high-tech disruption become eschatological. Instead of emphasizing the openness of the future, they exploit this openness to suggest the end of uncertainty. And instead of emphasizing the cyclicality inherent in standard disruptive innovation discourses, they point toward a liberatory 'end of history,' rung in through the (bio)technological sublimation of humanity.

Situating the inquiry

Heeding Hogarth's (2017) recent call for situating our inquiries, I am locating this investigation in what many consider the birthplace and epicentre of modern-day high-tech disruption: Silicon Valley, or, to its residents and admirers, 'the Valley.' Silicon Valley actors are often said to have placed the notion of 'disruption' at the very core of their collective striving. To wit, one of the focal rites of passage for any Silicon Valley start-up is an appearance at a conference series called TechCrunch Disrupt!, a conference that occupies a central place in Silicon Valley lore and that featured in the eponymous HBO television series of the same name (Smith 2014). In the Valley, so-called 'moonshots,' that is highly speculative technology developments, are a regular feature of firms' activity portfolios (Scudellari 2017). This high-tech speculation is not inconsequential: in financial numbers, Silicon Valley accounts for approximately 36 per cent of all venture capital technology investments; in the area of digital health, venture capital investment per capita is higher here than anywhere else in the world (Hathaway and Rothwell 2015).

Several previous works have noted Silicon Valley's particular ideological blend of often left-leaning counter culture and its attachment to a hyper-capitalist form of libertarianism (e.g. Barbrook and Cameron 1996, Duff 2016, Levina 2017). Duff (2016) labels this particular combination of ideologies 'iCapitalism.' iCapitalism as a mind frame and economic driving force originated in the late Twentieth Century in the geographic area of the San Francisco Bay but has since spread across the globe as a model to be aspired to and copied. Barbrook and Cameron (1996, p. 56) interpret it as a quasi-

religious and highly exclusive faith characterized by 'a bizarre mishmash of hippie anarchism and economic liberalism beefed up with lots of technological determinism.'

This paper's origins lie in an ethnographic study of the disruptive practices of digital healthcare enterprises located in Silicon Valley. Healthcare has for years been labelled as 'ripe for disruption' by the iCapitalist community of investors, journalists, conference organizers, and consultants (e.g. Khosla 2012). Starting in the mid-2000s, under the collective banner of 'digital health' or 'eHealth,' a range of technology ventures and larger enterprises set out to 'disrupt' the healthcare ecosystem through technologies ranging from wrist-worn sensors through remote healthcare provision to fully digital therapeutics and diagnostics (Topol 2015). During my investigation, two Silicon Valley-based digital health firms – Theranos and 23andMe – were heatedly discussed in the trade media and general business press, both for their uber-disruptive business practices and for their exorbitant financial valuations. These two companies are the focal cases for the present study. Theranos and 23andMe are both 'digital diagnostics' firms; the blood tests in the case of Theranos and genomic testing in the case of 23andMe are offered as diagnostic services to a consumer market, thus circumventing normal testing and prescription routes that involve physicians or hospitals. Both firms were also among the first digital health 'unicorns,' that is companies that are valued at over US$1 billion.

Because of the controversies surrounding them at the time of the investigation, direct access to these firms was not possible.[5] I draw instead on a range of secondary sources on these companies – newspaper articles, a book (Carreyrou 2018), regulatory filings, written correspondence to the firms from two regulatory bodies (the US Food and Drug Administration and the Securities and Exchange Commission), and a range of internet commentaries. I also utilize the firms' own materials, including their website, press releases, several interviews and videos featuring their founders, and publicly available business presentations. I supplemented these 'found' materials with interviews and observations conducted during my ethnographic investigation in the wider digital health ecosystem, which probed the concept of disruption and its role in building technology futures and fortunes more generally.

Introducing the disruptors

Founded in 2006, 23andMe is one of the oldest and most prominent firms in the relatively recent market of consumer genetics. 23andMe offers a direct-to-consumer service where a consumer either orders a so-called spit-kit over the internet or purchases one in a pharmacy or other retail outlet. The spit-kit contains a test-tube to collect the customer's saliva and an envelope intriguingly stamped as 'bio-hazard,' which serves to send the spit-kit back to the firm. The bio-material is then analysed through an 'SNP' test – a measurement of genetic variations – and test results are returned to the consumer through a personal log-in area on the firm's website. Test results typically include ancestry information, wellness and personality traits, and, depending on the product package chosen, indicators of susceptibilities to a range of hereditary diseases.

While there are many remarkable features about 23andMe (see for example Curnutte and Testa 2012, Turrini and Prainsack 2016, Hogarth 2017), three are particularly relevant to this paper's concerns. One, 23andMe's narrative revolves around liberating the consumer from the shackles of the healthcare sector (more on this point later), but its business model is that of a relatively conventional multisided market platform (Geiger and Gross 2019). In 23andMe's case, revenue is built through the secondary market of consumer genomic data sold – or in the firm's parlance 'shared' – with pharmaceutical firms as well as through a tertiary market of patent licensing (Geiger and Gross 2019). Two, though clearly positioning itself within a healthcare context, the firm is set up and managed as a technology firm, with extensive venture capital investment, social and company ties directly stretching into the digital dominator Google, and headquarters in Palo Alto (Hogarth 2017). And three, as we will see, at the helm of this firm stands a charismatic, outspoken and well-connected founder – Anne Wojcicki – who does not shy away from public limelight and controversy. At the

point of writing, 23andMe makes its products available in 55 countries and boasts on its website 'the largest cohort of genotyped and phenotyped individuals for research on the planet.'[6]

Theranos (founded in 2004) set out to disrupt the oligopolistic US blood-testing industry by offering direct-to-consumer and over-the-counter blood tests, administered through a simple finger prick in a pharmacy booth or in a consumer's home. Theranos' founder Elizabeth Holmes played directly into the archetypical Silicon Valley disruptor myth, setting up the company as a 19-year old Stanford drop-out on a quest to 'change the world' (Carreyrou 2018). Over a ten-year period, Theranos attracted venture capital backing of over US$700m in total, assembled a Board of Advisors consisting of the great and good of US politics and military, and succeeded in signing up its first customer – the pharmacy giant Walgreens (Carreyrou 2018). During this period, both the company and its founder achieved accolades including spots on the '30 under 30' and 'Top 10 medical innovations 2013' lists (Diamandis 2015). Theranos' rise culminated in 2014 when it hit a staggering – though of course purely hypothetical – US$9 billion valuation and was *en route* to become the first digital health 'decacorn' (start-ups valued at US$10 billion). Elizabeth Holmes herself was billed as the youngest-ever self-made female billionaire and was now widely seen as the second coming of master disruptor Steve Jobs.

A darker side to this disruptor dream soon emerged. Scientists started to note that the firm's secrecy around its technology meant that no peer-review results had been published and the technology was entirely unproven to the outside world (Diamandis 2015, Ioannidis 2015, 2016). Basing his initial insights on a handful of whistle blowers, in late 2015, investigative healthcare journalist John Carreryou published a series of searing revelations about the company in the *Wall Street Journal* (Carreyrou 2015). Shortly afterwards, the US Food and Drug Administration (FDA) noted that the diagnostic blood testing kit used by Theranos was in fact wrongly classified as a 'low risk' medical device, a category also used for dental floss (FDA 2015). In early 2016, the Center for Medicare and Medical Services of USA noted serious deficiencies with Theranos tests, saying that some even pose 'immediate jeopardy' to patients (Carreyrou 2016, Weaver 2016). In several further instalments of this saga, a Federal criminal investigation was launched, the company was investigated by the Securities and Exchange Commission (SEC) for investor fraud, it faced a class-action suit by investors and a lawsuit by its lead customer Walgreens for breach of contract (Weaver *et al.* 2016, Weaver 2017a, 2017b, Weaver and Siconolfi 2017). In September 2018, Theranos finally shut down, owing its investors over US$1 billion (Chen 2018), and at the time of writing several lawsuit remain pending.[7]

Despite the obvious differences in their evolution, what do the narratives of these two companies have in common, and what can we learn from them about the disruptor narratives of other technology firms? And are we indeed, as this paper argues, dealing with an elaborate spinning of an eschatological narrative web that may have fundamental repercussions on our understanding of the purpose and goals of capitalism (Fortun 2008)?

Disrupting to liberate the consumer: 'there is no comfort zone'

The first parallel between both companies' narratives is the myth of the coming healthcare consumer revolution, which they share with many other digital health firms. The figure of the sovereign consumer who is in full control of their own healthcare works as a discursive motor for the disruptive efforts these companies subscribe to. As a keynote speaker at the 2015 Health 2.0 conference in San Jose, Silicon Valley, put it: 'we live in a world of 'IWWIWWIWI': I want what I want when I want it' (field observation, Oct 4 2015). The conference organization Health 2.0's Annual Report 2014/15 talks about digital health's beginning 'as a movement that put technology in the hands of consumers and empowered them to be powerful agents in their own health trajectories.' The movement analogy permeates much of the discourse at the digital health conferences I attended. One speaker even filled this movement analogy with religious connotations when he exclaimed that 'we've come here because we've seen the light of a better future' (field observation, Oct 6 2015).

Both 23andMe and Theranos elevated the consumer into the rhetorical centre of their business universe, aiming to change a system where 'the consumer didn't have a voice on how healthcare was operating'.[8] Now, digital technologies would finally be 'driving this consumer revolution' in healthcare.[9] Liberatory tropes also permeate the two firms' much-repeated founding myths: In the case of Theranos, it revolves around a little girl – Elizabeth Holmes herself – who was afraid of needles and who as a grown-up aimed to save the world from the barbarism of the 'bloodletting' industry (Rago 2013). And 23andMe's founding myth revolves around the quest for emancipation through self-knowledge, which would finally 'enable consumers to take control' of their own destiny.[10] Thus, both firms ostensibly set out to free consumers from the shackles of a patriarchal and state-controlled healthcare system. Rather than an evolution, their vision of this consumer-led healthcare system is unabashedly frame-breaking: 'There is no comfort zone. We are pioneering a new world, centred on the consumer, where success depends on bold ideas and unprecedented scale.'[11]

The rhetoric of a consumer-led revolution betrays a strong neoliberal undercurrent, where consumer empowerment often equates to shifting responsibility from the state to the individual (Schwarzkopf 2011, Davies 2016). In healthcare, this shift is particularly significant as it may lead, in Levina's (2017) words, to a depoliticization of the body *and* the body politic. Appealing to this individualism, Elizabeth Holmes writes:

> You have a fundamental right to access information about your own health. And you should be able to access that information when it matters most – when there is still time to change your life, and the lives of those you love, for the better. (Holmes 2015)[12]

This narrative individualization of healthcare plays perfectly into the libertarian side of Silicon Valley's ideology – or its 'visceral antistatism' (Duff 2016, p. 1608). Healthcare is reduced to a purely individualist and self-entrepreneurial endeavour; an individualism enshrined in 23andMe's slogan of 'one incredible you.'

Disruption and the end of times: 'something short of [the zombie apocalypse] is almost necessary'

In Silicon Valley's digital health circles, the consumer-centric trope is closely linked with the need to overthrow the current system – not simply to innovate the healthcare system but to create what one conference speaker called 'tectonic disruptions' (field observation, HealthTech Conference, 27 Oct 2015). Digital health firms often align themselves with the consumerist Quantified Self movement, which sees itself as a technophile resistance movement against control by Big Business and Big Government (Nafus and Sherman 2014). Both 23andMe and Theranos' narratives strongly emphasize a complete break with the status quo, a status quo that is painted in the darkest of colours for their audiences. In one video, 23andMe founder Anne Wojcicki likens the current US healthcare system to a communist society, where consumers 'are so used to the system taking care of them that they're just completely apathetic.'[13] 'Elsewhere, she says to this 'Why do I need the rest of the healthcare industry? Why do I need the hospitals, why do I need the academics? We, the people, can actually stand up and self-report and we can crowdsource research.'[14]

Indeed, in my wider ethnographic investigation, this techno-revolutionary trope was ubiquitous and remarkable in its prominence to an outsider. As Levina (2017, p. 551) notes, 'If revolution is Silicon Valley's raison d'être, then disruption is its business model and the foundational principle of how the industry sees its place in the world.' It was promulgated at each of the industry conferences I attended, and it was reiterated in the stories many start-ups spun around themselves. One of my interviewees, a manager in an innovation incubator, was clear about his views of the potential costs of this revolution:

> I don't see the existing system gracefully evolving into what we see coming. I see the existing system being horribly disrupted in a very painful way that might for a significant period of time leave a whole lot of people not very well covered by insurance at all, by health care at all, there may be some serious epidemics that occur as this

> transition occurs before it becomes apparent that we need the new system. And people abandon the old system. I mean, I don't want to be too dismal about it, I don't think we'll have the zombie apocalypse, but, something short of that is almost a necessary element to wake people up to, you know, that change has to occur. (Research Interview, June 16 2016)

Thus, disruption, in the context of Silicon Valley digital health firms, means just that: an end of one and the beginning of a new era, even at the risk of a highly disorderly in-between. In the prevailing rhetoric, it is nothing short of a full-scale revolution, led by a collection of (health) technology disruptors.

Disruption and its leaders: 'I want to activate an angry population'

Disrupting the world for its own good can at times be a hard sell, and it needs good salespeople to get the message across. In the cases of both 23andme and Theranos, the two founders – Anne Wojcicki and Elizabeth Holmes – were also the most visible salespersons for the cause, displaying a palpable missionary zeal in their public appearances and leaving little doubt as to their own worldviews. These founders are not 'hackers' in the image of first-wave technology entrepreneurs (Coleman 2013); in fact they are extremely well connected into the technology and political establishment. In the case of Anne Wojcicki, her background as a Wall Street investment manager is noteworthy, as is her marriage to Google founder and CEO Sergey Brin. Elizabeth Holmes' connections, in turn, reach well into the US military and government officials (Carreyrou 2018). Yet, they clad themselves with the revolutionary aura of a rebel leader. Wojcicki's self-proclaimed mission is to 'just revolutionize healthcare.' She established her company from the outset 'as a mission-driven company … it was set out that I want to activate an angry population that wants to drive change in healthcare.'[15] Wojcicki goes to pains to associate herself and her company to leading a social movement, regularly evoking in her talks the HIV/AIDS patient activism in the 1990s: 'even the fact that we sell [the test] at US$99, which is barely break-even. We do a lot of partnerships for free … because it's the right thing to do.'[16] Likewise, Elizabeth Holmes' public talks and interviews were strewn with quotes such as 'It is a change that needs to happen in the world'[17]; 'we believe access to actionable health information is a basic human right.'[18]; 'We see a world … in which no one ever has to say, 'If only I'd known sooner,' a world in which no one ever has to say goodbye too soon'.[19]

Of course, the zeal displayed by the two founders is not atypical in the Valley, where charismatic leaders in the past two decades have reached from Steve Jobs describing the information revolution as the 'biggest revolution that ever happened' (Robinson 2013) to the brashness of a Mark Zuckerberg and the hubris of an Elon Musk. One can only surmise that the fact that both our company founders were women may have helped rather than hindered the emotional valence of their narratives at a time when the technology industry had to face its long-standing problems with sexism (Echeverri-Carrroll *et al.* 2018). In the case of Theranos, this may also explain the fervour with which technology and mainstream journalists bought into Holmes' narrative. Holmes 'bounced between TV networks as if she was a politician giving a stump speech,' being profiled for instance in the *New Yorker, New York Times* and *Vanity Fair* (Bilton 2016). Gottschall (2016) notes on this:

> … journalists didn't sceptically evaluate Holmes's story – they simply repeated it. They told and re-told Holmes's story until she began to seem less like an actual person, and more like a living symbol – of progress, of innovation, of female empowerment.

He points to the fact that once a story is thus established, any detractor only adds to its mythological charging by being usurped as the hero's 'shadowy antagonist.' Max Weber (2019/1922) contrasts such 'charismatic' leadership with bureaucratic and traditional authority as containing a clearly revolutionary character. For Weber, the 'charismatic' leader is extra-ordinary (*außeralltäglich*) and in this extra-ordinariness he is often likened to a prophet or magician (Adair-Toteff 2005). Riesebrodt (1999) reminds us that *charisma* itself is a religious term signalling a gift of grace from God,

which typically includes prophecy or wisdom. The portrayal of the tech entrepreneur as charismatic leader thus serves to strengthen the eschatological character of the disruptor narrative.

Disruption and its enemies: 'first they think you're crazy, then they fight you, and then all of the sudden you change the world'[20]

Where founders see their role as messianic, they also often claim a license to err on the road to deliverance – the end warrants the means, so to speak. To wit, when the first reports about Theranos' problems emerged in late 2015, they were in many quarters attributed to a company triggering the immune system of an encrusted and self-perpetuating bureaucracy. When I interviewed a venture capitalist in the Silicon Valley community in early 2016, his views on this case were likely shared by many others:

> … when you're suddenly getting a lot of attention … and you're a woman, and you probably are stepping on a lot of toes and you've just come out of being dark[21] for a long time, you're going to have people go after you. To secure their business model. I'm sure she's made mistakes, I'm sure there's a lot of mistakes going on with Theranos. But their core intention, it's the right one. It's individualized, and you take a look at the Theranos business, once they get it right, it's going to kick ass.

Thus, even in the face of emerging evidence of potentially fraudulent activity in the firm, the narrative that Theranos perpetuated of the inevitable healthcare consumer liberation served as a powerful inoculation against criticism and concern.

While 23andMe now has a range of diagnostic tests approved by the FDA, it may be pointed out that many science commentators were (and in some cases still are) highly sceptical of the knowledge certainties conveyed by consumer genetic testing firms (Thomas 2013, Brown 2018). In addition, 23andMe has had its own run-ins with the FDA. In late 2013, after six years of operating in the US market, the US Food & Drug Administration (FDA) issued a stern public warning letter to the firm, parts of which read as follows:

> … months after you submitted your 510(k)s and more than 5 years after you began marketing, you still had not completed some of the studies and had not even started other studies necessary to support a marketing submission for the PGS [Personal Genome Service]. It is now eleven months later, and you have yet to provide FDA with any new information about these tests. You have not worked with us toward de novo classification, did not provide the additional information we requested necessary to complete review of your 510(k)s, and FDA has not received any communication from 23andMe since May. Instead, we have become aware that you have initiated new marketing campaigns, including television commercials that, together with an increasing list of indications, show that you plan to expand the PGS's uses and consumer base without obtaining marketing authorization from FDA. Therefore, 23andMe must immediately discontinue marketing the PGS until such time as it receives FDA marketing authorization for the device (FDA 2013).

Regulatory clashes indicate that in both cases, the 'disruption for the good of the consumer' narrative seems to make it allowable for firms to stretch the limits of regulation and credibility with future-bound technology – and in many cases paint the regulator as yet another point of obstruction in the service of the status quo. In 23andMe's words:

> Pioneering means that often there is not an obvious path forward. But we also recognize that indecision leads to failure. We take initiative. We make thoughtful decisions, quickly. We gather data but do our best with imperfect information. We will make mistakes. But we admit them, learn from them, adjust, and keep blazing forward.[22]

Disruption and inevitability: 'you know the destruction is going to happen'[23]

As discussed previously, the inevitability of the predicted future is a central feature of an eschatological disruption narrative and serves as a powerful rhetorical device for undermining dissenting or critical questioning of innovation efforts (Winner 1998). In a remarkable session at the Harvard Science and Democracy Speaker Series 2012, Anne Wojcicki defended her company against critics

by urging that 'If we don't do it then China and other countries are going to.'[24] Raising the spectre of communism (yet again), this point essentially argues that any ethical debates we may have will become irrelevant if we do not allow entrepreneurial forerunners, such as herself, to move fast, irrespective of any potential consequences (see *Log* 2012 for commentaries on this speech).

This same sense of inevitability pervaded many of the digital health conferences I attended during my ethnography in the Valley. At one investor conference, a speaker augured that 'In 20 years there'll be a business-to-consumer behemoth, which will measure your genomics at birth, test all your vitals passively through a range of sensors and manage your entire health against a monthly subscription.' (field observation, RockHealth Conference, Sept 25 2015). No critical voices were raised in the audience against this techno-optimist vision of a fully privatized big-brother healthcare system; on the contrary, this statement was taken as accepted and to be achieved by entrepreneurial activity. Later, at the same conference, another speaker heralded 'the end of ageing,' and again, critical or even questioning voices were conspicuous by their absence in the audience (field observation, RockHealth Conference, Sept 25 2015). A screening of 'The Immortalists' followed: a 2014 documentary about two scientists' quest for the 'fountain of youth' – a combination of digital, genomic and biotechnologies that would make never-ending life a reality.[25] In Silicon Valley, this particular speculative technology is currently seen as something of a holy grail and has already attracted sizeable investments, including from 'moonshot factory' Google (Scott and DeFranscesco 2015) and from master disruptor Elon Musk.[26] Where the three narrative elements discussed thus far – the all-powerful consumer, the coming revolution and the charismatic leader fighting the good fight – place our digital health start-up stories into the sphere of the mythological, the sense of incontrovertibility and the vanity of resistance push their narrative once and for all into the eschatological realm.

Disruption and its unicorns: the promise of absolute riches

The last issue I wish to briefly touch upon is the role that monetary mythologizing plays in disruptor eschatologies. As is typical for Silicon Valley-based technology start-ups, both of our case firms are venture capital-backed. 23andMe has been financed to just under US$ 500 million over 11 rounds, with Google Ventures leading four of them. Theranos also went through 11 rounds of equity and venture capital financing, and including current debt financing, it totalled investments of over US$1.4bn.[27] In the latter case, many questions were raised in hindsight as to why none of the many investors seemed to have done proper due diligence regarding the firm's technology promises. The announcement of an investors' class action suit against Theranos claims that investors were blindsided by the company's extensive media coverage, which 'duped investors into placing their bets into the company' (Class Action Reporter 2017) – they fell prey to irrational exuberance, in other words. Several of my interviewees pointed to the fact that the firm was backed mainly by 'tourist' investors rather than the cadre of top VC firms housed on Palo Alto's Sandhill Road. Yet, the fact remains that over a ten-year period substantial numbers of highly educated professionals invested considerable funds into the firm, in an act of seemingly complete negligence of financial due diligence (Carreyrou 2018). Even a year after the wave of negative reporting and regulatory investigations started, a high-profile investor remained confident that 'There's Nothing Wrong With Theranos'[28] – or at least he stated so in public, rallying whatever faith was left to be rescued from the public at large and from fellow investors in particular. Investors' allegiance to Theranos' disruptor narrative may partly be explained with the fact that it is in their direct interest to perpetuate that very narrative, as one of my Silicon Valley interlocutors explained:

> … this is the downside of venture capital in some ways, they don't need to care whether, they would never say this but I'll say it, they don't care whether the product - [hesitates for a few seconds]. Their motivation is financially turned. Um, and frequently they will sell their shares before it's clear that the company is successful. But they call it successful because they made ten times, a hundred times their investment.

The religious connotations of money have been analysed in a long tradition of sociological literature, and even the most cursory of glances at the vocabulary of Silicon Valley venture capital reveals the extent to which they are oriented toward myth-building. Unicorns, for instance, have recently lost investors' interest to even rarer beasts called 'decacorns,' that is start-ups likely to reach valuations of over US$10 billion. Even the *Financial Times* notes that 'the start-up community has moved beyond the realms of fantasy to spawn a creature that cannot even be found on a Dungeons & Dragons board'.[29] Relatedly, conference speakers and reports on digital health technologies are wont to quote a 'three trillion-dollar opportunity' – that is the overall healthcare spend in the USA – or an even more fantastical 'seven trillion-dollar healthcare spend globally' (Conference observation, RockHealth, Sept 25 2015). These valuations are clearly reminiscent of 'the promise of absolute riches' inherent in late capitalism (Deutschmann 2001). In the Valley, this financial mythologizing and the myth of disruption are mutually dependent and reinforcing. The entrepreneur is the great destroyer, and venture capitalists stand as high priests, judging which disruption narratives will prevail and by their very touch sanctifying the chosen ones.

Discussion

In his treatise on the fictionality of capitalist expectations, Beckert (2016) argues that the credibility of fiction often hinges on the fact that they may well be true. Yet, he ends his book by alluding to Silicon Valley's version of hyper-capitalism as 'demonic,' with reference to the German-American theologist Paul Tillich. The present paper picks up at exactly this point by offering an interpretation of why these contemporary forms of capitalism we see emerging around the notion of technological disruption may indeed appear 'demonic,' or, as I would put it, eschatological.

In their visionary piece, Barbrook and Cameron (1996, p. 61) point to how the Californian ideology almost by necessity leads to an ideological end point in the emergence of the 'post-human: a biotechnological-digital manifestation of the social privileges of the "virtual class".' It is perhaps no coincidence that both firms under analysis in this paper occupy the intersection between 'iCapitalist' technology evangelism and the much-cited 'three trillion dollar' healthcare revolution. As argued above, the two companies share these fantasies with a host of others, all seeking to contribute to consumers' deliverance into a fully individualized and technologically mediated future. They also share them with a venture capital community that sees vast riches to be gained from this revolution – or rather from its foretelling, as riches can be made even if the revolution never comes to be (Fortun 2008).

The vocabulary and storytelling techniques used by these firms conjure in equal measure the necessity and inevitability of this revolution. Beyond mythology, the ubiquitous promise of disruption putting an end to the status quo gives licence to sketch a future that is at once fully open and fully closed – open because it is not accountable to current economic realities and its justificatory mandates, and closed because it is rendered as inevitable. Collectively, the conjuring up of this future perfect, as I have labelled it here, allows actors to present future technology markets as incontrovertible. In this finality, it does not matter much whether one company's technology fails or another turns out to be fraudulent. The current thinking in many quarters is that even if Theranos's technology was never functional, its narrative of a fully disintermediated consumer market for blood tests could be carried on by other Disrupt! warriors fighting the good fight.[30] Likewise, the market for immortality is currently talked about in the Valley as if it were a foregone conclusion rather than one of many different versions of a future society (and a highly controversial one for that).[31]

Muniesa (2017, p. 2) examined the vernacular of value creation as a political technology, which provides a 'radical form of disinhibition' and 'vast legitimation powers.' Freed by ontological uncertainty and the eschatological rhetoric of disruption, the unmooring of a company's goals from any mandate of specifying where and how exactly value may be created multiplies this Promethean potential. Even if the futures these high-tech disruption narratives sketch never come to pass, as political technologies their circulation will have been highly consequential in several aspects. First, in

terms of public and media attention, the technology narratives emanating from the Valley often hold a disproportionate place in public discourses and news spaces, perhaps as a consequence of the increasing entanglements of journalists with technology firm agendas (Bay 2010, Bell *et al.* 2017). One can assume that within such an attention economy, more mundane technology shifts may lose out on the big and bold statements emanating from high-tech disruptors. Second, venture capital investment as practiced in the Valley is explicitly geared toward firms whose valuations grow rapidly – and the intertwining between these valuations and public attention has been nicely encapsulated by Fortun (2001) in the notion of 'story stocks.' What other investments, one may ask, did this financing pass over in the interest of backing the next 'Google of healthcare'? Third, and perhaps most importantly, the continued circulation of the eschatological narratives this paper traced may have lasting effects on our collective moral and ideological consciousness, creating a worldview where technologies of consumer genomics or immortality are in fact seen as these disruptor narratives portray them: inevitable. In sum, it seems as if the raison d'être of a very large branch of capitalist activity is to 'move fast and break things,' to quote Facebook's infamous early business motto, then this also signals the permission for these companies to champion disruption without much regard for what may be broken in its wake.

Conclusions

In order to understand the specific version of capitalism that is bred in and spreads from Silicon Valley's current crop of bio-digital firms, an economic sociology of the future needs to address the mythological – and eschatological – elements apparent in high-tech disruption narratives. Does it matter whether Silicon Valley technologists and capitalists simply spin a good story for their personal enrichment, or whether their stories are invested in a greater ideological vision? I would argue that it does – as Loureiro (2010, p. x) stated: 'no *eschaton* without a *telos.*' Levina (2017, p. 549) notes that Silicon Valley 'is an ethos that shapes our cultural understanding of the relationship between innovation, technology, and capitalism.' The purse-strings that are opened in the service of disruption determine the shape of tomorrow's markets; perhaps less so through the markets that come to be as a result of their activities, but more fundamentally as a result of those futures these eschatological narratives suppress. As a thought experiment, we could start by contemplating how much research in other areas of health could have been funded with the hundreds of millions of dollars Theranos received from the investment market before its collapse, or how the 'immortality' dollars currently spent by VCs could help address the social differentiators of life expectancy. We are at the cusp of a time where the corporations in the small geographic area south of San Francisco will hold more data, more capital, and more power than any democratically elected government. In listening to what futures they narrate, we need to critically examine what end game they sell.

Notes

1. Beckert (2016) leans on Paul Tillich's notion of the demonic as that which is both form-giving and form-destroying (c.f. Thatcher 1978 for a deeper analysis of Tillich's ontology).
2. Available at https://dictionary.cambridge.org/dictionary/english/disruption [Accessed Nov 6 2019].
3. Available at https://www.etymonline.com/search?q=disruption [Accessed Nov 6 2019].
4. Incidentally, it also has been argued that Nietzsche is at the origin of a secular and anthropogenic eschatology, where man and not God is the harbinger of the future (Ausmus 1978).
5. When I started to focus on these two companies, in October 2015, Theranos had just been the subject of John Carreyrou's investigative article in the Wall Street Journal (WSJ), which accused them of wide-ranging deceit in their business practices (Carreyrou 2015). 23andMe, meanwhile, had been banned from diagnosing diseases in the US by the FDA due to regulatory scepticism over the diagnostic strength of their tests (BBC 2013).
6. *Research: Our approach.* 23andMe Media Centre. Avaible at https://mediacenter.23andme.com/research/ [Accessed Nov 6 2019].
7. Theranos, CEO Holmes, and Former President Balwani Charged With Massive Fraud. SEC Press release. *March 14, 2018.* Available at https://www.sec.gov/news/press-release/2018-41 [Accessed Nov 6 2019].

8. "The consumer does not have a real voice in healthcare" Google Zeitgeist Interview with Anne Wojcicki, Available at https://www.youtube.com/watch?v=z8NkU9Vh8jg [Accessed Nov 26 2019].
9. The Industrialist's Dilemma: Anne Wojcicki, CEO of 23andMe. Stanford Graduate School Video Series, 5 Feb 2016. Available at https://www.youtube.com/watch?v=edmUKj7WrFU [Accessed Nov 6 2019].
10. *Building a Customer-First Company: Anne Wojcicki, 23andMe.* StartUp Elements, 29 June 2015. Available at https://www.youtube.com/watch?v=dQPV9Xgsj6c [Accessed Nov 6 2019].
11. *Our Core Values: Think Big.* 23andMe Media Centre. Avaible at https://mediacenter.23andme.com/ [Accessed Nov 6 2019].
12. It is noteworthy that the article in which this statement appears was printed in the Wall Street Journal in July 2015 – only a few weeks before that same journal started to dismantle Holmes' tale of a consumer-led disruption of healthcare. If space allowed it, some observations on the complicity of mass media in promulgating techno-utopian determinism would be on order (Carreyrou 2015).
13. The Industrialist's Dilemma: Anne Wojcicki, CEO of 23andMe. Stanford Graduate School Video Series, 5 Feb 2016. Available at https://www.youtube.com/watch?v=edmUKj7WrFU [Accessed Nov 6 2019].
14. Hoffman (n.d.): Embrace the Gatekeepers. Available at https://mastersofscale.com/anne-wojcicki-how-and-why-to-embrace-gatekeepers/, accessed on Nov 8 2019.
15. *Anne Wojcicki: Co-Founder & CEO, 23andMe. (no date)* Available at https://www.makers.com/profiles/591f26dda8c7c425e029ca6a [Accessed Nov 6 2019].
16. *Building a Customer-First Company: Anne Wojcicki, 23andMe.* StartUp Elements, 29 June 2015. Available at https://www.youtube.com/watch?v=dQPV9Xgsj6c [Accessed Nov 6 2019].
17. Imbert (2016). Theranos CEO 'devastated' amid lab testing issues. Available at https://www.cnbc.com/2016/04/18/theranos-ceo-elizabeth-holmesim-devastated-we-didnt-catch-these-issues-faster.html [Accessed Nov 6 2019].
18. Available at https://www.theranos.com/leadership/board-of-directors [Accessed Nov 6 2019].
19. Roberts (2018). America's most-hated man, and its golden girl. Available at https://www.washingtonpost.com/blogs/post-partisan/wp/2018/03/15/what-makes-elizabeth-holmes-and-martin-shkreli-so-different/ [Accessed Nov 6 2019].
20. Elizabeth Holmes on Jim Cramer's 'Mad Money' programme on CNBC, October 2015, shortly after the first Carreyrou article appeared in WSJ (Friedman and Loria 2015).
21. In the start-up world, 'being dark' or being in 'stealth mode' means that ventures work on their products and business ideas in secrecy. This is typically done at a very early stage of the venture's development to prevent their product ideas from being stolen or copied by others. In the case of Theranos, this stealth mode lasted for over 10 years (Ioannidis 2015, 2016).
22. Available at https://mediacenter.23andme.com/ [Accessed Nov 6 2019].
23. Interview with a digital health consultant, Oct 2015 (personal communication).
24. HUCEnvironment (2012): Science and Democracy: Anne Wojcicki. Available at https://vimeo.com/channels/964760/40657814 [Accessed Nov 6 2019].
25. Available at https://theimmortalists.com/ [last accessed on Nov 26 2019].
26. Horton, J. S. and Priest, N. K. (2018): Silicon Valley's quest for immortality – and its worrying sacrifices. The Conversation Dec 10 2018. Available at https://theconversation.com/silicon-valleys-quest-for-immortality-and-its-worrying-sacrifices-101405 [Accessed Nov 6 2019].
27. Available at https://www.crunchbase.com/organization/23andme [Accessed Nov 6 2019].
28. DFJ's Draper: There's Nothing Wrong With Theranos. Bloomberg, June 24th 2016. Available at http://www.bloomberg.com/news/videos/2016-06-23/dfj-s-draper-there-s-nothing-wrong-with-theranos [Accessed Nov 6 2019].
29. Available at https://www.ft.com/content/41851362-5712-11e5-9846-de406ccb37f2 [Accessed Nov 6 2019].
30. Available at https://www.nanalyze.com/2018/01/blood-testing-startups-next-theranos/ [Accessed Nov 6 2019].
31. DFJ's Draper: There's Nothing Wrong With Theranos. Bloomberg, June 24th 2016. Available at http://www.bloomberg.com/news/videos/2016-06-23/dfj-s-draper-there-s-nothing-wrong-with-theranos [Accessed Nov 6 2019].

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Notes on contributor

Susi Geiger is a Full Professor of Marketing and Market Studies in the College of Business, University College Dublin, and holder of a European Research Council (ERC) Consolidator Grant, 'MISFIRES and Market Innovation', which studies activism in health care markets. Her research focuses on how complex markets are organized, with specific interests in technology and health care markets, and how they could become more equitable. She has published numerous articles on this issue, including in Organization Studies, Business & Society, Research Policy, Entrepreneurship Theory and Practice, and Marketing Theory. She has also co-edited the volume *Concerned Markets* (Edward Elgar, 2014).

References

Adair-Toteff, C., 2005. Max Weber's charisma. *Journal of Classical Sociology*, 5 (2), 189–204.
Agamben, G., 2011. *The kingdom and the glory: for a theological genealogy of economy and government*. Stanford University Press.
Ausmus, H.J., 1978. Nietzsche and eschatology. *Journal of Religion*, 58 (4), 347–364.
Barbrook, R. and Cameron, A., 1996. The Californian ideology. *Science as Culture*, 6 (1), 44–72.
BBC Website 2013. FDA bans 23andme personal genetic tests. 26 Nov. Available at https://www.bbc.com/news/technology-25100878 [Accessed Nov 9 2019].
Bay, M., 2010. Who are the tech press darlings? An empirical study of coverage of innovation-driven tech companies in US newspapers. *Innovation Journalism*, 7 (7).
Beckert, J., 2016. *Imagined futures: fictional expectations and capitalist dynamics*. Cambridge, MA: Harvard University Press.
Beckert, J. and Bronk, R., 2018. *Uncertain futures: imaginaries, narratives, and calculation in the economy*. Oxford, UK: Oxford University Press.
Bell, E.J., *et al.*, 2017. *The platform press: how Silicon Valley reengineered journalism*. Published Report, Tow Center for Digital Journalism, Columbia University.
Bilton, N., 2016. The secret culprit in the Theranos mess: the tech press may be as responsible as Elizabeth Holmes. *Vanity Fair* online edition, 2 May. Available from: https://www.vanityfair.com/news/2016/05/theranos-silicon-valley-media [Accessed 20 February 2018].
Brown, N., 2003. Hope against hype – accountability in biopasts, presents and futures. *Science Studies* 16 (2), 3–21.
Brown, K., 2018. How DNA testing botched my family's heritage, and probably yours, too. *Gizmodo*, 16 Jan. Available from: https://gizmodo.com/how-dna-testing-botched-my-familys-heritage-and-probab-1820932637/amp?__twitter_impression=true [Accessed 19 February 2018].
Carreyrou, J., 2015. A prized startup's struggles — Silicon Valley lab Theranos is valued at $9 billion but isn't using its technology for all the tests it offers. *Wall Street Journal*, Eastern edition, 15 Oct, A.1.
Carreyrou, J., 2016. 'Deficient practices' are found At Theranos. *Wall Street Journal*, Eastern edition, 28 Jan, A.1.
Carreyrou, J., 2018. *Bad blood: secrets and lies in a Silicon Valley start-up*. New York: Knopf.
Chen, A., 2018. Theranos is finally shutting down. Investors have lost nearly $1 billion in the company. *The Verge*, 5 Sept. Available from: https://www.theverge.com/2018/9/5/17822680/theranos-shutdown-elizabeth-holmes-blood-test-health-science.
Class Action Reporter, 2017. THERANOS: court upholds fraud claims in investor class action. Vol. 19, 30 May.
Cole-Turner, R., 2016. Eschatology and the technologies of human enhancement. *Interpretation: A Journal of Bible and Theology*, 70 (1), 21–33.
Coleman, E.G. 2013. *Coding freedom: the ethics and aesthetics of hacking*. Princeton, NJ: Princeton University Press.
Curnutte, M., and Testa, G., 2012. Consuming genomes: scientific and social innovation in direct-to-consumer genetic testing. *New Genetics and Society*, 31 (2), 159–181.
Davies, W., 2016. *The limits of neoliberalism: authority, sovereignty and the logic of competition*. London: Sage.
DeLashmutt, M.W., 2006. A better life through information technology? The techno-theological eschatology of post-human speculative science. *Zygon*, 41 (2), 267–288.
Deutschmann, C., 2001. *Die Verheißung des absoluten Reichtums: zur religiösen Natur des Kapitalismus*. Frankfurt: Campus Verlag.
Diamandis, E.P., 2015. Theranos phenomenon: promises and fallacies. *Clinical Chemistry and Laboratory Medicine (CCLM)*, 53 (7), 989–993.
Duff, A.S., 2016. Rating the revolution: Silicon Valley in normative perspective. *Information, Communication & Society*, 19 (11), 1605–1621.
Echeverri-Carroll, E.L., *et al.*, 2018. Unintended consequences on gender diversity of high-tech growth and labor market polarization. *Research Policy*, 47 (1), 209–217.
Esposito, E., 2013. The structures of uncertainty: performativity and unpredictability in economic operations. *Economy and Society*, 42 (1), 102–129.

Esposito, E., 2015. Beyond the promise of security: uncertainty as resource. *Telos*, 2015 (170), 89–107.
Esposito, E., 2018. Predicted uncertainty: volatility calculus and the indeterminacy of the future. *In:* J. Beckert and R. Bronk, eds. *Uncertain futures: imaginaries, narratives, and calculation in the economy*. Oxford, UK: Oxford University Press, 219–235.
FDA, 2013. *Warning letter*. Available from: https://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2013/ucm376296.htm [Accessed 26 January 2018].
FDA, 2015. *Theranos warning letter*. Available from: https://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2015/default.htm?Page=1.
Fortun, M., 2001. Mediated speculations in the genomics futures markets. *New Genetics and Society*, 20 (2), 139–156.
Fortun, M., 2008. *Promising genomics: Iceland and deCODE genetics in a world of speculation*. Berkeley: University of California Press.
Friedman, L. F. and Loria, K. (2015). Theranos founder was 'personally shocked' about the story slamming her company today. *Business Insider,* Oct 16 https://www.businessinsider.com/elizabeth-holmes-fires-back-at-her-critics-2015-10?r=US&IR=T [Accessed Nov 9 2019].
Fukuyama, F., 1989. The end of history? *The National Interest*, (16), 3–18.
Gayá, P., and Phillips, M., 2016. Imagining a sustainable future: eschatology, Bateson's ecology of mind and arts-based practice. *Organization*, 23 (6), 803–824.
Geiger, S., and Finch, J., 2016. Promissories and pharmaceutical patents: agencing markets through public narratives. *Consumption Markets & Culture*, 19 (1), 71–91.
Geiger, S., and Gross, N., 2017. Does hype create irreversibilities? Affective circulation and market investments in digital health. *Marketing Theory*, 17 (4), 435–454.
Geiger, S. and Gross, N., 2019. A tidal wave of inevitable data? Assetization in the consumer genomics testing industry. *Business & Society* (ahead of print).
Gottschall, J., 2016. Theranos and the dark side of storytelling. *Harvard Business Review* online edition. Available from: https://hbr.org/2016/10/theranos-and-the-dark-side-of-storytelling [Accessed 20 February 2018].
Graham, E., 2002. 'Nietzsche gets a modem': Transhumanism and the technological sublime. *Literature and Theology*, 16 (1), 65–80.
Hathaway, I. and Rothwell, J., 2015. A cure for health care inefficiency? The value and geography of venture capital in the digital health sector. *Brookings Institute Report*, 10 Sept. Available from: https://www.brookings.edu/research/a-cure-for-health-care-inefficiency-the-value-and-geography-of-venture-capital-in-the-digital-health-sector/.
Hogarth, S., 2017. Valley of the unicorns: consumer genomics, venture capital and digital disruption. *New Genetics and Society*, 36 (3), 250–272.
Holmes, E., 2015. How to Usher in a new era of preventive health care. *Wall Street Journal*, Eastern edition, 29 July, A.13.
Ioannidis, J.P., 2015. Stealth research: is biomedical innovation happening outside the peer-reviewed literature? *Jama*, 313 (7), 663–664.
Ioannidis, J.P., 2016. Stealth research and Theranos: reflections and update 1 year later. *Jama*, 316 (4), 389–390.
Khosla, V., 2012. Technology will replace 80 per cent of what doctors do. *Fortune*, 4 Dec. Available from: http://fortune.com/2012/12/04/technology-doctors-khosla/.
Lane, D.A. and Maxfield, R.R., 2005. Ontological uncertainty and innovation. *Journal of Evolutionary Economics*, 15, 3–50.
Levina, M., 2017. Disrupt or die: mobile health and disruptive innovation as body politics. *Television & New Media*, 18 (6), 548–564.
Loureiro, R.V., 2010. *Politics and eschatology: Christian, Muslim and liberal traditions and their visions of humankind's future*. College Station: Texas A&M University.
Meyers, G. and Van Hoyweghen, I., 2018. 'This could be our reality in the next five to ten years': a blogpost platform as an expectation generation device on the future of insurance markets. *Journal of Cultural Economy*, 11 (2), 125–140.
Mirowski, P., 2012. The modern commercialization of science is a passel of Ponzi schemes1. *Social Epistemology*, 26 (3-4), 285–310.
Muniesa, F., 2017. On the political vernaculars of value creation. *Science as Culture*, 26 (4), 445–454.
Nafus, D. and Sherman, J., 2014. This one does not go up to 11: the quantified self movement as an alternative big data practice. *International Journal of Communication*, 8, 1784–1794.
Pannenberg, W., 2008. Modernity, history and eschatology. *In: The Oxford handbook of eschatology*, ed. J.L. Walls. New York: Oxford University Press, 493–494.
Rago, J., 2013. Elizabeth Holmes: the breakthrough of Instant diagnosis. *Wall Street Journal*, 8 Sept.
Reinert, H. and Reinert, E.S., 2006. Creative destruction in economics: Nietzsche, Sombart, Schumpeter. *In:* J.G. Backhaus and W. Drechsler, eds. *Friedrich Nietzsche (1844–1900). The European heritage in economics and the social sciences*, Vol. 3. Boston, MA: Springer, 55–85.
Riesebrodt, M., 1999. Charisma in Max Weber's sociology of religion. *Religion*, 29 (1), 1–14.
Robinson, B.T., 2013. *Appletopia: media technology and the religious imagination of Steve Jobs*. Waco, TX: Baylor University.

Schumpeter, J.A., 1968 [1934]. *The theory of economic development*. 8th ed. Cambridge, MA: Harvard University Press.
Schumpeter, J.A., 2010 [1943]. *Capitalism, socialism and democracy*. London: Taylor & Francis.
Schwarzkopf, S., 2011. The political theology of consumer sovereignty. *Theory, Culture & Society*, 28 (3), 106–129.
Scott, C.T. and DeFrancesco, L., 2015. Selling long life. *Nature Biotechnology*, 33 (1), 31–40.
Scudellari, M., 2017. Big science has a buzzword problem. *Nature News*, 541 (7638), 450.
Shiller, R., 2000. *Irrational exuberance*. Princeton, NJ: Princeton University Press.
Smith, J., 2014. 'Silicon Valley' fact check: HBO Nails TechCrunch disrupt all the way down to the nametags. *The Observer Online*. Available from: https://observer.com/2014/06/silicon-valley-fact-check-hbo-nails-techcrunch-disrupt-all-the-way-down-to-the-nametags/ [Accessed 10 October 2018].
Thomas, M., 2013. To claim someone has 'Viking ancestors' is no better than astrology. *Guardian*, 25 Feb. Available from: https://www.theguardian.com/science/blog/2013/feb/25/viking-ancestors-astrology [Accessed 1 July 2017].
Topol, E.J., 2015. *The patient will see you now: the future of medicine is in your hands*. Tantor Media.
Turrini, M. and Prainsack, B., 2016. Beyond clinical utility: the multiple values of DTC genetics. *Applied Translational Genomics*, 8, 4–8.
Weaver, C., 2016. Flawed Theranos tests Hurt Patients — Some weren't told for months that their results were dubious. *Wall Street Journal*, Eastern edition, 21 Oct, A.1.
Weaver, C., 2017a. Theranos sets pact to refund Arizonans. *Wall Street Journal*, Eastern edition, 19 Apr, B.3.
Weaver, C., 2017b. Theranos agrees to 2-year ban from blood testing. *Wall Street Journal*, Eastern edition, 18 Apr, B.1.
Weaver, C. and Siconolfi, M., 2017. Business news: Theranos low on cash after settlement. *Wall Street Journal*, Eastern edition, 2 Aug, B.3.
Weaver, C. Carreyrou, J., and Siconolfi, M., 2016. Blood lab Theranos faces criminal probe. *Wall Street Journal*, Eastern edition, 19 Apr, A.1.
Weber, M., 2019/1922. *Economy and society. A new translation by K. Tribe*. Cambridge, MA: Harvard University Press.
Winner, L., 1998. Prophets of inevitability. *MIT's Technology Review*, 101, 62.
Woodruffe, H.R., 1997. Eschatology, promise, hope: the Utopian vision of consumer research. *European Journal of Marketing*, 31 (9/10), 667–676.