Big Tech

Kean Birch\textsuperscript{a} and Kelly Bronson\textsuperscript{b}

\textsuperscript{a}Graduate Program in Science & Technology Studies, York University, Toronto, Canada; \textsuperscript{b}School of Sociological and Anthropological Studies, University of Ottawa, Ottawa, Canada

Introduction

Big Tech is in the public and political spotlight. Usually defined as Apple, Amazon, Microsoft, Google/Alphabet, and Facebook/Meta, Big Tech is becoming the watchword for corporate surveillance, monopoly, and market power.\textsuperscript{1} Arguably, they are the defining institutions of our day, dominating our political economies, societies, and polities as Big Oil or Big Banks did in their time. Criticism of Big Tech is increasingly evident as well, cutting across popular books, academic work, film, and journalism: examples include, Shoshana Zuboff’s (2019) book \textit{The Age of Surveillance Capitalism}; recent documentaries like \textit{Social Dilemma} and \textit{Agents of Chaos}; and regular column inches in print media like the \textit{Financial Times} and \textit{The Economist}, this being particularly notable as these two are intellectual bastions of capitalism.

As public, political, and policy backlash against the activities of Big Tech followed results of the 2016 US Presidential Election, the 2016 British Referendum on Europe, and the 2018 revelations about Cambridge Analytica (Zuboff, 2019), commentators have highlighted the significant loss of trust in these digital technology companies and their wares – dubbed the ‘techlash’ (Foroohar, 2019). This techlash is hardly surprising since, as Prainsack (2019) points out, Big Tech firms increasingly underpin much of our social, political, and economic worlds by providing the digital infrastructure on which we rely to live our lives. Consequently, governments and others around the world are increasingly turning their regulatory gaze onto Big Tech, leading to a surge in policy and legislative measures to curb their social and market power. Big Tech has been the subject of critical political investigations, like the recent US Congressional Hearings on Online Platforms and Market Power, or the International Grand Committee on Big Data, Privacy and Democracy. Big Tech has also been the target of specific policy action, like the European Union’s (EU) recently passed \textit{Digital Markets Act} (DMA), which seeks to address the
problems caused by large digital platforms acting as ‘gatekeepers’ to increasingly essential digital infrastructure (G7, 2021).2

Much of this policy attention follows a number of in-depth investigations (e.g. HM Treasury, 2019; ACCC, 2020; US House of Representatives, 2020). One of the most comprehensive investigations of Big Tech – excluding Microsoft – was undertaken by the US Congress over a 16-month period from June 2019 to October 2020. Led by the Subcommittee on Antitrust, Commercial and Administrative Law, this investigation examined 1.3 million documents, held seven hearings, collected a range of testimony from stakeholders, competitors, and government, and culminated, in late July 2020, with the televised grilling of the CEOs of Apple (Tim Cook), Amazon (Jeff Bezos), Alphabet/Google (Sundar Pichai), and Meta/Facebook (Mark Zuckerberg). The final output was a 450-page report detailing a number of allegations about these Big Tech firms and the problems emerging from their centrality as technoscientific and political-economic ‘gatekeepers’ (US House of Representatives, 2020). Some of the allegations include: ‘controlling access to markets’, ‘charging exorbitant fees’, ‘imposing oppressive contract terms’, and ‘extracting valuable data from people and businesses’ (US House of Representatives, p.6).

Our goal in this Special Forum is to examine Big Tech’s dominance, technoeconomic practices, and societal implications through the analytical and empirical approaches commonly deployed in science and technology studies (STS). We do so in order to unpack the techno-economic ‘black box’ represented by these Big Tech firms, reflecting on their dominance of both technoscience and political economy through their configuration and reconﬁguration of techno-economic claims, narratives, conditions, practices, and processes.

**Big Tech: Scale, Platforms, and Governance**

We use the term ‘Big Tech’ to refer to the US-based, multinational corporations Apple, Amazon, Microsoft, Alphabet/Google, and Facebook/Meta. Others have used a variety of terms to refer to these corporations, as well as a number of other technology companies based in the USA (e.g. Uber, Netflix) and elsewhere (e.g. Alibaba, Tencent): for example, ‘the four’ (Galloway, 2018), ‘FAANG’ (Foroohar, 2019), ‘GAFAM’ (Wichowski 2020), and more besides (HBR, 2020; The Economist, 2020; Moore and Tambini, 2021).3 Our focus, in this guest introduction and Special Forum, is on the largest technology companies, however, hence why we prefer to use Big Tech. Name changes (e.g. from Facebook to Meta) and oscillating political-economic fortunes of smaller technology companies (e.g. Uber) also mean that Big Tech is a more useful and consistent term to deploy if we want to grapple with some of the analytical uniqueness of these digital leviathans, their scale, and their scalability (Prainsack, 2019; Birch et al., 2021; Pfotenhauer et al., 2021).
Much of the current academic and policy debate on Big Tech emerges from earlier research on and claims about two key aspects of their social and market power, and the subsequent need to find new governance mechanisms to manage the societal fallout from this power (Khan, 2016; Gorwa, 2019; Doctorow, 2020; Moore and Tambini, 2021). There is a logical emphasis on the size and scale of Big Tech, which is easiest to convey visually (see Figure 1). The five Big Tech firms now represent around 25 percent of the US S&P 500, being some of the largest corporations in the world by market capitalization (Birch et al., 2021). Their sheer scale is often used to explain their dominance. Scholars point to consequences of this scale, including network effects, winner-takes-all dynamics, and financial leverage (see European Parliament, 2020). Network effects entail the benefits users get from using a techno-economic service or platform that has an increasing number of other users, meaning that scale and scalability play a crucial role in the growth of digital firms (Kenney and Zysman, 2019). Winner-takes-all dynamics follow from network effects and reflect the competitive benefits that scale provides in data collection and analytics since access to data – or lack thereof – creates significant barriers to entry for startups and competitors (Sadowski, 2020). Financial leverage results from the expectations that investors have regarding the likely (data and financial)
monopolies resulting from network effects and winner-takes-all dynamics embedded in the scale of Big Tech firms, meaning that they can finance their operations at a lower cost than other firms (i.e. investors lend them capital at lower cost), including their competitors (Galloway, 2018).

Platforms and the ‘platformization’ they engender also play a key role in Big Tech’s power (Helmond, 2015; also see Srnicek, 2016; Langley and Leyshon, 2017; Nieborg and Helmond, 2019; Pistor, 2020). Platforms are, of course, implicated in the scale and scalability of Big Tech. As Helmond (2015) argues, this particularly concerns the idea that platforms play an increasing important role in our societies, politics, and economies. Platformization reflects a more expansive view of Big Tech as dominating digital infrastructures (e.g. platforms), boundary technologies (e.g. APIs, SDKs), rules and regulations (e.g. contractual terms), and users, competitors, and customers (e.g. advertisers, developers) (Helmond, 2015; also see Hein et al., 2020). Much of this analytical examination of platforms is not based on scale/size, but rather on examining the techno-economic extension of platform boundaries to enroll a range of other social actors. It is notable, for STS scholars, that this research has largely emerged in non-STS or STS-adjacent fields, like new media studies, critical data studies, algorithm studies, and law (e.g. Pasquale, 2015; Rosenblat and Stark, 2016; O’Neil, 2017; Zuboff, 2019), rather than in STS journals or the like.

What do these two dimensions – scale/scalability and platformization – mean for our attempts to address the public, political, and policy fallout from Big Tech? As Prainsack (2019) argues, the governance response to these two key dimensions of Big Tech often emphasizes increasing ‘individual control’ as the solution to increasingly egregious societal effects, especially those resulting from the massification of personal data collection and its use by Big Tech firms (Gorwa, 2019; West, 2019; Beauvisage and Mellet, 2020; Birch et al., 2021). Within an ‘individual control’ framework, better governance is deemed to rest on strengthening individual property or privacy rights as part of data protection policies, such as the EU’s 2018 General Data Protection Regulation (GDPR). Other scholars have suggested a more ‘collective’ approach, according to Prainsack (2019), but this represents far less politically popular governance mechanisms like data commons or data trusts (see Artyushina, 2020). As Birch et al. (2020) argue, though, the tendency to frame governance as an issue of individual privacy and data protection creates a very narrow spectrum for a potential politics to respond to the techno-economic effects of Big Tech. For example, individual responses do not (and perhaps cannot) address the scale and platformization of Big Tech (Edwards, 2018), while collective responses are currently too underdeveloped to do much at present (Pistor, 2020). Moreover, a narrow legal focus on data privacy and protection is compatible with corporate values such as profitability, setting legal compliance as a low bar for Big Tech. This sidelines values beyond profit, especially where these entail calls for social justice (Kinstler, 2020; Bronson, 2022). Here, an STS lens can provide new insights for getting
at the techno-economic implications of Big Tech and finding ways to ameliorate or govern their everyday impacts.

**Looking at Big Tech through an STS Lens**

Although Big Tech is facing the glare of negative publicity, there is a notable absence of discussion about it within science and technology studies (STS), with some exceptions outside of this Special Forum (e.g. Bronson and Knezevic, 2016; Goldstein and Tyfield, 2018; Birch *et al.*, 2020; Fourcade and Kluttz, 2020; Geiger, 2020; Sadowski, 2020; Birch *et al.*, 2021; Pfotenhauer *et al.*, 2021; Bronson, 2022). As a field, STS has not really engaged analytically or empirically with Big Tech as a specific and perhaps still emergent configuration of contemporary, technoscientific capitalism underpinned by monopoly and market power (Birch 2020; Birch and Muniesa 2020). Such configurations entail the techno-economic measurement and management of social relations and action, performatively driven by particular techno-economic logics as well as wider socio-technical imaginaries (Bronson, 2019; Bronson, 2022). For example, research on digital data illustrates the configuring of organizational practices by an ‘imperative to collect as much data as possible’ (Fourcade and Healy, 2017, p. 9; also Fourcade and Kluttz, 2020). These data are necessarily scored and ranked in particular ways (e.g. individually), thereby re-configuring organizations and organizational practices (e.g. accounting) in the process (Birch *et al.*, 2021). Here, STS scholars are ideally placed to unpack and explore the techno-economic assumptions and knowledge claims, measurement tools and standards, organizational practices and expertise, innovation and business strategies, and policy debates underpinning the ascendance of Big Tech. Moreover, all such aspects are political and normative at the same time as they are epistemic.

A defining feature of STS scholarship is that it engages with the politico-epistemic dimensions of technoscience, forcing us to consider scientific facts and technological artifacts as embedded with social dimensions and thus as socially located or contingent (Winner, 1980; Haraway, 1988; Yearly, 2005). Via a focus on particularities in the manifestation of science, technology, and innovation, STS scholars have challenged assumptions that technoscience somehow sit outside of human influence, thereby opening space for us to think about how humans might intervene to render things otherwise. Following in this tradition, the articles of this Special Forum make space for such interventions into the problem of Big Tech. Rather than treating Big Tech as a monolith, the papers in this collection highlight specificities in the practices of data collection and use across distinct sectors, cultures, and jurisdictions. Especially when read together, the papers thus reveal differences in how mega-enterprises operate across a variety of social locations, thereby troubling the very notion of a singular Big Tech.
The paper by Bronson and Sengers (2022), for example, sheds light on agricultural input corporations (e.g. chemical) as those now using big data as a revenue stream. They argue that while Big Ag Tech replicates the power and political economy of other sectors like social media, there are unique technical and ontological challenges to the uses and misuses of big data in agriculture. Monsanto, for example, has a long history of cultivating farmers’ dependence on technologies and the company is trading on these relationships to collect as much data from as many farms as possible; this in turn ensures their market dominance ‘because big data and analytics presents a scale-driven proposition that tethers success to control of these systems to control over large reservoirs of data.’

Similarly, the paper by Fuchs et al. (2022) draws attention to context-specificity with a well-known tech giant: Amazon. While companies like Google and Amazon are thought to have universal dominance, Fuchs et al. show that the ways by which Amazon controls workers are influenced by national political and labour culture. Fuchs et al. examine how Germany’s ‘relatively strong economic democracy,’ and ‘widespread working culture based on social partnership’ influences Amazon’s power to shape what they call ‘the “human-technology configuration”’.

The papers in this Forum also extend existing critical data studies scholarship by going beyond merely describing and problematizing unequal power relations, such as that between company and worker; many of the papers detail the processes and moves by which Big Techs acquired their power, and/or the moves by which this power is reinforced in the face of ongoing contestation. Birch and Cochrane (2022), for example, outline four forms of digital rentiership pursued by Big Tech firms in the pursuit of different kinds of economic rents: enclave rents, expected monopoly rents, engagement rents, and reflexivity rents. These forms of digital rentiership might reflect different mechanisms and arrangements pursued by Big Tech, but they also illustrate a common strategy pursued by these firms (i.e. exaction or extraction of value). In a subsequent paper, Hendrikse et al. (2022) delves into the distinction between monopoly power of tech firms today versus those through recent history, and they trace the twists and turns as Big Tech firms moved from computer manufacturers to digital platforms. In doing so, they show how this has gradually led to the ‘Big Techification’ of everything. Similarly, Lieverouw et al. (2022) seek to position the emergence of a ‘digital health assemblage’ in the USA within its historical context. While Big Tech firms and their founders have been strong advocates of digital health technologies, the importance of broader societal and policy changes in their development has often ended up hidden. If Hendrikse et al. and Lieverouw et al. historicize Big Tech, Selinger and Durant (2022) take what they call ‘a crystal ball approach’ in their examination of Big Tech by focusing on the future. They analyze the case of Amazon’s Ring technology to extrapolate from its existing features and sketch a future
characterized by worrisome restrictions of civil liberty and government independence.

While each paper describes the power (and power inequity) of Big Tech, many highlight the unstable nature of this power, or as Balzam and Yuran (2022) put it, the ‘fragility’. Many of the papers complicate facile notions of how Big Tech firms wield power, showing it is sometimes done in cooperation with non-obvious actors like state regulators or even critical academics *qua* corporate ethicists. Phan *et al.* (2022) describe a ‘virtue economy’ where the ethical issues arising from the uses and misuses of personal data (among other transgressions) get translated into market opportunities for those offering ‘ethical services’, including STS scholar for hire. Lanzing *et al.* (2022) explore the role of governments in the mutual shaping of technology-society relations in what they call a ‘tango’ of policy surrounding the use of COVID-19 contact tracing apps and the ‘colonization’ of personal privacy which has ensued from their state endorsement and use. Hellman also looks outside of Big Tech per se, to the peripheries (or tentacles) that support phenomenon like market concentration. Drawing on interviews with venture capitalists, Hellman (2022) troubles the received view of Big Tech’s monopoly power as stemming from ‘overt anticompetitive practices’. Rather, he argues, ‘the vacuum of serious competitors’ owes as much to a culture of VC that aims to create products that ‘enhance’ rather than compete with Big Techs’ offerings and strategies.

In describing the processes – complex and interwoven – by which values and culture and demands for profitability get translated into measurable outcomes, these papers remind us of the interplay between superstructural forces (like capitalism) and more mundane forces of imagination and desire. In doing this, the papers in this Forum show us that the targets for reform need not be limited to large-scale regulatory interventions (like anti-trust law) or interventions into the political economy of platforms. In this way, this Forum departs from much of the critical scholarship on Big Tech, which has been as captured by these dominant sites for intervention as have been the companies themselves; arguably, Big Tech has historically engaged with ethical considerations to the extent that ethical concerns touched on fears about waning legitimacy or profitability. Therefore, the dominant levers for change advanced by scholars have been formal processes like legal compliance or public relations. But what about broader moral justice concerns? What the papers in this Forum make clear is that there is space for intervention – scholarly or otherwise – between legal risk and abdication.

**Big Tech as a Techno-economic Configuration**

If STS can add something new, then, it is in addressing how the techno-economic configuration of Big Tech ends up constituted by and constituting a
broader societal shift in the position and implications of technoscience and political economy. This configuration extends beyond organizational boundaries to take in an ever-expanding ‘ecosystem’ comprising ‘heterogenous assemblages of technical devices, platforms, users, developers, payment systems, etc. as well as legal contracts, rights, claims, standards, etc.’ (Birch and Cochrane, 2022, 2). As noted previously, STS can help unpack how, and to what end, the mass and at-scale collection and exploitation of personal or user data enables Big Tech to digitally score, rank, and segment individual persons (Fourcade and Healy, 2017), while simultaneously analyzing the reconfiguration of Big Tech’s organizational practices and boundaries that results from this focus on the activities and lives of individuals. As Birch et al. (2021) note, Big Tech firms end up only able to understand individuals as ‘users’ in their ecosystems, with the attendant political and social fallout that this may entail. It is here that we think STS can intervene politically – and positively – in ongoing debates about the impacts Big Tech: there is already a growing interest in what Pfotenhauer et al. (2021) call the ‘politics of scaling’ – also see Avle et al. (2020) – and to which we want to add our call to engage with the ‘politics of modularity’ as a way to unpack where to intervene in Big Tech’s (ever-)expanding digital ecosystems.

According to Pfotenhauer et al. (2021), the politics of scaling entails both a policy concern with scale, reflecting the size of a techno-economic undertaking like a Big Tech firm, and a logic of scalability. By this, they mean techno-economic undertakings that are configured by a rationale of being scalable, of being scaled up to a societal level rather than remaining localized or contextualized. Here they draw on the work of Tsing (2012), who notes the universalizing tendency inherent in modernity emerging from this scalability logic (also Scott, 1998). As Avle et al. (2020, p. 238) also argue, scale thereby becomes both an ‘analytical tool’ through a concern with ‘scale making endeavours’ and an ‘object of inquiry’ that reflects ‘how scale is deployed by certain actors’. As such, it is as much an actor’s category, according to Pfotenhauer et al. (2021), as it is an analytical category denoting size (and power). With Big Tech, this can be seen in the ways that investors and financiers specifically sought and still seek out scalable technologies and business models – that is, ones that generate network effects, or winner-takes-all dynamics – with the expectation that scaling up both will achieve a scale/size that can dominate a market.

As Pfotenhauer et al. (2021, p. 6) point out, much of early STS scholarship was concerned with a rejection of universalism in ‘scientific claims to truth and objectivity’ as well as ‘expansion of technological systems’ and ‘the governance structures that accompany them’. Here, then, scalability in the context of Big Tech can be seen as another universalizing strategy constituting this techno-economic configuration. Scalability, though, results from what Gillespie (2020, p. 2) argues is the tendency of digital technologies and platforms to make ‘the small
… have large effects’; or, at least seem to have large effects. For, as Irani (2015), Seaver (2021), and others highlight, scale, scaling, and scalability are often more evident in their narrative claims than material operations. Irani (2015), for example, argues that much of the infrastructural work underpinning digital technologies – the ‘unscaleable’ – ends up being hidden and made invisible through the outsourcing of work (e.g. tagging images, cleaning data, moderating platforms, etc.), amongst other processes. Building on these arguments, Seaver (2021, p. 528) argues that scalability, therefore, is not inherent to any particular techno-economic setup, it is ‘rather a consequence of where project boundaries are drawn, in the service of particular visions of corporate futures’. Scalability requires an active drawing of the boundaries of Big Tech, as a techno-economic configuration, and these boundaries reflect more than size alone.

As a politics, a concern with scalability only gets at one aspect of Big Tech as a particular techno-economic configuration. The literature on platforms and platformization helps us get at another dimension of this configuration (Helmond, 2015; Nieborg and Helmond, 2019). Big Tech not only entails a politics of scaling, it also, simultaneously and interdependently, entails a politics of modularity. As the contributions to this Special Forum illustrate so well, thinking of Big Tech as a techno-economic configuration helps us to analyze how these firms extend themselves beyond their organizational and ecosystem boundaries. Helmond (2015) and Nieborg and Helmond (2019) frame this as a process of platformization, in which Big Tech firms develop proprietary technoscientific devices – application programming interfaces (APIs), software development kits (SDKs), and other plugins – to bring other social actors into an ecosystem they control. Nieborg and Helmond (2019) define these technological interfaces as ‘boundary resources’. The politics of this process, however, does not depend upon scalability, but rather on modularity; on the ease with which other social actors and devices can slot into an ecosystem (Hein et al., 2020). Modularity necessitates a capacity to integrate other social actors into an ecosystem and to develop techno-economic mechanisms to support this integration and interoperability. The specificity of Big Tech as a techno-economic configuration is their combination of scalability and modularity that enables them to retain control of an ecosystem. As Helmond (2015), Nieborg and Helmond (2019), and others note, this often involves technological devices, applications, and plugins, so-called ‘boundary resources’.

Building on these two aspects of Big Tech’s techno-economic configuration, we suggest that an important aspect of Big Tech is the development of ‘boundary assets’ that help to both constitute an organizational or ecosystem boundary – as a flexible interface, rather than separation – and provide the tools and devices necessary for other techno-economic entities then to cross that boundary. Reminiscent of work in STS on boundary objects and organizations (Star and Griesemer, 1989; Guston, 2001; Miller, 2001), the notion of boundary assets reflects the important role of technoscientific devices (e.g. APIs) in
enabling modular integration across boundaries, where these boundaries are understood as flexible and permeable interfaces. What makes boundary assets distinct in the context of Big Tech is that these devices are not only technoscientific, they are also political-economic. It is the proprietary assets owned by Big Tech that enables other social actors to access a digital ecosystem. Moreover, through their ownership of these assets, Big Tech can set the terms of engagement through contractual arrangements (e.g. terms and conditions), representing privately-made rules and standards controlled by Big Tech (Birch, 2017a). In this way, boundary assets not only enable integration across boundaries, the modular relations they constitute end up having significant value for Big Tech firms whose valuation is based on the capitalization of future earnings derived from the users in and of their ecosystems (Birch et al., 2021; also see Birch, 2017b; Muniesa et al., 2017; Birch and Muniesa, 2020). The more users (‘scale’) that boundary assets can enroll and integrate, the more valuable they become for Big Tech.

As a particular techno-economic configuration, Big Tech firms are increasingly defined as ‘gatekeepers’, especially in the policy discourse emerging from the EU (e.g. European Parliament, 2020). This gatekeeper role can be understood through the dual politics of scalability and modularity we have outlined here, as well as the tensions that arise from it. Big Tech has both the scale size to engender certain outcomes like network effects and the integrative capacity to constitute and control a broader ecosystem of social actors, devices, legal mechanisms, etc. As STS scholars, we are well-placed to unpack these dimensions of Big Tech, and affect an array of political, regulatory, and technoscientific objectives that support more publicly-engaged, democratic, responsible, and inclusive outcomes. We have the analytical and empirical tools to think systematically about and go beyond the status quo in our examination of the societal implications of Big Tech. All of which is increasingly necessary as these Big Tech firms come to dominate our societies today and, seemingly, for years to come.

Notes

1. The more recent public and political opprobrium increasingly heaped on Big Tech for their political-economic actions and impacts follows a longer history of critical takes on their social and political impacts, especially as this relates to their entrenchment of sexism, racism, and inequality (e.g. Pasquale, 2015; O’Neil, 2017; Hampton, 2021). Our focus in this Special Forum, however, is on their techno-economic configuration and its implications.

2. https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en

3. FAANG refers to Facebook, Apple, Amazon, Netflix, and Google, while GAFAM refers to Google, Apple, Facebook, Amazon, and Microsoft.

4. We are also drawing on discussions with Janet Roitman about the importance of APIs (and similar technologies), which have been happening in the Platform Economies
Research Network (PERN) at The New School, USA: https://platformeconomies.net/. Janet Roitman is currently undertaking an NSF-funded project titled ‘High Finance in Africa’ examining the important role of these APIs.

Acknowledgements

Thanks to Les Levidow for his comments on earlier drafts.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

Funding for the research done for this article comes from the Social Sciences and Humanities Research Council (SSHRC) of Canada (Ref. 435-2018-1136).

Notes on contributors

Kean Birch is an Associate Professor in the Graduate Program in Science and Technology Studies and Faculty of Environmental and Urban Change at York University, Canada. His most recent book is the co-edited volume (with Fabian Muniesa) Assetization: Turning Things into Assets in Technoscientific Capitalism (MIT Press, 2020).

Kelly Bronson is a Canada Research Chair in Science and Society in the School of Sociological and Anthropological Studies at the University of Ottawa, Canada. Her most recent book is Immaculate Conception of Data: Agribusiness, Activists and Their Shared Politics of the Future (McGill-Queen’s University Press, 2022).

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