

Association for Information Systems

AIS Electronic Library (AISeL)

AMCIS 2020 Proceedings

Philosophy in Information Systems (SIGPHIL)

Aug 10th, 12:00 AM

Algorithmic neutrality, algorithmic assemblages, and the lifeworld

Howard Rosenbaum

Indiana University, hrosenba@indiana.edu

Follow this and additional works at: <https://aisel.aisnet.org/amcis2020>

Rosenbaum, Howard, "Algorithmic neutrality, algorithmic assemblages, and the lifeworld" (2020). *AMCIS 2020 Proceedings*. 6.

https://aisel.aisnet.org/amcis2020/philosophical_is/philosophical_is/6

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2020 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Algorithmic neutrality, algorithmic assemblages, and the lifeworld

Completed Research

Howard Rosenbaum
Indiana University
hrosenba@indiana.edu

Abstract

The paper explores the role of algorithms in the constitution of the social world. Concepts drawn from the perspectives of social phenomenology and information systems are used to argue that algorithms are sociomaterial constructions that, as part of algorithmic assemblages, have become embedded in the lifeworld of people who routinely use digital devices in their online lives. The paper argues that as these assemblages become more deeply embedded in the social fabric, there is pressing need for critical analysis because of the power and information asymmetries that are uncovered when considering the roles of the complex organizations that control the algorithmic assemblages that increasingly shape people's digital lives.

Keywords

algorithms, algorithmic assemblages, lifeworld

Introduction

One of the defining characteristics of the last decade has been the emergence of big data as a sociotechnical force. Digital data are increasing at an increasing rate. This includes, for example, the intentional and unintentional trace data people leave behind as they interact online and data from the internet of things. Online quantified data has allowed powerful actors to represent more and more of the physical and social world as data and metadata, a process van Dijck, (2014; 198) has called "datification." However, big data are useless without algorithms, and there is a particular view of the nature and status of algorithms that clearly bears critical scrutiny, especially in light of the increasing importance they are playing in many people's lives.

The paper explores the role of algorithms in the constitution of the social world. Concepts drawn from the perspectives of social phenomenology and information systems are used to argue that algorithms are sociomaterial constructions that, as part of algorithmic assemblages, have become embedded in the lifeworld of people who routinely use digital devices in their online lives. This line of inquiry responds to Willson's (2016; 11) call that

...questions can be posed as to the broader philosophical issues raised around ontological understandings and experiences of the world that are engaged with and developed when the everyday is increasingly algorithmically articulated, or more simply, to ask how this might affect how people see and understand their environment and their relations.

After a brief discussion of algorithms, the concept of an algorithmic assemblage is introduced. This concept is used to describe the ways in which people, digital devices, algorithms, and the platforms and services they use are bound up together (Aragona, and Felaco, 2019; Lupton, 2016, Ananny, 2016, Perrotta and Williamson, 2016, Tanweer, Fiore-Gartland, and Aragon, 2016). Then the concept of the "lifeworld" from Schutz's (1970, 1967) social phenomenology is used to explore the nature and implications of the ways in which algorithmic assemblages have become entangled in the work and social lives of many people. It is suggested that a key component of the lifeworld is the "technological frame," (Bijker, 2010; Orlikowski and

Gash, 1992), a shared and taken-for-granted basis for the understanding of the nature and uses of technologies. This concept is used to explain the role of the myth of algorithmic neutrality in moving algorithmic assemblages into the background of the lifeworld. The paper concludes with an argument that as these assemblages become more deeply embedded in the social fabric, there is pressing need for critical analysis because of the power and information asymmetries that are uncovered when considering the roles of the complex organizations that control the algorithmic assemblages that increasingly shape people's digital lives. A contribution of this paper is to provide a preliminary sketch of a conceptual framework that can be used to conduct such an analysis.

Algorithms and algorithmic assemblages

Over 2 billion people routinely use at least one social media platform, whether it is Facebook, Youtube, WhatsApp, Twitter, Instagram, Pandora, Spotify, Tinder or some other emerging service (Chaffey, 2019; Statista, 2019, Spangler, 2019a, 2019b, Palotta, 2019). A common thread running through all of this activity is that it is mediated by algorithms, which are becoming increasingly important in many sectors of the social world (Napoli, 2013, 3). According to Kitchin (2016; 2)

... dozens of key sets of algorithms are shaping everyday practices and tasks, including those that perform search, secure encrypted exchange, recommendation, pattern recognition, data compression, auto-correction, routing, predicting, profiling, simulation and optimization...

Even serendipitous encounters with digital information are likely to be algorithmically-mediated (Sundin, et al. 2017; 226). The nature, extent, and effects of this mediation are not at all clear in large part because much of this algorithmic activity takes place in the deep background of people's digital lives.

Algorithms have meaning, significance, and impacts in domains outside of computer science such that "everything people see and do on the web is a product of algorithms" (Rainie and Anderson, 2017). The term "algorithm" is shorthand for an "algorithmic assemblage," the infrastructure that supports the implementation, maintenance, use, and evolution of algorithms and the programs, data, and platforms of which they are a part. An assemblage is a useful concept to employ here because it "affords insight into the emergence, temporality, spatiality, distributed agency and fragility of social formations" that include a wide range of organizational, technical, and individual actors (Lamprou, Mitev, and Doolin, 2014; 5).

Algorithmic assemblages as a type of digital assemblage, are "distinct patterns of ICT collections that, in use, are functionally equivalent and structurally similar, relying on standardised and commodified ICT and are neither formally designed nor collectively governed" (Sawyer, Crowston, and Wigand, 2014). They are relatively persistent and stable heterogeneous configurations of people, technologies, and data that come together to accomplish some task for a period of time (Müller and Schurr, 2016; 219). An algorithmic assemblage includes the algorithm, the software, the data structures and data on which the algorithm operates, the computational and network infrastructure that powers the algorithmic activity, the platform or interface through which it is available, and the devices with which people interact with the service or platform that uses the algorithm (Pink, et al., 2017, 8; Ananny, 2016; 7; Kavanaugh, McGarraghy, and Kelly, 2015; 8). There are human actors in the assemblage "debating the models, cleaning the training data, designing the algorithms, tuning the parameters, deciding on which algorithms to depend on in which context" (Gillespie, 2014a; 5). There are also the millions of people who, through their digital practices, enact assemblages on a daily basis. For this reason, algorithmic assemblages can best be seen as pervasive in social, cultural, economic, political, and cultural domains, or, stated more succinctly, as embedded in everyday life (Willson, 2016; 5; Matzner, 2019; 126; Berg, 2014: 1). For the purposes at hand, this concept is useful, because it describes large, dynamic, and heterogeneous configurations of technology, people, and data that cross organizational boundaries while keeping the focus on the role of algorithms in the assemblage. In this sense, algorithmic assemblages can be seen as an interesting subordinate concept within the broader concept of information systems.

An algorithmic assemblage is always "in play;" with "movement and the temporary, socially, materially and discursively accomplished 'coming-together' of heterogeneous entities into social practices" (Lamprou, Mitev, and Doolin, 2014; 1). It is characterized by entanglements involving its various components, the discourses competing to define it, and the organizations that compete to control it (Pink, Lanzeni and Horst, 2018; 2). Components of the assemblage change as people interact within it and with each other. However, over time algorithmic assemblage can adapt to changing conditions, moving towards a relatively stable, functional equilibrium even as it is evolving (Sawyer, Crowston, and, Wiegand, 2014; 52).

When a person uses a search engine or a social media platform through her smartphone or other digital device, she is interacting at one terminus of an algorithmic assemblage which is instantiated in a material and performative sense “as a running system, running in a particular place, on a particular computer, connected to a particular network, with a particular hardware configuration;” as she examines the results of her search, her “experience of algorithms can change as infrastructure changes” (Dourish, 2016; 5, 6). The assemblage operates largely without the need for human intervention, except for the end user, as it carries out the tasks and processes necessary to provide a response (Willson; 2016; 3). This activity, while technically sophisticated, is, in fact, a routine social practice and a mundane and mostly invisible part of daily life (Sundin, et al., 2017; 225). Algorithmic assemblages therefore have social functions, one of the more important of which is routinely establishing, shaping, and influencing a range of formal and informal social relations across time and space (Busco, 2009; 254).

An algorithmic assemblage is a socio-material accomplishment and a communication technology, connecting people, companies, governments, and other actors in an ongoing exchange of data, information, and services. Its effects emerge when it is used and this performative enactment involves the whole of the assemblage because “the conditions and consequences of algorithmic rules only come into being through the careful plaiting of relatively unstable associations of people, things, processes, documents and resources” (Neyland and Mollers, 2016; 1). This becomes important because, as they become embedded in people’s social practices, these assemblages impact the lives of the people who routinely use them in ways that are both significant and difficult to foreground.. One factor that contributes to the cloaking of algorithmic assemblages is the myth of algorithmic neutrality.

The myth of algorithmic neutrality

Over time, algorithmic assemblages can shift from the background to the forefront of people’s attention. In general, algorithmically mediated activity tends to be foregrounded when there is a breakdown, as when Facebook researchers’ experimental manipulation of news feeds became public in 2014 after the results were published as an academic paper. This type of incident brings the potential impacts of algorithms to widespread attention, but the resulting scrutiny tends to be short-lived. The return to normalcy is hastened by the relative invisibility and inscrutability of the assemblage and because of a myth that has defined algorithms as objective, neutral, authoritative, and benign.

What is the myth of algorithmic neutrality? According to Lustig and Nardi (2015; 743) algorithms “are simultaneously a set of abstract instructions (logic) and possibilities for action (control).” It is then a sensible inference that algorithms are largely neutral in terms of the ways in which they process data. They are seen to operate autonomously without the need for human intervention and have social and technical significance without being well understood by the general population of end users (Willson, 2016; 3; Seaver, 2017; 2; Rader and Gray, 2015; 173). When algorithms move from the computer scientist’s machine to commercial application they are seen as “strictly rational concerns, marrying the certainties of mathematics with the objectivity of technology” (Seaver, 2013; 2). They make it easier to find information, conduct the routine tasks of daily life, get work done, maintain social relationships, enable complex decisions, and engage with many institutional and individual actors. These are some of the main tropes that constitute the myth of algorithmic neutrality and authority. In this view of the social life of algorithms, they are tools that improve people’s lives, reducing the friction in many different types of online activities.

Reinforcing this view, algorithms are often described by the companies and organizations that own and/or employ them as trusted tools that provide fair and objective results free from bias, influence and error. Their output is seen as a technical resource that can facilitate consumer behavior (Willson, 2014; 5). In addition to providing a seemingly reasonable way for people to grasp the nature of algorithms, this myth serves another purpose. As “a carefully crafted fiction” it establishes the legitimacy of algorithms, the assemblage, and, by inference, of the company or organization that owns and/or uses them (Gillespie, 2014a, 14). When this myth is perceived as reasonable and persuasive, the provider of the assemblage is seen as a trusted and neutral actor and the social life of the algorithm as a benign entity is maintained. The more that this quality of algorithmic neutrality can be asserted and accepted, the more easily the claim can be made that the work of the algorithm is the result of the machine and not of humans and their subjectivity. A consequence is that the output of algorithmic assemblages is seen as reasonable and expected (Ananny, 2016; 11).

This myth is a “technological frame” (Lin, 2005; Bijker, 2001, 1997; Orlikowski and Gash, 1994, 1992) that includes the “the knowledge and expectations that guide actors’ interpretations and actions related to” an information technology artifact (Davidson, 2006; 24). This frame provides a narrative about a technology and shapes people’s understandings about the conditions under which and ways in which it should be used, and the intended consequences of use. Technological frames are important because they are keys to understanding the ways in which people use technologies (Orlikowski and Gash, 1994; 175). The myth of algorithmic neutrality, then, is a set of beliefs about a technological artifact, in this case an algorithmic assemblage, articulated and maintained in the public discourse by stakeholders with a vested interest in the successful, profitable, and continued use of the tools, platforms, and services enabled by their algorithms. How this frame is maintained “depends not just on its design but also on the mundane realities of news cycles, press releases, tech blogs, fan discussion, user rebellion, and the machinations of their competitors” (Gillespie, 2014b; 16). Technological frames play a significant role in maintaining the myth and helping algorithmic assemblages recede into the background of daily life.

Therefore, outside the world of computer scientists and others who study digital technologies, algorithmic assemblages are not typically in the foreground of most people’s attention. While knowing that algorithms exist, for many people, they are inside a classic black box and “pass us by without being noticed” (Beer, 2016; 2). There is comfort provided, however, by algorithmic objectivity which refers to the framing of the algorithm (and the assemblage of which it is a part) as impartial and unbiased, in large part because of its status as a complex technical artifact; done well, this frame can be maintained in times of controversy (Gillespie, 2014b; 2). The results of algorithmic activity, then, can be described by the provider of the tool, platform, or service that uses the algorithm as having “a powerful legitimacy, much the way statistical data bolsters scientific claims, with the human hands yet another step removed” (Gillespie, 2014a, 7). In fact, the pervasiveness and taken-for-grantedness of this myth helps algorithmic assemblages recede into the background where they operate quietly, efficiently, continually, and relatively unobtrusively in people’s digital lives as they routinely carry out a range of algorithmically-mediated activities.

Beer (2016; 2) suggests that researchers “need to think about the powerful ways in which notions and ideas about the algorithm circulate through the social world.” Algorithmic assemblages are not simply the lines of code that define algorithms, the infrastructure that makes them work, and the people who maintain and use them. They are “‘large’ spanning time and space, but ... also ‘small’ coming in contact with routine and everyday practice” (Bowker, Baker, Millerand, and Ribes, 2009; 113). This latter insight is discussed in the next section.

Algorithmic assemblages and the lifeworld

The lifeworld, a concept taken from Schutz’s social phenomenology (1967), describes the world that is given, self-evident, and experienced as shared. Schutz, in turn, borrowed the concept from Husserl (1913, 1936), who described the lifeworld as the world that we experience in a taken-for-granted way in our “pre and extra-scientific” lives. This world is practical and temporally dynamic, while also grounded in a structural certainty that that make possible double, the key to his version of phenomenology. For Husserl, the lifeworld was the starting point for his method of phenomenological doubt; in pursuit of the essences of things, the lifeworld was to be transcended (Muzetto, 2015, 261 Butnaru, 2015; 69; Yudin, 2016; 12, Vaitkus, 2005, 98). For Schutz, however, the lifeworld is not a realm to be transcended, it is the object of study. With this move, he socialized the lifeworld, leading Gurwitsch (1962, 51) to claim that

One of Schutz’s original contributions consists in his contention that the social character belongs to the life-world essentially and intrinsically. That world is a social and intersubjective world from the outset and throughout; it does not become so subsequently, as was maintained in a certain sense by Husserl

In the lifeworld we engage in many routine, repetitive, and mundane activities that become the contours of our social and organizational lives; of interest are those activities that involve interactions with and within algorithmic assemblages. As people make greater and more intensive uses of their digital devices and conduct more of their routine interactions online, more of the data and information that they consume are algorithmically curated (Rader and Gray, 2015; 173). An algorithmic assemblage is an “‘always on’ technology that follows users on smartphones, reacting to unread emails, examining never-ending social media newsfeeds, and constantly adapting new information in order to refine our digital dossiers” (Hess, 2014; 10).

The social phenomenological framework makes clear that the more people use digital devices to engage with algorithmically-driven online platforms and services, the more the assemblages of which these are a part become embedded in the lifeworld. Feenberg (2015; 230) describes this state of affairs as ontological, arguing that technological artifacts are as fundamental to social reality as are language and culture. While the form and function of technologies change over time and across societies, they are always present. As a complex form of technology, an algorithmic assemblage does not “transcend the lifeworld but rather forms a special part of it” (Feenberg, 2015; 234). As people use and integrate technologies into their lives, they develop routines and patterns of experience that shape their interactions with their devices and with the lifeworld. These patterns are “embodiment relations,” meaning that the artifact (Brey, 2000; 3)

does not, or hardly, become itself an object of perception. Rather, it 'withdraws' and serves as a (partially) transparent means through which one perceives one's environment, thus engendering a partial symbiosis of oneself and it.

As a consequence, the artifacts and the assemblages of which they are a part become a means by which people carry out their projects and tasks and, as the assemblages withdraw, they become extensions of the person. For example, a smartphone is a technical artifact in the lifeworld and a transparent and powerful means by which the lifeworld of the person using it is shaped. There is a technological frame that people use to make sense of the artifact (and the assemblage) and, in turn, the “technologies themselves co-constitute narratives and our understanding of these narratives by configuring characters and events in a meaningful temporal whole” (Coeckelbergh and Reijers, 2016; 325). This is particularly the case when the technologies have significant textuality (the smartphone as opposed to a hammer), because they provide people with easy ways to engage in sustained social interactions (Coeckelbergh and Reijers, 2016; 344). Through the smartphone, the person enacts an assemblage to search, to engage with social media or perform some online task; the resulting co-constituted narrative reinforces a technological frame (Davidson, 2006; 24), providing the person with an understanding of the assemblage characterized by beliefs in algorithmic authority, objectivity, and neutrality.

In this way, algorithmic assemblages become increasingly important in shaping the lifeworld. This is because, over time, as people routinely enact these assemblages, algorithmic logic comes to shape and control the data and information flows on which people depend and incorporate into many of their routine activities. This is the feedback loop of datafication wherein the assemblage is “not only ... collecting and analysing data about Internet users, but also as feeding such data back to users, enabling them to orient themselves in the world” (Kennedy, Poell, and van Dijck, 2015; 1). Algorithmic assemblages produce and certify knowledge making them powerful actors in the paramount reality of the lifeworld, the world of working (Gillespie, 2014a; 2). For this reason, the material and social world people produce and reproduce is shot through with the output of algorithmic assemblages (Eberle, 2012, 295). Accepting the technological frame of algorithmic neutrality, people domesticate algorithmic assemblages, bringing them into their homes and workplaces where they become a taken-for-granted part of people's routines.

Algorithmic assemblages are “built to be embedded into practice in the lived world that produces the information they process, and in the lived world of their users” (Gillespie, 2014a; 17). As people performatively enact it, an increasingly common outcome of engagement with these assemblages is that decisions about the relevance of information are being made through technical means that have epistemological consequences; they restrict the domain of what can be known, provide a means by which what is in the domain can be known, and influence the ways in which what is known can be used (Gillespie, 2014b; 1). They “help to bring about particular ways of seeing the world, reproduce stereotypes, reify practices ... and world views, restrict choices or open possibilities previously unidentified” (Willson, 2016; 5). In so doing, algorithmic assemblages shape the lifeworld in ways that are hidden and deeply entangled in people's social and work lives and in their routine information and decision-making practices.

As people interact with these algorithmic assemblages, they are also interacting with the powerful institutions and organizations that own and/or implement the algorithms. Although there are relationships of mutual shaping that are unintended consequences of these ongoing interactions, there are also distinct and powerful asymmetries at work. This is not without consequence because, over time, people begin to adjust their social actions and interactions in ways that “suit the algorithm they depend on” thereby, in a sense, making themselves algorithmically available and recognizable (Gillespie, 2014a; 2; 2016; 64). In terms of the bidirectional relationship between people and technology, this type of adjustment illustrates the material agency of the algorithmic assemblage which can take on gatekeeping and decision support

functions through control of the information flow to the individual, shaping the person's information life (Napoli, 2013; 8; Musiani, 2013; 1; Beer, 2009; 994). Gillespie (2014b; 21) describes the potential impacts of the increasing presence of algorithmic assemblage in the lifeworld:

It is easy to theorize, but substantially more difficult to document, how users may shift their world views to accommodate the underlying logics and implicit presumptions of the algorithms they use regularly. There is a case to be made that the working logics of these algorithms not only shape user practices, but lead users to internalize their norms and priorities.

A critical analysis of the myth of algorithmic neutrality and the asymmetries of algorithmic assemblages is needed because it “might well reveal something of the wider political dynamics of which they are a part” (Beer, 2016; 9).

Conclusion

As Dourish (2016; 1) points out, “[w]hen digital processes become more visible as elements that shape our experience, then algorithms in particular become part of the conversation about how our lives are organized.” Willson (2016; 2) argues, “[s]tudies of the everyday are ... partly concerned with rendering the seemingly invisible visible and thereby open to critique and the examination of power relations and practices that are in play.” This paper argues that algorithmically mediated interactions are becoming increasingly important in many people's lives. When using online services and platforms for search, entertainment and other activities, they are actually interacting with and within algorithmic assemblages. This routine activity, in a performative sense, brings assemblages to life as people, through their digital devices enact and become part of algorithmic assemblages. However, as these interactions become more habitual, the assemblage fades from view, becoming hidden in daily life. To understand why and how this happens, social phenomenology is proposed as a conceptual framework to pull back the curtain on these assemblages. This framework is particularly apposite because “relevance of phenomenology to the understanding of the social impact of communications technology, particularly the internet, has aroused the interest of many scholars” (Zhao, 2007; 140). A contribution of this paper is to provide an initial sketch of conceptual framework to explore the processes by which algorithmic assemblages play a role in organizing people's lives and can open these assemblages, their inherent asymmetries, and the myth of algorithmic neutrality and authority to sustained critique.

The concepts of the lifeworld, where the assemblages are embedded, and technological frames, which is how people think about these assemblages, are keys to understanding both the invisibility and power of assemblages. In the lifeworld, a pervasive and persuasive technological frame that is maintained in the public discourse about algorithms is a major part of the knowledge of acquaintance people have about algorithms and the assemblages of which they are apart. With these concepts, it becomes possible to account for the cloaking of algorithmic assemblages through widespread acceptance of a technological frame that encompasses the myth of algorithmic neutrality and a belief in algorithmic authority. As people use their digital devices to engage in algorithmically mediated activities in more parts of their social and work lives, the algorithmic assemblages that they enact become less visible and more significant. It is also possible to use these concepts to critically examine the ways in which technological frames shape understanding of assemblages. This matters because the back end of these assemblages is controlled by powerful corporate actors who take full advantage of the data and information asymmetries that exist in these assemblages. The lifeworld, is being influenced and shaped by the agendas of these corporate actors in ways that are difficult to see.

This framework suggests three avenues of investigation. First, is the micro level study of the ways in which individuals are immersed in algorithmic assemblages and how their interactions with algorithms shape their natural attitudes. This is in keeping with Couldry and Powell's (2014; 2) call for “a more open inquiry into what actual social actors, and groups of actors, are doing” when engaging in algorithmically mediated interactions” An intriguing avenue for research is opened up by the “broken data” metaphor, which focuses on how people engage with data in mundane settings (Pink, Ruckenstein, Willim, and Duque, 2018; 11) offer; this approach assumes data have materiality and can be broken and repaired as people carry out their algorithmically mediated activities. Second, is the study of the structure and functioning of algorithmic assemblages, which can take advantage of the methods used in infrastructure studies. Kitchin, (2016; 13) argues that a “way to undertake such research is to conduct ethnographies of how people engage with and are conditioned by algorithmic systems and how such systems reshape how organisations conduct their

endeavours and are structured.” Third, is the critical study of the power and information asymmetries inherent in algorithmic assemblages. An example of this approach is Striphas' (2015; 408) critical evaluation of algorithmic culture which argues that there has been an entanglement of digital technologies, discourse, big data analytics and political economy, raising the specter of the privatization and algorithmic automation of cultural decision-making. This could also involve an investigation of the organizations in whose platforms and services algorithms are enacted.

Acknowledgements

The author would like to thank the reviewers for their insightful and helpful comments, .

REFERENCES

- Ananny, M. 2016. “Toward an ethics of algorithms: Convening, observation, probability, and timeliness,” *Science, Technology & Human Values* (41:1), pp. 1-25.
- Aragona, B., & Felaco, C. (2019). "Big Data from Below. Researching Data Assemblages," *TECNOSCIENZA: Italian Journal of Science & Technology Studies*, 10(1), pp. 51-70.
- Beer, D. 2009. “Power through the algorithm? Participatory web cultures and the technological unconscious,” *New Media & Society* (11:6), pp. 985-1002.
- Beer, D. 2016. “The social power of algorithms.” *Information, Communication, and Society*. (20:1), pp. 1-13.
- Berg, M. 2014. “Participatory trouble: Towards an understanding of algorithmic structures on Facebook,” *Cyberpsychology: Journal of Psychosocial Research on Cyberspace* (8:3), pp. 1-8.
- Bijker, W. E. 2010. “How is technology made? That is the question!” *Cambridge Journal of Economics* (34:1), pp. 63-76.
- Bijker, W.E. 2001. “Understanding technological culture through a constructivist view of science, technology, and society,” *Visions of STS: Counterpoints in Science, Technology and Society Studies*, S.H. Cutcliffe and C. Mitcham (eds), New York: SUNY Press, pp. 19-34.
- Bowker, G. C., Baker, K., Millerand, F., and Ribes, D. 2009. “Toward information infrastructure studies: Ways of knowing in a networked environment,” *International Handbook of Internet Research*, J. Hunsinger, L. Klastrup, M. Allen (eds.), Dordrecht : Springer, pp. 97-117.
- Brey, P.A., 2000. “Technology and Embodiment in Ihde and Merleau-Ponty,” *Metaphysics, Epistemology and Technology (Research in Philosophy and Technology, vol. 19)*, C. Mitcham (ed.), London: Elsevier/JAI Press, pp.45-58.
- Busco, C. 2009. “Giddens’ structuration theory and its implications for management accounting research,” *Journal of Management & Governance*, (13:3), pp. 249-260.
- Chaffey, D. 2019. “Global social media research summary 2019”. *Smart Insights*. <https://www.smartinsights.com/social-media-marketing/social-media-strategy/new-global-social-media-research/>
- Coeckelbergh, M., and Reijers, W. 2016. “Narrative technologies: A philosophical investigation of the narrative capacities of technologies by using Ricoeur’s narrative theory,” *Human Studies*, (39:3), pp. 325-346.
- Couldry, N., and Powell, A. 2014. “Big data from the bottom up,” *Big Data & Society*, (1:2), pp. 1-5.
- Davidson, E. 2006. “A technological frames perspective on information technology and organizational change,” *Journal of Applied Behavioral Science*, (42:1), pp. 23-40.
- Dourish, P. 2016. “Algorithms and their others: Algorithmic culture in context,” *Big Data & Society*, (3:2), pp. 1-11.

- Eberle, T. S. 2012. "Phenomenological life-world analysis and ethnomethodology's program," *Human Studies*, (35:2), pp. 279-304.
- Feenberg, A. 2015. "Making the gestalt switch," *Postphenomenological Investigations: Essays on Human-Technology Relations*. Rosenberger, R. and Verbeek, P-P., (eds.), Lanham: Lexington Books, pp. 229-236.
- Gillespie, T. 2014a. "Algorithm [draft][# digitalkeywords]," *Culture Digitally*. <http://culturedigitally.org/2014/06/algorithm-draft-digitalkeyword/>
- Gillespie, T. 2014b. "The relevance of algorithms," *Media Technologies*. Gillespie, T., Boczkowski, P. and Foot, K. (eds.), Cambridge, MA: MIT Press, pp. 167-194.
- Gurwitsch, A. (1962). *The Common-sense World as Social Reality: A Discourse on Alfred Schutz*. Social Research, 50-72.
- Hess, A. 2014. "You are what you compute (and what is computed for you): Considerations of digital rhetorical identification," *Journal of Contemporary Rhetoric*, (4), pp. 1-18.
- Husserl, Edmund ([1913] 1982) *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy*, vol. 1: General Introduction to a Pure Phenomenology. The Hague: Nijhoff.
- Husserl, Edmund ([1936] 1970) *The Crisis of European Sciences and Transcendental Phenomenology*. Evanston, IL: Northwestern University Press.
- Kavanagh, D., McGarraghy, S. and Kelly, S. 2015. "Ethnography in and around an algorithm," *30th EGOS Colloquium: Sub-Theme 15: (SWG) Creativity, Reflexivity and Responsibility in Organizational Ethnography*, Athens, 3-5 July. <http://researchrepository.ucd.ie/handle/10197/7348>
- Kennedy, H., Poell, T., and van Dijck, J. 2015. "Data and agency," *Big Data & Society*, pp. (2:2), 1-7.
- Kitchin, R. 2016. "Thinking critically about and researching algorithms." *Information, Communication & Society*, (20:1), pp. 1-16.
- Lamprou E., Mitev N., Doolin B. 2014 "Information systems and assemblages," *Information Systems and Global Assemblages. (Re)Configuring Actors, Artefacts, Organizations*. IS&O 2014. IFIP Advances in Information and Communication Technology, Doolin B., Lamprou E., Mitev N., McLeod L. (eds), (446), Berlin: Springer, pp. 1-7.
- Lin, A., & Silva, L. 2005. "The social and political construction of technological frames," *European Journal of Information Systems*, (14:1), pp. 49-59.
- Lupton, D. 2016. "Digital companion species and eating data: Implications for theorising digital data-human assemblages," *Big Data & Society*, (3:1), pp. 1-5.
- Lustig, C., and Nardi, B. 2015. "Algorithmic authority: The case of Bitcoin," *2015 48th Hawaii International Conference on the System Sciences*, T.X. Bui and R.H. Sprague Jr. (eds.), Washington D.C: IEEE, pp. 743-752.
- Matzner, T. 2019. "The human is dead—Long live the algorithm! Human-algorithmic ensembles and liberal subjectivity," *Theory, Culture & Society*, (36:2), pp. 123-144.
- Müller, M., and Schurr, C. 2016. "Assemblage thinking and actor-network theory: conjunctions, disjunctions, cross-fertilisations." *Transactions of the Institute of British Geographers*, (41:3), pp. 217-229.
- Musiani, F. 2013. "Governance by algorithms," *Internet Policy Review*, (2:3), pp. 1-8.
- Muzzetto, L. (2015). Schutz, Berger and Luckmann. The question of the natural attitude. *SocietàMutamentoPolitica*, 6(12), 245-277
- Napoli, P.M. 2013. "The algorithm as institution: Toward a theoretical framework for automated media production and consumption," *Media in Transition Conference*, Massachusetts Institute of Technology. Cambridge, MA, pp. 1-36.

- Neyland, D., & Möllers, N. 2017. "Algorithmic IF... THEN rules and the conditions and consequences of power," *Information, Communication & Society*, (20:1), pp. 45-62.
- Orlikowski, W. J., and Gash, D. C. 1992. "Changing frames: Understanding technological change in organizations," *CISR WP No. 236, Sloan WP No. 3368-92*, Center for Information Systems Research, Sloan School of Management, Massachusetts Institute of Technology. pp. 1-33.
- Orlikowski, W. J., and Gash, D. C. 1994. "Technological frames: making sense of information technology in organizations," *ACM Transactions on Information Systems (TOIS)*, (12:2), pp. 174-207.
- Palotta, F. 2019. "Netflix added record number of subscribers, but warns of tougher times ahead," *CNN Business*.
<https://www.cnn.com/2019/04/16/media/netflix-earnings-2019-first-quarter/index.html>
- Perrotta, C. and Williamson. B. 2018. "The social life of learning analytics: cluster analysis and the 'performance' of algorithmic education," *Learning, Media and Technology*, (43:1), pp. 3-16.
- Pink, S., Lanzeni, D., and Horst, H. 2018. "Data anxieties: Finding trust in everyday digital mess," *Big Data & Society*, (5:1), pp. 1-14.
- Pink, S., Sumartojo, S., Lupton, D., and Heyes La Bond, C. 2017. "Mundane data: The routines, contingencies and accomplishments of digital living," *Big Data & Society*, (4:1), pp. 1-12.
- Pink, S., Ruckenstein, M., Willim, R., and Duque, M. 2018. "Broken data: Conceptualising data in an emerging world," *Big Data & Society*, (5:1), 1-13.
- Rader, E., and Gray, R. 2015. "Understanding user beliefs about algorithmic curation in the Facebook news feed". *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, ACM, pp. 173-182.
- Rainie, L. and Anderson, J. 2017. "Code-dependent: Pros and cons of the algorithm age," Pew Research Center 8 February
<http://www.pewinternet.org/2017/02/08/code-dependentpros-and-cons-of-the-algorithm-age/>
- Sawyer, S., Crowston, K., and Wigand, R. 2014. "Digital assemblages: Evidence and theorizing from the computerization of the US residential real estate industry," *New Technology, Work, and Employment*, (29:1), pp. 40-57.
- Schutz, A. 1970. "Alfred Schutz on phenomenology and social relations (Vol. 360)". Wagner, H. (Ed.). Chicago: University of Chicago Press.
- Schutz, A. 1967. "The Phenomenology of the Social World," Chicago: Northwestern University Press.
- Seaver, N. 2017. "Algorithms as culture: Some tactics for the ethnography of algorithmic systems," *Big Data & Society*, (4:2), pp. 1-12.
- Seaver, N. 2013. "Knowing algorithms," *Media in Transition*, (8), pp. 1-12.
- Spangler, T. 2019a. "Hulu zooms to 28 million total subscribers, up 12% so far in 2019," *Variety*.
<https://variety.com/2019/digital/news/hulu-28-million-total-subscribers-newfronts-2019-1203202212/>
- Spangler, T. 2019b. "Spotify now has over 100 million subscribers, Narrows, Q1 losses," *Variety*.
<https://variety.com/2019/digital/news/spotify-100-million-paid-subscribers-q1-2019-results-1203199998/>
- Statista. 2019. "Number of online dating users in the United States from 2017 to 2023 (in millions)"
<https://www.statista.com/statistics/417654/us-online-dating-user-numbers/>
- Striphas, T. 2015. "Algorithmic culture," *European Journal of Cultural Studies*, (18:4-5), pp. 395-412.
- Sundin, O., Haider, J., Andersson, C., Carlsson, H., and Kjellberg, S. 2017. "The search-ification of everyday life and the mundane-ification of search," *Journal of Documentation*, (73:2), pp. 224-243.

- Tanweer, A., Fiore-Gartland, B., and Aragon, C. 2016. "Impediment to insight to innovation: Understanding data assemblages through the breakdown–repair process," *Information, Communication & Society*, (19:6), pp. 736-752.
- Vaitkus, S. (2005). The "naturalness" of Alfred Schutz's natural attitude of the life-world. In (Endress, M., Psathas, G., and Nasu, H. (Eds.) *Explorations of the Life-World: Continuing Dialogues with Alfred Schutz*. Springer Netherlands, 97-121.
- van Dijck, J. 2014. "Datafication, dataism and dataveillance: Big data between scientific paradigm and ideology," *Surveillance & Society*, (12:2), pp. 197-208.
- Willson, M. 2016. "Algorithms (and the) everyday," *Information, Communication & Society*, (20:1), pp. 137-150.
- Yudin, G. (2016). Sociology as a Naïve Science: Alfred Schütz and the Phenomenological Theory of Attitudes. *Human Studies*, 1-22.
- Zhao, S. 2007. "Internet and the lifeworld: Updating Schutz's theory of mutual knowledge," *Information Technology & People*, (20:2), pp. 140-160.