

# Algorithmic culture

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## Abstract

Over the last 30 years or so, human beings have been delegating the work of culture – the sorting, classifying and hierarchizing of people, places, objects and ideas – increasingly to computational processes. Such a shift significantly alters how the category *culture* has long been practiced, experienced and understood, giving rise to what, following Alexander Galloway, I am calling ‘algorithmic culture’. The purpose of this essay is to trace some of the conceptual conditions out of which algorithmic culture has emerged and, in doing so, to offer a preliminary treatment on what it is. In the vein of Raymond Williams’ *Keywords*, I single out three terms whose bearing on the meaning of the word culture seems to have been unusually strong during the period in question: *information*, *crowd* and *algorithm*. My claim is that the offloading of cultural work onto computers, databases and other types of digital technologies has prompted a reshuffling of some of the words most closely associated with *culture*, giving rise to new senses of the term that may be experientially available but have yet to be well named, documented or recorded. This essay, though largely historical, concludes by connecting the dots critically to the present day. What is at stake in algorithmic culture is the gradual abandonment of culture’s publicness and the emergence of a strange new breed of elite culture purporting to be its opposite.

## Keywords

Algorism, algorithm, algorithmic culture, big data, crowd, culture, information, keywords, Raymond Williams

Easter 2009 might well be remembered for Amazon.com’s having outshined Jesus Christ. That much was true on Twitter, at any rate, where, during that long weekend in April, a sudden influx of short missives about the online retailer propelled it to the Number 1 spot

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on Twitter's trending topics list, unseating the Prince of Peace along the way (James, 2009b). As the Beatles learned back in 1966, however, 'more popular than Jesus' (as John Lennon had claimed of the band) is not necessarily an enviable position in which to find oneself. The hashtag to which the Twitterati directed tens of thousands of messages – #AmazonFail – indicated that something had gone terribly wrong with company. Why, they wondered, had Amazon apparently begun excluding gay and lesbian-themed books from its sales rankings, searches and bestseller lists?

Author Mark R Probst first brought the issue to widespread attention when, on Good Friday, he noticed that several gay romance books had lost their Amazon sales rankings, including his own novel, *The Filly*. Hoping the matter was a simple mistake, he wrote to Amazon customer service. The agent who emailed Probst explained that Amazon had a policy of filtering 'adult' material out of most product listings. Incensed, Probst (2009) posted an account of the incident on his blog in the wee hours of Easter Sunday morning, pointing out inconsistencies in the retailer's policy. The story was subsequently picked up by major news outlets, who traced incidences of gay and lesbian titles disappearing from Amazon's main product list back to February 2009 (Lavalée, 2009; see also Kellog, 2009; Rich, 2009).

In a press release issued on Monday afternoon, a spokesperson for Amazon attributed the fiasco to 'an embarrassing and ham-fisted cataloging error'. More than 57,000 books had been affected in all, including not only those with gay and lesbian themes but also titles appearing under the headings 'Health, Mind, Body, Reproductive and Sexual Medicine, and Erotica' (quoted in James, 2009a; see also Rich, 2009). An Amazon technician working in France reportedly altered the value of a single database attribute – 'adult' – from false to true. The change then spread globally throughout the retailer's network of online product catalogs, de-listing any books that had been tagged with the corresponding metadata (James, 2009b). This was not homophobia, Amazon insisted, but a slip-up resulting from human error amplified by the affordances of a technical system.

In the wake of the controversy, author and lesbian, gay, bisexual and transgender (LGBT) activist Larry Kramer observed: 'We have to now keep a more diligent eye on Amazon and how they handle the world's cultural heritage' (quoted in Rich, 2009). Indeed, Amazon may have started as a retailer, but it has grown into an exemplar of the many ways human beings have been delegating the work of culture – the sorting, classifying and hierarchizing of people, places, objects and ideas – to data-intensive computational processes.<sup>1</sup> Amazon's back-end data infrastructure is so vast, in fact, that in 2006 it began selling excess capacity to clients under the name Amazon Web Services. It also collects sensitive data about how people read through its Kindle e-book devices – which is to say nothing of how it profiles and then markets products to customers based on their browsing and purchasing patterns (Striphas, 2010). What one sees in Amazon, and in its kin Google, Facebook, Twitter, Netflix and many others, is the enfolding of human thought, conduct, organization and expression into the logic of big data and large-scale computation, a move that alters how the category *culture* has long been practiced, experienced and understood. This is the phenomenon I am calling, following Alexander R Galloway (2006), 'algorithmic culture'.<sup>2</sup>

The purpose of this essay is to trace one set of conditions out of which a data-driven algorithmic culture has developed and, in doing so, to offer a preliminary sense of what

‘it’ is. The overarching impulse here is historico-definitional, though there are many ways to execute such a project. One could focus on the propagation of ‘truthful’ statements (i.e. discourses) pertaining to algorithmic culture (Foucault, 1972), or map the sociological circuitry through which the concept has made its way through the world (Mannheim, 1955). Or instead, one could take an etymological tack in attempting to trace the origins of particular words, or adopt a philological thrust in trying to apprehend definitive usages of words in history.

While this essay combines elements of these approaches, it is inspired primarily by Raymond Williams’ (1983) work on keywords. This piece emphasizes moments of cat-achresis – instances of lexical ‘misuse’ that help concretize an alternative semantics for particular words and word clusters. These moments enable new or at least different ways of figuring reality through language, for example, in drawing what was long taken to be the conceptual *sine qua non* of qualitative human experience – *culture* – into the orbit of computational data processing (see, e.g. Kittler, 2006). It is a contention of this essay that the semantic dimensions of algorithmic culture (and also then of the related phenomena of big data, data mining and analytics, the themes of this special issue of *European Journal of Cultural Studies*) are at least as important as the technological ones, the latter, for perhaps obvious reasons, tending to command the spotlight. But as Williams (1983) noted, ‘some important social and historical processes occur *within* language’, giving rise to new existential territories that only later come to be populated by technical artifacts (p. 22; see also Striphas, 2014).

Moreover, a keywords approach is useful in apprehending latencies of sense and meaning that persist, insist and subsist in contemporary usage as ‘traces without ... an inventory’ (Gramsci, 1971: 324; see also Seigworth, 2000: 237). Logging that inventory, as it were, allows one to not only situate algorithmic culture within a longer *durée* but also reflect on claims to objectivity and egalitarianism that are now made in its name. Beyond semantics, what is at stake in algorithmic culture is the gradual abandonment of culture’s publicness and thus the emergence of a new breed of elite culture purporting to be its opposite.

## Keywords today

Gary Hall (2002) opens the final section of *Culture in Bits* with the line, ‘what if Richard Hoggart had had email?’ (p. 126). This is tantamount to asking, ‘what would the work of cultural studies’ canonical figures look like were it composed today, a time of ubiquitous digital computational technologies?’ Imagine, say, Raymond Williams (1958) were writing *Culture and Society* having to confront the #AmazonFail episode. How might he make sense of the entwining of culture, which he posited as a ‘court of human appeal’ (Williams, 1958: viii), and computational decision-making (see also Hallinan and Striphas, 2014)?

Williams’ (1983) original project was to show how *culture*, once a relatively obscure word in English-language usage, became ‘one of the two or three most complicated words’ by the start of the 20th century (p. 87). He did so by tracing semantic shifts across a network of terms, many of which formed the basis for his compendium, *Keywords* (Williams, 1976, 1983). The introduction to *Culture and Society* offers a more succinct version of the

story, focusing on five words whose history and interconnection uniquely embodied ‘a general change in our characteristic ways of thinking about our common life’: *industry, democracy, class, art and culture* (Williams, 1958: xiii). With the first four, Williams established a set of semantic coordinates, which he then used to chart *culture’s* shifting meaning and importance: from a pre-modern understanding grounded in husbandry to a more capacious, modern view – ‘a thing in itself’, encompassing not only ‘the general body of the arts’ but also ‘a whole way of life, material, intellectual, and spiritual’ (p. xvi).

Spanning the years 1780–1950, *Culture and Society* is bookended by two major historical events, namely, the industrial revolution and the end of the Second World War. The latter helped precipitate another great transformation referred to variously as the computer revolution, the communications revolution, the cybernetics revolution and so on (Beniger, 1986: 4–5). Prescient as he was, it is doubtful Williams grasped the full significance of his endpoint. More likely, he chose 1950 because the date marked mid-century, the moment in which the symbolics of history and futurity mingle more or less freely. Still, one can see Williams (1958) grasping to understand new technological contexts in his reflections on *communication* appearing in the conclusion to *Culture and Society* (pp. 296, 300–304, 313–319). It was not until the publication of *The Sociology of Culture*, however, that Williams (1981) broached the relationship between *culture, information* and digital technologies – but then only in passing, in the work’s conclusion (pp. 231–232).<sup>3</sup> He may not have been able to work out a fully revised theory of culture per se, but he managed to lay important groundwork for assessing how the semantic – and hence practical and experiential – coordinates of *culture* had shifted since 1950.

We are still living in the midst of this shift, although the nascent trends and tendencies Williams tried to make sense of in the early 1980s are more coherent today. The #AmazonFail episode illustrates this point, underscoring the degree to which shopping, merchandizing and a host of other everyday cultural activities are now data-driven activities subject to machine-based information processing (Striphas, 2009: 81–110). Indeed, the incident would not have been intelligible, much less possible, without a reshuffling of the terms surrounding the word, *culture*. Those that Williams (1958) identified in *Culture and Society* remain important, to be sure, but in recent decades a host of others have emerged. An extended list might include *analog, application, cloud, code, control, convergence, copy, data, design, digital, format, free, friend, game, graph, hack, human, identity, machine, message, mobile, network, noise, peer, platform, protocol, search, security, server, share, social, status, web* and many more.<sup>4</sup> Like Williams, however, I want to single out a small group of terms whose semantic twists and turns tell us something about senses and meanings of the word *culture* that are available today, and also then about the politics of big data, data mining and analytics. Williams identified the first one – *information*; the other two – *crowd* and *algorithm* – are my own.<sup>5</sup>

## Information

If *culture’s* usage is unusually ‘complicated’, then *information’s* is equally contradictory. John Durham Peters (1988) describes its etymology as ‘a history full of inversions and compromises’ (p. 10). Like a moody teenager, it swings from specificity to generality, and from the empirical to the abstract. Yet, this range is also what makes *information*

intriguing from the standpoint of algorithmic culture, which channels an older sense of the word that the *Oxford English Dictionary* or *OED* describes as, ‘now rare’ (‘Information’, n., n.d.; see also Peters, 1988: 11; Gleick, 2011).

When *information* enters the English language sometime around the 12th or 13th century CE, chiefly from Latin, the tension at the heart of the word is already becoming manifest. At this early stage, it operates in two main semantic registers: religion and law. The use that the *OED* claims is ‘now rare’ is the religious one, although it might be more apt to describe it as spiritual, even deific. Here, *information* denotes ‘the giving of form or essential character to something; the act of imbuing with a particular quality; animation’ (‘Information’, n., n.d.). This definition posits an irreducible connection between the shaping of something and the endowment with character, substance or life.

Information’s juridical definition derives from the codes of ancient Roman legal procedure. Broadly, it refers to ‘the imparting of incriminating knowledge’, and more specifically, in US law, to ‘an accusation or criminal charge brought before a judge without a grand jury indictment’ (‘Information’, n., n.d.). Although *information* here depends on and passes among incarnate human agents, this definition differs from the more recent understanding, ‘knowledge communicated concerning some particular fact, subject, or event’ (‘Information’, n., n.d.). In the legal sense, one does not refer to information per se but to something narrower in scope – ‘an information’, or even ‘information’. The corresponding verb form, ‘laying of information’, is a special type of communication – a speech act – whose outcome is to transform the innocent into the accused and to set forth social rituals intended to restore order in the wake of some disturbance. Here the definition comes closest to the religious sense of character- or quality-giving, although now the information ‘source’ is secular interaction.

The influence of early modern empiricism and idealism on the word *information* must not be underestimated. The definition to which I referred in passing, ‘knowledge communicated concerning some particular fact, subject, or event’, is indicative of the term’s encounter with these crosscurrents of early modern thought, for it posits information not as intrinsic quality or character but as extrinsic sense data. This bit of semantic drift is significant, underscoring how far the locus of information has shifted from pre-modern through early modern times and beyond. Although it continued to refer to a kind of existential work, divine or worldly, gradually, a more object-oriented definition sidelined this sense of the word.

The passive voice construction ‘knowledge communicated’ is important to dwell on, moreover, because it indicates that information – now conceived as a thing – always emanates from some source external to one’s self. In the framework of Immanuel Kant, it belongs to the noumenon, or the realm of unmediated sense data. This marks a significant departure from the spiritual and legal definitions, both of which locate information in the body vis-a-vis its incarnations, godly or performative. The object-oriented definition, on the other hand, inaugurates a process of abstracting information from the body; instead of being vested there, information becomes a separate raw material that must be given order vis-a-vis our cognitive faculties (‘Information’, n., n.d.).

The 20th century information theorist Norbert Wiener famously quipped that the natural world consists of ‘a myriad of To Whom It May Concern messages’ (quoted in Rheingold, 1985: 113), drawing a line back to the work of his early-modern forebears.

They similarly imagined a world bombarding us with sensory input. This was a broken, not a direct line, however, resulting in an even more diffuse meaning for the word. If information were akin to a 'To Whom It May Concern Message', then it need not be directed to anyone in particular. More to the point, in Wiener's formulation, it need not be directed to *anyone* at all.

Appropos, the stars of Wiener's two major books on cybernetics and information are neither the brain nor the cognitive structures that purportedly allow people to make our way in the world. They are, instead, photoelectric cells and antiaircraft guns, and more utilitarian things like automatic door openers and thermostats (Wiener, 1954, 1961). In contrast to wind-up clocks and other simple mechanical devices, which function in a manner more or less unattuned to environmental conditions, these machines 'must be *en rapport* with the world by sense organs' and adjust their behavior according to the information they receive (Wiener, 1954: 33; see also pp. 21–22). In 1944, the physicist Erwin Schrödinger (1967 [1944]) argued that life 'feeds on negative entropy', meaning that life is nothing more and nothing less than a small pocket of order within a world abuzz with information (p. 70). Four years later, Wiener told a similar story but threw in a major plot twist. If machines possessed an appetite for information, then apparently information was not particular to human beings.

From the Second World War on, then, machines begin being seen not merely as useful things but as custodians of orderliness. Critical to their work was information, which Gregory Bateson (2000 [1971]) defined as 'a difference which makes a difference' (p. 315). Bateson, like Wiener, identified as a cyberneticist, so in one sense it should not surprise to find him defining information in terms of bits, or simple yes–no decisions. But in another sense, his definition may surprise. Bateson was a trained anthropologist and spouse of Margaret Mead, to whom he was married for 14 years. They had one child together, Mary Catherine, who also became a noted anthropologist. In a family so thick with interest in people and culture, it is telling that Bateson never bothered with the question 'to whom?' when he called information 'a difference which makes a difference'. By the early 1970s, information was only residually the process by which people and things were endowed with substance, trait or character – *in-formed*, as it were. It had become, instead, a counter-anthropological leveler, smoothing over longstanding differences between humans and machines: Inform-uniform. James Gleick (2011) puts the matter succinctly: 'it's all one problem' (p. 280).

In 1966, Michel Foucault concluded *The Order of Things* (1971 [1970]) by claiming that 'man is an invention of recent date ... [a]nd one perhaps nearing its end' (p. 387). Six years later, Gilles Deleuze and Félix Guattari (1983) opened *Anti-Oedipus* by proclaiming that 'everything is a machine' – plant life, animal life, mechanical devices, electronic goods, economic activities, celestial bodies and more (p. 2). Sandwiched between them was Bateson, the an-anthropologist anthropologist for whom cultural life becomes one type of information processing task among many. One can also see emerging the sense of cultural objects, practices and preferences as comprising a corpus of *data* (from the Latin, 'something given'), albeit data that exceed the traditional view of the human sciences in the agnosticism toward the intended recipient. No longer would human beings hold exclusive rights as cultural producers, arbiters, curators or interpreters – a welcome development, perhaps, given the shame, disrespect and brutality elites



have long exacted in the name of cultural difference. But what if the apparent uniformity between people and machines resulted in cultural practices and decision-making that were no better in-formed?

## Crowd

The etymology of the word *crowd* is, like that of *information*, a study in polarity reversal. It entered the English language around the 15th century CE as an adaptation of verbs extant in Dutch, German and Frisian denoting pressuring or pushing. The English verb form 'to crowd' preserves this early meaning of the word, although in some contexts the element of physical force may be figurative rather than literal. The *OED* mentions that *crowd* was 'comparatively rare down to 1600', which means its rise roughly coincides with early modernity ('Crowd', n.d.). The noun form of the word has often been used interchangeably with *mass*, *mob*, *multitude* and *throng* to refer to large gatherings of people, generally in public, especially in urban settings. Frequently, it denotes impedance, inefficiency and frustration, as in the expressions 'fighting the crowds' and 'three's a crowd'. It also conveys individual anonymity and engaged inaction, as in the phrase, 'a crowd of onlookers'.<sup>6</sup> For these reasons *crowd* has, until recently, harbored almost exclusively pejorative connotations.

Semantically, *crowd* comes fully into its own in the 19th century, becoming a mainstay of journalistic and scholarly attention.<sup>7</sup> Charles Mackay's *Extraordinary Popular Delusions and the Madness of Crowds*, first published in Britain in 1841, is a key text in this regard. The book chronicles incidents in which, as Mackay (2001 [1841]) puts it, 'whole communities suddenly fix their minds upon one object, and go mad in pursuit of it' (p. ix). The list ranges from stock bubbles to hairstyles, catch phrases, slow poisoning, dueling, occult practices and the mania for tulips in 17th century Holland. It is a capacious book, yet one that offers surprising little in the way of explicit insight into crowds – at least beyond their guilt by association with practices and events that, for Mackay, evidenced the collective abandonment of reason. Instead, he seems to play to the conventional wisdom of the time: 'Men, it has been well said, think in herds; it will be seen that they go mad in herds, while they only recover their senses slowly, and one by one' (Mackay, 2001 [1841]: x).

But Mackay does not only play to the conventional wisdom – he also plays upon it. Preceding his statement about 'thinking in herds' is a passing reference to an analogous concept: the 'popular mind' (Mackay, 2001 [1841]: x). Terminologically, it is a small difference, but semantically it is a bait-and-switch. The verb phrase 'thinking in herds' would seem to designate an active, living process, albeit one in which any individual contribution registers diffusely. The noun form 'popular mind' largely elides that process, positing some overarching *thing* referring to everyone in general and no one in particular. And in this way, *crowd's* etymology closely parallels that of *information*, which follows the term's divestiture from the human body, its transformation into an immaterial object and its dispersal into the world.

This way of conceiving of crowds culminates in Gustave Le Bon's (2002 [1895]) *The Crowd: A Study of the Popular Mind*. Le Bon offers something like the explanatory framework absent in Mackay. Le Bon's book is occasioned by 'the entry of the popular classes into political life', whom he paints a vicious, unthinking horde: 'History tells us

that from the moment when the moral forces on which a civilisation rested have lost their strength, its final dissolution is brought about by those unconscious and brutal crowds known, justifiably enough, as barbarians' (Le Bon, 2002 [1895]: xii–xiii; see also Arnold, 1993 [1869]).

Le Bon's book has been read, understandably, as an attack on crowds (see, for example, Milgram and Toch, 2010; Surowiecki, 2004). It is one, to be sure, and an elegy for the decline of privileged minority rule akin to Edmund Burke's (1999 [1790]) *Reflections on the Revolution in France*. Yet, there is a tone of resignation evident in Le Bon's prose, suggesting a kind of begrudging acceptance of the emerging political realities of the time: 'The age we are about to enter will in truth be the ERA OF CROWDS', he states (Le Bon, 2002 [1895]: x; emphasis in original). This may help to explain why *The Crowd* also contains a handful of passages in which Le Bon offers a more equivocal view, such as this one: 'What, for instance, can be more complicated, more logical, more marvelous than a language? Yet whence can this admirably organised production have arisen, except it be the outcome of the unconscious genius of crowds' (Le Bon, 2002 [1895]: v)?

Whether by default or by design, Le Bon was drawing on a subterranean line of thinking about crowds. This line developed in the overlap of Classical Liberalism and the Scottish Enlightenment and received its most enduring expression in the work of Adam Smith. It was Smith (1977 [1776]) who, in *An Inquiry into the Causes of the Wealth of Nations*, struggled to make sense of apparently spontaneous economic activities whose outcome was – in Le Bon's words – 'admirably organised production'. Yet, the figure of the crowd is noticeably absent from Smith. In fact, the word *crowd* appears only four times in his 375,000 word magnum opus, and only then in verb form. His figure is a different one, and of a different kind, although it performs rhetorical work comparable to Le Bon's 'genius' crowd. This is the famous 'invisible hand', which, in Smith's (1977 [1776]) view, aligns the interests of individual economic actors with the needs of a society as a whole (p. 477).

Mysterious, ghostlike, the 'invisible hand' is essentially a *deus ex machina* of economic activity, and in this regard it is not too far removed from the spiritual sense of *information* mentioned earlier. In the 20th century, Friedrich A Hayek would make the link more explicit, helping to bolster the more affirmative view of crowds nascent in both Smith and Le Bon. The key work here is Hayek's (2007 [1944]) *Road to Serfdom*, published in 1944, arguably the strong state's high-water mark in both Europe and the United States. Hayek believed there ought to be some force to which was assigned the task of holding the state in check; for him, that force was the economic sphere. Hence, his desire to strip the state of the responsibility of economic planning and to leave the task of coordinating economic activities up to individual actors dispersed far and wide (Hayek, 2007 [1944]: 232). Instead of positing that coordination resulted from the arcane workings of an invisible hand, Hayek stressed the crucial role that *information* – his word – played in choreographing this intricate group dance, particularly through the price system (Hayek, 2007 [1944]: 95).

Like Smith, Hayek had little to say about crowds per se. His understanding of the individual, however, harkened back to the earliest English-language sense of *crowd* as the exertion of force on others. And with this, he helped to usher the idea of the intelligent, constructive crowd more fully into view. He was not alone in this endeavor. In 1965, the



economist Mancur Olson (1971), a friend of Hayek, refuted the claim that groups were intrinsically stupid and irrational by describing the hidden ‘logic’ underlying collective action.<sup>8</sup> So, too, with sociologist Stanley Milgram, whose early work on obedience to authority was given subtlety and dimension in his later work on crowds, where he dismantled the view that crowds caused otherwise mindful people to become deluded (Milgram, 2010; Milgram and Toch, 2010). Finally, inasmuch as he was Hayek’s ideological opposite, we must nonetheless reckon with the contributions Raymond Williams made to the redemption of crowds. The conclusion to *Culture and Society* is an extended critique of the notion of masses-as-mob, culminating in the insight, ‘there are in fact no masses; there are only ways of seeing people as masses’ (Williams, 1958: 300). The alternatives Williams proposes – ‘community’ or ‘common culture’ – bear an uncanny resemblance to the sense of *crowd* I have been tracing here: a ‘complex organization, requiring continual adjustment and redrawing’; denying the individual the possibility of ‘full participation’, while still granting her or him a modicum of effect or influence; and incapable of being ‘fully conscious of itself’ (Williams, 1958: 333–334).

It is this set of positive connotations that crystallizes into contemporary terms like ‘crowdsourcing’, ‘crowd wisdom’ and a host of cognates, all of which have entered popular usage over the last two decades or so: ‘hive mind’, ‘collective intelligence’, ‘smart mobs’, ‘group genius’ and more (see, for example, Howe, 2008; Jenkins, 2006; Kelly, 1995; Levy, 1999; Rheingold, 2002; Sawyer, 2007; Shirky, 2008; Surowiecki, 2004; Tapscott and Williams, 2006). The translation between then and now is hardly perfect, owing to the diverse traditions out of which this vision of crowds has emerged, which is to say nothing of the technological transformations that have occurred over the last century. Indeed, when Williams (1958) wrote about the ‘solidarity’ necessary to sustain a ‘common culture’ (pp. 332–338), could he have anticipated the degree to which, today, that solidarity would be forged computationally? And what then to make of the redemption of crowds, when proprietary computer platforms have become the major hubs for interaction online?<sup>9</sup>

## Algorithm

Compared to *information* and *crowd*, *algorithm* is a less obvious keyword by means of which to make sense of culture today. If the former two terms could be considered dominant, or prevalent, as judged by their popular usage, then the latter would best be described as emergent, or restricted, though tending in the direction of conventionality. Yet, as James Gleick (2011) puts it in *The Information*, ‘[t]he twentieth century gave algorithms a central role’ (p. 206).<sup>10</sup>

*Algorithm* comes to modern English from Arabic by way of Greek, medieval Latin, Old French and Middle English. Historically, it has maintained close ties to the Greek word for number, *arithmós* (ἀριθμός), from which the English form *arithmetic* is derived. *Algorithm*’s most common contemporary meaning – a formal process or set of step-by-step procedures, often expressed mathematically – flows from this connection, although the *OED* insists it is a point of etymological ‘perversion’ (‘Algorism’, n., n.d.). In fact, the word is a ‘mangled transliteration’ of the surname of a 9th century mathematician, Abū Jafar Muḥammad ibn Mūsā al-Khwārizmī, who lived much of his life in Persia

(‘Algorithm’, n., n.d.). *Algorithm* is recorded in English for the first time at the beginning of the 13th century CE as *augrim*, in Chaucer’s *Canterbury Tales*, whereupon it undergoes a long series of orthographic transformations before settling into what, from the early 18th century until the early 20th century, becomes its conventional spelling, *algorism* (Karpinski, 1914: 708). The present-day rendering of the word, *algorithm*, likewise appears around the start of the 18th century, but it does not become the standard orthography until almost 1940.

The confusion stems mainly from two key mathematics texts attributed to al-Khwārizmī from which his name, and eventually two different though related senses of the word *algorithm* wind their way into English. The first manuscript, *Al-Kitāb al-Mukhtaṣar fī ḥisāb al-jabr wa-al-Muqābala* (*The Compendious Book of Calculation by Restoration and Balancing*), introduced many of the fundamental methods and operations of algebra. It is the primary work through which the word *algebra* itself, adapted from the Arabic *al-jabr*, diffused through Moorish Spain into the languages of Western Europe (Crossley and Henry, 1990: 106; Smith and Karpinski, 1911: 4–5; see also Karpinski, 1915). Incidentally, the word appearing just before *al-jabr* in the Arabic version of the title, *ḥisāb*, though translated as calculation, also denotes *arithmetic*. *Algorithm*, *arithmetic*: conceptually, they have been a stone’s throw away from one another since the 9th century. Consequently, it is hardly the case that one corrupted the other. It is more accurate to say that, until the second quarter of the 20th century, the arithmetic sense of the word *algorithm* was not dominant or preferred.

The other key work is al-Khwārizmī’s untitled text on Hindu- or Indo-Arabic numbers, or what today many Westerners simply refer to as ‘Arabic’ numerals. It is widely believed that this untitled manuscript of al-Khwārizmī’s played a major part in introducing Europeans to Arabic numerals in the middle ages (Crossley and Henry, 1990: 104). Just as Al-Khwārizmī’s name became synonymous with arithmetic through the algebra book, so too did it become synonymous with the Arabic system of numeration itself. The form of the word *algorithm* that has today fallen out of favor, *algorism*, is a legacy of this association. Until the early 20th century, Arabic numerals were commonly referred to as ‘the numbers of algorism’ (‘Algorism’, n., n.d.)

Still, this is not the only or most interesting sense of the term. *Algorism*’s semantic context includes a range of secondary meanings that are key to making sense of algorithmic culture. Among the most important is its close association with zero (Smith and Karpinski, 1911: 58). The word *zero* comes from *śūnya*, Sanskrit for ‘void’, which migrates into Arabic as *ṣifr*, meaning ‘empty’, the root from which the modern English language form *cypher* derives (Smith and Karpinski, 1911: 56–57). Thus, it is no coincidence that the phrase ‘cypher in algorism’ was long used interchangeably with the word *zero*; sometimes *cypher* would be used to designate any of the Arabic numerals, making it synonymous with *algorism* (‘Algorism’, n., n.d., ‘Cipher, Cypher’, n., n.d.). Moreover, until the middle of the 19th century, *cypher*, like *zero*, could refer to a placeholder – often in a derogatory sense, indicating a ‘worthless’ person (‘Cipher, Cypher’, n., n.d.). This was alongside what has emerged today as *cypher*’s more commonplace definition, namely, a secret code or the key by means of which to crack it.

So, on the one hand, we have *algorithms* – a set of mathematical procedures whose purpose is to expose some truth or tendency about the world. On the other hand, we have

*algorisms* – coding systems that might reveal, but that are equally if not more likely to conceal. The one boasts of providing access to the real; the other, like an understudy, holds its place. Why in the early 20th century did *algorithm* become preferred over *algorism*, so much so that the latter form is now all but an archaism?

In a word, *information*. The touchstones in this regard are two landmark papers, both written by engineers who worked at Bell Laboratories in the United States. The first, Ralph Hartley's 'Transmission of Information', appeared in 1928. The second, Claude E Shannon's 'Mathematical Theory of Communication', appeared in 1948. Hartley's paper was noteworthy for many reasons, chiefly technical, but perhaps his most audacious move was to subsume communication under the rubric of information. He states, 'In any given communication the sender mentally selects a particular symbol ... As the selections proceed more and more possible symbol sequences are eliminated, and we say that the information becomes more precise' (Hartley, 1928: 536). Hartley thus conceived of communication as a procedural activity – a game of chance in which the stake was information, or the likelihood of achieving identity of message within and across a specific context of interaction. He was followed in his work by Shannon, who raised the stakes on Hartley's theory.

One of the differences between Hartley and Shannon's papers was that Shannon placed significantly less faith in the process of communication. For Hartley, it was a relatively placid affair in which the revelation of symbols led to understanding and order. For Shannon, communication was a tumultuous affair consisting of such a complex ensemble of determinations, both past and present, that disorder was the state to which it naturally tended. Communication thus occurred within a context rife with uncertainty, or in the language of information theory, entropy; order could not be taken for granted but instead needed to be engineered. Shannon's problem was thus to figure out how to parse signal and noise, and thereby increase the odds that the system would achieve a sufficient degree of order. Hence, he needed to devise a set of procedures – an algorithm, if you will, although he did not use the term specifically – capable of dealing with the cascade of determinations that governed communicative encounters. Shannon may have believed he was developing a 'Mathematical Theory of Communication', but in fact he produced among the first *algorithmic theories of information*.

It is worth mentioning that Shannon was not just a talented electrical engineer, he was also a world-class cryptographer, having worked on several government-sponsored 'secrecy' projects at Bell Labs throughout the Second World War. During that time, he produced a lesser-known paper, originally classified, entitled 'A Mathematical Theory of Cryptography' (Shannon, 1945). Shannon operated, in other words, at the junction point of algorithms and algorisms. Or, as he described his work on communication and cryptography many years later, 'they were so close together you couldn't separate them' (quoted in Kahn, 1967: 744; see also Gleick, 2011: 216–218). Indeed for Shannon, communication in the ordinary sense of the term was nothing other than a special, simpler case of cryptography, or of ciphering and deciphering. Both in his view consisted of signals and noise stuck in a dizzying, entropic dance, along with telling redundancies that, if exploited using the right mathematics, could mitigate much of the turmoil and thereby point the way toward order (Rheingold, 1985: 119). What Shannon was essentially proposing in his work, then, was the use of *algorithms* to attenuate *algorisms*.

## Conclusion

I have tried my best to connect as many of the dots between the words *information*, *crowd* and *algorithm* as possible. I realize, of course, that there are a great many dots left to be connected – something that is inevitable in a synoptic piece such as this, which marshals a version of what Franco Moretti (2005) has called a method of ‘distant reading’ (p. 1). I am well aware of the prejudices of this research, moreover, particularly the privileging of the work and experiences mostly of White men of European descent. The purpose in doing so is not to exalt them. Instead, I am trying to tell a story about word-worlds or ‘universes of reference’ they helped call into being by using specific terms unconventionally (Guattari, 1995: 9). Having said that, I want to say a few more words about how the conceptual history I have presented here connects up with *culture*, and also then big data, data mining and analytics.

Matthew Arnold’s (1993 [1869]) *Culture and Anarchy* is infamous for having defined *culture* in elite terms, as ‘the best which has been thought and said’ (p. 190). Elsewhere in the book Arnold refers to *culture* as ‘sweetness and light’, thereby defining a model disposition for the small group of apostles whom he imagined would, like him, spread the gospel of culture. Yet, there is a third sense of *culture* present in the book which, while hardly overlooked, is overshadowed by these two more quotable definitions. He refers to culture as ‘a principle of authority, to counteract the tendency to anarchy which seems to be threatening us’ (Arnold, 1993 [1869]: 89). For Arnold, culture as authoritative principle meant a selective tradition of national – specifically English – art and literature that would, in his view, create a basis for national unity and moral uplift at a time when heightening class antagonism was threatening English society.

This latter definition – culture as authoritative principle – is the one that is chiefly operative in and around algorithmic culture. Today, however, it is not *culture* per se that is a ‘principle of authority’ but increasingly the algorithms to which are delegated the task of driving out entropy, or in Arnold’s language, ‘anarchy’. You might even say that *culture* is fast becoming – in domains ranging from retail to rental, search to social networking, and well beyond – *the positive remainder resulting from specific information processing tasks*, especially as they relate to the informatics of crowds. And in this sense, algorithms have significantly taken on what, at least since Arnold, has been one of culture’s chief responsibilities, namely, the task of ‘reassembling the social’, as Bruno Latour (2005) puts it – here, though, using an array of analytical tools to discover statistical correlations within sprawling corpuses of data, correlations that would appear to unite otherwise disparate and dispersed aggregates of people (see, e.g., Hallinan and Striphass, 2014).

I suggested at the outset of this article and at points along the way that part of what is at stake in algorithmic culture is the privatization of process: that is, the forms of decision-making and contestation that comprise the ongoing struggle to determine the values, practices and artifacts – the culture, as it were – of specific social groups. Tarleton Gillespie (2011) has explored this issue in relationship to Twitter’s trending topics, noting how the company’s black box approach creates all sorts of mystifications about how it adduces topical importance. ‘The interesting question is not whether Twitter is censoring its Trends list’, he writes. ‘The interesting question is, what do we think the Trends list is ... that we can presume to hold it accountable when we think it is “wrong”’ (Gillespie, 2011). His

point is that Twitter and its kin bandy about in what one might call the algorithmic real, where placeholders for trending topics and the like are presented as if they were faithful renderings of reality. But the issue is even more complex than this. Gillespie (2011) adds that '[w]e don't have a sufficient vocabulary for assessing the algorithmic intervention in a tool like Trends', an observation that underscores just how deeply entangled are questions of language, technology, big data, analytics and political economy. This is all the more reason to broach the issue of the privatization of cultural decision-making only after having explored the semantic context, or keywords, that frame the issue in the first place.

In brief, consider the product recommendations one sees on Amazon. These, says the retailer, are the result of one's browsing and purchasing histories, which are correlated with those of Amazon's millions of other customers – a crowd – to determine whose buying patterns are similar to one's own. You, too, might like what this select group has bought, and vice-versa – a process Amazon calls, 'collaborative filtering'. Google reportedly works in a similar way. Although the company has moved far beyond its original 'PageRank' algorithm, which measured the number of links incoming to a website to determine its relative importance, it still leverages crowd wisdom to determine what is significant on the web. As *Wired* magazine explained in 2010,

PageRank has been celebrated as instituting a measure of populism into search engines: the democracy of millions of people deciding what to link to on the Web. But Google's engineers ... are exploiting another democracy – the hundreds of millions who search on Google, using this huge mass of collected data to bolster its algorithm. (Levy, 2010: 99–100)

All this makes algorithmic culture sound as if it were the ultimate achievement of democratic public culture. Now anyone with an Internet connection gets to have a role in determining 'the best that has been thought and said'! I am tempted to follow here by saying, 'much to the chagrin of Matthew Arnold', but I am not convinced that algorithmic culture is all that far removed – in spirit, if not execution – from a kind of Arnoldian project. Despite the populist rhetoric, I believe we are returning to something like his apostolic vision for culture. The *Wired* magazine story from which I just quoted also says this: 'You may think [Google's] algorithm is little more than a search engine, but wait until you get under the hood and see what this baby can do' (Levy, 2010: 98). The problem is, thanks to trade secret law, nondisclosure agreements and noncompete clauses, virtually none of us will ever know what is 'under the hood' at Amazon, Google, Facebook or any number of other leading tech firms. As Gillespie (2007) is fond of saying, you cannot look under a hood that has been 'welded shut' (p. 222).

All this harkens back to the oldest sense of *information* – where some mysterious entity is responsible for imbuing people and objects with shape, quality or character. I do not mean to downplay the role that crowds play in generating raw data. Yet, it seems to me that 'crowd wisdom' is largely just a stand-in – a placeholder, an *algorism* – for algorithmic data processing, which is increasingly becoming a private, exclusive and indeed profitable affair. This is why, in our time, I believe that *algorithms* are becoming decisive, and why companies like Amazon, Google and Facebook are fast becoming, despite their populist rhetoric, the new apostles of culture.

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## Notes

1. This is not to suggest algorithmic culture is somehow strictly computational and therefore exclusive of human beings. As Tarleton Gillespie (2014) has noted, and as the preceding example suggests, algorithms are best conceived as 'socio-technical assemblages' joining together the human and the nonhuman, the cultural and the computational. Having said that, a key stake in algorithmic culture is the *automation* of cultural decision-making processes, taking the latter significantly out of people's hands (Flusser, 2011: 117).
2. Galloway does not offer a specific definition of 'algorithmic culture', nor does he provide any type of genealogy for the term. His having largely taken this suggestive idea for granted is a primary motivation for this essay.
3. Outside the United States, the book is simply titled, *Culture*.
4. Several of these terms appear in Fuller (2008), although the project does not adhere closely to a Williamsonian keywords approach. The Williams-inspired *New Keywords* (Bennett et al., 2005) contains only a handful of them. Ben Peters' (ed.) forthcoming *Digital Keywords* project is the most compelling project to have developed in this vein to date (Welcome, n.d.; see also Striplas, 2014).
5. Beyond Williams' passing interest in *information*, I can offer no strong empirical basis for the selection of these terms beyond my own intuition, or a desire to engage in a thought experiment that would attempt to see what new understandings of *culture* might emerge from having placed the word alongside *information*, *crowd* and *algorithm*. That said, one should not dismiss 'intuitive' methods as lacking in scholarly rigor. Henri Bergson (1992), for one, pioneered the project of recovering intuition from the Kantian doctrine of the faculties, seeing it as a way of relating to the world that was less categorical and therefore better attuned to duration (pp. 126–129). More recently, Lauren Berlant (2011) has made a strong case for the relationship of intuition, the somatic and the affective (pp. 52–53). Gregory J Seigworth (2006) also gets at the point in arguing for the relationship between intuition and what Williams has called the 'pre-emergent', which is to say a category of experience exceeding the realm of the visible and the articulable. It is also not a coincidence that Seigworth draws attention to the etymological links between the words *experience*, *experiment* and *empiricism* (Seigworth, 2006: 107–126; Williams, 1977: 132).
6. The exception here would be the word's usage in the phrase 'the usual crowd', which indicates familiarity with those who have assembled.
7. Williams (1983) notes that, prior to this time, the word *multitude* tended to predominate in English. It is the 18th and 19th centuries that see the rise of *mass* and, evidently, *crowd* as well (p. 192).
8. On Olson's friendship with Hayek, see p. viii.
9. For a critique of the politics of platforms, see Gillespie, 2010.
10. Although hardly a prevalent term in the English language, the word *algorithm*'s usage shows a dramatic upsurge from about 1960 on. Before that year, it barely registered, but between 1970 and 2000 its usage increased by about 350 percent, approaching levels comparable to *crowd* ('Algorithm', n.d.).

## References

- 'Algorithm', n. (n.d.) *OED Online*. Oxford University Press. Available at: <http://www.oed.com> (accessed 18 October 2010).



- 'Algorithm', n. (n.d.) *Dictionary.com*. Available at: <http://dictionary.reference.com/browse/algorithm?s=t> (accessed 8 February 2011).
- 'Algorithm' (n.d.) *Google Books Ngram Viewer*. Available at: [https://books.google.com/ngrams/graph?content=algorithm&year\\_start=1800&year\\_end=2000&corpus=15&smoothing=3&share=&direct\\_url=t1%3B%2Calgorithm%3B%2Cc0](https://books.google.com/ngrams/graph?content=algorithm&year_start=1800&year_end=2000&corpus=15&smoothing=3&share=&direct_url=t1%3B%2Calgorithm%3B%2Cc0) (accessed 5 May 2014).
- Arnold M (1993 [1869]) *Culture and Anarchy and Other Writings* (ed S Collini). Cambridge; New York: Cambridge University Press.
- Bateson G (2000 [1971]) *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*. Chicago, IL: University of Chicago Press.
- Beniger JR (1986) *The Control Revolution: Technological and Economic Origins of the Information Society*. Cambridge, MA: Harvard University Press.
- Bennett T, Grossberg L and Morris M (eds) (2005) *New Keywords: A Revised Vocabulary of Culture and Society*. Malden, MA: Blackwell Publishing.
- Bergson H (1992) *The Creative Mind: An Introduction to Metaphysics* (trans. M Andison). New York: Citadel Press.
- Berlant L (2011) *Cruel Optimism*. Durham, NC: Duke University Press.
- Burke E (1999 [1790]) *Reflections on the Revolution in France* (ed LG Mitchell). Oxford; New York: Oxford University Press.
- 'Cipher, Cypher', n. (n.d.) *OED Online*. Oxford University Press. Available at: <http://www.oed.com> (accessed 18 October 2010).
- Crossley JN and Henry AS (1990) Thus spake al-Khwārizmī: A Translation of the Text of Cambridge University Library Ms. li.vi.5. *Historia Mathematica* 17(2): 103–131.
- 'Crowd' (n.d.) *Google Books Ngram Viewer*. Available at: [https://books.google.com/ngrams/graph?content=crowd&year\\_start=1800&year\\_end=2000&corpus=15&smoothing=3&share=&direct\\_url=t1%3B%2Ccrowd%3B%2Cc0](https://books.google.com/ngrams/graph?content=crowd&year_start=1800&year_end=2000&corpus=15&smoothing=3&share=&direct_url=t1%3B%2Ccrowd%3B%2Cc0) (accessed 5 May 2014).
- Deleuze G and Guattari F (1983) *Anti-Oedipus: Capitalism and Schizophrenia* (trans. R Hurley, M Seem and HR Lane). Minneapolis, MN: University of Minnesota Press.
- Flusser V (2011) *Into the Universe of Technical Images* (trans. NA Roth). Minneapolis, MN: University of Minnesota Press.
- Foucault M (1971 [1970]) *The Order of Things: An Archaeology of the Human Sciences*. New York: Vintage Books.
- Foucault M (1972) *The Archaeology of Knowledge* (trans. AM Sheridan). New York: Pantheon Books.
- Fuller M (ed.) (2008) *Software Studies: A Lexicon*. Cambridge, MA: The MIT Press.
- Galloway AR (2006) *Gaming: Essays on Algorithmic Culture*. Minneapolis, MN: University of Minnesota Press.
- Gillespie T (2007) *Wired Shut: Copyright and the Shape of Digital Culture*. Cambridge, MA: The MIT Press.
- Gillespie T (2010) The politics of 'platforms'. *New Media & Society* 12(3): 347–364.
- Gillespie T (2011) Our misplaced faith in Twitter Trends. *Salon*. Available at: [http://www.salon.com/2011/10/19/our\\_misplaced\\_faith\\_in\\_twitter\\_trends/](http://www.salon.com/2011/10/19/our_misplaced_faith_in_twitter_trends/) (accessed 12 May 2014).
- Gillespie T (2014) *Algorithm* (Digital Keywords). Available at: <http://culturedigitally.org/2014/06/algorithm-draft-digitalkeyword/> (accessed 6 November 2014).
- Gleick J (2011) *The Information: A History, A Theory, A Flood*. New York: Pantheon Books.
- Gramsci A (1971) *Selections from the Prison Notebooks*. Reprint ed. (eds Q Hoare and GN Smith). New York: International Publishers Co.
- Guattari F (1995) *Chaosmosis: An Ethico-Aesthetic Paradigm*. Bloomington, IL: Indiana University Press.
- Hall G (2002) *Culture in Bits: The Monstrous Future of Theory*. London; New York: Continuum.

- Hallinan B and Striphos T (2014) Recommend for you: The Netflix Prize and the production of algorithmic culture. *New Media & Society*. Epub ahead of print 23 June 2014. DOI: 10.1177/1461444814538646.
- Hartley RVL (1928) Transmission of Information. *Bell System Technical Journal* 7(3): 535–563.
- Hayek FA (2007 [1944]) *The Road to Serfdom: Text and Documents – Definitive Edition* (ed Caldwell B). Chicago, IL: University Of Chicago Press.
- Howe J (2008) *Crowdsourcing: Why the Power of the Crowd Is Driving the Future of Business* (1st edn). New York: Crown Business.
- ‘Information’, n. (n.d.) *OED Online*. Oxford University Press. Available at: <http://www.oed.com> (accessed 18 October 2010).
- James A (2009a) Amazon calls mistake ‘embarrassing and ham-fisted’. In: *Seattle Post Intelligencer Blog*. Available at: <http://blog.seattlepi.com/amazon/2009/04/13/amazon-calls-mistake-embarrassing-and-ham-fisted/> (accessed 25 October 2010).
- James A (2009b) AmazonFail: An inside look at what happened. *Seattle Post Intelligencer Blog*. Available at: <http://blog.seattlepi.com/amazon/2009/04/13/amazonfail-an-inside-look-at-what-happened/> (accessed 25 October 2010).
- Jenkins H (2006) *Convergence Culture: Where Old and New Media Collide*. New York: New York University Press.
- Kahn D (1967) *The Codebreakers: The Story of Secret Writing*. New York: The Macmillan Company.
- Karpinski LC (1914) The algorism of John Killingworth. *English Historical Review* 29(116): 707–717.
- Karpinski LC (1915) Introduction. In: Karpinski LC (ed.) *Robert of Chester’s Latin Translation of the Algebra of Al-Khowarizmi*. New York: The Macmillan Company.
- Kellog C (2009) Amazon de-ranks so-called adult books, including National Book Award winner. In: LA Times Blogs – Jacket Copy. Available at: <http://latimesblogs.latimes.com/jacket-copy/2009/04/amazon-deranks-gayfriendly-books-the-twitterverse-notices.html> (accessed 25 October 2010).
- Kelly K (1995) *Out of Control: The New Biology of Machines, Social Systems, & the Economic World*. Reading, MA: Basic Books.
- Kittler F (2006) Thinking colour and/or machines. *Theory, Culture, & Society* 23(7–8): 39–50.
- Latour B (2005) *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford; New York: Oxford University Press.
- Lavallee A (2009) Blogs and Twitter coin ‘AmazonFail’. *Wall Street Journal – Digits*. Available at: <http://blogs.wsj.com/digits/2009/04/13/blogs-and-twitter-coin-amazonfail/> (accessed 25 October 2010).
- Le Bon G (2002 [1895]) *The Crowd: A Study of the Popular Mind* (Reprint edition). Mineola, NY: Dover Publications.
- Levy P (1999) *Collective Intelligence: Mankind’s Emerging World in Cyberspace* (trans. R Bononno). Cambridge, MA: Basic Books.
- Levy S (2010) How Google’s algorithm rules the web. *Wired*. Available at: [http://www.wired.com/magazine/2010/02/ff\\_google\\_algorithm/](http://www.wired.com/magazine/2010/02/ff_google_algorithm/) (accessed 17 September 2012).
- Mackay C (2001 [1841]) *Extraordinary Popular Delusions: And the Madness of Crowds*. Amherst, NY: Prometheus Books.
- Mannheim K (1955) *Ideology and Utopia: An Introduction to the Sociology of Knowledge* (Reprint edn). San Diego, CA: Harcourt.
- Milgram S (2010) Some conditions on obedience and disobedience to authority (3rd edn). In: Blass T (ed.) *The Individual in a Social World: Essays and Experiments*. London: Pinter & Martin Ltd, pp.128–150.

- Milgram S and Toch H (2010) Crowds. In: Blass T (ed.) *The Individual in a Social World: Essays and Experiments* (3rd edn). London: Pinter & Martin Ltd, pp.237–305.
- Moretti F (2005) *Graphs, Maps, Trees: Abstract Models for a Literary History*. London; New York: Verso.
- Olson M (1971) *The Logic of Collective Action: Public Goods and the Theory of Groups* (Revised edn). Cambridge, MA: Harvard University Press.
- Peters JD (1988) Information: Notes toward a critical history. *Journal of Communication Inquiry* 12(2): 9–23.
- Probst M (2009) *Ramblings from a Literature Lover and Sometimes Writer*. Amazon Follies. Available at: <http://markprobst.livejournal.com/15293.html> (accessed 25 October 2010).
- Rheingold H (1985) *Tools for Thought: The History and Future of Mind-Expanding Technology*. Cambridge, MA: The MIT Press.
- Rheingold H (2002) *Smart Mobs: The Next Social Revolution*. Cambridge, MA: Basic Books.
- Rich M (2009) Amazon says error removed listings. *The New York Times*, 14 April. Available at: <http://www.nytimes.com/2009/04/14/technology/internet/14amazon.html> (accessed 25 October 2010).
- Sawyer K (2007) *Group Genius: The Creative Power of Collaboration*. New York: Basic Books.
- Schrödinger E (1967 [1944]) *What is Life? The Physical Aspect of the Living Cell*. Cambridge; New York: Cambridge University Press.
- Seigworth G (2000) Banality for cultural studies. *Cultural Studies* 14(2): 227–268.
- Seigworth G (2006) Cultural studies and Gilles Deleuze. In: Birchall C and Hall G (eds) *New Cultural Studies: Adventures in Theory*. Athens: University of Georgia Press, pp.107–126.
- Shannon C (1945) *A Mathematical Theory of Cryptography*. Murray Hill, NJ: Bell Labs. Available at: <http://www.cs.bell-labs.com/who/dmr/pdfs/shannoncryptshrt.pdf> (accessed 27 June 2014).
- Shirky C (2008) *Here Comes Everybody: The Power of Organizing Without Organizations*. New York: Penguin Press.
- Smith A (1977 [1776]) *An Inquiry into the Nature and Causes of the Wealth of Nations* (ed E Cannan). Chicago, IL: University of Chicago Press.
- Smith DE and Karpinski LC (1911) *The Hindu-Arabic Numerals*. Boston, MA; London: Ginn and Co.
- Striphas T (2009) *The Late Age of Print: Everyday Book Culture from Consumerism to Control*. New York: Columbia University Press.
- Striphas T (2010) The abuses of literacy: Amazon Kindle and the right to read. *Communication and Critical/Cultural Studies* 7(3): 297–317.
- Striphas T (2014) The Internet of words. *The Chronicle of Higher Education*. Available at: <http://chronicle.com/article/The-Internet-of-Words/148179/> (accessed 15 August 2014).
- Surowiecki J (2004) *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*. New York: Doubleday.
- Tapscott D and Williams AD (2006) *Wikinomics: How Mass Collaboration Changes Everything*. New York: Portfolio Hardcover.
- Welcome (n.d.) *Digital Keywords: A Scholarly Workshop at the University of Tulsa*. Available at: <http://orgs.utulsa.edu/dkw/> (accessed 5 May 2014).
- Wiener N (1954) *The Human Use of Human Beings: Cybernetics and Society* (Revised edn). Cambridge, MA: Da Capo Press.
- Wiener N (1961) *Cybernetics or, Control and Communication in the Animal and the Machine*. New York: The MIT Press.
- Williams R (1958) *Culture and Society, 1780–1950*. New York: Columbia University Press.

- Williams R (1976) *Keywords: A Vocabulary of Culture and Society* (1st edn). New York: Oxford University Press.
- Williams R (1977) *Marxism and Literature*. Oxford: Oxford University Press (English).
- Williams R (1981) *The Sociology of Culture*. Chicago, IL: University of Chicago Press.
- Williams R (1983) *Keywords: A Vocabulary of Culture and Society* (Revised edn). New York: Oxford University Press.

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