

RESEARCH

Mediatization and the Internet of Things

James Miller

Hampshire College, US

jmiller@hampshire.edu

This article offers evidence from a literature review that mediatization research has yet to engage with the internet of things (IoT). This is a major lack, given the widely recognized importance of IoT phenomena, and may be attributable to mediatization's limited direct interest in media technology. Through an extended examination of media in cars, the article demonstrates the fertility of a mediatization approach toward what is argued to be a prototype example of the emerging IoT. The article concludes by suggesting future directions for empirical studies.

Keywords: Mediatization; internet of things; mediatization of automobility; media materiality

The material history of media in the 20th century turns on issues of mobility, or portability, or perhaps spatial distribution and accessibility. These different words describe roughly the same thing: the extent to which media require their users to arrange patterns of daily life around them; or the reverse, ubiquitously available media seem to present themselves for use in many aspects of social life. The phonograph and radio and television sets built into cabinets and the land-line telephone are ready examples of fixed or immobile media. Portable radios, especially after the introduction of the transistor in the fifties but foreseen and then produced in the twenties and thirties, and of course today's smartphone are instances of mobile media. Printed media long before them shared this quality of being consumable virtually anywhere and at anytime. A third category has elements of both immobility and mobility. With respect to historical time, it may be the most recent, not yet fully formed and so a bit speculative, and experienced as a kind of end point, a remarkable, futuristic, even utopian (or dystopian) achievement whose imagined next step in technological development has features of slightly unbelievable science fiction. 'Ambient media' labels media affordances that are part of non-media objects, like a screen on a gasoline pump, or that are constitutive elements of the built environment, as in a smart building that dynamically responds to and even anticipates informational needs according to time of day or user identity. GPS is another familiar example, with continuously available locational data intelligent enough to suggest alternative travel routes as a result of real-time feedback. Scott McQuire (2008) says that ambient media are already a defining feature of the contemporary city, and only becoming more so.

An Internet of Things

The internet of things (IoT) is another term for ambient media phenomena, one that has a family resemblance to earlier visions of 'ubiquitous computing' (Miller 2014). It is an increasingly common term to describe a world of interconnected, interactive and intelligent objects and spaces.¹ A related notion is the Industrial Internet, which means both the fundamental infrastructure required by the IoT – 'big data, machine learning and M2M [machine to machine] connectivity' (Greengard 2015: 51) and cloud computing – and the specific application of the IoT to the production and distribution of goods and services. A key technological element in the IoT is sensors, especially RFID (radio-frequency identification), both active (with its own source of power) and passive (drawing power from the device that reads the RFID tag). In fact, the beginnings of the IoT are usually traced to turn-of-the-century RFID work at MIT's Auto-ID laboratory, whose director coined

¹ Arthur D. Little and Telia (2017: 3) identify seven categories of connected things: vehicles, people, consumer gadgets, money, buildings, industrial processes and infrastructure. See also Miraz et al. (2015), Borgia et al. (2016) and Working Party on Communication Infrastructures and Services Policy (2016).

the term in 1999 (Madakam et al. 2015: 166). By one analysis (Evans 2011: 3), the IoT 'was born' when there were more connected devices than human beings, between 2008 and 2009.

Limited, somewhat isolated examples of the IoT can be found today in everyday life. Employees typically wear passive RFID nametags that control access to venues by unlocking some doors but not others. In dangerous industries like oil and mining, RFID tags note the location of workers. Self-tracking is the hallmark of the quantified-self movement, whose members digitally monitor various bio-metrics through wearable devices that wirelessly transmit their findings to smartphone apps, creating a 'data double'. Vehicles regularly pass through electronic tolling systems that can involve sensors in the pavement, automatic cameras, transponders in the vehicle, GPS locators, smartphone apps and real time billing systems. Near field communication (NFC) technology enables the Apple Pay and Google Wallet services that allow a consumer to use a smartphone to pay for a purchase. Smartphone applications make possible a huge range of virtual activities that used to require a separate journey – like depositing a check in the bank – to take place in the palm of one's hand. Larger scale, total system examples can be found in smart buildings like Amsterdam's The Edge, whose features include the highly individualized capacity to distribute personnel according to the day's particular work demand.² The experience of all these examples is noteworthy for its immateriality and for the reduced consciousness of user agency necessary to implement informational transactions between people and things and among things alone. While none of this is a seamless experience, each in its own way contributes to the growing sensibility of continuous interconnectivity among quite different objects and activities as one passes through the routines of daily life.

The information technology research firm Gartner (2015) predicted that in 2016 there would be about 6.4 billion connected things in the world, an increase of about 60% over 2014, growing to about 21 billion in 2020. Gartner claims that 5.5 million new things are connected daily. A report by Cisco (Bradley, Barber and Handler 2013) foresees an Internet of Everything (IoE) that connects people, processes, data and objects and will increase revenue and lower costs between 2013 and 2022 in the amount of \$14.4 trillion. One consequence of such intense digital connectivity, according to McKinsey (2016: 30), is that 'cross-border data flows are the hallmarks of 21st-century globalization' (see also Wasik (2013) and *MIT Technology Review* (2014)).

Realization of an internet of things, of course, requires considerable effort at infrastructural standardization (the ITU, IEEE and at least two industry associations are addressing the challenge) and the redesign of many aspects of the existing built environment. Even so, experts predict significant progress by 2025. Typical is the chief data officer of Deutsche Bank, JP Rangaswami, who foresees that

“(e)verything” will become nodes on a network ... People will engage with information using all of their senses ... today's connected devices [will] become smaller and smaller and slowly merge into the part of the body from where the particular sense related to the device operates' (Pew 2014: 6–7).

This is an amazing dream on the verge of science fiction. An internet of things seems both wholly new and pushes the imagination to its limits, while apparently being right around the corner.³

Mediatization

Making sense of the internet of things – conceptually, historically, empirically – is a challenge to media research. Mediatization offers a promising approach. 'No term has received more extensive attention in recent media theory than 'mediatization', John Corner (2018) observes, calling it 'media theory's word of the decade'. Marian Adolph (2017: 11, 24) boldly asserts that 'Mediatization research arguably has become one of the most vibrant fields of international media and communication research'. Adolph characterizes one version of mediatization as a process

'usually tied to the genealogy of media-technological innovation and the institutionalization of a media system (expansion, commercialization, etc.), thus native to *modern* social formations and often used diagnostically to make sense of accelerated social change (a media-centered perspective on the media as *drivers* of social processes)' (emphases in the original).

² See <http://www.bloomberg.com/news/videos/2015-09-23/see-the-world-s-greenest-office-building-the-edge>.

³ A blog that reports on the French technology scene recently listed 10 sci-fi devices in popular movies that 'came true'. See <http://www.rudebaguette.com/2014/04/18/10-sci-fi-connected-objects-that-came-true/>.

Similarly, Göran Bolin and Andreas Hepp (2017: 318) point to mediatization's 'sensitivity not only for media-related practices but also for their entanglement with objects and technologies'. This stress on the material aspects of media is the basis for Nick Couldry and Hepp's (2017: 34, 7, 141) view of the long history of mediatization. They say it has been characterized by 'successive and overlapping waves' of modes of communication technologies and label the first two waves mechanization and electrification. Couldry and Hepp say the present moment straddles what they term digitalization and datafication, together a period of 'deep mediatization' when there is 'a much more intense embedding of media in social processes than ever before'. This results in the experience of everyday life becoming 'necessarily entangled with the constraints, affordances and power-relations that are the features of media as infrastructures for communication' – a 'fully mediated' social reality. Interconnected, ubiquitous media and the data processes that course among them are, Couldry and Hepp rightly point out, 'part of the wider "Internet of Things", whose consequences for the texture of the social world are, at this point, uncertain'.

In order to explore mediatization's suitability for the study of the IoT, this paper first explores the extent to which foundational literature has already engaged with it and, second, offers an extended case study that takes a mediatization perspective on the historical development of an IoT-like built environment, the American automobile.

A (Brief) Review of (Some) Literature

Two caveats should be noted about the nature of this literature review. First, only well-known foundational texts were consulted with the idea that they are bellwethers of the field's tendencies. Secondly, the use of 'media' is necessarily fraught. What 'media' means today is not always clear, or can be disputed, since the term includes point-to-point communication (telephone), varieties of letter writing (email, texts, Tweets), audio, print and video – all of which can be available on a single, small personal device (smartphone). The collapse of distinctions among interpersonal, mass and social media communications is largely due, of course, to the convergence brought about by digitalization and the related metamorphic changes in the political economy of media industries. Artificial intelligence and advanced telematics only compound this situation. So, here 'media' must refer to both infotainment and communications media – that is, awkwardly, technological means of being informed and entertained and interacting with others – *and* infrastructural media, or the computerized systems that operate any number of vehicles and places, from aircraft to the light levels of a building. These two categories of digital media often overlap and merge into a unitary experience, accessible through a common interface. At least from the perspective of the user, they appear the same. And when in strictly technological terms they are not, they are close enough, as when a smartphone functions as a thermostat. IoT conceptions tend to elide familiar distinctions implied by the term 'media'.

Selected publications of self-described mediatization research were reviewed for direct mentions of the internet of things, for whether there was a primary focus on media technology, and especially digital media, and for general statements regarding the value and purpose of and approach to the study of media technology. The following work was examined: (1.) articles that introduce themed journal issues dedicated to mediatization (Hepp, Hjarvard and Lundby 2010; Couldry and Hepp 2013); (2.) special reports (Hepp 2013a; Kaun and Fast 2014); (3.) the critical exchange in *Media, Culture and Society* (Deacon and Stanyer 2014, 2015; Hepp, Hjarvard and Lundby 2015; Lunt and Livingstone 2016; Ekström et al. 2016); (4.) monographs (Hepp 2013b, Hjarvard 2013); and (5.) collections (Lundby 2009b, Lundby 2014a; Hepp and Krotz 2014a; Driessens et al. 2017).

1. Themed issue introductions

Andreas Hepp, Stig Hjarvard and Knut Lundby (2010) introduce the significance of mediatization empirical research by arguing that existing research is inadequate because it focuses either on short-term effects or on media per se (i.e., medium theory). The latter is insufficient because, they claim, it attributes linear historical change to the introduction of a single new medium, which they imply but do not say is synonymous with technology. Nick Couldry and Hepp (2013: 194, 195, 196) make a passing reference to medium theory, which they link to the similar notion of the 'ecology of communication'. In one descriptive phrase, they mention these approaches' stress on 'the influence of the media in their materiality as means of communication'. They refer to actor-network theory (ANT), which they claim is 'still barely acknowledged ... in media and communications research'.⁴ One of the articles they introduce, by Klaus Bruhn Jensen (2013: 210, 214,

⁴ There is a body of work, however, that actively embraces ANT because, as Andéa Belliger and David Krieger (2016: 21, 24?) say, 'with the advent of "new media", most of the foundational distinctions upon which Media Studies had been built disappear ... Once media are assumed to be things ... they can enter into causal relations with other things'.

215), offers a strong endorsement for attending to media technological change by critically observing that mediatization research tends to extrapolate ‘from the epoch of *mass* mediatization to an emerging digital media environment, without considering the extent to which relevant rules and resources may have to be reconfigured, perhaps even in epochal ways’ (emphasis in the original). Jensen also writes that medium theory is an approach ‘from which mediatization researchers have regularly distanced themselves as an “other”’. He concludes this has been a mistake.

2. Reports and working papers

Anne Kaun and Karin Fast (2014: 6) ‘map overlooked areas of mediatization’ and identify research that is about mediatization but not necessarily within media studies. They discuss at length research on digital music production, distribution and consumption technology and make reference to how digital media alter story creation and reception, encouraging new narrative forms, along with the emergence of digital art. Experiments with gender identity are linked with the technologies of social network sites, and changes in play and instruction with computer games. Internet use by young people is mentioned in terms of technologically enhanced mobility. Instagram use at museums is discussed, as is a project studying the aesthetics of post-war tape recording and another on the consequences of e-book for publishing.

Hepp (2013a: 10, 13) identifies ‘mediatization waves’ that create ‘qualitatively different media environments’ and describes digitalization as one of them.

3. *Media, Culture and Society* exchange

Media technology issues play very little role in this critical exchange about mediatization. David Deacon and James Staney (2014: 1038), seeking to show historical continuities in media’s involvement in war, mention growing literature that addresses how ‘new digital media technologies have penetrated, restructured, diffused and globalized military conflict’. In their response, Hepp, Hjarvard and Lundby (2015: 316, 321) offer mediatization as an antidote to a field ‘ever more specialized, introverted and focused on [new] media technologies and their particular applications’. They also make a passing reference to the ‘material perspective’, though without explanation.⁵ ‘Mediatization waves’ makes an appearance as ‘moments of qualitatively intense media change, for example, when a certain digital media technology is appropriated in a certain context for the first time’. Deacon and Staney (2015: 665–666) conclude that ‘media centrism’ is ‘bad’ and ‘media-centeredness’ is ‘legitimate’. One understanding of this position is that any concession to technological causality is out of bounds. Peter Lunt and Sonia Livingstone (2016: 463, 464) acknowledge that ‘digitally networked technologies’ mediate ‘many, even all, dimensions of society.’ They quote Johan Fornäs approvingly to the effect that mediatization is an historical process that raises the ‘importance’ of media in evermore sectors of life. Finally, Mats Ekström et al. (2016: 1091, 1101) note that while media consequences may be widespread and even transformative, attention must be paid to their individual differences, including ‘technological affordances’.

4. Monographs

Hepp (2013b: 4, 11–28, 57, 60), who tends to be identified with the ‘social constructivist’ or micro-sociological analysis of small life words (or ‘communicative figurations’), explains that his use of ‘media’ means media technology, and distinguishes between ‘first order’ media, which seems to mean narrowly technical, perhaps infrastructural aspects, and ‘second order media’, which adds social institutional arrangements and content. He discusses the Toronto School and its descendants in medium theory (Innes, McLuhan, Meyrowitz), rejecting what he says is their emphasis on a single medium that defines an era. Reflecting on cyberspace as a product of digital media, Hepp says that it ‘suggests a comprehensive shift in culture... today media cultures are technicized cultures’. Hepp invokes Raymond Williams’s reminder that media are both technologies and cultural forms, and discusses how in practice they are intertwined, observing that media materiality is a means to reify existing communication action. Hepp is generally attentive to technology issues.

Hjarvard (2013: 12, 121) articulates his understanding of mediatization, and applies it to four case studies. His is the more sociological/historical-institutional approach, to some extent arguing for media powerful enough to force other institutions to conform to their ‘logic(s)’ of representation, something he views as having arisen during high modernity. This, he says, is an idea shared with medium theory, though he warns

⁵ Casemajor (2015) identifies six approaches to digital materialism. See also Miller (2015).

against reducing a medium to its 'technological "nature"'. Hjarvard's most direct engagement with media technology, apart from a discussion of ANT, comes in his study of LEGO, where he charts the company's move away from plastic bricks to the bytes of 'computer games, intelligent bricks' and various other media-related products.

5. Collections

In Lundby's (2009b) first mediatization anthology, Norm Friesen and Theo Hug (2009: 64, 66, 74) make a strong case for what is sometimes called German media studies, which affords primacy to 'mediality', or the material features of a given medium that shape its representational forms and influence its use. Friesen and Hug argue that the materiality of media acts as an unrecognized 'a priori condition', even an epistemology for how modern people know. While their interest lies in applying this insight to educational pedagogies, they advocate the more general attention to 'media-ecological configurations of technologies specific to a particular age or era'. Lynn Schofield Clark (2009) looks to the Toronto School and its descendent, what might be called the NYU School (Postman, his student Meyrowitz, along with Ong), for the roots of mediatization theory, and goes on briefly to comment on their relationship to cultural studies, actor-network and cybernetic theories. She views them as being on a spectrum from hard to soft technological determinism, and of value to the development of mediatization thinking. In his editor's conclusion, Lundby (2009a: 301) distinguishes between what he regards as cultural studies' theory of mediation, which 'may emphasize human agency to such an extent that it under-examines technologies' and mediatization's inclination to investigate 'the ways in which technologies and humans together co-create realities and hence jointly contribute to social change'.

Hepp and Friedrich Krotz (2014b: 5, 4), in the introduction to their collection, once again warn against what they call 'macrolevel medium theory', the idea that a single medium dominates an historical place and time. And they note the value in taking a 'transmedial' perspective, one that acknowledges the multiplicity of media that characterizes most social settings. Thomas Steinmaurer's (2014: 91) contribution examines early telephone history as the roots of the present condition of 'perpetual contact'. Mark Deuze (2014: 209) advocates a wide-ranging conceptual appreciation of 'media life', one that recognizes the 'fused relations between technology, body, environment and social role' in the mediatization of everyday experience. In her concluding reflection, Clark (2014: 313–316) considers McLuhan's past popularity and the 'celebrated' contemporary, best-selling writers who argue for and against a McLuhanesque 'soft technological determinism' version of mediatization.⁶

Lundby's (2014a) *Mediatization of Communication* is part of a book series that 'aims to offer a portrait of the current state of the art in the study of communications' (Schulz and Cobley 2014: v). At more than 700 pages, three pounds and \$300, the volume should be taken as a definitive attempt to present a comprehensive account of mediatization. Three chapters address media technology in a sustained way. André Jansson's (2014: 278, 280, 292) model of mediatization begins with the

'indispensability of new "media things" [which] refers to the general social acceptance of literally buying into a particular way of communication, and to the restructurings through which the material presence of these things are naturalized in people's day-to-day lives'.

This leads him to reflect on "the phenomenology of human-technology relations", and to conclude by observing that new media forms are a consequence of 'technics and properties'. Mirca Madianou (2014) reports on an extended ethnographic study of how new media have transformed the experience of migration, and especially what she terms the mediatization of parenting. Her focus is on digital literacy applied to mobile phones with their capacity for transnational texting and money transfer. She also considers the use of webcams that allow migrant mothers to see their far away children, and the steady adoption of other services like Facebook. Niels Ole Finnemann (2014: 299, 301, 312, 318) believes that digital media introduce a radical change in the materialization of media', and aims to address 'this blind spot' in mediatization research. One change he sees is that 'there is no exclusive limit between media and non-media'. Finnemann observes that mediatization for too long defined itself in mass media terms and now must articulate its understanding of digital media, and so 'redefine the concepts of media and mediatization'.

⁶ Miller (2014) mostly addresses the technologies and concepts of 'ubiquitous computing' and encourages – surprise – incorporation of technology into mediatization theory-building.

Findings

What is there

In the reviewed literature, there are several authors – Jensen, Hepp to some extent, Clark, Steinmaurer, Deuze, Jansson, Madianou and Finnemann – who engage directly with the mediality and materiality of technology. Some of them are explicitly curious about what might be the distinctive and ‘disruptive’ nature of digital media. Their work is in this way ‘media centered’ (not, as they see it, the too narrow and outlawed ‘media centric’). Some are thinking conceptually, while others are working empirically or historically.

There are also repeated warnings of the inadequacies of medium theory and the dangers, by placing research emphasis on media technology, of elevating deterministic power over human agency. At best there is ambivalence about studying new media technology closely and sympathetically.

Summing up the most recent and largest collection of mediatization research, Sonia Livingstone and Peter Lunt (2014: 708–709, 710) explain that the field so far has addressed three time frames (decades, centuries and millennia), onto which, they say, Göran Bolin’s (2014) contribution to the volume overlays interest in the ‘recent impact of digital networked technologies on society’, ‘the rising power of media as institutions’ and the ‘broader theorizing of the media’s role in society throughout history’. Livingstone and Lunt claim that ‘many [researchers] are now exercised about the role of new digital technologies’. This enthusiasm, they advise, should be tempered because the ‘contours of the “digital age” [are] as yet unclear; so too are the benefits of adopting a mediatization approach to their analysis’. Similarly, in introducing the collection, Lundby (2014b: 8), its editor, observes that to speak of ‘the media’ is for him to refer merely to ‘technologies or tools in communication’. However, the ‘core of mediatization is the social and cultural transformations, not technical media as such. Any deterministic take on mediatization has to be rejected’. Krotz (2009) is more conflicted about how to weigh media technology, first seeming to dismiss its importance in favor of political economy, but then acknowledging a future of ‘living objects’, which seem to include advanced media technology (see Miller (2014: 110–111) for a discussion).

What is not there

Surprisingly, there appears to be no direct mention of the Internet of Things or its synonyms. Even the abstract concept of such phenomena is mostly absent from what might be considered some of the foundational literature of mediatization.

The IoT and the Automobile

The sort of research that could fill this void is illustrated by the following case study, which explores the historical mediatization of space and the technology that realized it, by focusing on the American automobile.

The car is a dramatic example of a bounded built environment where it might be said metaphorically that media moved in and became, to an extent that was probably unforeseen, an essential structural element, influencing its design and especially the experience of its occupants (Miller 2017).

The long US history of media in cars demonstrates how the automobile has rapidly developed, in recent years, into a ‘computer on wheels.’⁷ From the 1930s into the 1990s, a number of media devices were steadily integrated into the automotive interior. They included AM, FM and satellite radio; and 8-track, cassette, CD, DVD and mp3 players. More recently, the list has expanded to include satellite navigation and wireless connections for personal digital devices, while the car itself has developed into a mobile internet hotspot. A variety of driver assistance technologies now exist, such as multiple cameras, lane-sensing, automatic braking, self-parking and so on. Manufacturers regularly update their cars’ software.⁸ An onboard device creates a continuous record of the car’s activity. Taken together, these digital media comprise automotive infotainment and infrastructural operating systems. From the perspective of the driver, whose interface is the dashboard and steering wheel, where controls are increasing responsive to touch, speech and gesture, they are nearly indistinguishable. It is not too much to say that the automobile is increasingly designed and constructed around media. This is even more the case for partially and fully autonomous vehicles.

Automobility has been profoundly shaped by media.⁹ At the time radios were new to the car, people listened together – a shared family experience, and going for a ride was itself still a novelty. Today, media

⁷ According to one estimate, ‘electronics account for 40 percent of the cost of making a car’ today (*MIT Technology Review Business Report* 2014, 2).

⁸ This is usually done by a visit to the dealer. Tesla, however, uses the internet to send updates directly to the car. See <http://www.teslamotors.com/support/software-updates> and (Bullis, 2014).

⁹ Jeremy Packer (2008) explores how CB radio became integrated into the practices of long-haul trucking, especially those that sought to evade regulation.

consumption in the car is mostly a solo activity. Researchers label this a ‘cocooning effect’, ‘acoustic shielding’ (Bijsterveld et al. 2014: 7) and ‘auditized space’ (Bull 2001: 364, 370). The car is now a ‘sanctuary’ from domestic stress, work life, the necessity of commuting. At the same time, and somewhat paradoxically, the accessibility of mobile email, text messaging and phone calls turns the automobile into an extension of home and work place.

Under these conditions, the automobile serves as a case study in the mediatization of a built environment. The car is a place where human action melds with machinic operation. (Karin Knorr Cetina (2001) calls this phenomenologically ‘dissociative dynamic’ ‘objectural relations’). Infotainment and infrastructural media are a defining, immaterial, inescapable presence in the experience of modern automobility. John Urry’s car-driver (2004) is now better described as a car-driver-media hybrid. As a consequence, the car is probably the closest, most familiar actual example of the yet-to-be-realized internet of things.

According to the 2009 US National Household Travel Survey (Krumm 2012; see also <http://nhts.ornl.gov/>), which was not restricted to automobiles alone, the average time spent driving was about an hour and 15 minutes or 38 miles each day. In 2013, the average time to travel to work in the US ranged from 12 to 33 minutes. Eleven percent of fulltime workers traveled 60–90 minutes to work. Older drivers (45–64) were the most likely to drive alone and driving alone increased to about three-quarters of commuters in 2013 from 64 percent in 1980 (Jarosz and Cortes 2014). Travel by car also provides non-instrumental rewards, or ‘affective-symbolic reasons’. In general, the daily commute, as Gatersleben and Uzzell (2007: 418–419) put it, offers ‘an opportunity to read, to be alone, to daydream and fantasize or to unwind after a day at the office. This may be the one time in the day when individuals have any time to themselves, where no demands are being made on them by others; it becomes “their time”’. Media in cars may enhance the initial ‘non-instrumental’ desirability of driving, while helping to reduce the unpleasantness of much routine auto travel. This gives them a uniquely two-fold value.

If the media-as-built-environment, IoT view of the future proves accurate, media in cars – an enclosed design space with its media tightly integrated and increasingly available through natural user interfaces – offers a compelling template. Media analysis tends to focus on hardware (devices) and software (content), what Barry Schwartz (2015: 67) calls ‘thing technology’. More influential here may be the ‘idea technology’ that characterizes the experience of media in cars, which ‘can suffuse through the culture and have profound effects on people before [it is] even noticed’.

From In-Car Media to the IoT: UI Design

Approach the present-day automobile as a designed and mass-produced environment, with a degree of customization, that functions as private vehicular transportation. Its interior, where the driver and passengers encounter media, features comfortable seating, climate control and insulation from exterior sound. Media interfaces are available in the dashboard and between the front seats, with a bias toward driver accessibility.¹⁰ High-resolution screens grow larger and easier to manipulate, and there is a wireless connection for smartphones. Direct touch of various kinds operates the media, while speech has more limited application. Multiple speakers are placed throughout the interior, providing superior sound reproduction. Some of these media are for interaction (phone calls, text), some for information (news, GPS), some for entertainment (music and video). Still others control some of the car’s operation (ride and handling, interior temperature, mechanical monitoring). The experience of automobility is now strongly, inescapably, one of mediatized space.¹¹

There are few other places – some workstations, perhaps, or an airplane cockpit – that share this description. A distinctive attribute of today’s automobile interior is that media fall readily to hand, while almost never, by design, being an object physically separate from the car. Moreover, since there need to be few distractions from the automobile driver’s main task of driving, even when operating media, media in cars may be a useful place to look for guides to future IoT interface design. Operation of media in an automotive interior

¹⁰ Concept cars by definition stretch this conventional description. The Mercedes-Benz F 015 offers ‘four rotating seats that allow face-to-face configuration, as well as six display screens harmoniously built into the front, rear and side panels. It’s a digital arena that allows passengers to interact with the vehicle through gestures, eye tracking and hi-res touch-screens’ (see https://www.mbusa.com/mercedes/future/model/model-All_New_F015_Luxury).

¹¹ See <http://www.cnet.com/pictures/2017-audi-a4s-virtual-cockpit-and-mmi-are-sensational-pictures/> and, ‘Now this is mobile technology’, *Audi Magazine*, no. 109 (2015). Automotive enthusiast magazines and electronics websites regularly assess a new model’s new media, while manufacturers introduce them at the annual Consumer Electronics Show (CES). Owned by the US consumer electronics trade association, the CES showcases more than 3,600 exhibitors, including manufacturers, developers and suppliers of consumer technology hardware, content technology delivery systems and more; a conference program with 220 conference sessions; and more than 165,000 attendees from 150 countries’ (<https://www.cesweb.org/about-us>).

must be immediately intuitive, easily within reach, physically or otherwise, and should probably allow for the use of more than one means of control. For both aesthetic and practical reasons, media in cars are noteworthy examples of being well integrated into their built environments, even to the point of being barely noticeable.

Drivers and passengers might be distracted by travel, but they remain in their seats, and their relationship to in-car media is spatially fixed. In an internet of things, devices may remain fixed but be encountered by people on the move. This is an important difference and complicates the lessons that can be drawn directly from the development and use of automotive media interfaces. When considering potential IoT interface design, apart from the lessons of media in cars, the designer Dan Gärdenfors (2015) identifies three types, invisible (especially when the device operates automatically or semi-automatically), physical (screenless, but a tiny display) and remote controlled (by means of an application).

A larger design context for locating media in cars is an architectural one. This is the tradition of *gesamtkunstwerk*, or total, systemic, highly efficient design. Examples include the Smithsons' 1956–1958 Appliance Houses (Smithson 1959, Colomina 2004), Buckminster Fuller's 1946 Dymaxion House (Ashby nd), Gerrit Rietveld's 1924 Schröder House (Mulder and van Zijl 1999) and Margarete Schüte-Lihotzky's 1926 Frankfurt Kitchen (Hessler 2009). Wally Smith and Hannah Lewi (2008: 654) offer a cleverly insightful historical treatment of 'the magic of machines in the house' that reveals the performativity and irony implicit in technology that recedes into an 'ambient, personalized environment'. Any evaluation of in-car media's relationship to an IoT must examine the details of interface design as an attempt to create a complex system of integrated spatial design that like Le Corbusier's furniture design is 'interested in finding the "most elementary expression" of a phenomenon' (Rüegg 2014: 107).

Mediatization Research and the IoT: What Is To Be Done?

The answer to that question depends on how one perceives the problem. Is it hostility toward or ignorance about media technology? Is a subject like the potential IoT simply too much about engineering or commerce to be of interest to mediatization?

Contributors to the Lundby (2009, 2014a) and Hepp and Krotz (2014a) collections imply theory-building with a particular disciplinary and regional point of view, one with a Nordic and German emphasis. Regions and nations have identifiable intellectual traditions and styles. In ways that merit exploring, mediatization research may incorporate media studies that are not very British and certainly not American, and so be a kind of alternative to the longtime Anglophone dominance of communications. If something like this is so, and if it has an influence on the way media technology has largely been written out of or made marginal to mediatization, curious by its absence is German media studies as epitomized in Friedrich Kittler's (1992) radical materialist claim that, 'there is no software.' Also missing from this geographical explanation is the Netherlands, which literally lies between the Scandinavian countries and Germany and has been disproportionately important in the development of science and technology studies (STS), a discipline that can be said to put technology at the center of its investigations, including the intellectually neighboring sound studies program.

Equally curious is the repeated invocation of medium theory as a measure of what mediatization is not, with respect to technology. There is actually very little evidence that medium theory proponents are active today or have been in the recent past or were even all that influential. Perhaps this is another indicator of distancing from what is perceived as an unwelcome North American heritage.

This review of key literature's neglect of the internet of things and the historical study of the mediatization of the American automobile lead to related suggestions for future mediatization research. The first come from mediatization's friendly critics. Lunt and Livingstone (2016: 465) believe that mediatization 'sensitizes media researchers' to 'a heightened historical awareness' that goes beyond 'a simple polarization of "now" and "before"...' Likewise, Ekström et al. (2016: 1198–1100) note a lack of 'cross-temporal' research that compares 'levels and kinds of mediatization between different historical periods'. They advocate examining media in diverse social settings at a single point in time. This would require a multi-disciplinary approach to contextualize and weigh media significance 'in relation to other kinds of technical, political, economic, social and cultural processes'. In addition, they urge attention to media specificity, both media 'types, genres, technologies or institutions' as well social and geographic contexts.

It is also clear that as part of its maturation mediatization must actively collaborate with and be informed by allied disciplines that have already thought through the complex questions of human and nonhuman agency, the adoption and diffusion (and creative processes) of innovations (going beyond the useful but somewhat limiting 'domestication' of media), the design and implications of user interfaces in the broadest sense and the 'evolution of useful things' (Petroski 1994). An example is the preface to the 25th anniversary

edition of *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Bijker and Pinch 2012). Wiebe Bijker (Maastricht) and Trevor Pinch (Cornell, and recent president of the Society for Social Studies of Science, or 4S) succinctly review the development of three related approaches, the social construction of technology (SCOT), large-scale technological systems (LTS) and actor-network theory (ANT). In the process, they restate the anti-deterministic goal of their volume, from a quarter century ago. In 24 pages, they provide a useful introduction to these powerful, well-established, voluminous literatures. Similarly, Merritt Roe Smith (1994) finds a deterministic influence not so much in technology itself as in American popular beliefs about it.

Mediatization is an historical process by which social practices and institutional arrangements change through the introduction of new media technologies. It may often be the case that new media industries and occupations gain power by augmenting or supplanting existing media. This is a complex and usually drawn-out process where a new medium – speaking in shorthand for numerous players and dynamics – may enhance the qualities of existing media before establishing its own identity. David Thorburn and Henry Jenkins (2004) provide a nuanced and historically rooted discussion of this process (see also Winston (1998). Recent work on the historical mediatization of the automobile has led to collaboration with mobility studies scholars, whose recent professional association president is Mimi Sheller, a sociologist who worked with John Urry on media-related studies.¹² And Judy Wajcman (2014), another sociologist and another former 4S president, connects the changing historical experience of time to what may or may not be its speed-up due to digital media. And so on.

Media-in-cars have made the automobile a 'computer on wheels', steadily reducing the amount and kind of necessary human intervention. The mediatized car may portend, especially in its autonomous version, the experience of an internet of things. The lack of attention to the IoT in the mediatization research under review indicates neglect, a failure of intellectual imagination and a potential obstruction to the continuing development and relevance of mediatization theory and empirical research.

Competing Interests

The author has no competing interests to declare.

References

- Adolph, M.** 2017. The identity of mediatization: Theorizing a dynamic field. In: Driessens, O, et al. (eds.), *Dynamics of mediatization: Institutional change and everyday transformations in a digital age*, 11–33. London: Palgrave.
- Ashby, J.** nd. Preserving a prototype: Buckminster Fuller's Dymaxion House. Available at: <http://hpef.us/publications/preserving-the-recent-past-publications/preserving-a-prototype>.
- Belliger, A and Krieger, D.** 2016. The end of media: Reconstructing media studies on the basis of actor-network theory. In: Spöhrer, M and Ochsner, B (eds.), *Applying the actor-network theory in media studies*, 20–37. Hershey, PA: IGI Global.
- Bijker, W and Pinch, T.** 2012. Preface to the anniversary edition. In: Bijker, W, et al. (eds.), *The social construction of technological systems: New directions in the sociology and history of technology*, xi–xxxiv. Cambridge: MIT Press.
- Bijsterveld, K,** et al. 2014. *Sound and safe: A history of listening behind the wheel*. New York: Oxford University Press.
- Bolin, G.** 2014. Institution, technology, world: Relationships between the media, culture and society. In: Lundby, K (ed.), *Mediatization of communication*, 175–197. Berlin: De Gruyter Mouton.
- Bolin, G and Hepp, A.** 2017. The complexities of mediatization: Charting the road ahead. In: Driessens, O, et al. (eds.), *Dynamics of mediatization: Institutional change and everyday transformations in a digital age*, 315–331. London: Palgrave.
- Borgia, E.** 2016. Editorial: Special issue on internet of things: Research challenges and solutions. *Computer Communications*, 89–90: 1–4. DOI: <https://doi.org/10.1016/j.comcom.2016.04.024>
- Bradley, J, Barber, J and Handler, D.** 2013. Embracing the internet of everything to capture your share of \$14.4 trillion. *Cisco*. Available at: http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/loE_Economy.pdf.

¹² There was an Intersections of Media and Mobilities session at the 2017 meetings of the International Association for the History of Transport, Traffic and Mobility (T2M), held at Lancaster University. See also Miller (2018).

- Bull, M.** 2001. Soundscapes of the car: A critical ethnography of automobile habitation. In: Miller, D (ed.), *Car cultures*, 357–374. Oxford: Berg.
- Bullis, K.** 2014. Tesla Motor's over-the-air repairs are the way forward. *MIT technology review*, 14 January. Available at: <https://www.technologyreview.com/s/523621/tesla-motors-over-the-air-repairs-are-the-way-forward/>.
- Casemajor, N.** 2015. Digital materialisms: Frameworks for digital media studies. *Westminster papers in communication and culture*, 10(1): 4–17. DOI: <https://doi.org/10.16997/wpsc.209>
- Clark, L.** 2009. Theories: Mediatization and media ecology. In: Lundby, K (ed.), *Mediatization: Concept, changes, consequences*, 85–100. New York: Peter Lang.
- Clark, L.** 2014. Mediatization: Concluding thoughts and challenges for the future. In: Hepp, A and Krotz, F (eds.), *Mediatized worlds: Culture and society in a media age*, 307–323. London: Palgrave.
- Colomina, B.** 2004. Unbreathed air 1956. In: van den Heuvel, D and Risselada, M (eds.), *Alison and Peter Smithson: From the house of the future to a house of today*, 31–49. Rotterdam.
- Corner, J.** 2018. 'Mediatization': Media theory's word of the decade. *Media Theory*, 21 May. Available at: <http://mediatheoryjournal.org/john-corner-mediatization/>.
- Couldry, N and Hepp, A.** 2013. Conceptualising mediatization: Contexts, traditions, arguments. *Communication theory*, 23(3): 191–202. DOI: <https://doi.org/10.1111/comt.12019>
- Couldry, N and Hepp, A.** 2017. *The mediated construction of reality*. Cambridge: Polity.
- Deacon, D and Stanyer, J.** 2014. Mediatization: Key concept or conceptual bandwagon? *Media, culture and society*, 36(7): 1032–1044. DOI: <https://doi.org/10.1177/0163443714542218>
- Deacon, D and Stanyer, J.** 2015. 'Mediatization and' or 'mediatization of'? A response to Hepp et al. *Media, culture and society*, 37(4): 655–657. DOI: <https://doi.org/10.1177/0163443715580761>
- Deuze, M.** 2014. Media life and the mediatization of the lifeworld. In: Hepp, A and Krotz, F (eds.), *Mediatized worlds: Culture and society in a media age*, 207–220. London: Palgrave.
- Driessens, O, et al. (eds.)** 2017. *Dynamics of mediatization: Institutional change and everyday transformations in a digital age*. London: Palgrave. DOI: <https://doi.org/10.1007/978-3-319-62983-4>
- Ekström, M, et al.** 2016. Three tasks for mediatization research: Contributions to an open agenda. *Media, Culture and Society*, 38(7): 1090–1108. DOI: <https://doi.org/10.1177/0163443716664857>
- Evans, D.** 2011. The internet of things: How the next evolution of the internet is changing everything. *Cisco Internet Business Solutions Group*. Available at: https://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf.
- Finneman, N.** 2014. Digitization: New trajectories of mediatization? In: Lundby, K (ed.), *Mediatization of communication*, 297–321. Berlin: De Gruyter Mouton.
- Friesen, N and Hug, T.** 2009. The mediatic turn: Exploring concepts for media pedagogy. In: Lundby, K (ed.), *Mediatization: Concept, changes, consequences*, 63–83. New York: Peter Lang.
- Gårdenfors, D.** 2015. All or nothing? *User interfaces for the internet of things*. March 31. Available at: <https://medium.com/the-conference/all-or-nothing-interfaces-for-the-internet-of-things-15b64bd04ae3>.
- Gartner.** 2015. Gartner says 6.4 billion connected 'things' will be in use in 2016, up 30 percent from 2015. 10 November. Available at: <http://www.gartner.com/newsroom/id/3165317>.
- Gatersleben, B and Uzzell, D.** 2007. Affective appraisals of the daily commute. *Environment and behavior* 39(3): 416–431. DOI: <https://doi.org/10.1177/0013916506294032>
- Greengard, S.** 2015. *The Internet of things*. Cambridge: MIT Press.
- Hepp, A.** 2013a. *The communicative figurations of mediatized worlds: Mediatization research in times of the 'mediation of everything'*. Working Paper No. 1, University of Bremen.
- Hepp, A.** 2013b. *Cultures of mediatization*, trans. Keith Tribe. Cambridge: Polity.
- Hepp, A, Hjarvard, S and Lundby, K.** 2010. Mediatization – empirical perspectives: An introduction to a special issue. *Communications*, 35: 223–228. DOI: <https://doi.org/10.1515/comm.2010.012>
- Hepp, A, Hjarvard, S and Lundby, K.** 2015. Mediatization: Theorizing the interplay between media, culture and society. *Media, culture and society*, 37(2): 314–324. DOI: <https://doi.org/10.1177/0163443715573835>
- Hepp, A and Krotz, F. (eds.)** 2014a. *Mediatized worlds: Culture and society in a media age*. London: Palgrave.
- Hepp, A and Krotz, F.** 2014b. Mediatized worlds: Understanding everyday mediatization. In: Hepp, A and Krotz, F (eds.), *Mediatized worlds: Culture and society in a media age*, 1–15. London: Palgrave.
- Hessler, M.** 2009. The Frankfurt kitchen: The model of modernity and the 'madness' of traditional users, 1926 to 1933. In: Oldenziel, R and Zachmann, K (eds.), *Cold war kitchen: Americanization, technology and European users*, 163–184. Cambridge: MIT Press.


- Hjarvard, S.** 2013. *The Mediatization of culture and society*. London: Routledge. DOI: <https://doi.org/10.4324/9780203155363>
- Jansson, A.** 2014. Indispensable things: On mediatization, materiality and space. In: Lundby, K (ed.), *Mediatization of communication*, 273–295. Berlin: De Gruyter Mouton.
- Jaros, B** and **Cortes, R.** 2014. In US, new data show longer, more sedentary commutes. *Population Reference Bureau*. September. Available at: <http://www.prb.org/Publications/Articles/2014/us-commuting.aspx>.
- Jensen, K.** 2013. Definitive and sensitizing conceptualizations of mediatization. *Communication Theory*, 23(3): 203–222. DOI: <https://doi.org/10.1111/comt.12014>
- Kaun, A** and **Fast, K.** 2014. *Mediatization of culture and everyday life*. Karlstad University Studies. 3.
- Kittler, F.** 1992. There is no software. *Stanford Literature Review*, 9(1): 81–90.
- Knorr Cetina, K.** 2001. Objectural practice. In: Schatzki, T, Knorr Cetina, K and von Savigny, E (eds.), *The practice turn in contemporary theory*, 175–188. London: Routledge.
- Krotz, F.** 2009. Mediatization: A concept with which to grasp media and societal change. In: Lundby, K (ed.), *Mediatization: Concept, changes, consequences*, 21–40. New York: Peter Lang.
- Krumm, J.** 2012. How people use their vehicles: Statistics from the 2009 national household travel survey. *SAE Technical Paper 2012-01-0489*. Available at: <https://www.microsoft.com/en-us/research/wp-content/uploads/2016/12/2012-01-0489-SAE-published.pdf>.
- Little, A** and **Telia.** 2017. *Connected things: New digital ecosystems – unlocking the growth potential of IoT*. Available at: <https://www.teliacompany.com/globalassets/telia-company/documents/about-telia-company/connected-things---2017-edition.pdf>.
- Livingstone, S** and **Lunt, P.** 2014. Mediatization: An emerging paradigm for media and communication research? In: Lundby, K (ed.), *Mediatization of communication*, 703–723. Berlin: De Gruyter Mouton.
- Lundby, K.** 2009a. Conclusion: Consensus and conflict. In: Lundby, K (ed.), *Mediatization: Concept, changes, consequences*, 293–303. New York: Peter Lang.
- Lundby, K.** (ed.) 2009b. *Mediatization: Concept, changes, consequences*. New York: Peter Lang.
- Lundby, K.** (ed.) 2014a. *Mediatization of communication*. Berlin: De Gruyter Mouton.
- Lundby, K.** 2014b. Mediatization of communication. In: Lundby, K (ed.), *Mediatization of communication*, 3–35. Berlin: De Gruyter Mouton.
- Lunt, P** and **Livingstone, S.** 2016. Is ‘mediatization’ the new paradigm for our field? A commentary on Deacon and Stanyer (2014, 2015) and Hepp, Harvard and Lundby (2015). *Media, Culture and Society*, 38(3): 462–470. DOI: <https://doi.org/10.1177/0163443716631288>
- Madakam, S** and **Tripathi, S.** 2015. Internet of things (IoT): A literature review. *Journal of Computer and Communications*, 3: 164–173. DOI: <https://doi.org/10.4236/jcc.2015.35021>
- Madianou, M.** 2014. Polymedia communication and mediatized migration: An ethnographic approach. In: Lundby, K (ed.), *Mediatization of communication*, 323–346. Berlin: De Gruyter Mouton.
- McKinsey Global Institute.** 2016. *Digital globalization: The new era of global flows*. March. Available at: <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows>.
- McQuire, S.** 2008. *The media city: Media, architecture and urban space*. New York: Sage.
- Miller, J.** 2014. Intensifying mediatization: Everywhere media. In: Hepp, A and Krotz, F (eds.), *Mediatized worlds: Culture and society in a media age*, 107–122. London: Palgrave.
- Miller, J.** 2015. The dematerializing interface. *Westminster papers in communication and culture*, 10(1): 66–80. DOI: <https://doi.org/10.16997/wpsc.213>
- Miller, J.** 2017. Mediatization of the automobile. In: Driessens, O, et al. (eds.), *Dynamics of mediatization: Institutional change and everyday transformations in a digital age*, 203–223. London: Palgrave.
- Miller, J.** 2018. Media and mobility: Two fields, one subject. *Journal of Transport History*, 39(3): 381–397. DOI: <https://doi.org/10.1177/0022526618793396>
- Miraz, M,** et al. 2015. A review on internet of things (IoT), internet of everything (IoE) and internet of nano things (IoNT). *Internet technologies and applications (ITA)*, 219–224. Wrexham. DOI: <https://doi.org/10.1109/ITechA.2015.7317398>
- MIT Technology Review Business Report.** 2014. The Internet of Things. July/August. Available at: <https://www.technologyreview.com/business-report/the-internet-of-things/>.
- Mulder, B** and **van Zijl, I.** 1999. *Rietveld Schröder house*. New York: Princeton Architectural Press.
- Packer, J.** 2008. Mobility without mayhem: Safety, cars and citizenship. Durham: Duke University Press. DOI: <https://doi.org/10.1215/9780822388906>

- Petroski, H.** 1994. *The evolution of useful things*. New York: Vintage.
- Pew Research Center.** 2014. The internet of things will thrive by 2025. 14 March. Available at: www.pewinternet.org/2014/05/14/internet-of-things/.
- Rüegg, A.** 2014. *Le Corbusier: Furniture and interiors 1905–1965*. Zurich: Scheidegger and Spiess.
- Schulz, P** and **Cobley, P.** 2014. Preface to handbooks of communication science series. In: Lundby, K (ed.), *Mediatization of communication*, v–vii. Berlin: De Gruyter Mouton.
- Schwartz, B.** 2015. *Why we work*. New York: Simon and Schuster.
- Smith, M.** 1994. Technological determinism in American culture. In: Smith, M and Marx, L (eds.), *Does technology drive history? The dilemma of technological determinism*, 1–35. Cambridge: MIT Press.
- Smith, W** and **Lewi, H.** 2008. The magic of machines in the house. *Journal of Architecture*, 13(5): 633–660. DOI: <https://doi.org/10.1080/13602360802453376>
- Smithson, A.** 1959. Caravan – embryo ‘appliance house?’. *Architectural Design*, 29(2): 348.
- Steinmaurer, T.** 2014. Mediatized connectivity: Historical traits of telephony and theoretical considerations about a new dispositive of communication. In: Hepp, A and Krotz, F (eds.), *Mediatized worlds: Culture and society in a media age*, 91–106. London: Palgrave.
- Thorburn, D** and **Jenkins, H.** 2004. Introduction: Toward an aesthetics of transition. In: Thorburn, D and Jenkins, H (eds.), *Rethinking media change: The aesthetics of transition*, 1–16. Cambridge: MIT Press.
- Urry, J.** 2004. The ‘system’ of automobility. *Theory, Culture and Society*, 21(4/5): 25–39. DOI: <https://doi.org/10.1177/0263276404046059>
- Wajcman, J.** 2014. Pressed for time: The acceleration of life in digital capitalism. Chicago: University of Chicago Press. DOI: <https://doi.org/10.7208/chicago/9780226196503.001.0001>
- Wasik, B.** 2013. In the programmable world, all our objects will act as one. *Wired*. May 14. Available at: <http://www.wired.com/2013/05/internet-of-things-2/>.
- Winston, B.** 1998. *Media technology and society: A history from the telegraph to the internet*. London: Routledge.
- Working Party on Communication Infrastructures and Services Policy.** 2016. The internet of things: Seizing the benefits and addressing the challenges. *OECD*. Available at: [http://www.oecd.org/official-documents/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2015\)3/FINAL&docLanguage=En](http://www.oecd.org/official-documents/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2015)3/FINAL&docLanguage=En).

How to cite this article: Miller, J. 2019. Mediatization and the Internet of Things. *Cultural Science Journal*, 11(1), pp. 1–12. DOI: <https://doi.org/10.5334/csci.113>

Submitted: 03 July 2018 **Accepted:** 11 January 2019 **Published:** 30 January 2019

Copyright: © 2019 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

 *Cultural Science Journal* is a peer-reviewed open access journal published by Ubiquity Press.

OPEN ACCESS 