THEORISING WEB 3.0

ICTs in a Changing Society

Special Issue Editorial by the Editors

***Keywords**: information systems; web 2.0; web 3.0; theory*

***Abstract**:*
Purpose
In this Editorial introduction the broad phases of web development – the read-only Web 1.0, the read-write Web 2.0, and the collaborative and Internet of Things Web 3.0 – are examined for the theoretical lenses through which they have been understood and critiqued.

Design/Methodology/Approach
This is a conceptual piece, in the tradition of drawing on theorising from outside the Information Systems field, to shed light on developments in ICTs.

Findings
Along with a summary of approaches to Webs 1.0 and 2.0, the Editors contend that a more complex and post-structuralist theoretical approach to the notion of, and the phenomenon of Web 3.0, offers a more interesting and appropriate theoretical grounding for understanding its particularities.

Value
The discussion presages five further papers engaged with ICTs in a changing society, each of which similarly addresses novel theoretical understandings.

1. Introduction

It is crucial to understand how ICT innovation is associated with change in society. The complex interrelationships between societal changes and the ICTs in use by both different societies and different sectors of societies encompass both technologically deterministic shifts grounded in fundamental telecommunications infrastructure (e.g. mobile internet in developing countries) and intensely social emergence trends such as the ever-shifting patterns of social media usage. Are ICTs reflecting, driving, or simply material-virtual manifestations of the accelerated change in contemporary society?

A focus on change, on the one hand, and on theorising and understanding change, on the other, is sometimes lacking in the Information Systems field in general. *Information Technology and People* is perhaps one of the few journals that tries to engage with them. Focussed, as many of us are, on the more day-to-day issues of how ICTs are used and engaged with in the world around us, stepping back to look at the broader sweep of recent history is something of a luxury. To use an old adage, it is sometimes difficult to see the wood for the

trees, especially when the treeline is gradually shifting further up the mountain, and the mix of species is rebalancing.

The editors are therefore especially pleased to present a Special Issue focussing on six different aspects of ICTs in a Changing Society. We begin, here, with a focus on one such change in ICTs and Society – the developments in the world wide web - and follow with five high quality papers addressing other examples of the role of ICTs in societal change.

2. Webs 1, 2 and 3.0

We wish to argue, in this editorial, that the most recent change to the world wide web has expanded it beyond the (mobile)computer screen to which it has – in Web 1.0 and 2.0 – been largely confined, in such a fundamental manner that how we understand it must also change. The implication is that other examples of ICTs in societal change might also require new approaches.

When considering ICTs in a changing society, we must of course also ask – from what point of view? Although many others have written in the past about the broadly positivist bias of IS literature (Orlikowski & Baroudi 1991; Lyytinen et al 2007; Becker et al 2007; Paul 2007; Gallivan & Benbunan-Fich 2008; Galliers 2008; Paul 2008; Liu & Myers 2011), our task in this editorial is to suggest, perhaps, that the moment for a more interpretivist leaning – if it had not before – has certainly now arrived, in particular with the advent of the Internet of Things, or what some are calling Web 3.0.

Web 3.0 – a web no longer confined to browsers, or even to screens - is a web in a world of multi-device, multi-channel and multi-directional throughput of information, involving sensors and many other devices we never see. The change this represents is immense. Web 3.0 is a web in which ICTs are all the more clearly revolving around *us*, our information, our needs, and in real time: a web that some are beginning to call, 'the Stream' (Spivack 2013). We wish to consider this latest trend, Web 3.0, and to put forward a suggestion for what it might mean, and what points of view we might need to understand it. To do so, we will need first to consider what others are already saying about it, but then also to consider how Webs 1.0 and 2.0 were theorised. We argue that two 'turns' in theorising, that have taken place in the social sciences, are needed for a correct theorising of Web 3.0 – the poststructuralist turn, by which we might come to understand information systems as decentred, and more distributed than heretofore, and the complexity turn, by which we might come to understand such systems as open systems, with emergent properties that are not predictable from initial conditions.

2.1 Approaches to Web 3.0

Definitions of Web 3.0 in the literature fall into reasonably clear categories: (i) those focussed on the technologies, by and large unquestioning with regard to the social or theoretical aspects; (ii) those focussed (either positively or negatively) on the social meaning of this development; and (iii) those who question the entire notion of such theorising. In the first category, perhaps Jim Hendler's voice is paradigmatic, writing about the wealth of data flooding the

internet sphere – often described as Big Data – with a definition of Web 3.0 as "Semantic Web technologies integrated into, or powering, large-scale Web applications" (Hendler 2009). This is very different from the Internet of Things definition we believe to be a more accurate depiction of Web 3.0. Many others echo this broadly technological focus in their understanding of the phenomenon; (e.g. Lassila and Hendler 2007; Cronk 2007; Tsai et al 2009; Weiss 2010; Pattal and Zeng 2009). As with Web 2.0, beyond perhaps some use of social network theory, most papers addressing the phenomenon use little if any truly theoretical lens to approach it (Chong 2011).

By contrast, in the (smaller) second category, Fuchs et al (2010), focussing on the social political ramifications, dub Web 3.0 as a web of co-operation – arguably not that different from the depiction of Web 2.0 as the read-write web. Harris (2008), Tasner (2010), and Watson (2009) have all written about Web 3.0 in this vein. For many of these and other authors, Web 2.0 was widely seen as a "cultural construct profoundly influenced by business rhetoric" (Barasi & Treré 2012; Everitt and Mills, 2009; Fisher, 2010; Fuchs, 2010; Sandoval and Fuchs, 2010; Zeldman 2006), and Web 3.0 will be much the same.

In the (even smaller) third category, Barasi and Treré seem to concur with this definition of "a new online environment, which will integrate users' generated data to create new meaning. In contrast to Web 2.0, which is understood as being based on users' participation, Web 3.0 will be based on users' cooperation." But they nonetheless criticize the whole idea of "whether concepts such as Web 1.0, 2.0 and 3.0 can be viable and successful theoretical models for social analysis" when they are, in fact, "cultural constructs" in themselves (Barasi and Treré 2012:1285).

Our own view of the notion of Web 3.0 is that it is a useful distinction to make, in the same vein as it is useful to distinguish between primarily agricultural and primarily industrial economies, although there is always, now, a mixture of both, and the difference is more social than technological in the case of the web. Such cultural constructs, for all their historical and theoretical contingency –and regional specificity - are, in the end, our only windows, and to dismiss them is to dismiss all theory. We concur with Barasi and Treré that concepts such as Web 2.0 and 3.0 "are entrenched within an evolutionary and temporary understanding of Web developments" which "tends to give a linear progression to coexisting social and technical trends" (Barasi and Treré 2012:1269) and that this is problematic. Nonetheless "the political economy and the neo-liberal discourses of new Web applications" (Barasi and Treré 2012:1285) cannot be wished away, and the logics of capitalism in the internet age are indeed both fast-paced and sweeping large populations with them in their wake (Gill 2003; Hardt & Negri 2000). Yes, "concepts of Web 2.0 and Web 3.0 often carry assumptions of users' practices: Web 2.0 is seen as enabling user participation whilst Web 3.0 is seen as triggering users' cooperation," (Barasi and Treré 2012:1269) and this is why, in this editorial, we contend that – for information systems scholars in particular - Web 3.0 requires an alternative world-view to characterise it clearly. Like Web 2.0 in comparison to Web 1.0, it is less about

technological innovation and systems than it is about usage, and how what we have is engaged with, and incorporated into, our day-to-day activities.

Web 3.0, in our view, is more deeply complex than is thus far envisaged in the literature. Take, for example, the phenomenon a few years ago of #uksnow. Opinion leader Paul Clarke (Clarke 2009), musing one wintry morning on his blog, envisioned what could happen with crowd-sourced data as snow unexpectedly began to fall in the UK. A few hours later, keen coder and opinion watcher Ben Marsh (Marsh 2009) had created the code needed for a Twitter-GoogleMaps mashup and #uksnow was available to the blogosphere. Aggregator sites that comment upon blogs, and highlight 'trending' topics on Twitter, picked up on the existence of this mashup, and, as is the way with the blogosphere, popularity fed popularity.

Following the instructions on Ben Marsh's website, thousands of people using the micro-blogging site, Twitter, tweeted two simple pieces of information: the first three or four digits of the UK postcode of their current location, and a rough gauge of the heaviness of the snow in their location as a mark out of five, e.g. "BL7 2/5". People provided this information to the #uksnow 'hashtag' on Twitter (e.g. they tweeted "#uksnow BL7 2/5"). These tweets, as they were made across the country, created what is known as a Twitter stream. Such streams can be 'captured' with simple search tools, and either displayed or used by a web application for another purpose. The resulting stream from the remote gathering of the #uksnow hashtag provided the data to place one of five different sized snowflake pictures onto a GoogleMap of the UK, thus creating a real-time snow-map of the UK at http://www.benmarsh.co.uk/snow/. It was clear that very often people were standing outside to accurately gauge the snow, and using their mobile internet device to provide the required tweet. This is easily deduced from the prevalence of Twitpic photos whose short urls accompanied the location and snow data in the tweets (e.g. "#uksnow BL7 2/5 http://twitpic.com/ua98w43fh").

By the end of the first day Microsoft had created – albeit briefly – a clone[1]. The application lived on for several more days, as the snowfall continued, but it was in the first 36 hours that the application gained a critical mass of tweets and 'user acceptance'. The Baseball World Series was taking place simultaneously in the United States, but was briefly eclipsed in terms of Twitter traffic volume by the number of people tweeting about (and to) #uksnow. (Kreps and Fletcher 2010)

This #uksnow event is a good example what we are describing here as Web 3.0. To borrow and expand upon Orlikowski's (2006) notion of the scaffold, the physical infrastructure is readily identified as the mobile internet, encompassing the internet-enabled mobile devices themselves, the masts which broadcast and receive the signals within each cell, and the server farms which host and route the millions of digital files involved. This technological scaffold is coupled with

[1] See http://twitpic.com/1boki for a screengrab of what had been posted at http://estc.msn.com/br/intl/twitter/uk/snow.html. Ben Marsh uploaded the image of this clone helpfully annotated with the internet cliché; "FAIL"

the meteorological scaffold of snow clouds moving across the British Isles, with varying precipitation according to atmospheric conditions and topographic elevation. Added into this mix are the cultural phenomena of social networking, and the microblogging techniques for using a minimally truncated (140 character) version of the (160 character) short messaging service standard, a political situation in which salt is scarce, a media obsessed with disaster and the age-old continuous British fascination with the weather. The resulting 'mashup' in the narrow sense as a web-based application and in the wider sense as a specific event of diverse circumstances represents a situation that benefits from the understanding of Orlikowski's (2006) scaffolded sociomateriality.

Trying to understand and interpret the phenomenon, from either a techno-centric or purely human-centred perspective, would miss so much of this confluence of interrelated aspects of modern life. The scaffolding that makes #uksnow possible, moreover, displays how emergent cultural and social practices can come together in response, not just to the weather but to the possibilities newly inherent in the technological scaffolding of the mobile internet and the potential of microblogging. #uksnow is temporary – a quick script that presents itself in response to snow, and is simply forgotten and discarded once the snow has melted and the performance completed. It also represents a supremely flexible array of potential implementations for both the technologies involved and the cultural obsessions they directly cater to.

2.2 Systems

In the past, prior to the World Wide Web, computing systems were small, discrete, short, and controllable. Since the advent of ICTs, with Web 1.0, Web 2.0, and now Web 3.0, it has become important to ask: is our notion of 'system' sufficiently broad? We contend that our understanding of what a 'system' is, needs to grow, in order best to conceive what is unfolding. In suggesting this, we acknowledge two things: (i) that many other voices are suggesting the same thing as part of their own new definitions of the term 'system', e.g. Luhman's (1995) new social systems theory, Buckley's (1998) theory of society as a complex adaptive system, Barabasi's (2003) concept of scale-free networks, Wallerstein's (2004) world systems analysis, and, of course, Castells' (2000) networked society; and (ii) that many (if not all) of these authors, working as they are in a new branch of the field of sociology, may well be unfamiliar to an IS readership. Whilst it is not our intention in this editorial to provide a review or introduction to these authors' work, we do aim to introduce to an IS readership some of the theoretical underpinnings these authors rest their own ideas upon: namely, aspects of *poststructuralist* thought, and of the *complexity turn*, (Castellani & Hafferty 2009; Kreps 2015), as they relate specifically to our tentative new definition of the notion of Web 3.0. We shall look at complexity first.

2.3 Complexity

Of course, complexity and information systems are not strange bedfellows, and this paper is not the first to suggest a confluence. A Special Issue in *Information Technology and People (ITP)* on Complexity and IS was published in 2006. In their introductory paper to the ITP Special Issue, Jacucci, Hanseth and Lyytinen argue that complexity needs to be taken seriously in IS research (Jacucci et al

2006). Benbya & McKelvey's core paper of this special issue, in particular, inferred that information systems development projects are complex not only because they deal with complex technological issues, "but also because of organisational factors beyond a project team's control (Benbya & McKelvey 2006). Earlier, Van Aardt (2004), had asserted that any information system displays the characteristics of a complex adaptive system. But Van Aardt concentrated on the emergence of order as opposed to causal predetermination, and the irreversibility of a system's history and unpredictability of its future, citing the context of open source software as the best example of IS as a complex adaptive system. Benbya & McKelvey, went further, suggesting that *all* information systems act as complex adaptive systems (Benbya & McKelvey 2006). This was insightful and innovative work, but – in our opinion - fell short of its promise.

A note by Kallinikos which critiques the Benbya & McKelvey paper (Kallinikos 2006), highlights their continued embrace of a *"representational* view of information and coding as mapping of an exogenous reality that is reflected on what we call 'user requirements,' considered both as independent and the starting point for coding," (Kallinikos 2006). This, as Kallinikos contends, "bypasses one of the major, contemporary sources of instability in organisations, which is no other than the changing organisational conditions (and user requirements) created by the very development of information systems themselves. In other words, the ghost is not simply outside but inside the house as well," (Kallinikos 2006). The human parts of the information system, in short, cannot be separated from the information technology such that the IT project team can then safely proceed without them.

Grounded in Herbert Simon's seminal paper from 1962 on the 'Architecture of Complexity', cited by both Benbya & McKelvey and by Kallinikos, and the notion that complex systems have a hierarchical structure, these approaches to complexity focus upon the distinction between a *decomposable* system and a *nearly decomposable* system, in which in the latter "the interactions among the subsystems are weak, but not negligible." (Simon 1962). For Benbya & McKelvey (2006), then, it seems that the human and non-human 'subsystems' of an information system might be pried apart for the more predictable information technology project to get underway. Yet, as Agre points out, "hierarchy is a somewhat more diverse phenomenon than the universal ambitions of Simon's theory require," (Agre 2003). Indeed the ambition of Simon to subsume everything under his notion of hierarchy manages to ignore a great variety of instances where the modular approach simply does not hold, and his argument is "a product of its time…: [the] high-water mark of the classical hierarchical organization" (Agre 2003).

Self-organisation, in fact - the favoured notion of the general systems theory of the time, and championed by such complexity theorists as Prigogine (1984) and Kauffman (1995), among others - turns out to be a much better description, certainly of the reality of contemporary information systems, than *hierarchy*. As Agre asserts, "Precisely because Simon's image of hierarchy is spatial, it does not fit well with the networked world, which collapses many types of distance,"

(Agre 2003). A more durational view is required, and, as Cilliers (1998) reminds us, the intricate - and often sensitive - relationships between components, both within and between 'subsystems,' are often – for all that they may be considered 'weak' – nonetheless the most important aspects of complex systems, capable of bringing both sweeping and fundamental changes, in the manner of the famous image from chaos theory of how a single butterfly's wing could set off a tumble of unpredictable outcomes flowing around the planet (Kauffman 1995:17).

2.4 Poststructuralist thought

The core philosophical implication of such a re-imagining of systems as is implied by the insights of complexity is that the safe, clear integrity and boundaries of systems, as we have conceived them in the past, begin to dissolve. Expanding, for a moment, our understanding of systems beyond the simple computing information systems usually discussed in IS literature, one of the core insights of structuralist thought in the 20th century was that those things which, in the 19th century and before, we had placed at the centre of a broad notion of 'systems', were, in fact, not central, but determined by the systems themselves (Joseph 2012). The poststructuralist thought of the 1960s and thereafter contributed the further insight that such structure was itself all too often not even 'systematic': 'open' systems (Bertalanffy 1950), in socio-historical contexts, are self-organising and self-determining (Foucault 1997), and changing so continuously as to render any systemic definition redundant as soon as it is made.

The most basic, traditional definition of a system, of course, with which most information technologists are familiar, is that it consists of an integrated whole with a boundary, an inside, and an outside. An information system might similarly be defined as an integrated system of hardware and software used by people and organizations to create, collect and process data. Yet just as interpretivist researchers will immediately suggest that an information system is not merely 'used' by people and organizations, but that the system might be considered to include, in complicated interrelationships of change and constraint, those people and organizations, so the notion of systems as integrated wholes, with insides, outsides, and boundaries, is itself being challenged by these new complex understandings.

It is our contention that Web 3.0 is paradigmatic of both these practical, complex systems, and of the philosophical shift required to understand them. To try to grasp – as our first category of commentators, epitomised by Hendler, above, do - the nature of much of what is transpiring in Web 3.0, as a traditional 'information system,' we suggest, is, for example, like using soil science – although useful and accurate in its own right for studying soil - to try to understand agriculture as a whole. This approach is to ignore all the wealth of additional materials such as differing kinds and gradations of seeds, the attention of animals and birds, the changeability of the weather, and the whole range of different kinds of machinery put to work to manage that soil. This approach, moreover, does not even begin considering the whole historical, cultural, regional and transnational complexity of the human agricultural communities and agri-economies working those machines, sourcing and planting

those seeds, and managing that soil. So, just as the soil scientist must work with the seed scientist, the irrigation technician with the farm equipment manufacturer, and all in the end with the farmer, who must in turn work with the seed wholesaler and the vagaries of the market for his/her product, so the information technologist must understand that what has been conceived as a 'system,' amongst information technologists, is in fact something far more complex and contingent.

Theoretical tools that conceive information communication technologies (ICTs) not merely as open, but as *complex* systems, in short, must be developed, and not only open in the sense of incorporating a range of human and other factors not native to the information technology itself, but open in the sense of duration. Much of what transpires in what we categorise as Web 3.0, in short, is *emergent,* in the sense used by complexity theorists such as Kauffman (1995), for whom a *complex* whole can "exhibit collective properties, 'emergent' features that are lawful in their own right." (Kaufmann 1995: viii).

2.5 Post-systems thought

A number of authors in the Information Systems field have begun to describe ways in which such a post-'systems' theoretical approach might be carved out, most notably Claudio Ciborra (2002), but also Wanda Orlikowski (2002;2006;2008) and others. As the latter in particular points out, the notion of practices can be very useful in conceiving the more durational aspects of such events (Schatzki 2001), but this 'practice turn' remains an under-theorised, diverse collection of approaches, and needs more robust ideas to move forward. But the late information scientist Claudio Ciborra placed a concern for human existence and for our working lives at the core of any study of ICTs and their use in organisations. This work proves more fruitful for our discussion. Information systems studies moreover increasingly are turning to studying ICTs in society and in the home, outside of organisational contexts, as ICTs become ever more a part of our day-to-day lives: social media in particular epitomises the more social, domestic use of ICTs outside of organisational contexts, underscoring the importance of placing people at the core of our understanding of ICTs. Yet in order to do so, as has been the case in many other respects, Information Systems studies must continue to turn to theoretical traditions outside of the discipline to properly understand what is going on. So, in sum, to conceive of Web 3.0 as merely a new 'ICT system' is to close off a great array of different elements of what is in fact going on within this phenomenon, and thereby not to understand it at all.

3. Theorising the History of the Web

It is our contention, in this paper, that Web 3.0 - a web that includes much more than data and hypertext, and user-involvement much deeper than content provision, requires a philosophical shift amongst information systems scholars both to understand and to make use of that epithet. To highlight Web 3.0 in distinction to Web 1.0 or Web 2.0 we present a table (Table 1) that outlines what we claim as the key features of each stage in terms of their technical, social and theoretical differentiators. While the table can by no means be exhaustive we have used key indicative features that assist in both drawing close associations between these aspects within each specific 'stage' as well as revealing the

difference within specific features across 'stages'. We use the term 'stage' intentionally in this table to indicate a notion of performativity and its significance rather than to suggest a simplistic or direct technical progression. In the case of Web 3.0 particularly the stage does not coalesce around a set of technical features as its central defining rationale but rather as the scene-setting for events.

Web 1.0, a label that has only been applied retrospectively, represents the broadcast model web of static HTML pages primarily served to desktop computers, and which was primarily understood through the theoretical frameworks of Computer-mediated communications, audience research and socio-technical approaches in which users were positioned as consumers of specific content. A hallmark of Web 1.0 is a technical worldview that facilitated an approach prioritising integrated structured documents. Both the technology and the design sentiment of Web 1.0 echoed this understanding. The political agenda of research around Web 1.0 regularly drew upon specific technological and political icons but most noticeably that of the Whole Earth 'Lectronic Link and the Electronic Freedom Foundation respectively. Rheingold's "The Virtual Community" (1993) became the celebratory textbook for Web 1.0 that positioned – in a clearly technologically determinist manner - its technologies as the harbinger of digital utopia founded upon specific democratising ideals. These claims were more easily made in a social environment where - up until 1995 - there were still some forms of restrictions on the commercial use of the Web and the internet more broadly. However, the work of Rheingold was not accepted uncritically and the works of, for example, McLuhan (1964) and Fiske (1982) already laid out positions that rejected the notion of a passive audience consuming broadcast messages, or democratic liberation achieved through specific forms of media consumption. While the prevailing notion of Web 1.0 was defined through a print analogy tied to wired networks of desktop computers the opportunity and scope for critique was equally ultimately limited in its potential.

Web 2.0 is generally regarded as the user-generated content world of social-networks, blogs and a database-driven web (O'Reilley 2007) – and has been frequently described within the theoretical framework of social network analysis (e.g. Kirchoff et al 2008; Hercheui 2011), and with reference to Bourdieu's notions of field and habitus (Song 2010; Levina & Orlikowski 2009), as well as being associated with concepts of sociomateriality. The "habitus" of individuals is the source of meaning-making and social action. "As a 'system of durable and transposable dispositions which [functions] as a matrix of perceptions, appreciations, and actions', it is a mode of engagement that is 'acquired through lasting exposure to particular social conditions and conditionings" (Song 2010:256). The relationship of habitus to that of "field" is that as "habitus mediates between an individual and a given social environment, it 'operates like a spring that needs an external trigger and thus it cannot be considered in isolation from the particular social worlds or "fields" within which it evolves' (Bourdieu 1990; Song 2010). Web 2.0 is presented in this context through examples of the "users" of interactive sites whose content is primarily provided by them but is shaped by the nature and theme of the site. This framing conforms Web 2.0 to notions of a relationship between field and habitus: users of Web 2.0,

in other words, Song and Orlikowski argue, take up the 'habitus' of use determined by the 'field' of Web 2.0.

Web 3.0 is different. Regarded at the least as a more co-operative version of the read-write approach of Web 2.0, but – we argue – so deeply impacted by the Internet of Things as to be something that has outgrown the browser-on-screen location of Web 1.0 and 2.0, Web 3.0 is phenomenon in which we are no longer users but part of the applications that emerge and disappear, producers, subjects and beneficiaries of the Big Data that characterises it. Albeit perhaps *instantiated* in Web 2.0 technologies, and in the Internet of Things, Web 3.0 is larger than both, and qualitatively different. We argue that the notion of 'habitus' in the context of Web 3.0 does not capture the subtlety or fluidity of the human-nonhuman relationship expressed on this stage. Moreover, Bergson's understanding of the distinction between habit and memory, outlined in *Matter and Memory* (Bergson 1908) and how Deleuze developed this in the 1960s and later, (Deleuze 1966; 1986; 1987) whereby habit is described as something learned by rote and instantiated in the present, can be read as breaking down the distinction between habitus and field completely. The Deleuzian critique of such notions of identity formation has been explored in relation to virtual environments and social networking profiles (Kreps 2008, 2010). Bourdieu's fields are also susceptible to a Foucauldian critique in which it can be argued that discursive formations, situated in a field of knowledge/power, display a microphysics of power far more subtle and ubiquitous than the rather top-down understanding of power displayed in the notion of fields (Foucault 1995). The philosopher/sociologist debate between the ideas of Foucault and Bourdieu is not one to rehearse in any depth in this editorial. The point here, we contend, is that the notion of 'habit' requires repetition and enough time to develop – whether it is the 'working class' habit in Bourdieu's reading or the mechanistic repetition – 'learning by rote' – by which Bergson distinguishes habit from memory. In the bricolage-oriented, mangled (Pickering 1995) world of the mobile mashup, or of the twittersphere, where practices are emergent, spontaneous and flaneurial, there simply isn't enough time to develop a habit: the speed of development and emergence here makes notions of habitus redundant.

In the Web 3.0 context our analysis problematises even the notion of users and developers: the user becomes or contributes data; users are no longer confined to a Web 1.0 passivity or merely the labourers and tools for the generation of content within Web 2.0 social networking. The celebrated phenomenon of reblogging and retweeting, of being part of a crowd from which data is sourced, turns 'users' into channels – the cogs of a machine, part of the network and elements of a wider 'application.' The barriers to participation (in order to perform) have become much lower, enabling more and more 'users' to 'develop' complex mashups – with the potentially teleological argument that not many people need to write code anymore. Google App Inventor for example enables even the most casual experimenter to produce what might appear to be highly complex technical 'systems': the point is that the technologies have become largely invisible; it is the idea, the spontaneity, the linkages, that have become

paramount. We don't need to be mechanics to drive a car, and creating web applications is rapidly becoming a similar social phenomenon.

We present below, then, a table in which we try to capture the main features, hardware, software, and software development practices of Webs 1.0, 2.0, and 3.0, alongside the theoretical frameworks through which the first two have primarily been interpreted, and through which we believe the third is best approached.

Stage	Main feature	Hardware	Software	Software development	Theoretical Frameworks	
Web 1.0	Website publishing static information	Desktop computer, server, wired Internet	Static HTML pages published by web author	Integrated single document	Standard broadcast publishing 'democratised' – first big expansion of publishing since printing press *[utopian and/or restrictive technical in scope]*	CMC / socio-technical / McLuhan / Fisk [*passive audience receiving broadcast model*]
Web 2.0	Website presenting user generated content	Desktop or laptop computer, server, wired/wifi Internet	Database driven website with content uploaded by users employing HTML, CSS, PHP, Javascript	Separation of form and content of document	Social network theory *[instrumental and lacking sociological depth]*	Song – Bourdieu's field/habitus *[Bergson/Deleuze critique of notions of habit/memory]* Orlikowski – sociomateriality. *[Bourdieu habitus constrained]* discursive practice
Web 3.0	Application using crowd-sourced data, Internet of Things	Desktop or laptop computer, smartphones, server, wired/wifi/ Mobile Internet	Mashup of HTML, CSS, PHP, JavaScript, APIs, and public micro-blogging IM service	Distributed components and services mashup beyond the document model – document that hits the browser is no longer the centre-piece	Latour (1992, 2004) – actor network, seamless web of heterogeneous interconnections *[lacking understanding of power]*	BRICOLAGE / mangle / complexity Bergson /Derrida/Deleuze – material-discursive; temporal seamless flow and decentred knowledge/power bricoleur discourse - flaneur

Table 1 Comparisons of Webs 1.0, 2.0 and 3.0 technical, social and theoretical frameworks

We hope the above characterisation of Web 3.0, its development from what has gone before, and its differences, offers readers of the Special Issue a framework within which to better understand ICTs in a changing society. The five papers we have gathered together for this issue each – in their own way – addresses ICTs and societal change with a similarly broad perspective, and asks us to think differently.

8. The Special Issue

We cannot understand how society changes today – or how best to theorise it - if we do not know how it has changed - or how it was theorised - yesterday. Arthur Tatnall looks at "Computer Education and Societal Change: History of Early Courses in Computing in Universities and Schools in Victoria". Looking back over 50 years of computing, education and computer education in Victoria, Australia, Tatnall uses actor-network theory in his analysis of the effects people, organisations, processes, technologies, and a variety of human and non-human actors have had upon computing education. There is much here that those engaged in creating new curricula and technologies can learn from – the benefit of hindsight being all too rare in the fast pace of contemporary change. Over the period covered different paradigms have been dominant in both designing and explaining the development of the range of systems used, as Tatnall makes clear. There is a need for further research in how what we have described as Web 3.0 will affect the development of educational systems in both schools and universities. Education, like big ships, typically turns very slowly, but there is an imperative inherent in the current shift to Web 3.0 that new approaches will be needed soon if we are to avoid educating people in the wrong skills.

In their paper "ICT and Environmental Sustainability in a Changing Society: The View of Ecological World Systems Theory" Lennerfors, Fors and van Rooijen look into the possibilities and threats ICTs create for the environment. Although ICTs can help to decrease our ecological footprint by lessening the need for more traditional industrial solutions, they can also increase it through, for example, the need to extract rare earths, or the need for new and seemingly always bigger server farms. The problem with looking into ICTs effect on the environment, however, is that much research tends to stay at the level of a single or a few examples, while holistic approaches are missing. To fill this gap, Lennerfors *et al* offer a tour through ecological world systems theory, which they propose as a possible lens to clarify our perception of the changes ICTs cause in society.

Another way to look at the environmental issues ICTs create is offered by Patrignani and Whitehouse in their paper "Slow Tech: Bridging Computer Ethics and Business Ethics". They tie the discussion of environment even more strongly to societal change, and offer two examples in which computer ethics in a business context becomes 'slow tech'. What slow tech means, according to Patrignani and Whitehouse, is similar to the notion of 'slow food': it must be *good*, meeting the needs of the humans using and being targeted by the systems; *clean*, taking the environment into account and not polluting; and *fair*, taking into account the rights of those who produce the applications.

Both Lennerfors *et al* and Patrignani and Whitehouse look at the current stage of ICTs, offering us another way to do things: eschewing growth for growth's sake in favour of new and better ways forward through the virtual. This kind of approach promises much for the future, and how Web 3.0 could truly realise better, and environmentally sustainable goals. Taking their cue to look at things more holistically, rather than only through the lenses of traditional information systems theories, we may yet get ourselves on the right path.

Lahtiranta, Koskinen, Knaapi-Junnila and Nurminen focus on changes in society through "Sensemaking in the Personal Health Space". In their paper they tackle some of the issues arising from patients becoming more empowered in health care services that are having to respond to greater and greater need. This creates conflicts especially coupled with the need for more cost effective services. Lahtiranta *et al* offer a framework through which to clarify the situation and a case study on how to apply the framework to practice and achieve better results such as self-care.

Migrants change societies. They do it just by migrating to a new place, either by starting a new community within a community or strengthening an existing one. In the article "Is The Mobile Phone Old Wine in a New Bottle? A Polemic on Communication-Based Acculturation Research" Aricat looks at the effect of the mobile phone on this dynamic: is its effect neglible, with old traditions continuing as before, just with new tools. Or is it – at least in the case of South Asian ethnic groups migrating to Singapore seeking work – that mobile phones rather perpetuate separation than help overcome it. Societal change has many aspects, of course, and a fuller picture of the situation only opens from the article itself.

Even though both Lahtiranta *et al* as well as Aricat look at slices of the new environment, they both look at how the latest stage empowers, or fails to empower, users, through new distributed components and services. In the case of Lahtiranta *et al*, hope seems to come from the new personal health services that could enable users form a more holistic picture of themselves and their position in the world. In Aricat's more pessimistic piece even though some new possibilities open, they do not enhance the position of the migrants as could be expected.

All five articles can be seen through a lens of the development of IS design through the three stages (and beyond) of the development of ICTs, or Webs, as described above. They do indeed answer to the call's main request of helping us "understand how ICT innovation is associated with change in society". As we had far more potential specific topic areas in the call than there is space in a Special Issue, it is not surprising that some issues were not handled – and even very important ones such as Gender Diversity in ICT or ICT use in Peace and War were not touched on this time. However, we are happy to note, that within the five accepted papers most of the areas in the call (on top of the two mentioned before), Computers and Work, Ethics of Computing, History of Computing, ICT and Society, ICT and Sustainable Development, Information Technology: Misuse and The Law, Social Accountability and Computing, Social Implications of Computers in Developing Countries, and Virtuality and Society are handled to one degree or another.

We want to thank all the authors who enabled this Special Issue for their contribution, and hope that readers will take with them a better understanding of the current stage of IS, ICT and Web development and what it means to the people using them.

References:

Agre, P., (2003) Hierarchy and History in Simon's 'Architecture of Complexity', *Journal of the Learning Sciences* 12(3) http://polaris.gseis.ucla.edu/pagre/simon.html (accessed 3/8/2015).

Barabasi, AL (2003) *Linked: The New Science of Networks* Cambridge MA: Perseus Publishing

Barassi, V., and Treré, E. (2012) Does Web 3.0 come after Web 2.0? Deconstructing theoretical assumptions through practice. *New Media & Society* 14.8: 1269-1285.

Becker, J & Niehaves, B (2007) Epistemological perspectives on IS research: a framework for analysing and systematizing epistemological assumptions *Information Systems Journal* 17, 197-214

Benbya, H., & McKelvey B., (2006) Toward a complexity theory of information systems development *Information Technology and People* 19(1),12-34

Bergson, H (1908) *Matter and Memory* (ed 2004) Dover NY

Bertalanffy, L. (1950) Theory of Open Systems in Physics and Biology *Science* 111(2872) pp23-29

Bourdieu, P (1990) *In other words.* Polity Press, London

Buckley, W (1998) *Society - A Complex Adaptive System: Essays in Social Theory*. Australia: Gordon and Breach

Castellani, B & Hafferty FW (2009) *Sociology and Complexity Science* Berlin: Springer

Castells, M (2000) *The Rise of the Network Society* Oxford MA: Blackwell Publishers

Chong, E. and Xie, B. (2011). The Use of Theory in Social Studies of Web 2.0. In Proceedings of the 44th Annual Hawaii international Conference on System Sciences - Volume 03. HICSS. *IEEE Computer Society*, Washington, DC

Ciborra, C (2002) *The Labyrinths of Information: Challenging the Wisdom of Systems* Oxford University Press

Cilliers, P. (1998) *Complexity and Postmodernism* London: Routledge

Clarke, P. (2009) A flurry of #uksnow. *Honestly Real. The blog of Paul Clarke*. [WWW document] http://honestlyreal.wordpress.com/2009/02/01/a-flurry-of-uksnow/ (accessed 4th January 2011).

Cronk, H (2007) Pushing Towards Web 3.0 Organizing Tools *Social Policy* Vol 38, 1 pp27-34

Deleuze, G. (1966) *Le Bergsonisme*, Paris: Press Universitaires de France.

Deleuze, G. (1986) *Foucault*, Minneapolis: University of Minnesota Press

Deleuze, G, Guattari, F. (1987) *A thousand plateaus : capitalism and schizophrenia*, Minneapolis: University of Minnesota Press.

Derrida, J (1978) *Writing and Difference,* trans. Alan Bass. London: Routledge, pp 278-294

Everitt D and Mills S (2009) Cultural anxiety 2.0. *Media, Culture & Society* 31: 749–768.

Fisher E (2010) Contemporary technology discourse and the legitimation of capitalism. *European Journal of Social Theory* 13: 229.

Fiske, John (1982): *Introduction to Communication Studies*. London: Routledge

Foucault, M. (1995). *The Archaeology of Knowledge*. London, Routledge.

Foucault, M. (1997). *The Order of Things*. London, Routledge.

Fuchs C (2010) Social software and Web 2.0: Their sociological foundations and implications. In: Murugesan S (ed.) *Handbook of Research on Web 2.0, 3.0, and X.0: Technologies, Business, and Social Applications*, vol. II. Hershey, PA: IGI-Global, pp.764–789.

Fuchs, C., et al. (2010) Theoretical foundations of the web: cognition, communication, and co-operation. Towards an understanding of Web 1.0, 2.0, 3.0. *Future Internet* 2.1: 41-59.

Galliers, B (2008) A discipline for a stage? A Shakespearean reflection on the research plot and performance of the Information Systems field *European Journal of Information Systems* 17, 330-335

Gallivan, M & Benbunan-Fich, R (2007) Analysing IS Research Productivity: An inclusive approach to global IS scholarship *European Journal of Information Systems* 16, 36-53

Gill, S. (2003). *Power and Resistance in the New World Order.* Basingstoke: Palgrave.

Hardt, M., & Negri, A. (2000). *Empire.* London: Harvard University Press.

Harris D (2008) *Web 2. 0 Evolution into the Intelligent Web 3. 0: 100 Most Asked Questions on Transformation, Ubiquitous Connectivity, Network Computing, Open Technologies, Open Identity, Distributed Databases and Intelligent Applications*. Newstead, Australia: Emereo Publishing.

Hendler, J. (2009) Web 3.0 Emerging *Computer* 42.1 (2009): 111-113.

Hercheui, M. (2011) A literature review of virtual communities: the relevance of understanding the influence of institutions on online collectives *Information, Communication and Society* 14.1:1-23

Jacucci, E., Hanseth, O., & Lyytinen, K (2006) Taking Complexity Seriously in IS Research. 19(1),5-11

Joseph, J.E (2012) *Saussure* Oxford: Oxford University Press.

Kallinikos, J (2006) *Complexity and information systems development: A comment on Benbya and McKelvey*. http://personal.lse.ac.uk/kallinik/docs/BenbyaMckelvey.doc (accessed 3/8/2015).

Kaufmann, S. 1995. *At Home in the Universe.* Oxford: Oxford University Press.

Kirchhoff, L., Stanoevska-Slabeva, K., Nicolai, T., & Fleck, M. (2008) Using social network analysis to enhance information retrieval systems *Applications of social network analysis (ASNA) Zurich 7: 1-21*

Kreps, D (2008) 'Virtuality: Time, Space, Conciousness and a Second Life' Chapter in *Exploring Virtuality: Social, Global and Local Dimensions* Eds: Niki Panteli and Mike Chiasson (Palgrave)

Kreps, D & Fletcher, G (2010) #uksnow: webscience weather watch. *IR11* Gothenberg, Sweden

Kreps, D. (2010) My Social Networking Profile: Copy, Resemblance or Simulacrum. A Poststructuralist Interpretation of Global Information Systems, *European Journal of Information Systems* 19(1): 104-115

Kreps, D (2015) *Bergson, Complexity and Creative Emergence* London: Palgrave MacMillan

Lassila, O & Hendler, J (2007) Embracing Web 3.0 *IEEE Explore* i07 1089-7801

Latour, B. (1992) Where are the missing masses? Sociology of a few mundane artefacts, in W. Bijker and J. Law, (eds.) *Shaping Technology, Building Society*: Studies in Sociotechnical Change, Cambridge, MA: MIT Press, pp.225–258.

Latour, B. (2004) Nonhumans, in S. Harrison, S, Pile, N, Thrift, (eds.) *Patterned Ground: Entanglements of Nature and Culture*, London:Reaktion Books, pp.224–227.

Levina, N & Orlikowski, W (2009) Understanding Shifting Power Relations Within and Across Oorganizations: A Critical Genre Analysis *Academy of Management Journal* Vol. 52, No. 4, 672–703.

Liu, F and Myers, M (2011) An analysis of the AIS basket of top journals *Journal of Systems and Information Technology* 13, 1, 5-24

Luhmann, N (1995) *Social Systems* Stanford, CA. Stanford University Press.

Lyytinen, K, Baskerville, R, Iivari, J, & Te'eni, D (2007) Why the old world cannot publish? Overcoming challenges in publishing high-impact IS research. *European Journal of Information Systems*, 16, 317-326

Marsh, B. (2009) *The blog of Ben Marsh* [WWW document] http://www.benmarsh.co.uk/ (accessed 4th January 2011)

McLuhan, M.(1964): *Understanding Media*. New York: Mentor

O'Reilley, T (2007) What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software. Online at http://mpra.ub.uni-muenchen.de/4578/ *MPRA* (accessed 3/8/2015).

Orlikowski, W. and Baroudi J (1991) Studying information technology in organisations: research approaches and assumptions *Information Systems Research* 2, 1, 1-28

Orlikowski, W & Yates, J (2002) It's About Time: Temporal Structuring in Organizations. *Organisation Science* Vol 13. No 6 pp684-700

Orlikowski, W. (2006) Material knowing: the scaffolding of human knowledgeability, *European Journal of Information Systems* 15(1): 460–466

Orlikowski, W & Scott, S (2008) The Entangling of Technology and Work in Organizations *LSE Working Paper Series* 168

Pattal, M, Li, Y, & Zeng, J (2009) Web 3.0: A real personal Web! More opportunities & more threats *IEEE Third International Conference on Next Generation Mobile Applications, Services and Technologies*

Paul, R (2008) The only duty we owe to history is to rewrite it: reflections on Bob Galliers' article, 'A discipline for a stage?' *European Journal of Information Systems*, 17(6), 444-447

Paul, R (2007) Challenges to Information Systems: Time to change *European Journal of Information Systems* 16, 193-195

Pickering, A. (1995). *The Mangle of Practice: Time, Agency and Science*. Chicago, IL: University of Chicago Press.

Prigogine, I., & Stengers, I., (1984) *Order out of Chaos*. London: Flamingo

Rheingold, H (1993) *The Virtual Community Homesteading on the Electronic Frontier* Addison-Wesley Reading, MA

Sandoval M and Fuchs C (2010) Towards a critical theory of alternative media. *Telematics and Informatics Special Issue* 27(2): 141–150.

Schatzki, T, Cetina K, & Savigny, E (eds) (2001) *The Practice Turn in Contemporary Theory* Routledge, Abingdon, Oxon UK

Simon, H. (1962) The Architecture of Complexity. *Proceedings of the American Philosophical Society*. Vol. 106(6)

Song, F.W. (2010). Theorizing Web 2.0. *Information, Communication & Society*, Vol. 13, No. 2, pp. 249-275.

Spivak, N (2013) Why Cognition-as-a-Service is the next operating system battlefield *GigaOm* http://gigaom.com/2013/12/07/why-cognition-as-a-service-is-the-next-operating-system-battlefield/#! (accessed 3/8/15)

Tasner M (2010) *Marketing in the Moment: The Practical Guide to Using Web 3.0 to Reach your Customers First*. Upper Saddle River, NJ: FT Press.

Tsai, C, Lee, C, Tang, S. (2009) The web 2.0 movement: Mashups driven and web services, *WSEAS Transactions on Computers* 8(8): 1235-1244

Van Aardt, A., (2004) Open source software development as complex adaptive systems. *Proceedings of the 17th Annual Conference of the National Advisory Committee on Computing Qualifications, Christchurch, New Zealand*, 6-9 July

Wallerstein, I (2004) *World Systems Analysis* Durham and London: Duke

Watson M (2009) *Scripting Intelligence: Web 3.0 Information, Gathering and Processing* (Apress Series: Expert's Voice in Open Source). New York: Springer Publishing.

Weiss, M, Gangadharan, G. (2010) Modeling the mashup ecosystem: Structure and growth. *R and D Management* 40(1): 40-49

Zeldman, J (2006) Web 3.0 A List Apart http://www.alistapart.com/articles/web3point0 (accessed 3/8/2015).

Zimmer M (2008) The externalities of Search 2.0: The emerging privacy threats when the drive for the perfect search engine meets Web 2.0. First Monday 13(3).

Available at: http://firstmonday.org/ojs/index.php/fm/article/view/2136 (accessed 3/8/2015).