Informatics as Social Science

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Abstract

Introduction. A vast body of research has shown information science to be a social science, but information science's identity as both a social science and a non-social science has become all the more uncertain, or simply has been left to the discretion of the reader.

Method. This paper traces the specifics of information science as a social science. The paper examines the background of the social sciences in the history of academic disciplines. The paper discusses the ways in which positivism and interpretativism, the leading traditions of the social sciences, assert themselves in information science as a social science.

Conclusions. It is argued that received ideas about the social sciences impact how information science as a social science is perceived. It is also argued that information science as a social science can and should provide valid scientific explanations. This paper distinguishes social interaction as the defining feature of information science as a social science. To this end, the paper proposes global complexity not as a theory or solution, but as a metaphor for information science as a social science to address the pressing issues of our increasingly interconnected world.

Introduction

The University of Lincolnshire and Humberside's (ULH) mission is:

Literature analyses (Brier 2008; Capurro 2008a; Dahl 2007; Vega-Almeida et al. 2009) have revealed information science to have three modes: 1) engineering or technical discipline, 2) human or cognitive discipline and 3) social science discipline. However, there is little guidance as to how to differentiate between these three modes of information science. To add to the confusion, some literature considers the humanities and the social sciences to be interchangeable (Good 2000; Huang and Chang 2008; Mazlish 1998, 2001; Wallerstein et al.; Williams 2000). With collaboration in all facets of research becoming more commonplace (Bates 2010; Clarke and Walsh 2009; Cronin 2001; Cronin, Shaw and La Barre 2003, 2004; Holland 2008; Sonnenwald 2007; Wiggins and Sawyer 2010), debate on the modes of information science is fundamental if researchers in this field wish to assert the identity of their work. The present paper focuses on information science as a social science, although discussion will involve other modes as well.

Since the three selected modes of information science constitute the key argument of the present paper, they warrant explanation. To be clear, the word mode is just one choice among many, such as domains, classes, subfields, areas, dimensions, foci, threads and so on, to express the same phenomenon. One of the most graphic ways of describing information science's modes is with a football analogy. Imagine the fans of Real Madrid (Spain) and Manchester United (UK). Though one group, sharing or cheering the same mode (Real Madrid), Real Madrid's fans can vary in characteristics such as economic status, language, profession, age, sex, nationality, culture, education, race, religion and location. Real Madrid's fans can span several groups or subgroups. The fans can even disagree with or argue about Real Madrid's coach. No group or subgroup is less supportive of Real Madrid because of sex, education, nationality

and so forth. This is the same for Manchester United's fans. Note that one can very well be a fan of both teams. Even so, one does not confuse Real Madrid with Manchester United. Teams here represent the selected modes of information science. Information science as a social science aims to dispel the misconceptions or confusion spread about one mode or team at the expense of another.

More interestingly, football can be innate or natural for some fans or difficult or impractical for others. Nevertheless, the non- (football) players are no less fans of Real Madrid than the players. This means that a characteristic of a mode can be an innate or added feature. This is important to bear in mind because one can think of a characteristic as something only inherent or contingent. Experience shows characteristics to be innate (e.g., reason, justice and language.) or contingent (e.g., profession, neighbourhood, education, culture, or belongings). Terminology varies depending on the researcher - plural (groups of Real Madrid's fans) or singular (group of Real Madrid's fans) - but the process remains the same: different individuals share one team or mode. This is what happens with information science as a social science. We will discuss the characteristic(s) or specific(s) of each mode later.

This implies that the more we discuss, bicker, or fight over the definition or nature of information science, the more we are called information scientists. The more we argue about social phenomena, the more we are called adherents of information science as a social science. When it comes to categorization the first thing that comes to mind is uniformity, unity, order, or agreement. However, categorisation does not necessarily mean uniformity or agreement. In effect, we are trained to make order in our house or workplace, but we are not trained to make or live with disorder, conflict and chaos. To say the least, we live with disorder more than we wish or think. The role of information science as a social science is not to resolve or repress disagreement, but to expose the social world in its fullness or crudeness or diversity.

The reason that information science has come to be described as a social science can be found in the nature of information itself. Support for this includes Garfinkel's (2008) recently published manuscript on information theory. Written between 1949 and the early 1950s, the manuscript strongly criticises Shannon's writing and other works foundational to information concept (Cibangu 2010a) and affirms at length the social nature of information. Garfinkel advocated 'a process of refinement and a movement from pure information theory - so to speak - to a more social [emphasis mine] treatment of information' (2008: 32). Half a century after Garfinkel first formulated his ideas, at XEROX in Palo Alto (California, USA), one of the leading centres of information technologies, Brown and Duguid claimed, 'documents also help structure society, enabling social groups to form, develop and maintain a sense of shared identity' (2000: 189). Recently, information analysts Zhang and Benjamin agreed, stating 'we are concerned with information that has social purposes [emphasis mine]' (2007: 1935). Particularly interesting is Shneiderman's assertion that 'attaining universal usability will make clear the need to also pursue "universal sociability", that is, technology that supports social principles common to all communities' (2009: xxvii). These theorists, among others, are bringing the significance of information science as a social science into sharper relief.

While the idea of information as a social concept has received uncontested acceptance in information science circles, it is not uncommon for information scientists to find themselves taking a specific position concerning the social sciences and information science. For instance, information science as a social science might be conceived of as a soft, value-neutral, unscientific, or less quantitative science (Dick 1995, 1999; Nyce and Thomas 1998, 1999; Sandstrom and Sandstrom 1995, 1998, 1999). In order to consider the specifics of information science as a social science, it is essential to be clear about the paradigms or theoretical foundations of the social sciences. Hjørland's (1998a, 1998b, 2000a, 2000b, 2002a, 2002b, 2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2005c, 2005d, 2007, 2009a, 2010a), Hjørland's and Albrechtsen's (1995) and Vakkari's and Cronin's (1992) work provides an extensive account of the use and significance of paradigms in information science.

Since it does not engage the commensurability debate, this paper does not employ the word paradigm in the strictly Kuhnian sense. (For more background on the commensurability debate, see Guba and

Lincoln (2005), Kincaid (1996), Morgan (2007), Tashakkori and Teddlie (2003) and Teddlie and Tashakkori (2009)). This paper uses, primarily, the terms lines of thought or positions as alternatives to paradigm. The commensurability thesis states that paradigms are not communicable or comparable between each other (Kuhn 1996). However, as apparent below, this paper does not consider paradigms to be exclusive of one another.

The social sciences

Social science concepts have permeated our thinking with such magnitude that we simply take them for granted. More specifically, information science jargon uses many social terms, such as: people, interaction, community, diversity, management, development, leadership, social network, profile, users and literacy. In addition, the social sciences influence the way we think and act. In effect, 'many people today perceive the world differently because they have been exposed to the perspective of the social sciences' (Darity 2008: xii). We gain a more nuanced understanding of how to live in society and perform more informed research, when we take the social sciences into account, than can be achieved by non-social scientific approaches.

Information science literature has taken the social sciences into account on various fronts. For instance, authors have conducted extensive bibliometric or reference analysis of the social sciences (Glänzel and Schoepflin 1999; Hart 1983, 1984; Huang and Chang 2008; Palmer and Cragin 2008; Small 1981; T.D. Wilson 1980).

This paper is concerned with the paradigms that underpin research in the social sciences and discusses how these paradigms affect information science as a social science. As Dick noted, 'it would seem that a picture of what it is to be a social science has held the library community captive' (1995: 221). It can be argued that the way we perceive the social sciences impacts our attitude toward information science as a social science. To this end, an investigation into the social sciences' background is useful.

The social sciences' background

When the social sciences, namely sociology, anthropology, economics, psychology and political science, were first established as academic disciplines in the early 1700s to late 1800s, scholarly discussions gravitated around modernist principles, which emphasise the power of human reason to discover and dominate nature and its laws (Benton and Craib 2001; Friedman 1999; Suppe 1999).

Unlike natural order (Bacon 1960; Darwin 1967; Hobbes 1994; Hume 1999; Machiavelli 1996), social order was believed to be chaotic, selfish, indeterminate, subjective, non-testable and unprincipled. By way of illustration, Hume believed in the power of reason to decipher the laws of the universe, but lamented that the human mind had been undermined or obscured by prejudices that were the source of opinions, senses, perceptions, or impressions. At that time, science was seen, ultimately, as a discipline designed to rescue the mind from obscurity; hence, the word enlightenment was used to characterise this era of intellectual and scientific liberation. 'In this way we shall liberate the human intellect from natural and material forces' (Brier 2008: 81). From this perspective, a social science does not amount to a science.

The founding fathers of the social sciences in the 19th century would consider themselves indefatigable defenders of objectivity for social research (Comte 1970; Durkheim 1982; Marx 1955, 1977; Weber 1949). They fought to secure objectivity and scientific rigour in the social sciences. Weber expounded ideal types or universal principles to understand social order. Marx considered economics to be as rigid as physics. Durkheim perceived social order to be ruled by laws he called social facts; laws which sociology sought to study experimentally. Comte characterised sociology as positive, calling it social physics, since it followed objective or positive principles. Positive principles or positivism or operationalism teaches that the scientific method assures the acquisition of knowledge through observation and experiment, in opposition to or rejection of feelings, opinions, or metaphysics.

Like many social sciences, information science had to align itself with positivism in order to provide objective and testable knowledge (Brooks 1980a, 1980b, 1980c, 1980d; Frické 2009; Svenonius 2004). 'From the Age of Enlightenment's encyclopedists through Comte's positivism to the Vienna Circle and logical positivism, the idea of information has been interpreted in increasingly rationalistic and materialistic ways' (Brier 2008: 82). In this sense, information science as a social science can be thought of as objective and positive.

However, there has also been a strong reaction against positivism from within the social sciences, led by the stance that the social world does not have to be objective. One of the staunchest, yet often forgotten, 19th-century opponents of positivism was the German social theorist Windelband (1980). Against the positivistic preference for general laws, Windelband applied the concept of historicism to defend the importance of unique and particular cases. He asserted that historicism (to be explained below) offers value-, context- and event-based knowledge, paving the way for the social sciences to defend a subjective, value-laden and case-specific social science. Not surprisingly, information science as a social science has found itself in the middle of this intellectual battle (Brooks 1980a, 1980b, 1980c, 1980d; Dick 1995, 1999; Olaisen 1996; Webber 2003; P. Wilson 1996; T.D. Wilson 1981) as information science's dissatisfaction with positivism has increased. In fact, historicism has evolved in multiple schools, whose goals tend to cluster around anti-positivistic tenets. To illustrate, Garfinkel criticised the tendency to thingify or reify (2008: 133) information.

Two major trends have emerged in the social sciences, divided primarily between advocates of positivism and those of historicism. While the word positivism has remained comparatively constant since the 19th century, different terms have been used in lieu of historicism, depending on the nuance of the argument. These include: interpretativism (Geertz 2000; Gubrium and Holstein 2003; Holstein and Gubrium 2005; Kincaid 1996; Lincoln and Denzin 2003; Prasad 2002; Schwandt 2003, 2007; Sherratt 2006), naturalism (Hammersley and Atkinson 2007; Lincoln and Guba 1985) and constructivism (Lincoln and Denzin 2003; Teddlie and Tashakkori 2009).

Whether in response to, or in reaction against, positivism, all seek to excavate the meanings and understandings of people's actions and their worlds. Historicism insists on socio-historical developments when interpreting human actions. Naturalism aims to understand human actions not in experimental or manipulated settings, but in their natural state (not to be confused with, at least as understood in this article, naturism, which proposes that things be known according to the laws of nature). Constructivism professes that meaning is individually and collectively constructed. For consistency, this paper uses the word interpretativism. It should be noted that although both positions have diversified tremendously in the last few decades, discussions of ensuing positions have remained dependent on, or conducive to, the original definitions of the terms positivism and interpretativism. Discussion as to the role of the social sciences based on positivism and interpretativism is far from settled (Schwandt 2003).

However, it is beyond the goal of the present essay to settle the dispute. To varying degrees, these two positions have asserted themselves in information science literature (Bates 2005, 2006, 2008; Burke 2007; Capurro 2008b; Cibangu 2010b; Cornelius 1996, 2002; hjorland 2000b, 2002a, 2002b, 2003a, 2003b, 2003c, 2004a, 2004b, 2005a, 2005b, 2005c, 2005d, 2009b, 2010b; Picard and Dixon 2004; Vakkari and Cronin 1992; Williamson 2002). Proponents of these positions are believed to provide different types of scientific explanation.

Scientific explanation for information science as a social science

Since Windelband's (1980) proposed division between nomothetic and idiographic knowledge, in his inaugural speech on May 1, 1894 as the then President of the University of Strasbourg, the social sciences have been faced with one of the most embattled notions in the history of academia: the notion that social science discourse (and therefore information science as a social science) cannot yield scientific explanation or objective knowledge of social phenomena. It is generally believed that nomothetic knowledge seeks to explain objective phenomena quantitatively, whereas idiographic

knowledge describes subjective phenomena qualitatively. By extension, scientific explanation is said to be governed by empirical and objective procedures, while the social sciences or human and social worlds belong to the idiographic domain. According to this argument, information science as a social science is idiographic. Upon thorough analysis, however, this widespread interpretation of the nomothetic and idiographic binary represents a significant distortion of the Windelbandian thought.

At no point, for instance, did Windelband mention any opposition of science to anti-science or quantitative to qualitative; rather, he explained,

In their quest for knowledge of reality, the empirical sciences either seek the general in the form of the law of nature or the particular in the form of the historically defined structure. On the one hand, they are concerned with the form which invariably remains constant. On the other hand, they are concerned with the unique, imminently defined content of the real event. The former disciplines are nomological sciences. The latter disciplines are sciences of process or sciences of the event. If I may be permitted to introduce some new technical terms, scientific thought is nomothetic in the former case and idiographic in the latter case. (1980: 175)

Here and elsewhere, Windelband referred to empirical sciences, implying that information science as a social science can very well be empirical and scientific, offering both the nomothetic and idiographic types of knowledge. In greater detail, Windelband remarked,

We should also bear in mind that this methodological dichotomy classifies only modes of investigation, not the contents of knowledge itself. It is possible - and it is in fact the case - that the same subjects can be the object of both a nomothetic and an idiographic investigation. This is related to the fact that, in a certain respect, the distinction between the invariable and the unique is relative. (1980: 174-175)

Here we can infer that the content of scientific knowledge spans both physical and social worlds. Indeed, 'scientists are able to develop ever more valid understanding of the social and cultural world' (Sandstrom and Sandstrom 1995: 191). Windelband's remarks can help protect information science as a social science from a reductionist form of social science identity. Clearly, both nomothetic and idiographic domains can be just as scientific and unscientific, depending on whether or not the rules of empirical procedures are respected.

For better or worse, however, the nomothetic/idiographic distinction has left an immense impact on the social sciences, with dichotomies such as quantitative and qualitative, objective and subjective, positive and interpretative, hard and soft, physical and metaphysical, deductive and inductive, etic and emic, scientific and unscientific, to name but a few. For space constraints, only the quantitative and qualitative dichotomy will be examined here.

Quantitative and qualitative methods for information science as a social science

In the aftermath of the Windelbandian duality, social science methods have clustered around two methodologies: the quantitative and the qualitative. Because of the magnitude of challenges and mistakes involved, it is helpful to address this division at the outset. Traditionally, quantitative research concerns itself with large sample, randomly selected, whereas qualitative research deals with small samples purposefully selected (Babbie 2010; Creswell 2008; Crotty 1998; Jessor et al. 1996; Patton 2002; Phillimore and Goodson 2004; Picard 2007; Teddlie and Tashakkori 2009; Zhang and Wildemuth 2009). In other words, the aim of quantitative research is to establish verifiable and predictable truths, whereas qualitative research allows in-depth analysis of specific cases. Upon examination, however, this divide between research methods echoes the divide between positivism and historicism, raising questions for the scientist. While qualitative analysis can very well provide in-depth analysis of facts and quantitative research is able to yield valid general laws (George and Bennett 2005), researchers in information science as a social science can elect which method best matches the research questions investigated.

It is increasingly acknowledged that 'neither qualitative nor quantitative analysts have a ready-made formula for producing good research' (Brady et al. 2004: 9). Neither method can wholly address the

always-fleeting complexity of reality. 'One version of conventional wisdom holds that achieving analytic rigor is more difficult in qualitative than in quantitative research. Yet in quantitative research', Brady et al. stated, 'making valid inferences about complex political processes on the basis of observational data is likewise extremely difficult. There are no quick and easy recipes for either qualitative or quantitative analysis' (2004: 10). Good researchers in information science as a social science should be aware of the inherent limitations of the methods used.

Quantitative research is characterised by several limitations (Babbie 2010; Creswell 2008; Patton 2002; Teddlie and Tashakkori 2009; Wildemuth 2009; Wildemuth and Cao 2009a), of which this paper considers three (I have chosen to discuss the following three limitations as they pertain to the subject matter): (1) lack of context and related specificities, giving figures abstracted from a sample and applicable or generalizable to the whole population, (2) measurability as the condition for truth and knowledge acquisition, considering non-measurable events as non-scientific or less generalizable, and (3) the bigger-the-truer belief, using big (generalizable) figures or majority as the criterion for validity or truth.

However, information stands to be one of the most complex and fleeting realities of human existence. For this reason, information remains embedded in everyday context, resists measurability and determines unique cases. For example, there is more to learn with information on and within a specific context or place of drug use than mere figures about drug use in general. Equally, one cannot measure or capture the universe, yet the universe is true. Finally, experience shows that small details behind societies' or individuals' big numbers reveal more information than big numbers can tell. Disability is a typical example. From in-depth observation (qualitative research) of a disabled child, for example, one can derive more information about the medical care system of that child's society than official statistics can (quantitative research).

Qualitative research too displays several limitations (Babbie 2010; Creswell 2008; Patton 2002; Picard 2007; Teddlie and Tashakkori 2009; Wildemuth and Cao 2009b; Zhang and Wildemuth 2009), of which this paper considers three that relate to information topic: (1) lack of absolute truths, leaving all knowledge dependent on and relevant to context, (2) overemphasis of individuality, making individuals the centre or criterion of truth acquisition, and (3) data about society that is difficult to control or account for. To explain, information resists relativism, individualism, and unaccountability.

A good example is human dignity that is not and should not be, a context-dependent, but universally applicable and accountable value. One needs to be able to count or measure the number of times the marginalised or defenseless have been trodden down. The question arises as to why and how to integrate both interpretativist and positivist analysis. While the goal of this paper is not to dictate formulas, it is important to mention that integration of perspectives depends on selected research questions and considered methods. Teddlie and Tashakkori (2009), Tashakkori and Teddlie (2003) and Creswell (2009) supplied us with some of the fullest accounts of integrated method. Information as a subject matter is so vast and fleeting a topic that we seek the fullest view of investigated questions as much as we can. In a fascinating study, Fidel (2008) examined emerging work of integrated method in information science. At this level, Lincoln's and Denzin's remarks are helpful,

Many social scientists [including authors of information science as a social science] now recognize that no picture is ever complete – that we need to employ many perspectives, hear many voices, before we can achieve deep understandings of social phenomena... The modernist dream of a grand or master narrative is now a dead project. (Lincoln and Denzin 2003: 1055)

How do we do that? Imagine that a person decides to prepare a meal with a best friend. There are myriad ways the person can collaborate with or involve the friend in cooking. For example, the friend can cook first and the person after, they could both cook together, or they can identify items for each to cook separately at one's convenience. Regardless of the approach, the whole point is that the person seeks and values the friend's contribution in her cooking and each always and graciously acknowledging the strengths and limitations of the other. The act of preparing the meal thus becomes an inclusive or

integrated work. It would be unproductive for the person to simply consider the friend as worthless or less worthy than her. This is what happens with traditional methodologies wherein qualitative analysis is widely believed to be less scientific or less worthy than quantitative work. Despite this, social phenomena are too complex to be reduced to one method. The easiest and most convincing way to be inclusive in information science as a social science, in my view, is to take side with the vulnerable or weak of society and assess how far selected methods cater to or account for the weak. To give one example, it would be a mistake to investigate the European Union's medical care (European Commission 2009) information systems only in terms of measureable or accountable figures, leaving aside the situated (very often inhumane) experiences of the uninsured immigrants.

One needs to accommodate both research traditions in order to attempt a reconciliation between the two, rather than continued partisanship. In fact, despite persistent calls for integrated methodologies (Creswell 2009; Howe 1988, 1998, 2003, 2004, 2005, 2009; George and Bennett 2005; King et al. 1994; Sandstrom and Sandstrom 1995, 1998, 1999; Tashakkori and Teddlie 2003; Teddlie and Tashakkori 2009), division has intensified. Sandstrom and Sandstrom observed,

Opposing the term [qualitative] to quantitative research or positivist science is seriously to distort both its potential and practice. The phrase qualitative research has been used so loosely in LIS [library and information science] publications that it has come to represent virtually any method lacking the rigor of a random-sample survey or producing data not destined for inferential statistical analysis. (1995: 181)
As suggested earlier, information science as a social science can be utterly empirical and rigorous, using qualitative and/or quantitative analysis.

Some of the most deeply ingrained perceptions surrounding quantitative and qualitative opposition concern certainty and generalization. 'Despite the fact that science, like the social sciences, enshrines uncertainty at its core, the hierarchical relation between science and the social sciences that pertains in the academy', Moore remarked, 'still holds to the view that science is more certain than social science, that its truths are more verifiable and more profound. It is indeed strange that so many intellectuals should hold to this view' (2002: 533). Moreover, Kerr described the social sciences as 'soft sciences' (2008: 614). These statements showcase the diminished status accorded to the social sciences. In other instances, positivism and related methods are discredited (Dick 1995, 1999; Sandstrom and Sandstrom 1995). Information science as a social science needs to avoid this reductionism. Neither positivism nor historicism can fully comprise science; rather each is a partial means of understanding.

Some critics believe that the social sciences are unfit for generalization, or that social generalization is a weak genre of generalization (Kincaid 1996; Smith 2003). They also assume that causation is not a scientific fashion of presenting reality. Needless to say, valid generalizations can very well be obtained about the social world and causality can and should be encouraged. Extensive precautions and skills needed for generalization concerning data based on small samples are well-documented (Brady and Collier 2004; Eisenhardt 1989; George and Bennett 2005; Kincaid 1996; King et al. 1994; Reiss 2007, 2009; Yin 2009). These include the practices of undertaking the number of observations, testing and developing theories, identifying selection bias, degrees of freedom, counterfactual analysis, process tracing and inference as well as using causation to explain social facts. It becomes obvious that information science as a social science can provide valid generalizations and employ causal inference with quantitative and/or qualitative research.

There has also been a tendency to expect that the social sciences would become one discipline with one method, easily predictable, testable and verifiable (Beam 1983; Lenski 1994; Van Langenhove 2000). In contrast, one of the pivotal exponents of the social sciences, Schumpeter stipulated,

...there is, in principle, no social science - only individual social sciences. And these social sciences in no way form a unified structure or an organic whole. They each arose in response to some particular need. They are in no way coordinated with one another. The sum of all scholarship does not form an organic whole. (Schumpeter 2003: 58)

No single science has assumed a monolithic hold on discovery or truth, much less a group of sciences. Information science as a social science constitutes a pluralistic forum of methods and paradigms to ensure diverse and evolving positions. With the rapid spread of information brought on by advances in digital technologies, the world is increasingly manifesting its diversity.

Digital technologies and information science as a social science

In our current digital era, a discourse in information science as a social science without a word on digital technologies, more precisely information and communication technologies, to use a more information-specific concept, would be incomplete. Positivism and interpretativism have engendered distinct lines of thought to articulate these technologies and I have synthesised these lines of thought into four categories: 1) technological determinism, 2) human determinism, 3) social determinism and 4) multidimensionality.

First, technological determinism, largely an off-spring of positivism, perceives technology to be the motor of social progress. Although not without some disagreement, technological determinism has had spectacular success around the world with the Green Revolution (Borlaug 2000a, 2000b; Perkins 1997; Smale et al. 2008). The Green Revolution has and still does propel the dissemination and use of new technologies to improve agricultural productivity in poor nations. For our discussion of digital technologies, one of the typical examples of technological determinism is the Negroponte (1995) project. The project advocates worldwide dissemination of computers to each child to fight poverty. To be specific, as Yoshimi observed,

...it is generally assumed that information technology alone can fundamentally alter society. The exact nature of the technology cited as the explanatory variable has changed with the times. At one time it was television; later it was the main-frame computer, then it was the computer network and most recently mobile media. (Yoshimi 2006: 276)

Information science has used a technological determinism perspective to build and justify information systems. By this logic, the goal of information science as a social science is to modernise or upgrade society.

Leading proponents of this line of thought are the economist Schumpeter (1939a, 1939b, 1949),who perceived technology to have the power of innovation and Marx, with the idea that 'the hand-mill gives you society with the feudal lord; the steam-mill, society with the industrial capitalist' (1955: 95). This line of thought rests on modernist beliefs. Despite criticism, 'the idea that "new information technology" will bring about a more advanced "information society" has remained constant' (Yoshimi 2006: 276). To avoid reductionism, information science as a social science needs to articulate informed positions about technological determinism.

The second line of thought, human determinism, finds shortcomings in technological determinism by championing the centrality of human agency. Marx's (1959) 1844 Manuscript represents one of the most compelling sources on human determinism. Human determinism constitutes one of the most pervasive schools of thought in information science, with foci that encompass a host of topics: ethics, policy, information seeking, sense making, economic development and others. According to this position, the goal of information science as a social science is to infuse society with greater human awareness or agency. As Case noted,

It was not until the 1970s that investigations begin to branch out beyond the focus on formal channels and task-oriented needs. The emphasis shifted away from the structured "information system" toward the person as a finder, creator and user [emphasis mine] of information. (2007: 6)

This does not imply that one only values and acknowledges human power. As Denzin and Lincoln put it, 'there is a shifting center to the project: the avowed humanistic and social justice commitment to study the social world from the perspective of the interacting individual ' [emphasis mine] (Denzin and Lincoln 2005: xvi). There are certainly other forces involved, including technology, but the human potential to affect information science as a social science remains the focal point.

The third line of thought, social determinism, regards society and its structures as the driving force of reality. Depending on the theorist, social determinism has emphasised social structures under several guises. For example, Foucault (2002) perceived discourse as social practices or structures that shape individuals and their worldviews. These structures vary in several respects. Lincoln and Guba (2003) posited society as the milieu wherein meaning is locally and collectively constructed by individuals. Marx (1977) asserted that the social modes of production shape individuals and their values. Parsons (1937, 1951) regarded society as an organic system acting upon and shaping individuals. Distinctive of social determinism,

is rejection of the view that the locus of knowledge is in the individual; learning and understanding are regarded as inherently social; and cultural activities and tools (ranging from symbol systems to artifacts to language) are regarded as integral to conceptual development' (Palincsar 1998: 348).
Here, one can see that social determinism proves to be the converse of human determinism. This is just a sketch; a more sustained discussion of the authors cited above and the related ideas, is beyond the scope of this paper. Following the position of social determinism, the goal of information science as a social science is to assert social forces upon individuals and their products.

The fourth and last line of thought, which is defended in this paper, bears on multidimensionality, in the hopes of allowing a broader approach to social reality and information systems. As the German scholar Küng wrote,

...scientific research is… not to be identified with one-sidedness one dimensionality… we must reckon a priori with the multidimensionality and multilevel character of reality; the real can indisputably occur in very different ways. (Küng 2007: 33)
This paper argues for multidimensionality from the perspective of global complexity theory, of which Urry (2003, 2005a, 2005b) constituted the most vocal champion. As apparent below, for information science as a social science, global complexity theory entails a fuller vision of social reality. For the sake of clarity, this section begins with a cursory overview of complexity theory to take us into the consequences of the Urryan complexity.

Although at least half a century old, only in the past few decades has complexity theory begun to enjoy systematic attention in the humanities and social sciences. In the field of information science, for example, Tredinnick (2009) investigated the contributions of complexity theory to Web discourse. Moreover, literature acknowledges that 'the notion of complexity is itself complex. There is no clearly articulated, let alone universally accepted, definition… Complexity is seen differently between fields and also carries different connotations even within the same field' (Hutzschenreuter and Guenther 2009: 374).

Hence, there are several ways in which authors engage complexity theory. One of the easiest ways to engage with it in information science is to refer to classic information theory (Shannon 1948; Shannon and Weaver 1949). Information theory's central tenet revolves around the linear sender-receiver relation. Shannon's information theory is a milestone for the concept of information (Brier 2008; Cornelius 2002; Geoghegan 2008; Kline 2006; Verdú 1998) and lends itself well as the platform from which complexity theorists are able to furbish their stances (Arthur et al. 1997; Brock 2001; Chettiparamb 2006; Colander 2000; Louçã 2001a, 2001b; Walby 2006, 2007, 2009; Werndl 2009). Shannon analysed information to measure and predict the effect or impact of the message in the cause-effect or sender-receiver channel. Thus, the goal was to prevent disturbance, turbulence, disorder, noise, chaos, or instability in order to maximise the impact of information for the receiver (Cover and Thomas 2006; Verdú 1998; Verdú and McLaughlin 2000). In essence, the lower the disorder, chaos, or noise in the channel, the higher the message, certainty, or equilibrium.

In contrast, complexity theory (Baumgartner 2009; Bawden 2007; Brattico 2008; Cambel 1992; Cannon and St. John 2007; Hutzschenreuter and Guenther 2009; Mason 2008; Niessen et al. 2008; Tredinnick

2009) preys on nonlinearity, chaos, turbulence, turmoil, instability, non-equilibrium, unpredictability and uncertainty. The sender-receiver conduit ceases to be the determinant or cause of information effect; any small event from anywhere can and should make not an impact, but rather waves and large-scale changes. Complexity theory offers uncontrolled, far-from-equilibrium and non-stable dynamics (Byrne 1998; Dann and Barclay 2006; Law and Urry 2004 ; Tredinnick 2009; Urry 2005a, 2005b; Walby 2006, 2007, 2009; Waldrop 1992, 1999; Woehle 2007). Information science as a social science is not a descriptor and predictor of sender-receiver effects, but a vector of and/or pointer to emerging dynamics and resultant interactions. At the global level, this holds much greater consequences.

Three key concepts are central to Urry's complexity analysis (2003, 2005a, 2005b). First, Urry repositioned complexity at the global level. Complexity 'involves a sense of openness and multiple futures … in relationships, households and persons across huge distances in time and space' (Urry 2005a: 3). In this sense, information science as a social science bridges the global or general and the local or particular and thus reconciles the binaries discussed earlier such as positivism vs. interpretativism and quantitative vs. qualitative. Positivism and interpretativism fuse and converge into unpredictable, emerging and self-organizing global dynamics. The dynamics are such that they cannot be approached in isolation or non-interaction. We will discuss interaction in the specifics of information science as a social science in a moment; for now, note that information science as a social science requires us to interact both particularly and generally.

Secondly, Urry meticulously argued for a complexity turn and not a theory to the fullest. 'From then [the late 1990s] on we can say the complexity turn takes off within the social and cultural sciences… Overall, complexity approaches both signify and enhance a new "structure of feeling"' (Urry 2005a: 2-3). Thorough examination of the Urryan work reveals a constantly pluralistic usage of complexities and complexity theories. Information science as a social science does not impose a complexity theory, but proposes a feeling of structure or network or a metaphor to attend to the chaos embedded in the multilevel character of the social world.

Finally, Urry considered the self-organizing, not finalized, dynamics of global complexity: 'Global systems are characterised by unpredictability and irreversibility; they lack finalized 'equilibrium' or 'order' (Urry 2005b: 249). One of the biggest limitations of Shannon's theory is to think of information as an impact, effect, or series of bits. For information science as a social science, information is not a simple intellectual construct or finalized impact predictable and demonstrable, but a continuum of self-adapting dynamics and forces.

That does not mean that one should not attempt to measure impacts, but that information science as a social science supplies us with myriad un-finalized identities, voices, forces, or waves. Reality is and should be, in perpetual and un-disturbed turmoil and noise. We need noise in order to hear the multitudinous voices of the silenced, the muted and the repressed. As shown earlier, the naturalist's or interpretativist's role is to un-disturb reality. Information science as a social science needs turmoil in order to investigate the ways in which the captives, or the hurting, can get out. Information without noise, turmoil, disturbance, or chaos remains manipulated, experimental, linear, unidimensional, unnatural and repressive. Information science as a social science values noise or chaos to enrich information order with both the particular and the general. However, to be clear, 'chaos is not complete anarchic randomness but there is an "orderly disorder" present within such systems' (Urry 2005a: 8). Information science as a social science searches for the substance or meaning of chaos: given its multidimensionality theory of information, not one voice is a bother or nuisance, but rather the very feature or cachet of the vast imbroglio of our world. Now that the lines of thought of the social sciences and information and communication technologies have shown us the insights and arguments of information science as a social science, let us turn to the specifics.

The specifics of information science as a social science

This section examines information science identity, or more precisely, what makes information science both social and non-social among sciences. There is no unified or fixed list of scientific disciplines.

Nonetheless, as sciences progress, there are some generally accepted assumptions that govern scientific disciplines, one of which and perhaps the most central to our concerns, is that not only have scientific principles and methods come to be germane to all disciplines, but misconceptions around them have been diminishing. The following debate discusses information science's three modes (see Dahl 2007: 2023; Furner 2004: 427-428; Taylor 1991: 218; Summers et al. 1999: 1155): 1) technical or physical science mode, 2) human science mode and 3) social science mode.

Technical or physical mode

'Information science (computer science)… [has built] on paradigms in the tradition of the experimental, mathematical and engineering disciplines' (Wegner 1983: 163). One of the most distinctive features of engineering, physical sciences and natural sciences derives from the fact that mathematics serves as the vehicle to best communicate parameters and models, as well as to formalise solutions (Dorf 2004; Jódar et al. 2008; Quarteroni 2009). This is because engineers and physical and natural scientists employ numbers to identify the relationships among phenomena. Biology or life sciences concern themselves with the processes of organic life, with an emphasis on reproduction or growth, however, they too consistently use mathematical models in the prediction and explanation of observed natural phenomena (Altman-Price and Mevarech 2009; Jódar et al. 2008; Kaundal and Raghava 2009; Quarteroni 2009). Although they are concerned with life processes, life sciences (e.g., agronomy, biology and pathology) greatly employ mathematical model to explain natural phenomena, a model which is central to or characteristic of physical sciences. Hammersley and Atkinson explained,

the methodological model… is physical science, conceived in terms of the logic of the experiment [emphasis in original] where quantitatively measured variables are manipulated in order to identify the relationships among them… Events are explained 'in deductive fashion by appeal to universal laws, holding across all relevant (Hammersley and Atkinson 2007: 5)

This way of thinking rekindles the positivist principles discussed earlier. For example, in the area of knowledge representation or organization, Svenonius (2004) showed the potential of positivistic techniques to improve indexing effectiveness.

Engineering, in turn, is characterised by the invention and/or discovery of artifacts or products (Dorf 2004). Another distinctive feature of engineering, natural sciences and cognate sciences is that they draw, to a large extent, on physics (Koponen 2009; Nagel 1961). Atomic theory is a good example that, despite its chemical orientation, applies physical properties of electrons and protons, all of which are expressed by mathematical modelling. Mathematical modelling can be employed in the observation, prediction and interpretation of information uses and needs, which means that information science can be viewed as a technical or physical science. When the above research focus, that is, the discovery or manipulation of artifacts, natural phenomena, or organic life, is central to information science work, information science falls under the technical mode. As Arms emphasised, 'information science is a quantitative discipline. We will be failing our students if we allowed them to graduate without good computing skills and a solid mathematical background' (2005: 84). Another case in point for research conducted under the technical mode of information science concerns the design of interactive or assistive devices for impaired users (Wobbrock and Gajos 2008; Wobbrock and Myers 2008; Wobbrock et al. 2008). This research aims for improved (technical) usability of information artifacts. Understood this way, as I argue below, information science is not an information science as a social science, although it might carry some social aspects.

Human science mode

'Though significantly social scientific in character, our field has a strong humanities tradition and not surprisingly the new thinking rapidly found adherents within those ranks' (Cronin 2008: 468). The humanities are also considered by some to be interchangeable with the social sciences (Good 2000; Huang and Chang 2008; Mazlish 1998, 2001; Wallerstein et al.1996; Williams 2000); however, here the discussion focuses on the difference between the humanities and social sciences. Human sciences have, to a great extent, gained an established status owing to Dilthey (1928, 1973, 1988) and Husserl (1977). Irrespective of some disagreement here and there between them, Dilthey and Husserl shared

common threads in their work. More specifically, Dilthey and Husserl understood human sciences to be studies of inner life, mind, brain, inner experience, sovereign will, abstract reflection, emotionality and the like. This is in opposition to natural or physical sciences, which deal with experiences of external phenomena. In this respect, both human and natural sciences deal with experience. The difference is that experience in human sciences passes through inner experience, whereas in natural sciences, experience is that of cause and effect or objective facts.

The human mode or the world of inner experience is so vast that not one author or version of an author can fully account for it. It includes myriad layers: mental states, rationality, irrationality, discourse, behaviour, emotion, affect, pain, dreams, feelings, memory, heart, mind, among others. For example, just because a study focuses on the mental states of a child born with a brain defect does not make the study or the child less human. Dilthey (1928, 1973, 1988) is mentioned here simply for historical purposes since he contributed to human sciences as an established discipline. There are several commonly forgotten inner world authors such as Buddha (Armstrong 2001), who argued for inner freedom and happiness, Confucius (Chin 2007), who argued for human goodness in the world, the Ancient Egyptian Eloquent Peasant (Parkinson 1991), who saw speech as a human value and the concept of Greek eudemonia (human flourishing) (Aristotle 1962). This is just a fraction of the complex world of human inner experience. Husserl's (1977) phenomenology, just like Confucius' humanism (Chin 2007), shows our in-the-world status to stand on or connect with the human and social aspects at the same time (one can even add the technological aspect). This is something to encourage since it provides more space, work and layers or inclusivity than it reduces. Needless to say that information behaviour passes through or points to inner experience. A powerful example is information ethics.

In sum, human sciences focus on emotional, speculative, intellectual, mental, rational, or irrational dimensions of lived experience. It can be said that in capturing one or more aspects of inner experience as the end-product of its research, information science becomes a human science. One of the current overarching themes engage information behaviour (Fisher and Julien 2009; Johnson 2009; Nahl and Bilal 2007; Schwieder 2010; Spink et al. 2008; T.D. Wilson 2010) or philosophical reflections made about and/or within information science (Floridi 2008, 2009; Frohman 2004; Furner 2004, 2010). Of course, this does not make information science a social science. Also, as previously remarked, this does not mean that work done in the cognitive sciences or information behaviour subfields, for example, is equal to that of philosophy or any other humanities discipline (although in some instances it can be) but that it shares a focus on the inner, reflective, or brain-centred (human) mode or experience. As Furner observed (albeit with a slightly different terminology), 'the quantity of [information science] work that may be classed under the third heading [humanities] is small' (2004: 427). The human mode continues to gain momentum. Hjørland concurred, 'I do not believe that we can do a good job in information science if we ignore epistemology and the philosophy of science' (2010b: 1078). However, just like that of natural world, human experience does not, in and by itself, lead to or equate with science; this is achieved by following research procedures properly.

Social science mode

The third and last mode of information science encompasses the social sciences. To say the very least,

Large-scale social theorizing has enabled the field [information science] to better understand the complex interplay of technical factors and social forces that together drive developments in ICTs [information and communication technologies] and also to avoid the pitfalls of parochialism and reductionism… Suffice it to say, "the social" has long been part of our field, either implicitly or explicitly.' (Cronin 2008: 467)

With recent global challenges, interest in addressing social topics has proliferated across information science. And the increasing plasticity (UNESCO 2009) of our interactions and identities makes social research an ever-more important tool of wisdom. Information science as a social science becomes, indisputably, a required subject of the field.

As Hjørland pointed out, 'there is today a trend toward a social paradigm for information science' (2010a: 217). A little more than three decades earlier, information science literature displays an articulated support for the social science perspective. Roberts noted, 'although no agreed definition of the scope of this science [information science] has emerged most contributors to the debate accept the social significance of information concepts and phenomena and, hence, that information science is a social discipline' (Roberts 1976: 249). To gain a better understanding of information science as a social science's specifics, the meaning of the word social needs to be clarified. Danziger (2000) and Putnam (2000) supplied us with some of the most informative definitions of the concept. In differentiating social capital from other forms of capital, Putnam argued,

Whereas physical capital refers to physical objects and human capital refers to properties of individuals, social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them… The difference is that "social capital" calls attention to the fact that civic virtue is most powerful when embedded in a dense network of reciprocal and social relations. A society of many virtuous but isolated individuals is not necessarily rich in social capital. (2000: 19)

What constitutes and justifies the word social is not just the word itself, but rather the exchange, connection, network,trade-off, reciprocation or 'communicative net-work' [emphasis mine] (Garfinkel 2008: 161) between two or more individuals, engaging in small- or large-scale groups. In truth, social interaction defines, or more exactly, establishes the building block of what makes social behaviour, social phenomena, a social world, or a social unit. In other words, 'social sciences sought to discover laws governing the social realm - in effect laws that allow the predictability of human interaction' (Kerr 2008: 614). Kerr's point can certainly be extended to include information science as a social science. Information science as a social science takes us to the roots of our sociality or interconnectedness with one another; more specifically, information science as a social science locates us within the global or general and the local or particular. Without interaction, the social or global systems remain inactive or manipulative. As way of illustration, a few practical examples will be helpful.

Suppose we take a six-year old Vietnamese child away from its parents to assess how the child's left eye processes information on a Facebook homepage. Such a study is not within the realm of the social sciences. However, if we try to see how the same child responds to or interacts with the information provided by the parents, this is social science research conducted in a small-scale group. If we examined how the same child interacted with the information given by other six-year-old children from different countries around the world, that would constitute social science in a large-scale setting. In either case, we can apply any theoretical frameworks already discussed to explain the child's social behaviour, or simply to explain the social unit within which the child has performed. We can do that empirically, by using qualitative and/or quantitative methods, or theoretically, by approaching literature and deriving the gaps and insufficiencies involved. Information science as a social science might appeal to a theorist or discipline whose ideas or teachings aim for social interaction. A typical example of information science as a social science is the recent stream of research in librarianship, the overarching goal of which has been to engage in community building and community analysis (Casey and Savastinuk 2007; Diaz and Fields 2007). Community constitutes one manifestation of human interaction. Most importantly, online social networks are becoming a tremendous source of study for information science as a social science.

A crucial question arises as to the power and legitimacy to decide the specifics of information science as a social science: this is where postmodernism represents a much needed voice. As apparent in several works (Frohman 1994; Lincoln and Denzin 2003; Wersig 1992), postmodernist views bring into question essential or foundational powers and identities. Information science as a social science needs to self-criticise or self-appraise to deconstruct the identities hidden behind its specifics. The benefit is seeing the hidden authorities and identities that undermine or govern social interaction. To do this, one needs to hear and sing as many voices of the social world as possible. The job of information science as a social science is allowing or augmenting, not limiting or reducing, the voices of the social world. The easiest way to allow voices is not to reject them. As claimed earlier, the goal is not to create a world of

those who agree about social interaction, though it can happen, but those who deal with or feed on the social world, or those who sing the social world voice, so to speak. Alongside postmodernist voices are those such as feminism, critical theory, pragmatism and constructivism. Information science as a social science seeks to describe, exhibit, or unveil and not prescribe or inhibit, social interaction. This 'is more like seeding rhizomes than growing a tree' (Frohman 2009: 303). Diversity and disagreement should not be seen as a threat to or elimination of human nature, or something so unnatural that it needs explanation. Back to our football fans' example: just because Real Madrid's and Manchester United's fans can disagree with one another, or have a different definition or style of football, does not make them less social groups of football fans.

The following are some of the most pressing research topics of information science as a social science: immigration, poverty, international development, terrorism, race, ethnic conflict, digital inequality, crime and human rights. Evidently, the criterion for determining the social identity of information science is this: if there is no connection or network, information science becomes non-social. This is where the multidimensionality of information science as a social science helps to unearth the fullness of the complexities embedded in the social: 'The complex system can therefore only be adequately described holistically' (Tredinnick 2009: 798). This also has ramifications for how one raises a research question or hypothesis, observes or analyses it and proposes a solution. Social science skills are not reserved or restricted to any single discipline. Multidisciplinary research might include technical, cognitive and social modes at the same time, but there must be a focus on one of the modes. What is of great importance is how or where the researcher places that focus. Perhaps more challenging, 'the field [information science] is very fragmented' (Hjørland 2003c: 367). Although integral to or indicative of scientific progress, as one would argue, fragmentation without focus or situational awareness can be misleading. This paper maps or situates the work done in information science as a social science.

Conclusion

We have surveyed the social science identity of information science and also discussed some of the misunderstandings involved. For a tighter grasp, our attention on the social mode has cursorily, by no means exhaustively, involved the human and technical modes. With information and communication technologies becoming a challenge to all disciplines, this paper is an invitation to engaged, yet less frequently discussed, inquiry about the focus and identity of our work in an increasingly collaborative, interdisciplinary, connected and, all-too-often, confusing research environment. Identity without clarity or focus cannot help but lead to replication, parochialism, hostility, esotericism and intolerance. Librarianship, arguably the first citizen in the land of information science, so to speak, is no longer alone. As should be clear from above, the field engages the technical, human and social modes, unreservedly, taking us in unknown and often disquieting directions. We cannot move forward in peace without tolerance and mutual acceptance.

Entrenched positions about methods and lines of thought exacerbate division and undermine our understanding of (information) reality. Quantitative and qualitative research methodologies are neither inherently scientific nor unscientific, neither soft nor hard science; each has rules to yield valid and generalizable results. Technological, human, or social determinism cannot in isolation fully account for the complexity and chaos of our world. Armed with complexity theory, this paper proposes a multidimensional perspective for information science as a social science, not as a solution, but as a tool or a metaphor in order to include the muted and the voiceless. The specifics of information science as a social science lie in our interconnectedness and interactions, rather than in the word social.

Social phenomena prove to be so complex that we need to include all voices and to support and encourage all lines of thought and modes. Just as everyone should feel welcome in information space, let us develop a socially informed information science that accommodates all methods, waves and approaches, free, or at least aware, of misconceptions and accompanying reductionism. In the era of complexity, information science as a social science redirects our attention to information not as an idea, but a space of emerging forces. Information science as a social science brings chaos centre stage of information. Failure to receive information as noise, force, or chaos, will keep our interactions

repressive, divisive, manipulated and artificial. We can incorporate research on information science as a social science into any topic of information, using the themes that best fit our work. On the one hand, a social science knowledge base can be difficult to acquire. On the other hand, information science's identity is often pushed to the sidelines of our research centres and publication venues, making all the more urgent a discussion about our social science identity.

References

Altman-Price, A. & Mevarech, M. (2009). Genetic evidence for the importance of protein acetylation and protein deacetylation in the halophilic archaeon Haloferax volcanii. Journal of Bacteriology, 191(5), 1610-1617.

Arms, W.Y. (2005). Information science as a liberal art. Interlending & Document Supply, 33(2), 81-84.

Armstrong, K. (2001). Buddha. New York, NY: Penguin Books.

Aristotle. (1962). The Nichomachean ethics(M. Oswald, Trans.). New York, NY: Bobs-Merrill.

Arthur, W.A., Durlauf, S. & Lane, D. (Eds.). (1997). The economy as an evolving complex system II.Reading, MA: Addison-Wesley.

Babbie, R.E. (2010). The practice of social research.(12th ed.).Belmont, CA: Wadsworth.

Bacon, F. (1960). The new organon and related writings. Indianapolis, IL: Bobbs-Merrill.

Bates, J.M. (1999). The invisible substrate of information science. Journal of the American Society for Information Science, 50(12), 1043-1050.

Bates, J.M. (2005). Information and knowledge: an evolutionary framework for information science. Information Research, 10(4). Retrieved September 16, 2009, from http://informationr.net/ir/10-4/paper239.html (Archived by WebCite® at http://www.webcitation.org/5s0F0jMCX)

Bates, J.M. (2006). Fundamental forms of information. Journal of the American Society for Information Science, 57(8), 1033-1045.

Bates, J.M. (2008). Hjørland's critique of Bates' work on defining information. Journal of the American Society for Information Science and Technology, 59(5), 842-844.

Bates, J.M. (2010). An operational definition of the information disciplines. In iConference 2010 Proceedings, University of Illinois, Champaign, IL, USA , (pp. 19-25). Champaign, IL: University of Illiniois. Retrieved April 30, 2010 from http://nora.lis.uiuc.edu/images/iConferences/2010papers_Allen-Ortiz.pdf (Archived by WebCite® at http://www.webcitation.org/5s0EjltIS) [This link leads to the first set of papers of the proceedings: the papers have not been given individual urls, which makes accurate referencing rather difficult. You will need to page down to find Bates's paper.]

Baumgartner, M. (2009). Inferring causal complexity. Sociological Methods & Research, 38(1), 71-101.

Bawden, R. (2007). Complexity: unruly and otherwise. Perspectives in Biology and Medicine, 50(4), 614-624.

Beam, D. R. (1983). Toward a system-based unified social science. In F. Machlup & U. Mansfield (Eds.), The study of information: interdisciplinary messages (pp. 607-618). New York, NY: John Wiley.

Benton, T. & Craib, I. (2001). Philosophy of social science: the philosophical foundations of social thought. New York, NY: Palgrave.

Borlaug, E.N. (2000a). Ending world hunger: the promise of biotechnology and the threat of antiscience zealotry. Plant Physiology, 124(2), 487–490.

Borlaug, E.N. (2000b). The Green Revolution revisited and the road ahead. Nobelprize.org. Retrieved September 16, 2009, from http://nobelprize.org/nobel_prizes/peace/laureates/1970/borlaug-lecture.pdf (Archived by WebCite® at http://www.webcitation.org/5s0HXJcpS)

Brady, E.H. & Collier, D. (Eds.). (2004). Rethinking social inquiry: diverse tools, shared standards. Lanham, MD: Rowman & Littlefield.

Brady, E.H., Collier, D. & Seawright, J. (2004). Refocusing the discussion of methodology. In H.E. Brady & D. Collier (Eds.), Rethinking social inquiry: diverse tools, shared standards (pp. 3-20). Lanham, MD: Rowman & Littlefield.

Brattico, P. (2008). Shallow reductionism and the problem of complexity in psychology. Theory & Psychology, 18(4), 483-504.

Brier, S. (2008). Cybersemiotics: why information is not enough! Toronto: University of Toronto Press.
Brock, A.W. (2001). Chaos theory. In N.J. Smelser & P.B. Baltes, International encyclopedia of the social and behavioral sciences (Vol. 3, pp. 1643-1646). New York, NY: Elsevier.
Brooks, C.B. (1980a). The foundations of information science: part I. Philosophical aspects. Journal of Information Science, 2(3-4), 125-133.
Brooks, C.B. (1980b). The foundations of information science: part II. Quantitative aspects: classes of things and the challenge of human individuality. Journal of Information Science, 2(5), 209-221.
Brooks, C.B. (1980c).The foundations of information science: part III. Quantitative aspects: objective maps and subjective landscapes. Journal of Information Science, 2(6), 269-275.
Brooks, C.B. (1980d).The foundations of information science: part IV. Information science: the changing paradigm. Journal of Information Science, 3(1), 3-12.
Brown, S.J. & Duguid, P. (2000). The social life of information. Boston: Harvard Business School Press.
Burke, C. (2007). History of information science. Annual Review of Information Science and Technology, 41, 3-53.
Byrne, D. (1998). Complexity theory and the social sciences. London: Routledge.
Cambel, B.A. (1992). Applied chaos theory: a paradigm for complexity. New York, NY: Academic Press.
Cannon, R.A. & St. John, H.C. (2007). Measuring environmental complexity: a theoretical and empirical assessment. Organizational Research Methods, 10(2), 296-321.
Capurro, R. (2008a). Pasado, presente y futuro de la noción de información. [Past, present and future of the information concept.] Paper presented at the Encuentro Internacional de Expertos en Teorías de Información, 6, 7 Noviembre 2008, Léon, España. Retrieved December 23, 2008 from http://www.capurro.de/leon.pdf (Archived by WebCite® at http://www.webcitation.org/5s0I15ubw)
Capurro, R. (2008b). Interpreting the digital human. Paper presented at the conference "Thinking critically: alternative perspectives and methods in information studies". Center for Information Policy Research, School of Information Studies, University of Wisconsin-Milwaukee Wisconsin, May 15-17, 2008. Retrieved December 23, 2008 from http://www.capurro.de/wisconsin.html (Archived by WebCite® at http://www.webcitation.org/5s3JcID3w)
Case, O.D. (2007). Looking for information: a survey of research on information seeking, needs and behavior. (2nd ed.). Boston, MA: Academic Press.
Casey, E.M. & Savastinuk, C.L. (2007). Library 2.0: a guide to participatory library service. Medford, NJ: Information Today.
Chettiparamb, A. (2006). Metaphors in complexity theory and planning. Planning Theory, 5(1), 71- 91.
Chin, A. (2007). The authentic Confucius: a life of thought and politics. New York, NY: Scribner.
Cibangu, K.S. (2010a). [Review of the book Toward a sociological theory of information, by Garfinkel, H.] Journal of Documentation, 66(2), 297-299.
Cibangu, K.S. (2010b). Paradigms, methodologies and methods. Library & Information Science Research, 32(3), 177-178.
Clarke, S. & Walsh, A. (2009). Scientific imperialism and the proper relations between the sciences. International Studies in the Philosophy of Science, 23(2), 195-207.
Colander, D. (Ed.). (2000). The complexity vision and the teaching of economics. Northampton, MA: Edward Elgar.
Comte, A. (1842/1970). Introduction to positive philosophy (F. Ferré, Trans.). Indianapolis, IN: Bobbs-Merrill.
Cornelius, I. (1996). Meaning and method in information studies. Norwood, NJ: Ablex.
Cornelius, I. (2002). Theorizing information for information science. Annual Review of Information Science and Technology, 36(1), 392-425.
Cover, M.T. & Thomas, A.J. (2006). Elements of information theory. (2nd ed.). New York, NY: John Wiley.
Creswell, W. J. (2008). Educational research: planning, conducting and evaluating quantitative and qualitative research. (3rd ed.). Upper Saddle River, NJ: Pearson Education.
Creswell, W.J. (2009). Research design: qualitative, quantitative and mixed methods approaches. (3rd ed.). Thousand Oaks, CA: Sage.

Cronin, B. (2001). Hyperauthorship: a postmodern perversion or evidence of a structural shift in scholarly communication practices? Journal of the American Society for Information Science and Technology, 52(7), 558-569.
Cronin, B. (2008). The sociological turn in information science. Journal of Information Science, 34(4), 465-475.
Cronin, B., Shaw, D. & La Barre, K. (2003). A cast of thousands: coauthorship and subauthorship collaboration in the 20th century as manifested in the scholarly journal literature of psychology and philosophy. Journal of the American Society for Information Science and Technology, 54(9), 855-871.
Cronin, B., Shaw, D. & La Barre, K. (2004). Visible, less visible and invisible work: patterns of collaboration in 20th century chemistry. Journal of the American Society for Information Science and Technology, 55(2), 160-168.
Crotty, M. (1998). The foundations of social research: meaning and perspective in the research process. London: Sage.
Dahl, D. (2007). Social-biological information technology: an integrated conceptual framework. Journal of the American Society for Information Science and Technology, 58(13), 2021-2046.
Dann, Z. & Barclay, I. (2006). Complexity theory and knowledge management application. The Electronic Journal of Knowledge Management, 4(1), 11-20.
Danziger, K. (2000). Making social psychology experimental: a conceptual history, 1920-1970. Journal of the History of the Behavioral Sciences, 36(4), 329-347.
Darity, A.W., Jr. (2008). Introduction. In W. A. Darity, Jr. (Ed.), International encyclopedia of the social sciences: vol. 1 (pp. xi-xvi). Detroit, MI: Macmillan Reference USA.
Darwin, C. (1967). The origin of species. New York, NY: E.P. Dutton.
Denzin, K.N. & Lincoln, S.Y. (2005). Preface. In N.K. Denzin & Y.S. Lincoln (Ed.), The Sage handbook of qualitative research (3rd ed., pp. ix-xix). Thousand Oaks, CA: Sage.
Diaz, K. & Fields, M.A. (2007). Digital storytelling, libraries and community. In N. Courtney (Ed.), Library 2.0 and beyond: innovative technologies and tomorrow's user (pp. 129-139). Westport, CT: Libraries Unlimited.
Dick, A.L. (1995). Library and information science as a social science: neutral and normative conceptions. Library Quarterly, 65(2), 216-235.
Dick, A.L. (1999). Epistemological positions and library and information science. Library Quarterly, 69(3), 305-323.
Dilthey, W. (1928). Die Geistige Welt: Einleitung in die Philosophie des Lebens [The spiritual world: introduction to the philosophy of life.] Stuttgart, Germany: B.G. Teubner Verlagsgesellschaft. (Gesammelte Schriften 5, Hrsg. Georg Misch.)
Dilthey, W. (1973). Der Aufbau der Geschichtlichen Welt in den Geisteswissenschaften [The structure of the historical world in the human sciences]. Stuttgart, Germany: B.G. Teubner Verlagsgesellschaft. (Gessamelte Schriften 7, Hrsg. B. Groethuysen.)
Dilthey, W. (1988). Introduction to the human sciences: an attempt to lay a foundation for the study of society and history (R. J. Betanzos, Trans.). Detroit, MI: Wayne State University Press.
Dorf, C.R. (2004). Engineering handbook. (2nd ed.). New York, NY: CRC Press.
Durkheim, É. (1895/1982). The rules of sociological method: and selected texts on sociology and its method (W.D. Halls, Trans.). London: Macmillan.
Eisenhardt, M.K. (1989). Building theories from case study research. Academy of Management Review, 14(4), 532-550.
European Commission. (2009). Health care: indicators from the SILC survey (from 2004 onwards). Retrieved August 15, 2010, from http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/hlth_care_silc_esms.htm (Archived by WebCite® at http://www.webcitation.org/5s3LbGZ56)
Fidel, R. (2008). Are we there yet?: mixed methods research in library and information science. Library & Information Science Research, 30(4), 265-272.
Fisher, K.E. & Julien, H. (2009). Information behavior. Annual Review of Information Science and Technology, 43, 317-358.
Floridi, L. (2008). Information ethics: a reappraisal. Ethics and Information Technology, 10(2-3), 189-204.

Floridi, L. (2009). The information society and its philosophy: introduction to the special issue on the philosophy of information, its nature and future developments. The Information Society, 25(3), 153-158.
Foucault, M. (2002). The archaeology of knowledge (A.M.S. Smith., Trans.). New York, NY: Routledge.
Frické, M. (2009). The knowledge pyramid: a critique of the DIKW hierarchy. Journal of Information Science, 35(2), 131-142.
Friedman, M. (1999). Reconsidering logical positivism. Cambridge: Cambridge University Press.
Frohman, B. (1994). Communication technologies and human subjectivity: the politics of postmodern information science. Canadian Journal of Information and Library Science, 19(2), 1-22.
Frohman, B. (2004).Documentation redux: prolegomena to (another) philosophy of information. Library Trends, 52(3), 387-407.
Frohman, B. (2009). Revisiting "what is a document"? Journal of Documentation, 65(2), 291-303.
Furner, J. (2004). Information studies without information. Library Trends, 52(3), 427-466.
Furner, J. (2010). Philosophy and information studies. Annual Review of Information Science and Technology, 44, 162-200.
Garfinkel, H. (2008). Toward a sociological theory of information. Boulder, CO: Paradigm.
Geertz, C. (2000). The interpretation of cultures: selected essays. New York, NY: Basic Books.
Geoghegan, D.B. (2008).The historiographic conceptualization of information: a critical survey. IEEE Annals of the History of Computing, 30(1), 66-81.
George, L.A. & Bennett, A. (2005). Case studies and theory development in the social sciences. Cambridge, MA: MIT Press.
Glänzel, W. & Schoepflin, U. (1999). A bibliometric study of reference literature in the sciences and social sciences. Information Processing and Management, 35(1), 31-44.
Good, J. (2000). Disciplining social psychology: a case study of boundary relations in the history of the human sciences. Journal of the History of the Behavioral Sciences, 36(4), 383-403.
Guba, G.E., & Lincoln, S.Y. (2005). Paradigmatic controversies, contradictions and emerging confluences. In N.K. Denzin & Y.S. Lincoln (Eds.), The Sage handbook of qualitative research. 3rd ed., (pp. 191-215). Thousand Oaks, CA: Sage.
Gubrium, F.J. & Holstein, A.J. (2003). Analyzing interpretive practice. In N.K. Denzin & Y.S. Lincoln (Eds.), Collecting and interpreting qualitative research materials 2nd ed., (pp. 487-508). Thousand Oaks, CA: Sage.
Hammersley, M. & Atkinson, P. (2007). Ethnography: principles in practice. (3rd. ed.). New York, NY: Routledge.
Hart, H.P.H. (1983). Characteristics of social science information: a selective review of literature. Part I. Social Science Information Studies, 3(3), 147-164
Hart, H.P.H. (1984). Characteristics of social science information: a selective review of literature. Part II. Social Science Information Studies, 4(1), 15-30.
Hjørland, B. (1998a). Theory and metatheory of information science: a new interpretation. Journal of Documentation, 54(5), 606-621.
Hjørland, B. (1998b). The classification of psychology: a case study in the classification of a knowledge field. Knowledge Organization, 25(4), 162-201.
Hjørland, B. (2000a). [Review of the book Open the social sciences: report of the Gulbenkian Commission on the restructuring of the social sciences, by Wallerstein, I. et al]. Knowledge Organization, 27(4), 238-241
Hjørland, B. (2000b).Library and information science: practice, theory and philosophical basis. Information Processing & Management, 36(3), 501-531.
Hjørland, B. (2002a).Domain analysis in information science: eleven approaches, traditional as well as innovative. Journal of Documentation, 58(4), 422-462.
Hjørland, B. (2002b).Epistemology and the socio-cognitive perspective in information science. Journal of the American Society for Information Science and Technology, 53(4), 257-270.
Hjørland, B. (2003a). Empiricism and positivism. In J. Feather & P. Sturges (Eds.), International encyclopedia of information and library science (2nd ed., pp. 179-181). London: Routledge.

Hjørland, B. (2003b). Hermeneutics. In J. Feather & P. Sturges (Eds.), International encyclopedia of information and library science 2nd ed., (pp. 223-225). London: Routledge.
Hjørland, B. (2003c). Semantics and knowledge organization. Annual Review of Information Science and Technology, 41, 367-405.
Hjørland, B. (2004a).Domain analysis: a socio-cognitive orientation for information science research. Bulletin of the American Society for Information Science and Technology, 30(3), 17-21.
Hjørland, B. (2004b).Arguments for philosophical realism in library and information science. Library Trends, 52(3), 488-506.
Hjørland, B. (2005a). Empiricism, rationalism and positivism in library and information science. Journal of Documentation, 61(1), 130-155.
Hjørland, B. (2005b). Library and information science and the philosophy of science. Journal of Documentation, 61(1), 5-10.
Hjørland, B. (2005c). Comments on the articles and proposals for further work. Journal of Documentation, 61(1), 156-163.
Hjørland, B. (2005d). The socio-cognitive theory of users situated in specific contexts and domains. In K.E. Fisher, S. Erdelez & L.E.F. McKechnie (Eds.), Theories of information behavior (pp. 339-343). Medford, NJ: Information Today.
Hjørland, B. (2007). Information: objective or subjective/situational? Journal of the American Society for Information Science and Technology, 58(10), 1448-1456.
Hjørland, B. (2009a). Concept theory. Journal of the American Society for Information Science and Technology, 60(8), 1519-1536.
Hjørland, B. (2009b). The controversy over the concept of information: a rejoinder to professor Bates. Journal of the American Society for Information Science and Technology, 60(3), 643.
Hjørland, B. (2010a). The foundation of the concept of relevance. Journal of the American Society for Information Science and Technology, 61(2), 217-237.
Hjørland, B. (2010b). Answer to professor Szostak (concept theory). Journal of the American Society for Information Science and Technology, 61(5), 1078-1079.
Hjørland, B. & Albrechtsen, H. (1995). Toward a new horizon in information science: domain analysis. Journal of the American Society for Information Science and Technology, 46(6), 400-425.
Hobbes, T. (1651/1994). Leviathan. London: J.M. Dent.
Holland, A.G. (2008).Information science: an interdisciplinary effort? Journal of Documentation, 64(1), 7-23.
Holstein, A.J. & Gubrium, F.J. (2005). Interpretive practice and social action. In N.K. Denzin & Y.S. Lincoln (Eds.), The Sage handbook of qualitative research 3rd ed., (pp. 483-505). Thousand Oaks, CA: Sage.
Howe, R.K. (1988). Against the quantitative-qualitative incompatibility thesis (or dogma die hard). Educational Researcher, 17(8), 10-16.
Howe, R.K. (1998). The interpretive turn and the new debate in education. Educational Researcher, 27(8), 13-20.
Howe, R.K. (2003). Closing methodological divides: towards democratic educational research. Dordrecht, Netherlands: Kluwer.
Howe, R.K. (2004). A critique of experimentalism. Qualitative Inquiry, 10(1), 42-61.
Howe, R.K. (2005). The question of education science: experimentism versus experimentalism. Educational Theory, 55(3), 307-322.
Howe, R.K. (2009). Isolating science from the humanities: the third dogma of educational research. Qualitative Inquiry, 15(4), 766-784.
Huang, M.-H. & Chang, Y.-W. (2008). Characteristics of research output in social sciences and humanities: from a research evaluation perspective. Journal of the American Society for Information Science and Technology, 59(11), 1819-1828.
Hume, D. (1999). An enquiry concerning human understanding. New York, NY: Oxford University Press.
Husserl, E. (1977). Phenomenological psychology: lectures, summer semester, 1925 (J. Scanlon, Trans.). The Hague, Netherlands: Martinus Nijhoff.

Hutzschenreuter, T. & Guenther, F. (2009). Complexity as a constraint on firm expansion within and across industries. Managerial and Decision Economics, 30(6), 373-392.
Jessor, R., Colby, A. & Shweder, A.R. (1996). Ethnography and human development: context and meaning in social inquiry. Chicago: University of Chicago Press.
Jódar, L., Acedo, L. &Villanueva, J.R. (2008). Mathematical models in life sciences & engineering. Computers & Mathematics with Applications, 56(3), 593-846.
Johnson, D.J. (2009). An impressionistic mapping of information behavior with special attention to contexts, rationality and ignorance. Information Processing & Management, 39(5), 735-760.
Kaundal, R. & Raghava, P.S.G. (2009). RSLpred: an integrative system for predicting subcellular localization of rice proteins combining compositional and evolutionary information. Proteomics, 9(9), 2324-2342.
Kerr, K. (2008). Social science. In W. A. Darity, Jr. (Ed.), International encyclopedia of the social sciences: vol. 7 (pp. 614-618). Detroit, MI: Macmillan Reference USA.
Kincaid, H. (1996). Philosophical foundations of the social sciences: analyzing controversies in social research. New York, NY: Cambridge University Press.
King, G., Keohane, O.R. & Verba, S. (1994). Designing social inquiry: scientific inference in qualitative research. Princeton, NJ: Princeton University Press.
Kline, R.R. (2006).Cybernetics, management science and technology policy: the emergence of "information technology" as a keyword, 1948-1985. Technology and Culture, 47(3), 513-535.
Koponen, T.I. (2009). Cluster growth poised on the edge of break-up, II: from reaction kinetics to thermodynamics. Physica A: Statistical Mechanics and its Applications, 318(13), 2659-2665.
Kuhn, S.T. (1996). The structure of scientific revolutions. (3rd ed.). Chicago, IL: University of Chicago Press.
Küng, H. (2007). The beginning of all things: science and religion (J. Bowden, Trans.). Grand Rapids, MI: Eerdmans.
Law, J. & Urry, J. (2004). Enacting the social. Economy and Society, 33(3), 390-410.
Lenski, G. (1994). Societal taxonomies: mapping the social universe. Annual Review of Sociology, 20, 1-26.
Lincoln, S.Y. & Guba, G.E. (1985). Naturalistic inquiry. Beverly Hills, CA: Sage.
Lincoln, S.Y. & Guba, G.E. (2003). The seventh moment: out of the past. In N.K. Denzin & Y.S. Lincoln (Eds.), Collecting and interpreting qualitative research materials 2nd ed., (pp. 1047-1065). Thousand Oaks, CA: Sage.
Louçã, F. (2001a). Complexity. In J. Michie (Ed.), Reader's guide to the social sciences: vol. 1 (pp. 259-261). Chicago, IL: Fitzroy Dearborn.
Louçã, F. (2001b). Nonlinear dynamics. In J. Michie (Ed.), Reader's guide to the social sciences: vol. 2 (pp. 1141-1142). Chicago, IL: Fitzroy Dearborn.
Machiavelli, N. (1531/1996).Discourses on Livy (H. C. Mansfield & N. Tarcov, Trans.). Chicago, IL: University of Chicago Press.
Marcus, E.G. (2002). Intimate strangers: the dynamics of (non) relationship between the natural and human sciences in the contemporary U.S. university. Anthropological Quarterly, 75(3), 519-526.
Marx, K. (1847/1955). The poverty of philosophy. Moscow: Progress Publishers.
Marx, K. (1844/1959). Economic and philosophic manuscripts of 1844 (M. Mulligan, Trans.). Moscow: Progress Publishers.
Marx, K. (1867/1977). Capital: a critique of political economy (B. Fowkes, Trans.). New York, NY: Vintage Books.
Mason, M. (2008). Complexity theory and the philosophy of education. Educational Philosophy and Theory, 40(1), 4-18.
Mazlish, B. (1998). The uncertain sciences. New Haven, CT: Yale University Press.
Mazlish, B. (2001). Reflections on the human sciences and their history. History of the Human Sciences, 14(4), 140-147.
Moore, L.H. (2002). The business of funding: science, social science and wealth in the United Kingdom. Anthropological Quarterly, 75(3), 527-535.
Morgan, L.D. (2007). Paradigms lost and pragmatism regained: methodological implications of combining qualitative and quantitative methods. Journal of Mixed Methods Research, 1(1), 48-76.

Nagel, E. (1961). The structure of science: problems in the logic of scientific explanation. New York, NY: Harcourt, Brace and World.
Nahl, D. & Bilal, D. (Eds.). (2007). Information and emotion: the emergent affective paradigm in information behavior research and theory. Medford, NJ: Information Today.
Negroponte, N. (1995). Being digital. New York, NY: Knopf.
Niessen, T., Abma, T., Widdershoven, G., van der Vleuten, C. & Akkerman, S. (2008). Contemporary epistemological research in education: reconciliation and reconceptualization of the field. Theory & Psychology, 18(1), 27- 45.
Nyce, M.J. & Thomas, P.N. (1998). Qualitative research in LIS: redux: a response to a [re] turn to positivistic ethnography. Library Quarterly, 68(1), 108-113.
Nyce, M.J. & Thomas, P.N. (1999). Can a "hard" science answer "hard" questions? A response to Sandstrom and Sandstrom. Library Quarterly, 69(2), 295-298.
Olaisen, J. (1996). Pluralism or positivistic trivialism: criteria for a classified subjectivism. In J. Olaisen, E.Munch-Petersen & P. Wilson (Eds.), Information science: from the development of the discipline to social interaction (pp. 277-318). Stockholm, Sweden:Scandinavian University Press.
Palincsar, A.S. (1998). Social constructivist perspectives on teaching and learning.Annual Review of Psychology, 49, 345-375.
Palmer, L.C. & Cragin, H.M. (2008). Scholarship and disciplinary practices. Annual Review of Information Science and Technology, 42(2), 163-212.
Parkinson, B.R. (1991). Voices from ancient Egypt: an anthology of Middle Kingdom writers. Norman, OK: University of Oklahoma Press.
Parsons, T. (1937). The structure of social action. New York, NY: Free Press.
Parsons, T. (1951). The social system. London: Routledge.
Så
Patton, Q.M. (2002). Qualitative research and evaluation methods. (3rd ed.). Thousand Oaks, CA: Sage.
Perkins, H.J. (1997). Geopolitics and the Green Revolution: wheat, genes and the Cold War. New York, NY: Oxford University Press.
Phillimore, J. & Goodson, L. (2004). Qualitative research in tourism: ontologies, epistemologies and methodologies. New York, NY: Routledge.
Pickard, A. (2007). Research methods in information. London: Facet Publishing.
Pickard, A. & Dixon, P. (2004). The applicability of constructivist user studies: how can constructivist inquiry inform service providers and systems designers?Information Research, 9(3). Retrieved May 5, 2010 from http://informationr.net/ir/9-3/paper175.html (Archived by WebCite® at http://www.webcitation.org/5s0NfFVpj)
Prasad, A. (2002). The contest over meaning: hermeneutics as an interpretative methodology for understanding texts. Organizational Research Methods, 5(1), 12-33.
Putnam, D.R. (2000). Bowling alone: the collapse and revival of American community. New York, NY: Simon and Schuster.
Quarteroni, A. (2009). Mathematical models in science and engineering. Notices of the AMS, 56(1), 10-19.
Reiss, J. (2007). Do we need mechanisms in the social sciences? Philosophy of the Social Sciences, 37(2), 163-184.
Reiss, J. (2009). Causation in the social sciences: evidence, inference and purpose. Philosophy of the Social Sciences, 39(1), 20-40.
Roberts, N. (1976). Social considerations towards a definition of information science. Journal of Documentation, 32(4), 249-257.
Sandstrom, R.A. & Sandstrom, E.P. (1995). The use and misuse of anthropological methods in library and information science research. Library Quarterly, 65(2), 161-199.
Sandstrom, R.A. & Sandstrom, E.P. (1998). Science and nonscience in qualitative research: a response to Thomas and Nyce. Library Quarterly, 68(2), 249-254.
Sandstrom, R.A. & Sandstrom, E.P. (1999). Antiscientific approaches to the study of social life: a rejoinder to Nyce and Thomas. Library Quarterly, 69(2), 299-303.
Schumpeter, A.J. (1939a). Business cycles: vol. 1. A theoretical, historical and statistical analysis of the capitalist process. New York, NY: McGraw-Hill.

Schumpeter, A.J. (1939a). Business cycles: vol. 2. A theoretical, historical and statistical analysis of the capitalist process. New York, NY: McGraw-Hill.
Schumpeter, A.J. (1949). The theory of economic development: an inquiry into profits, capital, credit, interest and the business cycle (R. Opie, Trans.). Cambridge, MA: Harvard University Press.
Schumpeter, A.J. (2003). How does one study social science? Society, 40(3), 57-63.
Schwandt, A.T. (2003).Three epistemological stances for qualitative inquiry: interpretivism, hermeneutics and social constructionism. In N.K. Denzin & Y.S. Lincoln (Eds.), Collecting and interpreting qualitative research materials 2nd ed., (pp. 189-213). Thousand Oaks, CA: Sage.
Schwandt, A.T. (2007). The Sage dictionary of qualitative inquiry. (3rd ed.). Thousand Oaks, CA: Sage.
Schwieder, D. (2010). Motivated information behavior. In iConference 2010 Proceedings, University of Illinois, Champaign, IL, USA (pp. 218-223). Retrieved April 30, 2010 from http://nora.lis.uiuc.edu/images/iConferences/2010papers2_Page-Zhang.pdf (Archived by WebCite® at http://www.webcitation.org/5s3KBk3fa)
[This link leads to the second set of papers of the proceedings: the papers have not been given individual urls, which makes accurate referencing rather difficult. You will need to page down to find Schwieder's paper.]
Shannon, E.C. (1948). A mathematical theory of communication. The Bell System Technical Journal, 27(3 & 4), 379-423 & 623-656. Retrieved 15 August, 2010 from http://cm.bell-labs.com/cm/ms/what/shannonday/shannon1948.pdf (Archived by WebCite® at http://www.webcitation.org/5s0Ome6c1)
Shannon, E.C. & Weaver, W. (1949). The mathematical theory of communication. Urbana, IL: University of Illinois Press.
Sherratt, Y. (2006). Continental philosophy of social science: hermeneutics, genealogy and critical theory from Greece to the twenty-first century. New York, NY: Cambridge University Press.
Shneiderman, B. (2009). Foreword. In B. Whitworth & A. de Moor (Eds.), Handbook of research on socio-technical design and social networking systems: vol. 1 (pp. xxvi-xxix). Hershey, PA: Information Science Reference.
Smale, M., Singh, J., Di Falco, S. & Zambrano, P. (2008). Wheat breeding, productivity and slow variety change: evidence from the Punjab of India after the Green Revolution. Australian Journal of Agricultural and Resource Economics, 52(4), 419-432.
Small, H. (1981). The relationship of information science to the social sciences: a co-citation analysis. Information Processing & Management, 17(1), 39-50.
Smith, J.M. (2003). Social science in question: towards a postdisciplinary framework. London: Sage Publications.
Sonnenwald, H.D. (2007).Scientific collaboration. Annual Review of Information Science and Technology, 41, 643-681.
Spink, A., Cole, C. & Waller, W. (2008). Multitasking behavior. Annual Review of Information Science and Technology, 42, 93-118.
Suppe, F. (1999). The positivist model of scientific theories. New York, NY: Oxford University Press.
Summers, R., Oppenheim, C., Meadows, J., McKnight, C. & Kinnell, M. (1999).Information science in 2010: a Loughborough University view.Journal of the American Society for Information Science and Technology, 50(12), 1153-1162.
Svenonius, E. (2004). The epistemological foundation of knowledge representations. Library Trends, 52(3), 571-587.
Tashakkori, A. & Teddlie, C. (2003). The past and the future of mixed methods research: from data triangulation to mixed model designs. In A. Tashakkori & C. Teddlie (Eds.), Handbook of mixed methods in social and behavioral research (pp. 671-702). Thousand Oaks, CA: Sage Publications.
Taylor, S.R. (1991). Information use environments. In B. Dervin & M.J. Voigt (Eds.), Progress in communication sciences 10, 217-255.
Teddlie, C. & Tashakkori, A. (2009). Foundations of mixed methods research: integrating quantitative and qualitative approaches in the social and behavioral sciences. Thousand Oaks, CA: Sage Publications.
Tredinnick, L. (2009).Complexity theory and the web. Journal of Documentation, 65(5), 797-816.

UNESCO. (2009). Investing in cultural diversity and intercultural dialogue. Paris: UNESCO. Retrieved November 10, 2009 from http://unesdoc.unesco.org/images/0018/001852/185202E.pdf (Archived by WebCite® at http://www.webcitation.org/5s0PkdQOO)
Urry, J. (Ed.). (2003). Global complexity theory. Malden, MA: Blackwell.
Urry, J. (Ed.). (2005a). The complexity turn. Theory, Culture & Society, 22(5), 1–14.
Urry, J. (Ed.). (2005b). The complexities of the global. Theory, Culture & Society, 22(5), 235-254.
Vakkari, P. & Cronin, B. (Eds.). (1992). Conceptions of library and information science: historical, empirical and theoretical perspectives. London: Taylor Graham.
Van Langenhove, L. (2000). Rethinking the social sciences? A point of view. Foundations of Science, 5(1), 103-118.
Vega-Almeida, L.R., Fernández-Molina, J.C. & Linares, R. (2009). Coordenadas paradigmáticas, históricas y epistemológicas de la Ciencia de la Información: una sistematización. Information Research, 14(2). Retrieved April 28, 2010 from http://informationr.net/ir/14-2/paper399.html (Archived by WebCite® at http://www.webcitation.org/5s0W1Ih7g)
Verdú, S. (1998). Fifty years of Shannon theory. IEEE Transactions on Information Theory, 44(6), 2057-2078.
Verdú, S. & McLaughlin, W.S. (Eds.). (2000). Information theory: 50 years of discovery. Piscataway, NJ: IEEE Press.
Walby, S. (2006). Complex social systems: theorizations and comparisons in a global era. London: Sage Publications.
Walby, S. (2007). Complexity theory, systems theory and multiple intersecting social inequalities. Philosophy of the Social Sciences, 37(4), 449-470.
Walby, S. (2009). Globalization and inequalities: complexity and contested modernities. Thousand Oaks, CA: Sage Publications.
Waldrop, M.M. (1992). Complexity: the emerging science at the edge of order and chaos. New York, NY: Simon and Schuster.
Waldrop, M.M. (1999). Complexity. London: Penguin.
Wallerstein, I., Juma, C., Keller, F.E., Kocka, J., Lecourt, D., Mudimbe, Y.V., et al. (1996). Open the social sciences: report of the Gulbenkian Commission on the restructuring of the social sciences. Stanford, CA: Stanford University Press.
Weber, M. (1949). Critical studies in the logic of the cultural sciences: a critique of Eduard Meyer's methodological views. In E. Shils & H.A. Finch (Eds.), Max Weber on the methodology of the social sciences (pp. 113-188). New York, NY: The Free Press.
Webber, S. (2003). Information science in 2003: a critique. Journal of Information Science, 29(4), 311-330.
Wegner, P. (1983). Paradigms of information engineering. In F. Machlup & U. Mansfield (Eds.), The study of information: interdisciplinary messages (pp. 163-179). New York, NY: John Wiley.
Werndl, C. (2009). What are the new implications of chaos for unpredictability? The British Journal for the Philosophy of Science, 60(1), 195-220.
Wersig, G. (1992). Information science and theory: a weaver bird's perspective. In P. Vakkari & B. Cronin (Eds.), Conceptions of library and information science: historical, empirical and theoretical perspectives (pp. 201-217). London: Taylor Graham.
Wiggins, A. & Sawyer, S. (2010). Intellectual diversity in iSchools: past, present and future. In iConference 2010 Proceedings, University of Illinois, Champaign, IL, USA (pp. 294-299). Retrieved April 30, 2010 from http://nora.lis.uiuc.edu/images/iConferences/2010papers2_Page-Zhang.pdf (Archived by WebCite® at http://www.webcitation.org/5s3KBk3fa)
[This link leads to the second set of papers of the proceedings: the papers have not been given individual urls, which makes accurate referencing rather difficult. You will need to page down to find Schwieder's paper.]
Wildemuth, M.B. (2009). Sampling for extensive studies. In B.M. Wildemuth (Ed.), Applications of social research methods to questions in information and library science (pp. 116-128). Westport, CT: Libraries Unlimited.

Wildemuth, M.B. & Cao, L.L. (2009a). Experimental studies. In B.M. Wildemuth (Ed.), Applications of social research methods to questions in information and library science (pp. 105-115). Westport, CT: Libraries Unlimited.
Wildemuth, M.B. & Cao, L.L. (2009b). Sampling for intensive studies. In B.M. Wildemuth (Ed.), Applications of social research methods to questions in information and library science (pp. 129-137). Westport, CT: Libraries Unlimited.
Williams, R. (2000). Sociology and the vernacular voice: text, context and the sociological imagination. History of the Human Sciences, 13(4), 73-95.
Williamson, K. (Ed.). (2002). Research methods for students, academics and professionals: information management and systems. (2nd ed.). Wagga Wagga, NSW, Australia: Charles Sturt University, Centre for Information Studies.
Wilson, P. (1996). The future of research in our field. In J. Olaisen, E. Munch-Petersen & P. Wilson (Eds.), Information science: from the development of the discipline to social interaction (pp. 319-323). Stockholm: Scandinavian University Press.
Wilson, T.D. (1980). On information science and the social sciences. Social Science Information Studies, 1(1), 5-12.
Wilson, T.D. (1981). Sociological aspects of information science. International Forum on Information and Documentation, 6(2), 13-18.
Wilson, T.D. (2010). Fifty years of information behavior research. Bulletin of the American Society for Information Science and Technology, 36(3), 27-34.
Windelband, W. (1980). History and science. (Rectorial address, Strasbourg, 1894). History and Theory, 19(2), 169-185.
Wobbrock, J.O. & Gajos, K.Z. (2008). Goal crossing with mice and trackballs for people with motor impairments: performance, submovements and design directions. ACM Transactions on Accessible Computing, 1(1), 4:1-37.
Wobbrock, J.O. & Myers, B.A. (2008). Enabling devices, empowering people: the design and evaluation of Trackball EdgeWrite. Disability and Rehabilitation: Assistive Technology, 3(1-2), 35-56.
Wobbrock, J.O., Myers, B.A. & Aung, H.H. (2008). The performance of hand postures in front- and back-of-device interaction for mobile computing. International Journal of Human-Computer Studies, 66(12), 857-875.
Woehle, R. (2007). Complexity theory, nonlinear dynamics and change: augmenting systems theory. Advances in Social Work, 8(1), 141-151.
Yin, K.R. (2009). Case study research: design and methods. (4th ed.). Thousand Oaks, CA: Sage Publications.
Yoshimi, S. (2006). Information. Theory, Culture and Society, 23(2-3), 271-278.
Zhang, P. & Benjamin, I.R. (2007). Understanding information related fields: a conceptual framework. Journal of the American Society for Information Science and Technology, 58(13), 1934-1947.
Zhang, Y., & Wildemuth, M.B. (2009). Qualitative analysis of content. In B.M. Wildemuth (Ed.), Applications of social research methods to questions in information and library science (pp. 308-319). Westport, CT: Libraries Unlimited.