The Occasional Informationist

irregular thoughts on the information sciences

The noblest pleasure: theories of understanding in the information sciences

Posted on March 21, 2016 by dbawden
This is a modified and updated version of a chapter published in ‘Theory development in the information sciences (http://www.amazon.co.uk/Theory-Development-Information-Sciences-Sonnenwald/dp/1477309063)’ (edited by Diane Sonnenwald, University of Texas Press, 2016, pages 281-299). Some newer references are included here, but for the full bibliography, see the original chapter.

My aim in writing the chapter was to set out my approach to theory construction in the information science discipline, and the information sciences more broadly. The approach emphasizes a qualitative and conceptual analysis and synthesis, aiming to create a form of understanding which brings coherence to complex sets of information. The chapter title stems from the statement by Leonardo da Vinci, rendered in English as “the noblest pleasure is the joy of understanding”.

To explain my approach to theory, I found it necessary to provide some background; not an autobiographical account, which I have given elsewhere (https://theoccasionalinformationist.com/2010/04/07/portrait-of-the-author-as-a-young-information-scientist/), but something about my intellectual origins. These are in the physical sciences, as with so many others of the ‘British school’ of information science, whose perspectives (http://openaccess.city.ac.uk/3154/) I have inherited to a considerable extent. These include a rather pragmatic attitude in general, and a liking for using concepts from, and analogies with, the physical sciences where this is feasible and sensible.

A ‘scientific informationist’
I came into information science from the physical sciences. My undergraduate education was in physics and chemistry, and my final degree in organic chemistry. ‘Theory’ in this context was objective, quantitative and empirical, and expressed as ‘laws’ and ‘principles’. For my doctorate, I made only a small disciplinary move, and worked on the handling of digital representations of chemical structures representation; what later came to be termed chemoinformatics. This was at the University of Sheffield, in an environment supporting a remarkably multi-faceted approach to the information disciplines (http://www.emeraldinsight.com/doi/abs/10.1108/JD-03-2013-0040), ranging from the humanities to the sciences, with an emerging social science perspective which was later to culminate in Tom Wilson’s widely adopted process models for information behavior.
My own research was firmly in the area of scientific information, and specifically chemical information. It involved the pragmatic development of systems which would be useful for practice: for retrieval of information, and for the correlation of molecular properties with chemical structure. The underlying theory, though we did not usually reflect on this, was over one hundred years old and was originally proposed by Alexander Crum Brown. His insight was firstly that the nature of chemical substances could be represented by structure diagrams, and secondly that the properties of chemical substances could be directly related to these structural representations. Techniques for handling digital versions of these representations, clever though they may have been, added little to this basic theory. This has been the basis of much of modern chemistry, including the pharmaceutical and fine chemicals industries. This remarkable combination of theory and information representation is perhaps paralleled only by the periodic table; perhaps this is why so many of the early generations of information scientists were trained in chemistry.

As for theories of information, Shannon’s Mathematical Theory of Communication was pretty much the only game in town. Its limitations in application to the concerns of the less technical end of the information sciences were well recognized, but there was interest in how it might be applied more widely.

After my doctoral studies, I took a job in a pharmaceutical research centre. I still thought of myself as a scientist, who happened to work with information rather than laboratory equipment: a ‘scientific informationist’ rather than an ‘information scientist’, in the terms of a question asked at my recruitment interview.

Although I was working as a practitioner, it was in a scientific research environment, where research and development in all fields were encouraged; and in the pharmaceutical information environment, which has been the source of many innovations in information systems and services. As a result of this, my interest in, and attitude towards, theories in the information sciences developed in several ways.

I extended my involvement in the use of digital data collections for the analysis of the relations between chemical structure and molecular properties, using both the structural analysis techniques developed in my doctoral studies and also methods involving theories of the relation between physical properties of substances and their biological activities. The underlying principles of these methods were undeniably ‘scientific’, they were empirical or semi-empirical in nature; they worked, and could account of observed properties, and predict the properties of new substances, but gave little insight into the reasons. While this is a common enough feature of many scientific theories, I came to find it limiting, in terms of lack of understanding of the issues.

Working on the development of systems for the retrieval of information on chemical substances and their reactions, I became aware that some of the concepts of organic chemistry – aromaticity, multiple inter-atomic bonds, atomic charges, and so on – were not as clearly defined or understood as I had been led to believe in my student days. (It is sometimes said that to ensure one understands a topic, one should give a lecture course on it. As an alternative, I would recommend trying to incorporate the topic into an information storage and retrieval system.)
The noblest pleasure: theories of understanding in the information sciences – The Occasional Informationist

severely practical task of providing better retrieval facilities was casting light on the nature of chemical concepts (http://www.mdpi.com/2227-9709/2/4/50), which are now recognized as being distinctly ‘fuzzy’.

As a developer of chemical retrieval systems, I was involved in devising systems for browsing and identifying patterns in chemical data sets, and some of these ideas were applied to bibliographic records. This led to the first ‘theory’, actually only a concept, which I can claim to have introduced. This is the idea of molecular dissimilarity (http://link.springer.com/chapter/10.1007/978-3-642-78027-1_33), and the idea that focusing on the most dissimilar items in a set, rather than on the most similar (which is common in many retrieval systems) is of interest. This is valuable for browsing (“I’ve seen this sort of thing, now show me something different”), and for spanning information spaces efficiently. In the chemical context, it allows the greatest variety of substances to be synthesized or tested for some property, desirable or otherwise.

Working with systems to encourage browsing, particularly within an organization whose raison d’être was innovation, led me to reflect on what information systems and services could contribute to creativity and innovation. At the time, this topic had not been examined systematically. I attempted a systematic literature analysis of the topic, and the resulting paper (http://jis.sagepub.com/content/12/5/203.short) has, I am told, been influential on a number of those researchers who have since developed this topic greatly. This paper did not propose a theory as such, but rather sought to bring together some rather disparate conceptions of the topic.

Finally, I was involved in a variety of evaluations of information systems and services. One exercise in particular, a collaborative project among a number of organizations to evaluate the performance of systems for providing toxicology information (http://jis.sagepub.com/content/5/1/3.short), led to development of new ways of assessing system performance. These used a detailed qualitative failure analysis, and more sophisticated ideas of relevance than were then the norm. This led me to think about evaluation more generally, and I realized that those methods which were ‘scientific’, actually told us least about why systems and services worked well or not. I was also disturbed by the then antagonism between the proponents of quantitative and qualitative evaluation. It seemed evident to me, based on my practical experience, that a combination of the two must be the optimum. I expressed these ideas in a book (http://www.amazon.co.uk/Oriented-Evaluation-Information-Systems-Services/dp/0566052091), which did not attempt to produce a theory of evaluation, but rather to reach an understanding of the various styles, and their associated methods, as they relate to one another, and also an appreciation of their relative merits.

In short, by the time I left a practitioner role and re-entered academia, I had developed a strong interest in qualitative conceptual analysis of information-related topics. I certainly did not see this as a theoretical position; rather a pragmatic assessment of what was good for the development of better systems and services on a rational basis. In so far as I espoused any theoretical perspective, it would have been that of Bertie Brookes. By then, I liked the idea of being an information scientist rather than a scientific informationist, and Brookes was giving information science a philosophical foundation, and even a fundamental equation. Furthermore, he was basing his ideas on the philosopher of Karl Popper, a very acceptable philosophical choice for someone from a scientific background. Although these ideas did not develop as Brookes might have wished, they
have, I believe, been strongly influential, and may yet have more to offer (http://openaccess.city.ac.uk/3130/). They have certainly affected my ideas, and continue to do so. (I also have a personal fondness for Brookes, who was on the interview panel which gave me my first academic position, and was the only panel member who smiled when I told what I regarded as a joke.)

My experience as a practitioner impressed me with the idea that theories in the information sciences very often began with issues stemming from practice. I am not a zealot in this regard, as it seems clear that concepts and ideas far removed from the everyday concerns of the information practitioner can sometimes play a valuable role in theories of information science. Nonetheless, it seems to me that the theory and practice in the information sciences will, and should, generally be intertwined; a belief which has been a strong feature of the ‘British school’ (http://openaccess.city.ac.uk/3106/). The science must have a link to vocational activities, and a concern for the practitioner. It should be the conceptual discipline that emerges from, interacts with, underlies and supports professional activity. As Brian Vickery wrote, “The theory of [information] science should spring from deep immersion in practice”.

Theory in information science

I believe that information science itself is best regarded, in the typology of Paul Hirst, as a field of study, rather than a traditional discipline. More specifically it is best regarded as a multi-disciplinary field of study (http://www.informationr.net/ir/12-4/colis/colis31.html), with its subject being all aspects of human recorded information. More specifically still, I believe that it is helpful, in setting the boundaries of what is still a wide and diverse area, to distinguish it by its focus on the information chain of recorded information (http://openaccess.city.ac.uk/3117/), as set out by my colleague Lyn Robinson. Necessarily, this means that it will overlap with other disciplines involved with aspects of the communication chain, such as computer science, publishing, psychology, and sociology.

If this viewpoint is accepted, it follows that it is unreasonable to expect there to be ‘a theory’ of information science specifically, or of the information sciences more generally. Rather, there will be a range of theories, dealing with different aspects of the subject, and very probably deriving from theories in cognate disciplines. We may also expect theories at different levels of scale and specificity (http://openaccess.city.ac.uk/6446/), dealing with emergent properties of information in different contexts.

There is considerable support for this viewpoint. Birger Hjørland, for example, wrote in 1998 (http://www.researchgate.net/publication/228717437_Theory_and_metatheory_of_information_science_A_new_interpretation) that it was difficult to give even one good example of an explicit theory in the information sciences. What we have are theories taken from other fields, and some “unconscious attitudes” guiding research and practice. Furthermore, such theories are generally limited to one particular aspect, context, technology or function. In support of this idea, a 2001 analysis of over 1,000 information science articles (http://web.simmons.edu/~benoit/lis403/pettigrew_jasist_52-1.pdf) by Pettigrew and McKechnie found that a majority of the theories mentioned were brought in from other disciplines. Where theories from within the information sciences themselves were present, these were typically rather specific theories, such as models of information seeking, rather than broader
theoretical perspectives; and, some were simply mentions of concepts. Similarly, of the 72 theories of information behaviour identified by Fisher, Edelez and McKechnie (http://www.amazon.co.uk/Theories-Information-Behavior-Asist-Monograph/dp/157387230X), most originated from outside the information sciences. Although there has been an increased emphasis on theory within the information sciences over recent years, the field still remains without a convincing theoretical foundation of its own.

Donald Case, discussing theories of information seeking and information-related behaviour (http://www.amazon.co.uk/Looking-Information-Research-Seeking-Behavior/dp/1780526547) generally, notes that four forms of theory for the social sciences have been identified:

1. a set of laws, i.e., well-supported empirical generalizations;
2. an inter-related set of definitions, axioms and propositions;
3. descriptions of causal processes; and,
4. vague concepts, untested hypotheses, prescriptions for good behavior.

The first is what I believed, from my scientific background, to be a proper theory. The third, although as Case points out we cannot expect strict causal laws in the social sciences, covers the process models of information behavior which have very popular over the years. The fourth is what, all too often, has passed for theory in the information sciences. I may even have been guilty of proposing such myself on occasions, though I did not, I hope, ever imply they were theories. The second covers the kind of theory which I found most congenial, and which I have been interested in developing.

I am primarily interested in developing ways of understanding information, and concepts related to information, in all the contexts in which it may appear. This necessitates incorporating insights from numerous disciplines and forms of knowledge. This, in turn, means that the kind of theories I am interested in developing are of a kind which would probably not be recognized as theories at all by my early mentors in the physical sciences. They are examples of what Gregor, in the context of information systems research, denotes as ‘theories for explaining’ (http://heim.ifi.uio.no/~petterog/Kurs/INF5220/NatureofTheoryMISQ.pdf); though I would prefer to regard them as ‘theories for understanding’.

Seeking understanding

The typical dictionary definition suggest that to understand is to ‘comprehend’ or to ‘grasp with the mind’, and this commonsense meaning is clear. The term is used differently in academic theorizing, however, including in the information sciences. Stock and Stock, following a common viewpoint, associate it with hermeneutics (http://www.amazon.co.uk/Handbook-Information-Science-Wolfgang-Stock/dp/3110373645), and the philosophy of Gadamer and Heidegger.

My own approach (http://openaccess.city.ac.uk/12975/) is somewhat different, and is rooted in philosophy of information. I have found particularly helpful the definition of understanding developed by the philosopher Jonathan Kvanvig (http://www.cambridge.org/catalogue/catalogue.asp?isbn=0521037867), in which he distinguishes understanding from information, knowledge and truth. He suggests that “understanding requires the grasping of explanatory and other coherence-making relationships in a large and comprehensive body of information. One can know many unrelated pieces of
information, but understanding is achieved only when informational items are pieced together”. The object of understanding (that which is understood) is, for Kvanvig, not constituted as a number of single propositions, but rather as an “informational chunk”. He refers to the grasping of the structure within this chunk as an “internal seeing or appreciating”. This approach is able to cope with ambiguity, contradiction, missing information, and all the other messy features present in real-world information collections.

This is not inconsistent with the typical dictionary definition, but it goes beyond it. It emphasizes that in understanding we are: (1) dealing with a large and complex of information; (2) going beyond a simple ordering and enumerating of the contents of that set; and, (3) gaining some holistic ‘grasp’ of the contents of the set.

It also draws from David Deutsch’s explanation of understanding (http://en.wikipedia.org/wiki/The_Fabric_of_Reality), as distinct from knowing, describing and predicting. He states that understanding is hard to define exactly, but it encompasses the inner working of things, why things are as they are and having coherence and elegance.

Finally, it seems to have something in common with Luciano Floridi’s view of knowledge (http://global.oup.com/academic/product/the-philosophy-of-information-9780199232383), as distinct from information. “Knowledge and information are members of the same conceptual family. What the former enjoys and the latter lacks … is the web of mutual relations that allow one part of it to account for another. Shatter that, and you are left with a … list of bits of information that cannot help to make sense of the reality they seek to address”. There is certainly a close link between understanding and knowledge. As Winograd and Flores put it (http://www.amazon.co.uk/Understanding-Computers-Cognition-Foundation-Design/dp/0201112973): “what we understand is based on what we know, and what we already know comes from being able to understand”.

Since writing the chapter, I have developed this approach to understanding further, in a paper with my colleague Lyn Robinson, and further developments will be presented at the 2016 CoLIS conference (http://www.abm.uu.se/colis9/).

In seeking this kind of theoretical understanding for concepts in the information sciences, my approach has been to make use of methods for gaining understanding of a topic, concept or issue of a body of recorded information. For most interesting topics there is a great amount of material available. These methods are mainly forms of systematic qualitative analysis and synthesis of information (http://www.lirjournal.org.uk/lir/ojs/index.php/lir/article/view/483). These go well beyond the conventional ‘literature review’ – although that will almost certainly be their starting point – in setting out to find, or to create, a structure or framework for understanding; and they may therefore count as theories in the sense discussed above. ‘Conceptual model’ would be a reasonable alternative way of describing many theories of this kind. They also draw on ideas for the ways in which qualitative research findings may be synthesized, when the meta-analysis approach to quantitative findings is not appropriate. See, for example, Barnett-Page and Thomas (http://www.webcitation.org/5shAOY1P7). It is worth saying clearly that this is not an exercise in linguistics, or analytical philosophy. We are not interested in the definition of terms, but in the relations among concepts. It also has an undeniably subjective aspect. As Byers puts it (http://www.amazon.co.uk/How-Mathematicians-Think-Contradiction-
Mathematics/dp/0691145997): “Understanding is a difficult thing to talk about. For one thing, it contains a subjective element, whereas drawing logical inferences appears to be an objective task that even sophisticated machines might be capable of making.”

I have come to the view that this kind of deep understanding is essential for both research and practice in the information sciences. For research, it enables us to fully comprehend and relate the concepts with which we deal. To those who argue that this is not really a theory in itself, we may say that it is perhaps a proto-theory, an essential basis, on which ‘true’ theories may be developed. For practice, it reflects the need, in a world in which information on almost any topic may be found readily, for a deep and reflective understanding. It may be argued that the most currently popular forms of information systems do little to support this.

Where relevant, such analyses have been augmented by empirical research, using established mixed-method approaches. Mixed-methods are usually needed to capture the complexity of the situations. In addition when this involves investigating some aspect of information behavior, I always advocate using, or extending, an established model rather than creating a new one. An example of this is provided by two of my colleagues, Andrew Robson and Lyn Robinson, who have integrated existing models from information behaviour (specifically Wilson’s model) and from communication studies (http://openaccess.city.ac.uk/3103/).

I believe that one of the current problems of the information sciences is the plethora of ‘novel’ empirical methods and models, which make comparison and cumulative progress difficult, as Case remarks (http://www.amazon.co.uk/Looking-Information-Research-Seeking-Behavior/dp/1780526547). Wilson’s well-known information behavior models, for example, are sometimes criticized on the grounds that they are simplistic, and ignore the subtleties and details of different contexts. The residual scientist in me always wishes to argue that this is, of course, correct, but that this is the whole point of a model of this sort – that it is simple and context free. Having a plethora of models for the same phenomenon, albeit in different contexts, rather defeats the point. If they are truly needed, then this suggests that understanding is lacking; and I would far rather begin by trying to create a general qualitative framework for such understanding than create a specific and detailed new model. (One could, of course, designate such a qualitative framework as a model, but I do not think this is a helpful use of the term.)

Examples

Some examples of this kind of theory development may make this general description clearer.

One instance is the developments of ideas relating to information paradoxes and problems – the downside to the information society and the ready availability of information in many environments. I first dealt with this when, having published some rather limited accounts of the phenomenon of information overload, I was asked to produce a more detailed literature analysis. The analysis proposed a framework for understanding what was meant by this term, information overload (which was rather over-used at the time), what were its causes, and what might be done to minimize its effects. I then went on, largely through the hard work of a doctoral student, to examine another ‘negative information phenomenon’ – information poverty (http://www.emeraldinsight.com/doi/abs/10.1108/00220410710759002). Through literature analysis and synthesis, and discourse analysis, it could be shown that this concept was very
malleable, and changed its meaning several times over the years. Any theory for understanding, and potentially preventing, information poverty has to take this into account, or it will be devoid of explanatory power, and far from useful.

These ideas were then enfolded into a more all-encompassing attempt to understand all of these information problems – what we termed the ‘dark side’ of information (http://openaccess.city.ac.uk/3109/) – in one fell swoop. This has in turn led to attempts by others to develop deep understanding of the ways in which such problems may be overcome. One such attempt is the work of my colleague, Lyn Robinson, with her doctoral student, Liz Poirier, in developing an understanding-providing theory of Slow information behaviour, applying the ideas of the Slow Movement in the context of the theory and practice of information seeking. Being Slow in information terms means taking purposeful action to create the space and time for making appropriate information choices for the context. It can assist a person’s capacity to absorb information and use it more effectively, by creating an ‘informational balance’. The initial empirical test of this theory used a novel method that was, appropriately enough, a Slow variant of the Delphi technique (http://openaccess.city.ac.uk/3175/), unimaginatively termed ‘Slow Delphi’.

Another topic which began quite separately, but ultimately linked with the former, is that of digital literacy (https://theoccasionalinformationist.com/academic/research-and-professional/information-behaviour-and-digital-literacy/). This began when I was personally perplexed by the multiplicity of ‘literacies’ appearing in the library/information literature – information literacy, digital literacy, media literacy, computer literacy, internet literacy, network literacy, library literacy, and others. This led me to produce a literature-based analysis of the concepts. Somewhat to my surprise, this remains one of the most frequently downloaded articles from its journal. Subsequently, feeling that information literacy, as prescribed within the academic library community in particular, was a rather restrictive model, I developed Paul Gilster’s concept of digital literacy into a very general model for understanding all information-related literacies at several levels. This model was then related to the ideas developed for the ‘dark side’ phenomena, to try to provide an overall conceptual model that links cause with effect with potential solution.

It is my experience that links of this sort occur with regularity with theories of this kind. Perhaps this is not surprising; as we saw above, the whole nature of understanding in this sense involves the making of links.

As a third example, I might mention an analysis of the Open Society philosophy in the specific context of library and information services. The idea of the Open Society was advanced by Karl Popper, in his best known work of political philosophy, and developed by the financier and philanthropist George Soros into an active program of supporting the development of civil society in former dictatorships and other closed societies. This program had, and still has, an important element of support for libraries, media and information provision.

The theory development in this example involved the translation of Popper’s principles of Open Society into the library/information context, as a set of principles explicable in terms of Popper’s conceptualization (http://openaccess.city.ac.uk/3179/). Although Popper’s political philosophy
seems far removed from his better known work in the philosophy of science, both are based on his epistemology of objective knowledge, which Brookes – as noted above – regarded as a philosophical foundation for information science.

Some further examples, offered without detailed comment, are: development of a conceptual framework for understanding the idea and scope of a digital library (http://www.researchgate.net/profile/Ian_Rowlands/publication/249722982_Digital_Libraries_A_Conceptual_Framework/links/54eeea950cf2e2830865bd5f.pdf), at a time when the term was being used in varying and potentially misleading ways; a synthesis of ideas on ‘information styles’ (http://openaccess.city.ac.uk/3110/), including a wide spectrum of findings and perspectives relating to individual differences and personality factors involved in information-related behaviour; and development of the topic of my first attempt at such theory development, information and creativity, analyzing the concept of browsing, and synthesizing ideas of serendipitous information encountering with the browsing process (http://www.facetpublishing.co.uk/title.php?id=046978&category_code=#table-of-contents-tab).

Recently, Lyn Robinson and I have been interested in the idea of the ‘gaps’ between conceptions of information in different domains (http://openaccess.city.ac.uk/6446/); most particularly, what, if anything, does the idea of information as an objective component of the physical world (http://openaccess.city.ac.uk/3167/) have to do with recorded human information. Unlike the examples above, the need for this kind of theory does not arise directly from the concerns of practice, but success in this respect could have interesting and largely un-anticipatable consequences for practice. It is a particularly challenging kind of problem, as it involves attempting to make connections between theories of many different kinds, from the mathematical explanatory and predictive theories of the physical sciences to those from philosophy and the human sciences. Whether such understanding will best be reached by ‘grand designs’, linking concepts of information at various levels, such as the early conceptions of Tom Stonier (http://www.amazon.co.uk/Tom-Stonier/e/B001HPYL0M) on the linking of physical, biological and social concepts on information or Luciano Floridi’s more recent development of his philosophy of information (http://global.oup.com/academic/product/the-philosophy-of-information-9780199232383), or by a series of smaller-scale integrative connections, each dealing with information at similar levels, remains to be seen.

Conclusions
Leonardo’s well known aphorism suggests that understanding has a special virtue. It is a particularly good place to start in developing theory for a discipline like information science, which has long been recognized to be a meta-discipline, or a borrowing and integrating science, as has been shown by numerous bibliometric studies. Such a science must necessarily draw many of its concepts from other disciplines, and either take its theories from them or adapt from others. A deep understanding of the nature and inter-relations of this mass of material, giving coherence and clarity, is the necessary beginning to other forms of theory, as well as valuable in its own right. In the longer term, we might hope that it could catalyze the reverse process – the generation of concepts and theories from the information sciences that would contribute to the theory base of other disciplines.
Postscript

After the first draft of the chapter was completed, I read an article (http://philsci-archive.pitt.edu/5131/1/Sustaining_a_controversy.docx) analyzing, from a historical and philosophical viewpoint, the aspect of theoretical organic chemistry which was the subject area for my undergraduate dissertation – and my only hands-on experience of research in the true scientific sense, with white coats, laboratory equipments and chemicals. This article describes the controversy, lasting for several decades, over the existence of ‘non-classical ions’, a concept derived as part of the theoretical study of reaction mechanisms. It was somewhat chastening to find that something in which one was personally involved is now officially historical. But beyond this, Goodwin writes in an intriguing way of the kind of ‘soft theory’ involved in this kind of physical organic chemistry: “theoretical explanations in this field are often produced after the fact to rationalize results, and … those explanations that are produced are frequently qualitative … organic chemists have made a trade-off: they have de-emphasized quantitative prediction and unambiguous explanation for something much more useful, given their pragmatic goals – a theory that helps them make plausible … assessments of the chemical behavior of novel, complex compounds.” The similarity with the kind of research in the information sciences which I have advocated here seems striking. Perhaps there is, in fact, not so much difference between the nature of the different fields as I had supposed; complex situations and emergent properties need similar treatment in both cases. And perhaps I was more influenced by this first exposure to research than I had realized; first influences are surprisingly long-lasting.

Posted in Uncategorized