Serendipity in research and the threat of technology

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Abstract

In contrast to public perceptions of research as a rigorous, structured and planned process, much research is, in Thomas Kuhn's terms, messy and accidental. From an analysis of case studies of how well-known researchers identified topics for research, serendipity appears to play a role in two-thirds of the cases, and in many of these reading is the source of serendipity. The types of reading most likely to lead to serendipitous research are monitoring browsing (regularly reading an information source e.g. a particular journal) and capricious browsing (random reading of texts without a definite goal). Whether such browsing stimulates serendipitous research is dependent on 'the prepared mind' and is personal. Librarians have been concerned for many years with how to promote browsing, but the growth of electronic texts and article-based publishing, while undoubtedly beneficial for searching, reduce the likelihood of productive browsing (especially capricious browsing) leading to serendipitous research. Guidelines for how researchers may address these challenges are given.

Before the 1960s, there was a clear consensus, both among academics and by the general public, of the nature and processes of scientific research. Research was seen as a structured, predetermined, rational process. A typical model of research would start by identifying a gap in knowledge from previous research, data would be collected to fill the gap, and clear predetermined procedures would be set up to analyse the data. There was, then, "a 'scientific method' that provides a formula which, if faithfully followed, will lead to discovery" (Wolpert, 1992, p. xi). Starting in the 1960s, academics questioned whether this model described the reality of most research, yet the general public still perceives research in this way.

Within academia, although often questioned, the scientific method model persists in two key sources. First, textbooks about science almost always present a neat linear picture of the scientific process. For example, Reiff, Harwood and Phillipson (2002) found that unambiguous step-by-step models dominated in 40 textbooks they analysed. Similarly, Finley and Pocovi (2000) identified a shared 6-step model in most textbooks:

1. Identify a problem
2. Form a hypothesis
3. Conduct an experiment to test the hypothesis while controlling variables
4. Collect and analyse data
5. Form conclusions
6. Present a theory.

This stepwise linear process presented in textbooks may influence public perceptions of the nature of science.

A second academic source promoting the scientific method model is research funding proposals. Nearly all funding bodies expect researchers to present a clear, complete picture of all the steps in the research before they start and may penalise funding recipients who deviate from this list of procedures.

While textbook writers, funding bodies and the general public mostly perceive research as heavily structured, academics who investigate the process of doing research hold very different views. Most famously, Thomas Kuhn (1970) in *The Structure of Scientific Revolutions* argued that much research is messy and accidental. Research ideas may come from anywhere (rather than being restricted to filling in a gap in knowledge), the focus of the

research may change as the research progresses (rather than being fixed at the beginning), and procedures need to be flexible to deal with problems (rather than rigorously following a predetermined process). Many active researchers also view the scientific method model as not reflecting reality. In their study of the research process, Reiff et al. (2002) interviewed researchers about the validity of the models presented in textbooks with one informant going so far as to say that "It's absolute gibberish" (p. 9). The reality of research, then, is that it is far less structured and predetermined and far more flexible and messy than the neat picture so often presented and accepted.

In this paper, I am taking the view of research as a messy, unpredictable process focusing on how "personal and historical accident" (Kuhn, 1970: 4) influence research. In other words, I will look at the "intuitive, coincidental or serendipitous" nature of research (Kirsch & Rohan, 2008) which has been previously marginalised in the literature. In doing this, I am restricting myself to examining where research ideas come from, especially the role of serendipity in finding topics to research. Having shown how serendipity plays a crucial role in some research, I will then consider the threat of relatively recent technological advances to the place of serendipity in stimulating discovery and innovation.

1. Serendipity as a source of research ideas

Serendipity is a word whose first use can be traced to a specific document written on a specific date. After reading a fable called 'The Three Princes of Serendip' (Serendip was an alternative name for Sri Lanka), on January 28th 1754 Horace Walpole in a letter to a friend, Horace Mann, wrote that the princes "were always making discoveries, by accidents and sagacity, of things which they were not in quest of" (quoted in Weiner, 2016, p. 209), and the term *serendipity* was born (Fine & Deegan, 1996).

Serendipity has been variously defined, humorously, as "looking in a haystack for a needle and finding the farmer's daughter" (quoting an anonymous comedian in Cooksey, 2004, p. 24), and, academically, as "the unique and contingent mix of insight coupled with chance" (Fine & Deegan, 1996, p. 3). This latter definition highlights the three key features of serendipitous events that influence research identified by Merton (1968, p. 6). For something to be a serendipitous stimulus for research, it must be "anomalous" (i.e. unique and contingent), "strategic" (i.e. involving insight leading to developments in theory), and "unanticipated" (i.e. chance). While in everyday life serendipity is generally viewed as synonymous with coincidence, in research an extra element is needed for serendipity to be productive. This is the strategic element or "if and how users attribute value to the accidental discoveries" (Carr, 2015, p. 11). In other words, in research serendipity highlights the importance of Pasteur's well-known quote, "Chance favours the prepared mind".

The history of science is full of serendipitous discoveries that led to major advances, including Archimedes' principle, dynamite, penicillin, bacterial roles in peptic ulcers, the Dead Sea scrolls, Teflon, and polyethylene oxide (Foster & Ford, 2003; Weiner, 2016). Even in fields where it seems that serendipity is likely to be irrelevant, such as mathematics, it can play a role. For example, Villani (2015, p. 187), a winner of the 2010 Fields Medal, describes how "chance redirected the course of my research to a degree I wouldn't have thought possible" in his proof of nonlinear Landau damping. What is less clear is whether serendipity has also played a role in developing applied linguistics.

2. Serendipity as a source of research ideas in applied linguistics

Investigations of the role of serendipity in research are largely based on anecdotes. The only such evidence concerning research in applied linguistics that I am aware of comes from a paper I presented at a previous DRAL conference (Watson Todd, 2011). In that research, I sent

open-ended questionnaires to well-known applied linguistics researchers asking them to describe the sources of their ideas for specific research studies.

A third of the studies followed a process similar to the traditional scientific method model based on filling a gap. For example,

> "I kept getting asked about which techniques were the best ones so I figured I needed to give a principled answer. I know of an earlier study but knew I had to have a more elaborate system. So, drawing on research that others had done and my own writing I figured out a new system."

(Case study A)

The majority of the studies, however, implied a far less structured process of generating research ideas. For instance, a couple of studies started with useful data for which researchers identified a research purpose. Half of the remaining less structured studies were prompted by serendipitous experiences, such as becoming intrigued by unexpected student behaviour:

> "This paper originally arose out of my anecdotal observations of the ways in which various language learners at my university were making use of the computer-based provisions in the language resource centres. It sought to find out what the practices and perceptions of learners [were] and to consider these in relation to current thinking on computer assisted language learning and learner autonomy."

(Case study B)

The other half of the less structured studies involved serendipitous reading. In some cases, the amount of serendipity is low as the researcher is reading texts related to their area of research interest.

> "I had read a brief report by Branigan, Pickering and Cleland in Cognition that used a novel technique in syntactic priming research (scripted interaction). It resembled the types of tasks commonly used in interaction research in L2 acquisition, so I decided to try the technique with L2 speakers to see if it would work."

(Case study C)

There were also cases where the level of serendipity was extremely high since the texts read had nothing to do with applied linguistics, and, in some cases, it was specifically noted that they were being read for pleasure.

> "Some years before I had read James Gleick's book Chaos: The Making of a New Science, and my understanding of language and its acquisition was transformed as a result. This book had nothing to do with language, but rather with complex, nonlinear, dynamic systems in nature. Nonetheless, it provided a much more satisfying way of dealing with issues of second language acquisition which I have been investigating for years."

(Case study D)

Finally, there was one outlier case where the serendipity involved personal relationships arising from a high school reunion:

> "The idea for this paper did not come from me, rather a high school friend had begun to look at the language used to represent African Americans during hurricane Katrina and realized that he needed some additional help for looking at features of language. We had reconnected through our high school reunion and so we thought collaborating was a good idea. We'll probably do one more paper with this data taking a more linguistic approach."

(Case study E)

Almost two-thirds of the cases in Watson Todd (2011), then, involved an element of serendipity in generating research ideas, and, in half of these or nearly one-third overall, the

serendipity came from reading. It therefore appears that serendipity can play an important role in stimulating research ideas in applied linguistics.

3. Serendipitous reading or browsing

Three types of serendipity have been identified as potentially influencing research ideas (Nutefall & Ryder, 2010). First, there is chance which involves a completely unexpected accidental event as in Case study E. Second, there is mystery investigation where some unexplained phenomenon is identified and research is conducted to attempt to provide an explanation as in Case study B. Third, there is browsing which is "a casual search for items of interest without clearly defined intentions" (p. 14). The two examples of serendipitous reading in Case studies C and D involve browsing.

Given that browsing has the potential to stimulate research and active knowledge searching, there is a sub-field in library science which aims to investigate ways of promoting productive browsing in libraries. This has led to typologies of browsing. Some of the typologies are based on the goal of browsing. For example, Bawden (1986) distinguishes purposive browsing or deliberately seeking new information in a broad subject area, exploratory browsing or the search for inspiration, and capricious browsing which is random and without a goal. For purposive and exploratory browsing, typologies based on methods of browsing have been created (e.g. Carr, 2015; Rice, McCreadie & Chang, 2001), which include situational browsing (or examining other sources in the same location as a specific item, such as skimming adjacent books on a library shelf), systematic browsing (or following up citations or references under a subject heading), and monitoring browsing (or regularly skimming an information source such as a journal). In the cases of serendipitous reading, Case study C is exploratory browsing based on monitoring, and Case study D is capricious browsing.

These types of browsing are not the only reasons for reading within the research context. Examining reading for professional purposes, Choo, Detlor and Turnbull (2000) identified four purposes in reading:

1. Undirected viewing where there is no specific information in mind; rather, reading patterns are sweeping. This is similar to capricious browsing.
2. Conditioned viewing where the goal is to increase knowledge in a broad topic area. The reading patterns are discriminating, and this is similar to purposive and exploratory browsing.
3. Informal searching is more specific with the goal of finding knowledge within narrow boundaries. The knowledge to be found is not predetermined but is highly constrained, and the reading patterns are selecting.
4. Formal searching involves identifying specific predetermined information where the reading patterns are retrieving.

The two types of viewing may lead to serendipitous reading stimulating research, but the two types of searching do not allow serendipity a role.

4. Serendipitous browsing and the impact of technology

We have seen that serendipitous browsing is an important source of research ideas and therefore we might expect that universities and libraries would attempt to create contexts where serendipitous browsing is likely to occur. However, largely due to the growth of technology, librarians are concerned that serendipitous reading is "an imperiled phenomenon" (Carr, 2015, p. 5). For example, with more space in libraries devoted to networked technologies and less to books and with information more frequently accessed through online searching, situational browsing (e.g. skimming adjacent books on a library shelf) is a dying art.

Relatively recent developments in technology have had a massive impact on academic reading. Increasingly, texts are being read on screen rather than on paper; increasingly, choices

about what to read are being made based on the results of online searches rather than browsing (Tenopir, King, Edwards & Wu, 2009); and increasingly, traditional libraries with stacks of paper books and journals are seen as archaic and irrelevant. These changes have in many ways been beneficial for researchers and made their lives much easier, but at the same time we are in danger of losing valuable affordances through the growth of technology.

The clearest benefit of technology for reading for research is the ease and accuracy of searching, especially formal searching. Full-text searches of massive quantities of academic publications, such as *Google Scholar*, are a godsend for researchers. Without such facilities, finding references to support specific points in writing up research is enormously time-consuming and frustrating.

The clear benefits for academic work of searching, together with the frequency with which we use search facilities in our everyday lives, make searching the default approach to finding information. Even when we are not really sure about what information we want, we tend to attempt searches rather than browse. This is especially true for a younger generation used to information on demand (Nutefall & Ryder, 2010). This increasing prevalence for searching over browsing has two negative effects. First, "by supplying answers with such ruthless efficiency, the internet cuts off a supply of an even more valuable commodity: productive frustration" (Greenman, 2010). Second, the chances of searching leading to serendipitous discoveries prompting new directions in research are very low.

While searching as the basis for finding texts to read reduces opportunities for serendipitous discovery, it should be stressed that this reduction is due to the way in which reading is directed rather than the technology itself. In the 1990s when the Internet was still young and fairly manageable, there were two main ways of finding information: searching and directories. Most directories used hierarchical trees to organise knowledge and these were suited to serendipitous discovery (Foster & Ford, 2003). As the Internet grew, directories became more and more difficult to maintain and were increasingly replaced by search engines to the point where there are now almost no useful directories, meaning that searching which precludes serendipity has become the default.

The changes in technology mean that browsing, whether in libraries or through directories, is playing a less and less important role in how academics identify texts to read with searching becoming primary. This trend, however, is less noticeable in applied linguistics than in, say, engineering (Tenopir, King, Spencer & Wu, 2009). This dominance of searching has impacts on reading research and publishing research.

For reading, once a useful text is found, the reading often happens on screen. Although not conclusive, there is evidence that navigating through long texts is easier on paper than in electronic formats (Jabr, 2013) and that comprehension from reading is higher when texts are read on paper than digitally (Carr, 2011; Mangen, Walgermo & Brønnick, 2013). The shift from print to electronic may therefore have further repercussions.

For publishing practices, with searching taking over from browsing, publishers have little reason to attempt to produce coherent issues of journals. Instead of editors taking care in selecting for inclusion and sequencing articles in an issue, the current practice of article-based publishing means that articles are treated like items on a production line with the next in line filling the next available slot. Hyland (2016) sees this as greatly reducing the role of editors in journal production and possibly leading to the demise of the journal in the long run.

5. Knowns, unknowns and serendipity in applied linguistics research

I have argued that the general public perceives research as following the predictable scientific method, yet much research follows a messy and accidental path. Research where the process approximates the scientific method attempts to fill gaps in knowledge, as in Case study A. Such research is a necessary and valuable part of knowledge generation and I am not

downplaying its importance. However, research to fill gaps does not lead to major advances in a field; these are far more likely to originate in serendipitous discovery. For example, the increasing use of chaos and complexity theory in applied linguistics and how this changes the way we conceptualise issues is largely down to the serendipitous reading reported in Case study D. Research stimulated by serendipitous discovery, often based on reading from browsing, is what drives the field forward (although, of course, not all serendipitous research leads to major advances).

This distinction between research which fills gaps and research which advances the field can be seen in terms of the categories famously set up in 2002 by Donald Rumsfeld, then US Secretary of Defence:

> "There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things we know we don't know. But there are also unknown unknowns. These are things we do not know we don't know."

In applied linguistics, the known knowns are the current accepted theories and knowledge base of the field. Researchers realise where there are gaps in this knowledge base - known unknowns - and conduct research to fill these. Most troubling are the unknown unknowns (Pawson, Wong & Owen, 2011) - if we do not know what it is that we do not know, there is no way that we can make plans to identify these. The only way that we can become aware of unknown unknowns, and so convert them to known unknowns, is by chance, in other words, serendipitous discovery.

Rumsfeld's categorisation also relates to purposes in reading. When we engage in searching, we know what information we are looking for. Thus, searching attempts to use the known knowns of the whole field to convert personal known unknowns into personal known knowns. Searching, then, while improving our own personal knowledge base does not affect the knowledge base of the academic community as a whole. When browsing, on the other hand, we do not know what information we will encounter, especially in the case of capricious browsing. The information we gain from browsing is mostly personal known unknowns and personal unknown unknowns, but in some cases may even be unknown unknowns for the whole field. For the last, if the information we gain stimulates us to conduct serendipitously-based research, our work may convert unknown unknowns for the whole field into known unknowns or known knowns, and in this way there is a major advance in applied linguistics.

6. The practices of influential researchers

Clearly, most applied linguistics research does not lead to major advances in the field; rather, it fills minor gaps in knowledge. Research which leads to major advances is rare and there are only a few applied linguists who do this. I would now like to be highly speculative and look briefly at the research and publishing practices of a few applied linguists who have, in my view, driven the field forward. I should also stress that this is a highly personal interpretation of what constitutes a major advance in applied linguistics.

First, there are some applied linguists responsible for major advances who work in ways similar to the majority of researchers, albeit on a far more productive scale. They conduct and publish research in mainstream ways, but have made significant contributions. In this group I would include Alison Wray for her work on formulaic language and Ken Hyland for his work on stance and engagement.

What I find interesting, however, is that a significant proportion of the applied linguists responsible for major advances do not follow typical research and publishing practices. For example, Henry Widdowson, responsible for the use - usage distinction and certain advances in stylistics, almost never conducts traditional research; and Michael Hoey, creator of lexical priming theory, has never published an article in a journal. Their work, and that of some other highly influential applied linguists such as M. A. K. Halliday (responsible for systemic

functional linguistics) and John Swales (originator of ESP genre analysis), is more akin to an exploration of ideas than to traditional research, and their publications rarely follow standard research publishing formats.

A further notable feature of the publications of these applied linguists is the relative paucity of references. The most recent published books by Halliday, Hoey and Widdowson each have 150 to 200 references; the nearest comparable books for size and date of publication on the library shelves each have 300 to 800 references. Similarly, recently published articles in journals by Halliday, Swales and Widdowson each have the lowest number of references of all the articles in that issue, a third to a half of the average number of references per article. When writing up research, most researchers feel a certain pressure to include a fair number of citations and technologically-driven searching makes this fairly straightforward. These influential applied linguists, on the other hand, may be confident enough not to feel this pressure, or even, speculatively, may prioritise browsing over searching as their source of knowledge.

7. Becoming a serendipitous browser

We have seen that serendipity can be a valuable source of research ideas, especially for research that drives the field of applied linguistics forward. Some serendipity comes from chance encounters, such as in Case study E, and is uncontrollable. While serendipity, by its very nature, is unpredictable, one way in which we may increase our chances of making serendipitous discoveries is by reading through browsing. Technological developments, however, mean that browsing is becoming a less common source of reading for research, with searching becoming predominant. If these arguments are valid, and I admit that this article is largely speculative, then as applied linguistics researchers we need to take steps to ensure that we engage in productive browsing.

One problem with browsing is that we cannot know beforehand how valuable any text we read will be. There are, however, a couple of things we can do to increase the likelihood that our browsing will be productive.

First, we can engage in monitoring browsing (regularly skimming an information source such as a journal). With applied linguistics now a broad discipline, we all have our areas of specialisation, and it is essential that we read the recent issues of two or three key journals in our area regularly (this does not mean that we must read all of the articles; rather, all articles should be skimmed and we might read, say, two articles in detail). For example, an applied linguist interested in varieties of English might monitor browse *World Englishes* and the *Journal of English as a Lingua Franca*. While this is eminently sensible and most researchers engage in such browsing, to increase the chances of serendipitous discoveries, we can broaden our monitoring browsing to include journals which cover a broad spectrum of applied linguistics, such as *Applied Linguistics* and *System*, and even journals from other fields which might be of some relevance, as in Case study C. Choosing high-quality journals means that what we read is more likely to be of value.

A second type of browsing which is even more serendipitous is capricious browsing where there is no goal for the reading at all. At the extreme, this might involve selecting a book at random from the library, but taking such a completely random approach will waste a lot of time. What is needed is some guidance to direct us to books which are likely to be worth our time. Asking colleagues for recommendations can help; the ratings on websites such as goodreads.com may be useful (although not for academic texts); or we may try to find lists of books worth reading. To help my colleagues and postgraduate students, I maintain such a list, divided into applied linguistics books and books of general interest (see http://arts.kmutt.ac.th/crs/templates/ about/Books_worth_reading.pdf) which I hope will enable others to engage in productive browsing.

In current academic work environments, academic staff have a multitude of demands on their time. While we may desire to engage in more reading, even capricious browsing with no goal, more urgent demands frequently take over and reading is postponed. As academics, we need to re-evaluate our priorities and make reading, even if not of any immediate use, a key work responsibility.

8. The genesis of an article

In this article I have made several arguments about sources of ideas for applied linguistics research. I have contrasted scientific method research which aims to fill gaps in knowledge or addresses known unknowns with messy serendipitous research. I have argued that this serendipitous research has the potential to address unknown unknowns which create new understandings in applied linguistics and drive the field forward. Such a non-scientific method research approach may be practised by several of the most influential applied linguists. Serendipitous research ideas are often derived from reading from browsing, but this browsing is under threat from technological innovations which promote searching as the main source of reading. Applied linguistics researchers need to take steps to address this threat and keep browsing-derived reading as a source of knowledge and of serendipitous research ideas.

To finish, I would like to look at how these arguments have contributed to the creation of this article. This paper does not present scientific method research; indeed, it is not even clear whether the paper should be counted as research although it does involve a loose analysis of existing data. Even if the article is not clearly serendipitous research, serendipity did play a major role in its genesis. As one of the organisers of the DRAL3/ESEA19 Conference, I felt obliged to contribute a paper. While considering what to present, I read *The Geography of Genius* (Weiner, 2016) for pleasure and was struck by a short section on the role of serendipity in the history of human development. This chimed with a paper I had given at a previous DRAL conference (Watson Todd, 2011) - the source of the case studies discussed earlier. In that paper, I had used the word 'serendipitous' once (referring to Case study E), but decided to revisit the full data set from the perspective of serendipity. I now had a topic to work on: serendipity in research.

The second thread in the current paper, the threat of technology, was stimulated when I was skimming recent issues of a journal, *Journal of English for Academic Purposes*. Normally, when browsing journals I will skip editorials. In this case, however, I had recently invited Ken Hyland to be a plenary speaker at this conference and he was the author of the editorial (Hyland, 2016). His views on the impact of article-based publishing practices on journals struck a chord, so I wrote a response (Watson Todd, 2017). On further consideration I realised how my brief response linked to serendipity in research and the second thread in this paper was born.

In writing up this paper, my references combine reading from browsing and reading from searching. Most of the references I have used which are articles, such as those from library science, come from searching using *Google Scholar*, a common approach to finding citations and, as I mentioned above, a godsend for academic authors. However, four of the citations are for books I have read for pleasure (Carr, 2011; Villani, 2015; Weiner, 2016; Wolpert, 1992).

Serendipity has played a role in the genesis of this paper in four main ways. First, the original idea - serendipity in research - was stimulated by capricious browsing. Second, this capricious browsing is also the source of several citations I use. Third, the second thread in the article - the threat of technology - was derived from monitoring browsing. Fourth, this monitoring browsing did not follow my usual practices because of the serendipitous event of having recently interacted with Ken Hyland for other purposes. In this way, we can see the multiple influences of different types of serendipity on a single article which I hope has proved stimulating.

References

Bawden, D. (1986) Information systems and the stimulation of creativity. *Journal of Information Science, 12*(5), 203-216. doi: 10.1177/016555158601200501

Carr, N. (2011) *The Shallows: What the Internet is Doing to our Brains*. New York: W. W. Norton.

Carr, P.L. (2015) Serendipity in the stacks: Libraries, information architecture, and the problems of accidental discovery. *College & Research Libraries, 76*(6), 831-842. doi: 10.5860/crl.76.6.831

Choo, C.W., Detlor, B. & Turnbull, D. (2000) Information seeking on the Web: An integrated model of browsing and searching. *First Monday, 5*(2). Available at: http://journals.uic.edu/ojs/index.php/fm/article/view/729/638 doi: 10.5210/fm.v5i2.729

Cooksey, E.B. (2004) Too important to be left to chance - serendipity and the digital library. *Science & Technology Libraries, 25*(1/2), 23-31. doi: 10.1300/J122v25n01_03

Fine, G.A. & Deegan, J. G. (1996) Three principles of serendipity: Insight, chance, and discovery in qualitative research. *International Journal of Qualitative Studies in Education, 9*(4), 434–447. doi: 10.1080/0951839960090405

Finley, F.M. & Pocovi, M.C. (2000) Considering the scientific method of inquiry. In J. Minstrell & E.H. van Zee (Eds.).*Inquiring into Inquiry Learning and Teaching in Science* (pp. 47-62). Washington, D.C.: American Association for the Advancement of Science.

Foster, A. & Ford, N. (2003) Serendipity and information seeking: An empirical study. *Journal of Documentation, 59*, 321-340. doi: 10.1108/00220410310472518

Greenman, B. (2010) Online curiosity killer. *The New York Times Magazine* 16 September 2010.

Hyland, K. (2016) Editorial - The death of the editorial. *Journal of English for Academic Purposes 23*, A1. doi: 10.1016/j.jeap.2016.07.003

Jabr, F. (2013). The reading brain in the digital age: The science of papers versus screens. *Scientific American*. Available at: https://www.scientificamerican.com/article/reading-paperscreens/

Kirsch, G.E. & Rohan, L. (2008) Introduction: The role of serendipity, family connections, and cultural memory in historical research. In G.E. Kirsch & L. Rohan, (Eds.) *Beyond the Archives: Research as a Lived Process* (pp. 1-12). Carbondale, IL: Southern Illinois University.

Kuhn, T. S. (1970) *The Structure of Scientific Revolutions*, second edition. Chicago: University of Chicago.

Mangen, A., Walgermo, B.R. & Brønnick, K. (2013) Reading linear texts on paper versus computer screen: Effects on reading comprehension. *International Journal of Educational Research, 58*, 61-68. doi: 10.1016/j.ijer.2012.12.002

Merton, R.K. (1968) *Social Theory and Social Structure*. New York: The Free Press.

Nutefall, J.E. & Ryder, P.M. (2010) The serendipitous research process. *The Journal of Academic Librarianship, 36*(3), 228-234. doi: 10.1016/j.acalib.2010.03.005

Pawson, R., Wong, G. & Owen, L. (2011) Known knowns, known unknowns, unknown unknowns: The predicament of evidence-based policy. *American Journal of Evaluation 32*(4), 518-546. doi: 10.1177/1098214011403831

Reiff, R., Harwood, W.S. & Phillipson, T.A. (2002) A scientific method based upon research scientists' conceptions of scientific inquiry. *Proceedings of the International Conference of the Association for the Education of Teachers in Science*. Charlotte, NC.

Rice, R.E., McCreadie, M. & Chang, S-J.L. (2001) *Accessing and Browsing Information and Communication*. Boston: Massachusetts Institute of Technology.

Tenopir, C., King, D.W., Edwards, S. & Wu, L. (2009) Electronic journals and changes in scholarly article seeking and reading patterns. *School of Information Sciences -- Faculty*

Publications and Other Works. Available at: http://trace.tennessee.edu/utk_infosciepubs/7

Tenopir, C., King, D.W., Spencer, J. & Wu, L. (2009) Variations in article seeking and reading patterns of academics: What makes a difference? *Library & Information Science Research, 31*, 139-148. doi: 10.1016/j.lisr.2009.02.002

Villani, C. (2015) *Birth of a Theorem* (tr. M. DeBevoise). London: Vintage.

Watson Todd, R. (2011) Where do research ideas come from? *Selected Proceedings of the Doing Research in Applied Linguistics Conference*. Bangkok: King Mongkut's University of Technology Thonburi.

Watson Todd, R. (2017) Response to editorial - The death of the editorial. *Journal of English for Academic Purposes 25*, 84-85. doi: 10.1016/j.jeap.2016.11.006

Weiner, E. (2016) *The Geography of Genius*. New York: Simon and Schuster.

Wolpert, L. (1992) *The Unnatural Nature of Science*. London: Faber and Faber.