

What Archivists Can Learn from Cosmology: The Enduring Paradigm in Einstein's Universe

Anthony Cocciolo, Ed.D.
Pratt Institute School of Information and Library Science

*Presented at Archival Education and Research Institute (AERI) 2013
June 17-21, 2013, Austin, TX*

ABSTRACT

Archivists and archival educators have become increasingly interested in expanded conceptions of archives. This movement is best captured by the Pluralizing the Archival Curriculum Group, which asks "How do we move from an archival universe dominated by one cultural paradigm to an archival multiverse[?]" (p. 73). Although there is a growing interest in incorporating multiple perspectives into archives thinking, rarely do concepts from the physical sciences get incorporated into these discussions. This paper will explore concepts from cosmology that have extensive bearing on how archives are conceptualized. Further, it will explore how these concepts are incorporated into the archives discourse, and conclude with suggesting a way that archivists of the future may incorporate this thinking into their descriptive practices.

Introduction

Archivists and archival educators have become increasingly interested in expanded conceptions of archives. This movement is best captured by the Pluralizing the Archival Curriculum Group, which asks "How do we move from an archival universe dominated by one cultural paradigm to an archival multiverse[?]" (p. 73). As an archives educator in New York City, I often find my students interested in pluralizing archives by applying contemporary social thought to their thinking about archives. They use concepts that touch on issues of power, representation, and social justice, often leaving state and institutional power called into question. Blouin and Rosenberg (2011) note that this tendency is not universal, finding that practicing archivists have grown away from historians and are more interested in "bureaucratic behavior and the imperatives of technology" (p. 93). Despite their reservations, those pluralizing students most often employ concepts originating in the humanities and cultural studies, which reflect the popularity of those concepts as well as the educational background of the students that employ them and the background of students who are attracted to the field of archives.

Although there is a growing interest in incorporating multiple perspectives into archives thinking, rarely do concepts from the physical sciences get incorporated into these discussions. This is not an occurrence that is unique to archival studies

but spans the social sciences. For example, Jonathan Boyarin (1994) asked, “Why is it that our physics are now those of Einsteinian relativity and quantum mechanics, whereas our politics and our rhetorics still assume a world as described by Newton and Descartes?” (p. 4) Despite how rarely physics factors into foundations of archives conversations, many concepts from cosmology have extensive bearing on how archives and history are conceptualized. For example, physicists contend that the notion of the past, present, and future is largely an illusion, albeit an illusion that is particularly useful for humans (or at least to those from Western civilizations) (e.g., Greene, 2005). Events that are thought of as occurring in the past are merely in a different point within spacetime, and those points are not theoretically inaccessible. Most archivists will consent that interpretation of past events and its respective documentation will occur over time, yet often will not contend the immutability or “pastness” of years gone by.

Like much of the sciences concerned with human activity, archivists most often employ a Cartesian conceptualization of time and space with a one-sided arrow pointing toward the future, which, although useful, is a particularly Western conception that physicists no longer believe is accurate. This paper will return to Boyarin’s question by discussing those ideas from physical cosmology that have bearing on how archives are conceptualized. The goal is to continue the pioneering work of pluralizing archives by giving some consideration to important concepts that may not necessarily be useful to humans in a everyday sense but may lead to new ways of thinking about archival work, such as how archivists might describe time and space in a post-Newtonian universe.

This paper will proceed first by discussing examples of how concepts from humanities and the cultural spheres get incorporated into discussions of archives, which I will argue is a product of the backgrounds of the individuals who employ them as well as indicative of the popularity of those concepts. Second, I will discuss those concepts from physical cosmology that have bearing on how archives are conceptualized. I will avoid concepts that are heavily debated in that field (e.g., the multiverse), and remain within theories that are widely accepted. And lastly, I will discuss how these concepts could prove problematic for the archives discourse, as evidenced in the literature, which often does not contest the immutability of space and time.

Humanities and Cultural Studies meet Archival Studies

As an archives educator in New York City, I have been interested in my students’ propensity to pluralize archives, particularly by applying concepts of power, representation, and social justice to their thinking of the role of archives in society. In the first class of my course Projects in Digital Archives at Pratt Institute School of Information and Library Science, students read Anne Gilliland’s excellent piece, “Enduring Paradigm, New Opportunities: The Value of the Archival Perspective in the Digital Environment,” and one student is given the task of discussing the piece through a presentation. The discussion question students are given the week before

is, “Gilliland (2000) discusses the use of the ‘archival perspective’ in thinking through the movement of resources to the digital information environment. What is the ‘archival perspective,’ and how is it useful (or not) in thinking about the digital information environment?” In this piece, the student learns about the cornerstones of archival practice, including the sanctity of evidence, respect des fonds, provenance, original order, lifecycle of records, organic nature of records, and hierarchy in records and their descriptions, as well as asked to consider how these ideas may be enacted in the digital information environment. In the Fall 2013 semester, the student tasked with discussing Gilliland’s (2000) piece did so, but then also looked to open up a larger discussion of the definition of an archive. He presented a PowerPoint, a slide from this deck is shown in Figure 1, which shows Michel Foucault and Jacque Derrida’s interpretation of an archive. Both thinkers conceptualize archives as an apparatus for exercising social control, where the social function of an archive is to structure what can be thought. Although an analysis of Foucault and Derrida’s interpretation of an archive are beyond the scope of this project, this example illustrates student readiness—especially from those with a humanities and cultural studies background—for incorporating perspectives from their own educational backgrounds.

+ **The Archival Perspective from afar**
What two French guys think

Michel Foucault (1926-1984)	Jacques Derrida (1930-2004)
<p>The archive is ...</p> <ul style="list-style-type: none"> ■ “the general system of the formation and transformation of statements” (127) ■ “the law of what can be said, the system that governs the appearance of statements as unique events” (129) <p><i>L'archéologie du savoir</i> (Paris: Éditions Gallimard, 1969)</p>	<p>The archive is ...</p> <ul style="list-style-type: none"> ■ “two principles in one: the principle according to nature or history, where things commence ... but also the principle according to the law, where command, authority, social order are exercised, the place from which order is given.” (9) ■ “the technical structure of the archiving archive also determines the structure of the archivable contents even as it comes into existence and its relationship to the future.” (10) <p>“Archive Fever: A Freudian Impression,” <i>Diacritics</i> 25 (2) (Summer 1995), 9-63</p>

Figure 1: LIS student PowerPoint slide on defining the archival perspective (reproduced with permission).

Notions that “there is no such thing as the truth” have been widely internalized by students, which is in part a byproduct of contemporary university education that emphasizes how power shapes one’s sense of reality. Students may be especially interested in pluralizing archives because of a discomfort in making truth claims based on the evidence available in an archive, and may seek justifications for not reaching strong conclusions. This is a valid position, however, it does invalidate much of the purposes of an archive if such archives can’t be used for substantiating claims about history.

If concepts from humanities and cultural studies have rocked once established notions of archives, research from the physical sciences could undermine them even further. Concepts from the physical sciences are rarely brought into conversations about archives, primarily because most archivists don’t have extensive background in the sciences, and students with undergraduate majors in the physical sciences typically don’t go to graduate school for archival studies. I will discuss some of those ideas that have bearing on how archives are conceptualized.

Space and Time as Understood by Cosmologists

Each semester when I begin a new course in archives, I—like most Westerners—depend on notions of the past, present, and future. The field of archives is particularly concerned with this, perhaps more than most fields, because we are usually processing inactive records (which means they are in the past to some extent), for people who may be interested in them in the present or future. Thus, most students come away with an understanding that archivists act as a connecting thread between past, present, and future. However, as I read more theoretical physics, I do begin to wonder if depending on this construct is so wise. Just because there seems to be a past, present, and future, is that the reality? Or is it like the flat earth, where only generations of teachers and persistent learning on the part of students keeps us from slipping back into thinking the world is flat?

Fixed space and time is how most humans experience reality, but most would consent that the systems for describing space and time are socially constructed (e.g., assigning dates from Christ’s birth or geographic coordinate systems). However, cosmologists have found that space and time—if considered separate entities—are not fixed with respect to each other. Rather, Einstein’s theory of relativity revealed that one person’s time is different from another person’s based on the speed at which they are traveling with respect to each other (Greene, 2005). This is best illustrated by Hafele and Keating’s (1972) experiment, where they placed two very precise clocks on two commercial aircrafts, one going eastward one way and one going westward, and upon landing compared the clocks to a stationary clock on the ground (see Figure 2). They found that the clocks on the commercial flights had lost a tiny amount of time, which further confirmed Einstein’s theory.



Figure 2. Hafele and Keating onboard commercial flight with atomic clocks (reproduced from *Popular Mechanics*, January 1972, p. 30).

In light of the theory of relativity, physicists have found that space and time are not separate entities but are different dimensions of a single entity, which they call spacetime. Brian Greene, physicist from Columbia University, and popularized by his books and PBS miniseries for *NOVA*, has likened spacetime to a loaf of bread. A diagram from his book *Fabric of the Cosmos* depicting the spacetime loaf is reproduced in Figure 3. He likens the passage of time to slicing a loaf of bread, where events we consider in the past are like earlier slices in the loaf. This is a straightforward conception of time, much like looking at a film strip up to the light, where one can see past and future events within the film. However, in the breadloaf—unlike the filmstrip—the angle of the slices vary based on the relative speed of one body to another. Thus, it is theoretically possible to move through the spacetime loaf since all of space and time is contained within it. Relatedly, events in the past are not really gone, they are just in another part of the spacetime loaf.

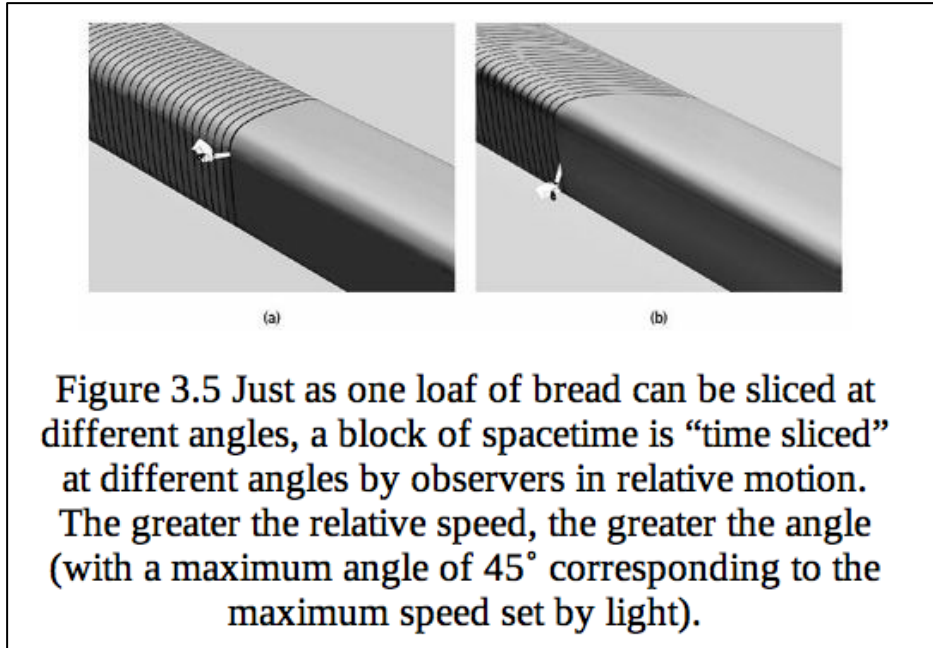


Figure 3. Spacetime loaf, reproduced from Greene (2005)

Thus, Greene (2005) contends that “there is convincing evidence that the spacetime loaf—the totality of spacetime, not slice by single slice—is real” (p. 131) and just “as we envision all of space as really being out there, as really existing, we should also envision all of time as really being out there, as really existing, too” (p. 139). Greene (2005) describes human experience with respect to past events as follows:

... events, regardless of when they happen from any particular perspective, just are. They all exist. They eternally occupy their particular point in spacetime. There is no flow. If you were having a great time at the stroke of midnight on New Year’s Eve, 1999, you still are, since that is just one immutable location in spacetime. It is tough to accept this description, since our worldview so forcefully distinguishes between past, present, and future. But if we stare intently at this familiar temporal scheme and confront it with the cold hard facts of modern physics, its only place of refuge seems to lie within the human mind. (p. 139)

The notion that time is an illusion has garnered the attention of thinkers outside of physics. For example, Craig Callender (2010), a philosopher of science, finds that “theoretical physics have come to believe that time fundamentally does not exist,” and believes that “a good argument can be made that time was already lost by 1915 and that we just have not fully come to grips with it yet” (p. 61). He supports his case by drawing on the work of many physicists, such as Carlo Rovelli (2008), who argues that “we must forget the notion of time altogether” (p. 1), and Paul Davies who argues, “From the fixed past to the tangible present to the undecided future, it feels as though time flows inexorably on. But that is an illusion” (p. 6).

Thus, there is growing sense that time itself does not exist, and all moments of the past, present and future exist within different points within the spacetime loaf. Greene—among others— believe that Einstein shared this view as a consequence of his theory of relativity. Einstein—in a letter to the family of a passing friend— writes “For we convinced Physicists, the distinction between past, present, and future is only an illusion, however persistent” (Speziali, 1972, p. 538).

Challenges to the Archives Discourse from Cosmology

Given the notion that space and time are not separate entities but are a single entity (“spacetime”) with all past, present, and future moments contained within it, how does the field of archives reflect this understanding? Before we look at literature in the field, we should first note that in English language, the notion of an integrated spacetime has not widely premeditated everyday language or individual conceptions of reality. To illustrate this, Google’s NGram viewer can be used to visualize the occurrence of words across five centuries in millions of published books.¹ This tool was used to search for “spacetime,” “space-time,” “space and time,” and “time and space,” where the first two terms represents the integrated concept, and the latter terms considers space and time as separate entities. Showing occurrence between 1800 to 2008, one will note that “time and space” and “space and time” far outstrip occurrences of “spacetime” or “space-time” (see Figure 4). Usages of time and space as separate entities has an extensive history in English language, showing strong usage throughout the late nineteenth century to the present. “Spacetime” as an integrated concept did not start getting used until its discovery in the early twentieth century, and has seen an increase in use, but is relatively modest compared to the other uses.

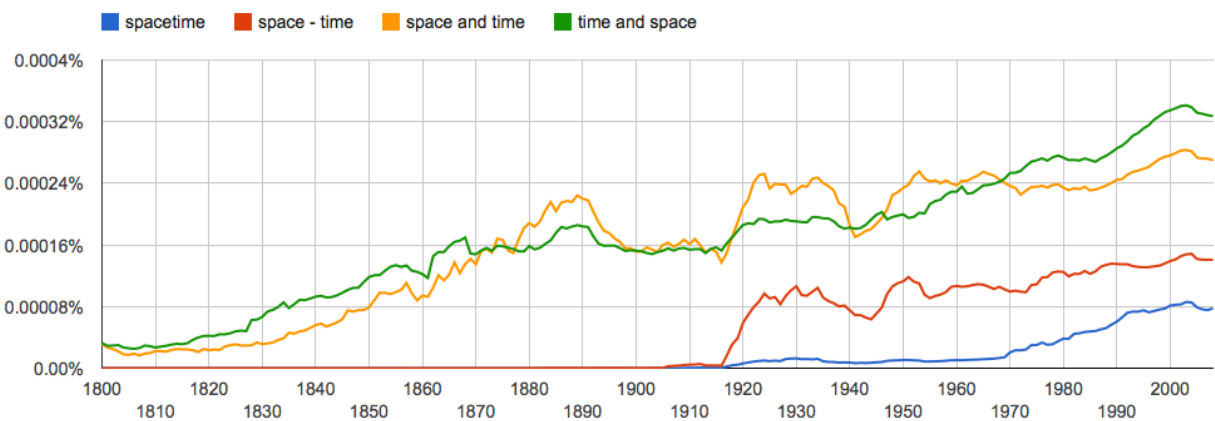


Figure 4: Google NGram plot of terms “spacetime,” “space-time,” “time and space,” and “space and time,” from 1800 to 2008.

¹ <http://books.google.com/ngrams>

Given that the integrated concept of “spacetime” is not widely represented in everyday English, how is this concept reflected in the field of archival studies? To study this, a search for references to space and time was conducted using Google Scholar, specifically within four major journals in the field of archival studies: *American Archivist*, *Archivaria*, *Archival Science* and *Journal of Archival Organization*. The search terms that were used include “spacetime”, “space-time,” “space and time,” “time and space.” This search returned 23 articles. I will discuss how these articles make use of space and time.

In introducing a special issue of *Archival Science*, Schwartz and Cook (2002) note that the “authors seek with us to demonstrate that the theories, principles, nature, and historical evolution of ‘archives’ as institutions and of ‘records’ as documents – collectively ‘the archive’ – are neither universal across space nor stable across time” (p. 5). This statement acknowledges that the human interpretation of archives as institutions and records as documents may change as a consequence of space and time. However, it does not seem to acknowledge that space and time are relative to each other, which is not uncommon. This is the use of space and time with the preposition “across,” which is the most frequent way “space and time” is used in the field. In this usage, time and space appear as a factor in how archives get interpreted, and by including the reference to time and space, it emphasizes how these interpretations may change depending on years gone by or places where the interpretation is taking place. For example, Cook (2001) uses it in a similar sense: “And there is not one narrative in a series or collection of records, but many narratives, many stories, serving many purposes for many audiences, across time and space” (p. 7).

Other examples of the use of time and space with the preposition “across” include the following statements:

- “Because physical capture allows for the separation of record from creator, it also allows for access to the record across space and time” (Anderson, 2012, p. 9).
- “In ISAD(G), the elements that address the extent to which the records’ integrity has been maintained across time and space include location of originals, related units of description, archival history, appraisal, scheduling and destruction information, and system of arrangement” (MacNeil, 2009, p. 94)
- “Documenting an event and its collective memory under one contextual umbrella could point the user to all relevant records no matter their location, uniting records at a conceptual level across time and space” (Bastian, 2009, p. 130)
- “The principal role of the record is, in fact, that of rendering the act or fact, which is the subject of the record in its original administrative context, accessible and knowable across time and space” (Guercio & Thibodeau, 2001, p. 244).

- “Information resides nowhere and everywhere. It reveals no author, occupies no space, promises no authenticity, exhibits no historicity. It flows anonymously across space and time” (Dodge, 1997, p. 120)
- “As technology changes across space and time, the on-screen appearance of such records—the way they are experienced by users—is unlikely to remain constant.” (Yeo, 2010, p. 96)

Although using time and space in conjunction with “across” is the most frequent, there is also use of it in conjunction with “over.” For example:

- “Records can have many creators over time and space. All should be identified in this component of provenance” (Millar, 2006, p. 65)
- “Research for archivists in this mode may be defined as the methodological investigation of the individual human, institutional, and societal dimensions of recordkeeping and documentary artifacts over space and time.” (Cook, 2000, p. 305)
- “Archivalterity refers to the acts of continuous and discontinuous change that transform the meaning and authenticity of a fonds as it is transmitted over time and space.” (MacNeil, 2008, p. 14)

In the first two examples, the preposition “over” is used in much the same way as “across” (e.g., you could switch “over” with “across” without changing the meaning much). Again, much like with the preposition “across,” space and time become a factor in how an archive is interpreted. The third example uses “over” in conjunction with “meaning” and “authenticity” getting “transmitted” over “time and space,” which is a slightly different use than the others but not significantly.

In addition, you see the use of space and time in the less abstract sense and the more colloquial and practical sense (e.g., “I don’t have any space or time to work on this”). For example, “even for an archivist in the miraculous circumstances of limitless money, space, and time...” (Tener, 1984, p. 228).

And lastly, there is the use of space and time in conjunction with the preposition “in.” For example, “Events occur in time and space” (Allen, 2005, p. 43). This statement is less about interpretation changing over space and time, but rather describing how events get located in space and time. This too is a unique usage, although not an unusual usage.

These examples from the four journals studied indicate that the field conceives of space and time as an important factor in how archives get interpreted. However, there is no use of the concept of spacetime, or a four-dimensional totality, which contains all past, present, and future moments.

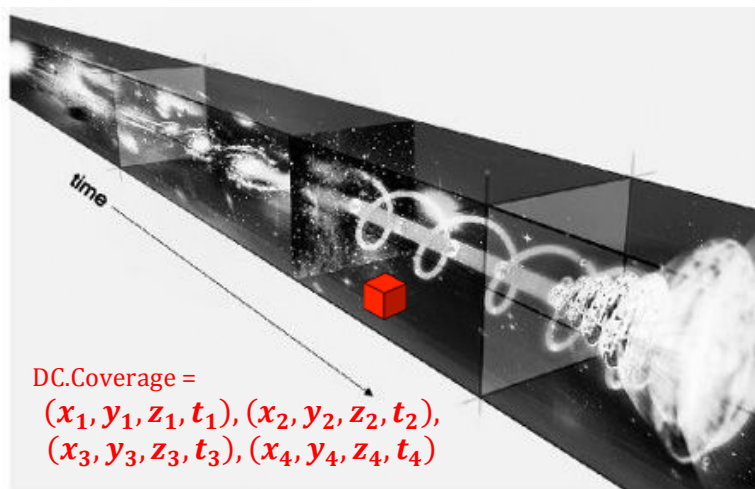
Spacetime as a concept is only discussed with respect to Upward’s (2000) records and archives continuum model, which was specifically designed to take into account

spacetime as a concept. However, when this model is referenced, it is most often used as a way of further pluralizing archives. For example, Anderson (2012) cites Upward's model, and uses it as a way to begin to approach non-Western notions of time. She argues for how "practitioners must begin to work with an expanded concept of record and sensitivity to differing time frames and worldviews" (p. 1).

With respect to archival standards, most do not take into account spacetime (they only recognize time and space). For example, *Describing Archives: A Content Standard (DACS)* accommodates space and time separately (geographic places and dates are considered separately). However, the Dublin Core metadata standard comes close to showing recognition of an integrated spacetime. For example, the "coverage" element in the Dublin core metadata scheme can cover the "spatial or temporal topic of the resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant."² In practice, you are just as likely to find a geographic location in this field as well as a date entry, or since that field can be repeated, both.

Archivists describing Time and Space in a post-Newtonian universe

In the distant future, perhaps archivists will not date from Christ's birth, and describe using Earth-based geographic names (e.g., Getty Thesaurus of Geographic Names), but rather will describe events with respect to their range within the spacetime loaf. This description could be a four-dimensional set of coordinates that cover the three dimensions of space, as well as the fourth dimension that is the time dimension (see Figure 5). For example, you could imagine the Dublin Core Coverage field being filled with a set of coordinates that describes this range. An illustration of this is shown in Figure 4, where the red cube and respective coordinates shows how the coverage of a record can be described with respect to absolute spacetime.



² <http://dublincore.org/documents/dcmi-terms/#terms-coverage>

Figure 5. The spacetime loaf (from Greene, 2005, p. 130), augmented in red with four-dimensional coordinates for describing the coverage of a particular record. Graphic only shown in 3-dimensions to aid intelligibility.

Conclusion

In conclusion, this paper explored what archivists can learn from cosmologists, and the extent to which concepts from the physical sciences have been incorporated into the archives discourse. Although the field has become interested in pluralizing archives, much of this thinking comes from humanities and cultural studies and not from the physical sciences, with the notable exception being Upward's (2000) continuum model. This is not surprising that these concepts have not been significantly integrated into archives thinking since they have not been incorporated into the social sciences or most people's thinking on everyday life, despite Einstein's theory of relativity is nearing its one-hundredth year anniversary. For example, the physicist Paul Davies (2002) writes that:

In daily life we divide time into three parts: past, present, future. The grammatical structure of language revolves around this fundamental distinction. Reality is associated with the present moment. The past we think of as having slipped out of existence, whereas the future is even more shadowy, its details still unformed.... Obvious though this commonsense description may seem, it is seriously at odds with modern physics. (p. 7)

This analysis does not mean to suggest that we start becoming vague with description (e.g., stop dating because there is no such thing as absolute time), or declare things so amorphous that we cannot use archives to make claims about history. Rather, this analysis does suggest there is something absolute—spacetime—that was created by the Big Bang, and within this spacetime loaf is the totality of the past, present and future. One could even imagine locating records within spacetime by describing a record with respect to its location within the four dimensions of spacetime. Although this is somewhat fanciful—and not technically possible or useful yet—it is interesting to contemplate how archives could function and thrive in Einstein's universe.

References

- Allen, R. B. (2005). Using Information Visualization to Support Access to Archival Records. *Journal of Archival Organization*, 3(1), 37-49.
- Anderson, K. (2012). The footprint and the stepping foot: archival records, evidence, and time. *Archival Science*, 12(3), 1-23.
- Bastian, J. (2009). Flowers for Homestead: A Case Study in Archives and Collective Memory. *American Archivist*, 72(1), 113-132.

Blouin Jr., F. X. & Rosenberg, W. G. (2011). *Processing the Past: Contesting Authority in History and the Archives*. New York, NY: Oxford University Press.

Boyarin, J. (1994). Space, Time, and the Politics of Memory. In J. Boyarin & C. Tilly (Eds.), *Remapping Memory: The Politics of TimeSpace* (pp. 1-37). Minneapolis: University of Minnesota Press.

Callender, C. (2010). Is Time an Illusion? *Scientific American*, 302(6), 58-65.

Cook, T. (2001). Archival science and postmodernism: new formulations for old Concepts. *Archival Science*, 1(1), 3-24.

Cook, T. (2005). "The Imperative of Challenging Absolutes" in Graduate Archival Education Programs: Issues for Educators and the Profession. *American Archivist*, 63(2), 380-391.

Davies, P. (2002). That Mysterious Flow. *Scientific American*, 287(3), 6-11.

Dodge, B. (1997). Places Apart: Archives in Dissolving Space and Time. *Archivaria*, 44, 118-131.

Gilliland, A. (2000). *Enduring Paradigm, New Opportunities: The Value of the Archival Perspective in the Digital Environment*. Washington, D.C.: Council on Library and Information Resources.

Greene, B. (2005). *The Fabric of the Cosmos: Space, Time, and the Texture of Reality*. New York: Vintage.

Guercio, M. & Thibodeau, K. (2001). Principles, Methods, and Instruments for the Creation, Preservation, and Use of Archival Records in the Digital Environment. *American Archivist*, 64(2), 238-269.

Hafele, J. C. & Keating, R. E. (1972). Around-the-World Atomic Clocks: Predicted Relativistic Time Gains. *Science*, 177(4044), 166-168.

MacNeil, H. (2008). Archivalterity: Rethinking Original Order. *Archivaria*, 66 (Fall), 1-24.

MacNeil, H. (2009). Trusting Description: Authenticity, Accountability, and Archival Description Standards. *Journal of Archival Organization*, 7(3), 89-107.

Millar, L. (2006). An Obligation of Trust: Speculations on Accountability and Description. *American Archivist*, 69(1), 60-78.

Pluralizing the Archival Curriculum Group (PACG). (2011). Educating for the Archival Multiverse. *American Archivist*, 74 (Summer/Spring), 69-101.

Rovelli, C. (2008). "Forget Time": *Essay written for the FQXi contest on the Nature of Time*. Retrieved 29 March 2013 from http://fqxi.org/data/essay-contest-files/Rovelli_Time.pdf.

Schwartz, J. M. & Cook, T. (2002). Archives, Records, and Power: The Making of Modern Memory. *Archival Science*, 2(1), 1-19.

Speziali, P. (Ed.) (1972). Albert Einstein and Michele Besso: Correspondence 1903–1955. Paris: Hermann.

Tener, J. (1984). Problems of Literary Archives: A Commentary. *Archivaria*, 18 (Summer), 228-231.

Upward, F. (2000). Modeling the continuum as paradigm shift in recordkeeping and archiving processes, and beyond – a personal reflection. *Records Management Journal*, 10(3), 115-139.

Yeo, G. (2010). 'Nothing is the same as something else': significant properties and notions of identity and originality. *Archival Science*, 10(2), 85-116.