2015 48th Hawaii International Conference on System Sciences

Identifying Theories Used in North American IS Research: A Bottom-Up, Computational Approach

Daniel S. Soper and Ofir Turel
Information Systems and Decision Sciences Department
California State University, Fullerton
dsoper@fullerton.edu oturel@fullerton.edu

Abstract

In an effort to shed light on the current stage of disciplinary evolution in the IS field, this study sought to systematically and objectively identify and document the theories that have been used in North American IS research, as well as to identify trends regarding the adoption of new theories and the rate of theory turnover. To this end, we used computational techniques to search more than 10 million Wikipedia article titles for candidate theory names, and contrasted the resulting list with the complete text of every research article published in three leading North American IS journals over a 24-year period. This process resulted in the identification of more than 300 unique theories that have verifiably appeared in these journals since 1990, along with their respective frequencies of appearance. Analyzing these frequency data revealed a strong upward trend in the number of unique theories appearing in North American IS research, as well as a significant, and likely unsustainable increase in theory turnover.

1. Introduction

The information systems (IS) field has grown dramatically by borrowing theories and models from many reference disciplines, such as psychology, sociology, and management, among others [2-4]. Although many IS researchers consider this theoretical diversity to be beneficial for the field since it can generate creativity and cross-disciplinary integration [4], others have noted the negative implications of this theoretical diversity, such as blurring the field'sboundaries [2, 6, 7].

Regardless of whether theoretical diversity is good or bad (or both), the discussion regarding this key facet of the IS field has been largely based on limited, personal, or anecdotal evidence (e.g., evidence derived only from abstracts, keywords, or citations) which in many cases is subject to biases in interpretation. For instance, many analyses of the theoretical diversity of the field have been based on researchers' own experiences [2, 5], citation analyses [8], manual literature reviews [4], manual analyses of titles and abstracts [6], and computational techniques applied to abstracts [9]. While such endeavors are essential for expanding and deepening the discussion on the theoretical diversity of the IS field, they often stop short of identifying the theoretical diversity in a systematic and unbiased fashion. For example, most researchers will not be able to answer with certainty even simple questions such as "How many new theories did the field utilize in the last year?", or "How has the number of theories used by the field changed over time?" Answers to questions such as these would allow the discussion regarding the field and its theoretical diversity to be based on empirical data rather than on anecdotal, personal, or otherwise limited observations.

Here we seek to bridge this gap by employing a bottom-up (grassroots), computational, automated, and systematic approach for identifying the theories that have appeared in leading North American IS journals, as well as for identifying trends in theory usage. Past work has noted variations in the topics and theories addressed by IS research in different parts of the world [18], and it is hoped that this study's focus on North American IS research can serve as a basis from which further insights regarding this parochialism can be derived. In this regard, we address the following two research questions: (1) which theories have appeared in North American IS research (as reflected by papers published in three top journals over the past 24 years)? and (2) in what ways has the number of theories used in this body of research changed over time?

The first research question is addressed in an exploratory fashion. More specifically, we apply computational approaches to the full set of article titles appearing in the English language Wikipedia to identify and screen candidate theory names. Arguably, this collection of article titles includes a substantial proportion of the names of the theories that have been advanced by science. We then contrast this list with the complete text of every research article published in *Management*

1530-1605/15 $31.00 © 2015 IEEE
DOI 10.1109/HICSS.2015.586

Information Systems Quarterly (MISQ), *Information Systems Research* (ISR), and the *Journal of Management Information Systems* (JMIS) between 1990 and 2013. Although this body of research is believed to encapsulate many of the key theories used in North American IS research, it has been noted that the IS field is divided into many intellectual communities [9], each of which focuses on different areas of inquiry and hence emphasizes or deemphasizes different theoretical perspectives. Our use of MISQ, ISR, and JMIS positions the current study within the *Management Information Systems* intellectual community (as defined by Larsen et al. [9]), and the results of our analyses should be viewed within that light.

Ultimately, our computational efforts aimed at addressing the first research question yielded a list of more than 300 theories, which vastly extends the scope of the IS field's known theoretical diversity. This list can serve as an objective, empirical basis for discussing the theoretical diversity of the field, and can point researchers to IS-related theories about which they might otherwise remain unaware. The second research question is addressed through an analysis of two specific hypotheses, which we will now proceed to develop.

Theory regarding the evolution of science [10, 11] suggests that disciplines iteratively progress through a series of distinct phases, namely *normal science*, *crisis*, and *scientific revolution*. During the normal science phase, researchers progress by examining phenomena within the boundaries of the discipline's dominant paradigms. The accumulation of anomalies or competing theoretical perspectives which cannot be readily resolved within the context of these paradigms can cause a disciplinary crisis, the result of which may be the revolutionary ouster of the old paradigms, and the establishment of newer, ostensibly superior paradigms.

Scientific disciplines reside primarily in the normal science phase, in which slow and consistent progress is made toward understanding its phenomena of interest in finer and finer detail [10]. On a macro scale, this quest for ever deeper levels of understanding inevitably requires researchers within a field to refine existing theories, formulate new theories, or adopt existing theories from other disciplines. In the absence of efforts aimed at theoretical integration and generalization, this process can be expected to manifest itself as continual growth in the number of theories used by a scientific field over time. Rendered as a hypothesis in the context of the current study, this becomes:

H1: The total number of unique theories used in North American IS research has been increasing over time.

The Unified Theory of Acceptance and Use of Technology [12] and a few other notable exceptions notwithstanding, very few efforts aimed at formal theory consolidation and generalization have appeared in leading North American IS journals. The seeming reluctance by the IS community to engage in this critical scientific task may be attributable to the rapidly expanding scope of IS research, but regardless of the underlying cause, the situation carries with it important implications for the IS field as a whole.

Assuming that the number of theories appearing in IS journals has indeed been increasing over time (per H1), and in light of the editorial constraints imposed by limited publication space, the paucity of efforts aimed at theory consolidation and generalization described above can be expected to manifest themselves in the form of increasing theoretical turnover or "churn" within the pages of IS journals. Put another way, it is a zero-sum-game, and in order for new theories to have time in the metaphorical spotlight, other theories must exit the stage. This introduction of new theories at the expense of others is also in line with fashion waves theory, according to which the IS field shows transitory bursts of interest in topics and associated theories [1]. We therefore expect not only an increase in the rate of emergence of new theories in the IS literature, but also a concomitant increase in the rate of theory dormancy. Stated as a hypothesis this becomes:

H2: The theoretical turnover in leading North American IS journals (i.e., the rate at which theories have been appearing and disappearing from the IS literature) has been increasing over time.

In the sections that follow, we describe in detail the methods used for addressing our research questions, after which we present and discuss our results. The manuscript concludes with a summary, discussion of limitations, and a few parting comments.

2. Method

A systematic five-step approach was developed as a means of inquiring into the research questions described above. As a broad introductory overview, our strategy involved first computationally identifying a very large set of potential theories, after which we employed computational linguistics to analyze the complete text of thousands of research articles from leading North American IS journals in order to ascertain which of those theories had been used in North American IS research. As this process unfolded, we were also careful to compute the frequency with which each theory had been used in the IS literature, thus allowing us to determine the extent to which both theory usage and theory turnover in the IS field have progressed and changed over time. Together, these activities yielded deep and fascinating insights into the nature and evolution of theory in the IS field.

The first of the five major tasks in our analysis was to identify a very large set of potential theory names, and for this purpose we began by downloading the complete set of article titles contained in the English language Wikipedia [13]. In light of the vast scope of this online encyclopedia, we reasoned that nearly any theory of even moderate renown would be likely to have an associated article in the English language Wikipedia. Although we acknowledge that Wikipedia may not contain an article for *every* scientific theory that has ever been proposed, it nevertheless represents the largest collection of human knowledge ever assembled [14], and can therefore reasonably be expected to contain information about at least a sizeable proportion of all known theories. At the time of our analysis, the English language Wikipedia contained 4,452,151 ordinary content articles and 6,168,284 so-called "redirects", which serve as alternative names for ordinary content articles[1]. In total, then, our initial set of article titles contained 10,620,435 entries.

As a means of extracting just those article titles which might refer to the name of a scientific theory, we filtered the complete set of titles using a case-insensitive wildcard search. Specifically, we extracted from the complete set of more than 10 million article names just those names that matched one of the following four search patterns (wherein a percent sign "%" is being used to represent the wildcard character): "%theory of %", "%model of %", "% theory", or "% model". These four patterns allowed us to capture a comprehensive set of theory name forms – for example, "Theory of Communicative Action", "Equilibrium Model of Group Development", "Social Learning Theory", and "Technology Acceptance Model" would all be identified using this approach. Of the 10,620,435 article names in the initial set, a total of 8,734 were identified as potential theory names subsequent to this wildcard search process. Of these, 5,396 (61.8%) matched one of the "theory" wildcard patterns described above, while 3,338 (38.2%) matched one of the "model" wildcard patterns.

In order to provide deeper insight into the efficacy of the wildcard search process, we next sought to quantify the extent to which the article names extracted through that process actually referred to genuine scientific theories. For this purpose, random samples of 100 "theory" article titles and 100 "model" article titles were extracted from the complete set and manually evaluated to determine whether their associated Wikipedia articles described genuine scientific theories. Since this process involved both sampling and human judgment, 95% binomial confidence intervals were also calculated in order to quantify the proportion of the complete set of article titles identified by the wildcard search that referred to genuine scientific theories. Table 1 reports the results of these analyses.

Sample Source	% of Sample Referring to Scientific Theories	95% CI
"theory" articles	88 of 100 (88.0%)	79.9% to 93.6%
"model" articles	41 of 100 (41.0%)	31.3% to 51.3%
overall total	129 of 200 (64.5%)	57.4% to 71.1%

Table 1. Proportions of Wikipedia articles identified by wildcard search which refer to genuine scientific theories.

When considered in light of the 8,734 articles identified by means of the wildcard search strategy, the values reported in the table above imply that between 5,013 and 6,210 of those articles refer to genuine theories.

Having computationally arrived at a large set of potential theory names, the second major step in our analysis involved identifying which of those theory names had appeared in the IS literature. For this purpose, we first assembled an electronic collection of every research article that had been published in *Management Information Systems Quarterly* (MISQ), *Information Systems Research* (ISR), and the *Journal of Management Information Systems* (JMIS) between 1990 and 2013. These three journals were chosen for the analysis both because of their lengthy publication histories and because they are generally considered to be among the finest scholarly journals in North American information systems research [15, 16]. Although we acknowledge that these three journals are an imperfect proxy for the IS field as a whole, we nevertheless believe that they are reasonably representative of a substantial proportion of the IS research that is published within Larsen et al's "MIS community" [8], and certainly represent key theories in North American MIS research. With respect to the timeframe used in the analysis, 1990 was chosen as the first year of the analytic timeframe because it was the first year in which all three of these journals were concurrently publishing research, while 2013 was used as the last year of the analytic timeframe because it was the last year for which complete data were available at the time of our analysis. In total, our collection of North American IS literature included 2,215 research articles spanning a 24-year publication history.

After having assembled our electronic library of IS research articles, we next converted each article into a machine-readable format using the Adobe optical character recognition (OCR) algorithm, after which we were able to extract the complete text of each article. Excepting for acronyms, all of the words in each article were converted to lowercase so as to eliminate any problems that might otherwise arise due to capitalization.

[1] In Wikipedia, a "redirect" page provides a mechanism through which alternative names can be established for articles within the encyclopedia. Visiting the page entitled "HICSS", for example, would automatically redirect the user's browser to the Wikipedia article for the Hawaii International Conference on System Sciences.

Using this strategy, the phrase *Cognitive Load Theory* would thus be viewed as equivalent to *cognitive load theory*, while an acronym such as *IS* would be viewed as distinct from the word *is*, thereby ensuring the accuracy of the results. Each of the 8,734 potential theory names was also subjected to this case conversion process, so as to allow potential theory names to be readily located within the corpus of IS literature. With these preliminary text processing tasks complete, we next searched for each potential theory name within the complete text of each research article, counting the frequency with which each theory appeared as the process unfolded. For this purpose, we developed a search strategy in which the potential theory names were iteratively considered beginning with the textually longest names and working toward the textually shortest names. After counting the frequency with which each potential theory name appeared in an article, all instances of that theory name were removed from the article text, after which the next potential theory name would be considered. By proceeding in this manner, we were able to eliminate any problems associated with one theory containing the name of another theory (e.g., the string "information systems theory" contains the substring "systems theory" – these are, of course, two very different concepts!). Upon completing the entire search process, a total of 665 potential theory names were identified as having appeared at least once in our corpus.

The third major step in our analytic procedure involved finding and removing duplicate theory labels. Since different authors often assign different names or labels to the same underlying theory (e.g., "theory of relativity" and "relativity theory" refer to the same underlying theory), and since our research objective was to identify the distinct set of theories that had appeared in our corpus of IS literature, the detection and removal of extraneous labels was necessary so as to yield a set of records wherein each potential theory was represented by just a single label. For this purpose, duplicates were identified as the set of potential theory names that were linked together via Wikipedia redirects. Inasmuch as the purpose of redirect pages in Wikipedia is to allow a single encyclopedia article to be identified using a set of alternative names, the Wikipedia redirect data served as a natural and very valuable source of alternative names for each potential theory. Using this information, 90 duplicate name labels associated with 77 potential theories were identified within our set of 665 theories. For each of the 77 theories for which more than one label was present, the label that appeared most frequently in our corpus of IS literature was retained as the primary name for that theory. The 90 duplicate name labels were then duly removed from the set of theory names, but not before the frequency counts for each of their associated underlying theories had been updated appropriately. Following this process, a total of 575 potential theory labels remained.

The fourth major step in our analysis was to identify and remove invalid, non-theory labels from the set of 575 potential theories. Put another way, it was necessary to remove a label from the data set if that label did not actually refer to a specific theory or class of theories. For this purpose, a label was removed if it referred to a concept that was generic or non-specific (e.g., causal model, process model, theoretical model, etc.), or if it referred to a methodological, analytical, or technological concept (e.g., structural model, data model, regression model, etc.). This process resulted in the removal of 156 non-theory labels from the data set, yielding a set of 419 candidate theories.

The fifth and final step in our methodological procedure was to validate the candidate theories by verifying that each candidate theory had actually been used in a semantically proper manner in the IS literature. Since the name of each of the 419 candidate theories was simply a short string of words, there was a possibility that those words may have been used in the literature in a way that did not actually refer to the theory under consideration. Further, there was also the possibility that a candidate theory did not appear in the body of any IS research articles, but instead appeared only in an article's leading or trailing matter (e.g., in an author biography or in an article's list of references). For this reason, a custom software tool was developed which extracted and displayed the text immediately surrounding each instance of a candidate theory in our corpus of IS literature. By examining the text immediately surrounding a candidate theory, it was possible to judge whether the theory in question had been used in an appropriate manner. Using this approach, a candidate theory was retained if at least one instance of appropriate usage could be identified (where "appropriate usage" meant that the theory had been used in the body of a research article in a contextually appropriate way), otherwise the theory would be removed from further consideration. This process resulted in the removal of 101 candidate theories, yielding a final set of 318 unique, verified theories and their associated frequencies of appearance over time.

In light of the values reported in Table 1, and in light of the hundreds of unique scientific disciplines, it is extraordinary that approximately 5% to 6% of all of the scientific theories currently described in Wikipedia have appeared in just three IS journals since 1990.

3. Results

Recall that our first research question sought to produce insights into the theories that have been used in North American IS research over time. Upon completion of our computational analyses, a total of 318 unique, valid theories were identified as having verifiably appeared within MISQ, ISR, or JMIS between 1990 and 2013. As a basis of comparison, we believe that the most complete extant list of theories used in information systems research is the AIS-affiliated *Theories Used in IS Research* wiki [17], which, at the time of this writing, contained a total of 88 unique theories. When compared to this existing resource, our efforts have thus expanded the known set of theories used in IS research by more than 360%. The resulting collection is, to the best of our knowledge, the most complete list of theories used in IS research ever assembled, and this list stands as one of the major contributions of our work. The complete collection of 318 theories (along with their alternate names) is provided for the scientific record in the appendix.

Beyond producing a more complete list of the theories that have been used in IS research, our second research question addressed the ways in which the number of unique theories appearing in North American IS journals has changed over time. As a means of gaining insights into this question, we formulated two specific hypotheses, the first of which relayed our theoretically driven expectation that the total number of unique theories appearing in IS research has been increasing over time. To test this hypothesis, we used the yearly theory frequency data described in the methodology section to test a linear model in which the year of publication was used to predict the number of unique theories appearing in our corpus of IS literature over time. The results of this analysis are depicted in Figure 1 below.

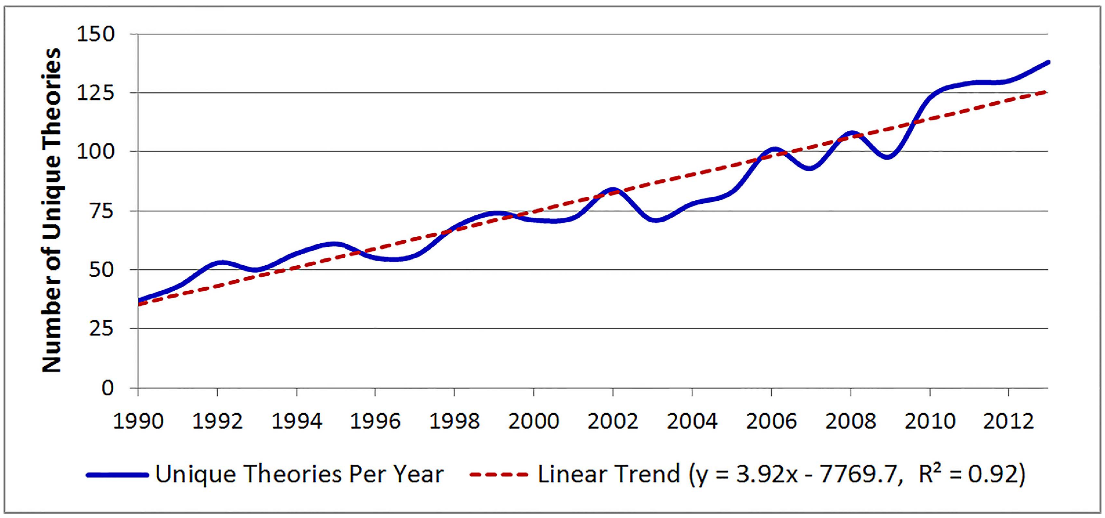

Figure 1. Number of unique theories appearing in three leading North American IS journals over time.

The figure above shows the total number of unique theories appearing in MISQ, ISR, and JMIS over time. The figure also contains a line of best fit and its associated linear equation (R^2 = 0.92) which reveals a cohesive upward trend. The parameter estimate for the *time* (year) variable in this linear equation indicates that on average, and without controlling for other factors, the number of unique theories appearing in MISQ, ISR, and JMIS has been increasing by approximately 3.92 theories per year.

In order to control for the possibility that the observed upward trend was attributable to a concomitant increase in the volume of research that has been published in the three journals over time, a second linear model was estimated which included the total number of words published each year as a predictor. This analysis produced a linear equation of $y = 2.57*year + 0.000021*words - 5091.2$, with an overall model R^2 of 0.97. Inasmuch as both the *time* (year) and *number of words published* parameters were observed to be highly significant ($p < 0.001$), the data provide strong support for our first hypothesis; i.e., even after controlling for the marked increase in the total number of words published per year during our analytic timeframe, the number of unique theories appearing in MISQ, ISR, and JMIS has been increasing by approximately 2.57 theories per year. Further, if we project this trendline a decade into the future, the data suggest that more than 170 unique theories will appear in these three journals alone by the year 2025. If not reconciled by means of theory integration and generalization, such a vast and fragmented theoretical landscape may ultimately precipitate a scientific crisis within the IS field [10].

Our second hypothesis expressed our expectation that the rate of theory turnover in leading North American IS journals has been increasing over time. For this purpose, we relied on the concepts of theory emergence and theory dormancy. In the context of the current analysis, a theory was considered to be new or emerging if it appeared in the literature during a particular year, but had not previously appeared for at least three years. Similarly, a theory was considered to be entering a period of dormancy if it appeared in our corpus of IS literature during a particular year, but then disappeared and was not seen again for at least three years thereafter. Although we acknowledge that our use of a three-year window for purposes of establishing theory emergence and dormancy was somewhat arbitrary, we believe that this span of time is reasonable in light of the rate of evolution of the IS field and typical editorial review cycles at IS journals.

In order to ensure the reliability and validity of the results, the adoption of a three-year window for purposes of determining theory emergence and dormancy also required that we constrain our inquiry to the 18-year period ranging from 1993 to 2010, since results from neither the first three years nor the last three years of our dataset could equitably be included. Figure 2 below shows the outcome of this analysis:

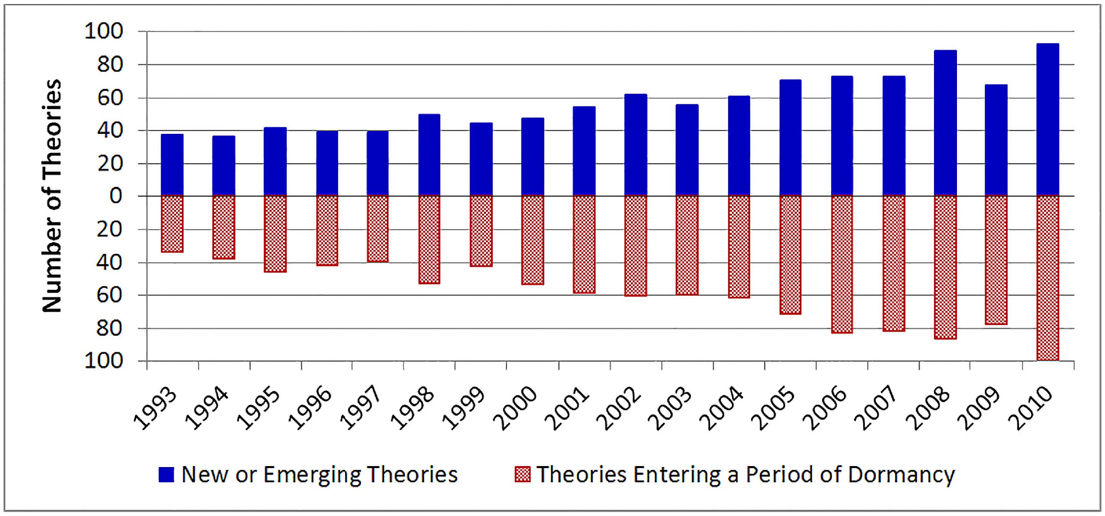

Figure 2. Theory emergence and dormancy in three leading North American IS journals over time.

The figure above shows (1) the number of theories that are either new or emerging from a period of dormancy during each year, and (2) the number of theories entering a period of dormancy during that year. When considered together, the figure suggests that the overall degree of theoretical "churn" or "turnover" in North American IS research has been increasing over time. As a means of formally testing this supposition, we estimated one linear model for the theory emergence data and another linear model for the theory dormancy data. With respect to theory emergence, our efforts yielded a linear equation of $y = 3.02*year - 5993.1$, with an overall model R^2 of 0.88 and a significance of the *time* (year) parameter of $p < 0.001$. With respect to theory dormancy, our analysis produced a linear equation of $y = 3.42*year - 6782.4$, with an overall model R^2 of 0.91 and a significance of the *time* (year) parameter of $p < 0.001$[2]. Together, these results provide strong support for our second hypothesis, and indicate that the number of new or emerging theories appearing in leading North American IS journals has, on average, been growing from year-to-year, as has the number of theories disappearing from those journals. A t-test of the difference between the two slopes revealed no significant difference in the rates of change of theory emergence and dormancy ($t_{(32)} = 1.046$, $p = 0.30$). It can thus be concluded that the rate at which new theories emerge in the literature has, on average, been statistically equal to the rate at which theories disappear from the literature over time.

In accordance with theory on disciplinary evolution, the observations described above imply that North American IS research has been adopting – or perhaps auditioning – new theories at an increasing rate, while simultaneously abandoning or shelving an approximately equal number of previously used theories in order to accommodate the new contenders. This lends empirical support to the fashion waves hypothesis [1]. Again, the long-term sustainability of this trajectory seems highly doubtful. If the rate at which new theories enter the field and old theories exit the field continues to increase, in what way can the IS field defensibly claim to have any sort of cumulative history or tradition?

4. Summary, Limitations, and Conclusions

This project sought to use a computational and systematic approach to identify the theories which have appeared in North American IS research over the past 24

[2] Quadratic models yielded an R^2 increase of less than 0.02. In light of the already large R^2 values, the more parsimonious linear models were retained.

years. To this end, we contrasted a very large set of unique theory names extracted from the article titles of the English language Wikipedia (screened from 10,620,435 entries) with the complete text of every research article published in three leading North American IS journals over a 24-year period (2,215 research articles in total). Addressing this research objective allowed us to make several important contributions.

First, we developed and introduced a computationally viable and effective approach for identifying meaningful concepts within a large corpus of text. The use of one source (Wikipedia) for identifying the target concepts and then contrasting those concepts with a second corpus of interest is unique, innovative, and overcomes many deficiencies of other search approaches (e.g., searching the target corpus alone). Hence, this computational approach may serve other projects which attempt to identify and quantify meaningful concepts in large bodies of text.

Second, this approach allowed us to substantially expand the largest known documented set of theories used in IS research from 88 theories to a much broader set of 318 theories. This is an important contribution because it allows us to quantitatively and qualitatively analyze and interpret the theoretical diversity of the IS field in a way that surpasses subjective judgments, personal experiences, or otherwise limited strategies. Moreover, this contribution is important since it can point researchers both to theories that have already been used in IS research (e.g., for proper citation and knowledge discovery), and to theories with which they may not be familiar, but which may nevertheless prove useful to their research.

This study further sought to examine how the number of theories used in IS research has changed over time. Following Kuhn's theoretical perspectives on scientific evolution [10, 11] and fashion waves theory [1], we developed and tested several research hypotheses related to the adoption and turnover of theories in the IS field. These hypotheses were evaluated using the objective theory frequency data extracted from the abovementioned corpuses of text, with the results supporting the Kuhnian theoretical foundation. Hence, another contribution of the current work lies in its empirical validation of Kuhn's theory regarding disciplinary development. It also empirically supports fashion waves theory. More importantly, our work also provides empirical evidence – perhaps for the first time using a data-driven analysis – of the rapidly growing and rapidly fragmenting theoretical scaffolding upon which contemporary IS research is built.

While the contributions of this work are sizable and important, we would also like to acknowledge that we have more work to do with regard to examining our enormous data set, particularly in identifying more facets of the evolution of the theoretical diversity of the IS field. These facets merit further research which will be communicated in our future work. We would also like to acknowledge one limitation of our approach. While the analytic strategy employed in this study was primarily computational, validation of proper theory usage relied on human judgment rather than purely computational techniques (e.g., for determining whether a theory had been used in a contextually appropriate manner). Future research may find and apply more automated approaches for handling such issues.

As a final note, we believe that there is some value in drawing a parallel between the evolution of science since the Renaissance and what appears to be unfolding in the IS field. Whereas in the time of Leonardo da Vinci it may have been possible for one learned individual to maintain a familiarity with virtually all of the extant scientific knowledge, the rapid evolution and exponential growth of the scientific enterprise quickly made such a feat infeasible for successive generations of scientists. In a similar fashion, pioneering IS scholars may reasonably have been able to maintain a familiarity with the full scope of scientific inquiry taking place in the IS field as a whole, however the results reported herein suggest that such a feat may no longer be possible.

The current trend toward theoretical expansion and fragmentation within the IS field is clearly not sustainable in the context of Kuhnian "normal science" [10], and stands, we believe, as a direct threat to the field's cohesiveness and long-term prospects. Indeed, Larsen et al. [9] have already noted the fragmentation of the IS field into several distinct intellectual communities, each with its own traditions, foci, and theoretical foundations. As these communities evolve and grow, so too may the distance between them. Although information technology currently serves as a common thread which binds these communities together, in the absence of efforts aimed at theory integration and generalization, this thread may ultimately prove insufficient to maintain the cohesion of the field as a whole. A theoretical crisis in the IS field may indeed be imminent.

5. References

[1] Baskerville, R.L., and Myers, M.D.: "Fashion waves in information systems research and practice", MIS Quarterly, 33(4), 2009. pp. 647-662.

[2] Benbasat, I., and Zmud, R.W., "The identity crisis within the IS discipline: Defining and communicating the discipline's core properties", MIS Quarterly, 27(2), 2003, pp. 183-194.

[3] Hassan, N.R., "Is information systems a discipline? Foucauldian and Toulminian insights", European Journal of Information Systems, 20(4), 2011, pp. 456-476.

[4] Hirschheim, R., and Klein, H.K., "A Glorious and Not-So-Short History of the Information Systems Field", Journal of the Association for Information Systems, 13(4), 2012, pp. 188-235.

[5] Agarwal, R., and Lucas, H.C., "The Information Systems Identity Crisis: Focusing on High-Visibility and High-Impact Research", MIS Quarterly, 29(3), 2005, pp. 381-398.

[6] Neufeld, D., Fang, Y., and Huff, S., "The IS identity crisis", Communications of the Association for Information Systems, 19, 2007, pp. 447-464.
[7] Somers, M.J., "Using the theory of the professions to understand the IS identity crisis", European Journal of Information Systems, 19(4), 2010, pp. 382-388.
[8] Moody, D., Iacob, M.-E., and Amrit, C., "In Search of Paradigms: Identifying the Theoretical Foundations of the Information Systems Field", 18th European Conference on Information Systems (ECIS), 2010
[9] Larsen, K.R., Monarchi, D.E., Hovorka, D.S., and Bailey, C.N., "Analyzing unstructured text data: Using latent categorization to identify intellectual communities in information systems", Decision Support Systems, 45(4), 2008, pp. 884-896.
[10] Kuhn, T.S., The Structure of Scientific Revolutions, University of Chicago Press, Chicago, IL, 1962.
[11] Kuhn, T.S., The Essential Tension: Selected Studies in Scientific Tradition and Change, University of Chicago Press, Chicago, IL, 1977.
[12] Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D., "User Acceptance of Information Technology: Toward a Unified View", MIS Quarterly, 27(3), 2003, pp. 425-478.
[13] Wikimedia Foundation, "Wikipedia, The Free Encyclopedia", in (Editor, 'ed.'^'eds.'): Book Wikipedia, The Free Encyclopedia, Wikimedia Foundation, Inc., San Francisco, CA, 2014
[14] Keller, J., "Is Wikipedia a World Cultural Repository?": The Atlantic, Atlantic Media Company, Washington, DC, 2011
[15] Ferratt, T.W., Gorman, M.F., Kanet, J.J., and Salisbury, W.D., "IS Journal Quality Assessment Using the Author Affiliation Index", Communications of the Association for Information Systems, 19, 2007, pp. 710-724.
[16] Rainer, K., and Miller, M., "Examining differences across journal rankings", Communications of the ACM, 48(2), 2005, pp. 91-94.
[17] Larsen, K.R., Theories Used in IS Research Wiki. http://istheory.byu.edu, accessed 01 May 2014.
[18] Galliers, R.D., and Meadows, M., "A discipline divided: globalization and parochialism in information systems research", Communications of the AIS, 11, 2003, pp. 108-117.

6. Appendix

The complete list of 318 unique, valid theories which verifiably appeared in MISQ, ISR, or JMIS between 1990 and 2013 is provided below. Alternative names for each theory (if any) appear in parentheses.

1. Absolute advantage theory
2. Absorptive capacity theory
3. Action theory
4. Activity theory (Scandinavian activity theory)
5. Actor-network theory (Actor network theory)
6. Agency theory (Agent principal theory, Principal agent theory, Principal-agency theory, Principal-agent theory)
7. Algorithmic game theory
8. Appraisal theory
9. Argumentation theory
10. Asymptotic theory (Large sample theory)
11. Attachment theory
12. Attribution theory (Kelley's attribution theory)
13. Auction theory
14. Australian model (Swan model)
15. Balance theory
16. Bass diffusion model (Bass model)
17. Bayesian decision theory
18. Bayesian theory (Bayesian probability theory)
19. Behavior theory (Behaviour theory)
20. Behavioral model (Behavioral modeling)
21. Behavioral theory of the firm (Behavioural theory of the firm)
22. Belief function theory (Dempster-Shafer theory)
23. Biological theory
24. Blackboard model
25. Capability maturity model (SEI software quality model)
26. Capital asset pricing model
27. Central capacity theory
28. Channel expansion theory
29. Chaos theory
30. Circuit theory
31. Classical test theory (Classical true score measurement theory)
32. Classification theory
33. Co-creation theory
34. Cognitive evaluation theory
35. Cognitive load theory
36. Cognitive theory
37. Coherence theory
38. Collaborative model
39. Collective action theory
40. Communication model (Models of communication)
41. Communication theory (Communications theory)
42. Competency model
43. Complementarity theory
44. Complexity theory
45. Computational complexity theory (Complexity theory in computation, Continuous complexity theory, Space complexity theory)
46. Computational learning theory
47. Computational theory (Computation theory, Computer theory, Theory of computation)
48. Computer science theory
49. Conceptual dependency theory
50. Conflict theory (Conflict model of society)
51. Consensus model
52. Consensus theory
53. Construal level theory
54. Constructivist theory
55. Consumer theory (Consumer choice theory)
56. Contingency theory
57. Contract theory
58. Control theory
59. Conversation theory
60. Correspondence theory (Correspondence theory of truth)
61. Covariation model
62. Crisis communication model
63. Critical social theory (Critical theory of society, Frankfurt school critical theory)
64. Critical theory
65. Culture theory (Cultural theory)
66. Cumulative prospect theory

67. Database theory
68. Decision theory (Empirical decision theory, Statistical decision theory)
69. Decision tree model
70. Dell theory (Dell theory of conflict prevention)
71. Dependency theory (Dependencia theory)
72. Design theory
73. Detection theory (Signal detection theory, Signal-detection theory)
74. Deterrence theory (Nuclear deterrence theory)
75. Development theory
76. Differential association theory
77. Diffusion of innovations theory
78. Disappointment theory
79. Discrepancy theory
80. Discrete choice model (Binary choice model, Qualitative response models)
81. Dissonance theory (Cognitive consistency theory, Cognitive dissonance theory)
82. Distribution theory
83. Domain theory
84. Dramaturgical theory
85. Drive theory (Drive reduction theory)
86. Dual process theory
87. Dual-coding theory (Dual code theory, Dual coding theory, Dual encoding theory, Dual-encoding theory)
88. Duality theory
89. Ecological theory (Ecology theory, Ecotheory)
90. Econometric model (Econometric modeling, Econometric models)
91. Economic order quantity model
92. Economic theory
93. Ecosystem model (Ecological model, Ecological modeling, Ecological modelling, Ecosystem modeling, Ecosystem models)
94. Educational theory (Education theory)
95. Elaboration-likelihood model (Elaboration likelihood model)
96. Emotional labor theory
97. Entity-relationship model (E-R model, Entity relationship model, Entity relationship modelling, Entity relationship models, Entity-relationship models, Er model, ER modelling, ERA model)
98. Equilibrium model of group development
99. Equity theory (Equity-theory)
100. Ethical theory
101. Evolutionary game theory
102. Evolutionary model
103. Evolutionary theory (Biological theory of evolution, Evolution theory, Evolutionism theory, Modern evolutionary theory, Scientific theory of evolution)
104. Exchange theory (Social exchange theory)
105. Excitation-transfer theory
106. Expectancy theory
107. Expectancy-value theory
108. Expectation confirmation theory (Expectation-confirmation theory)
109. Expected utility theory
110. Extreme-value theory (Extreme value theory)
111. Facet theory
112. Fashion theory
113. Field theory
114. Financial theory (Finance theory)
115. Five factor model (Big five model, Big five model of personality, Ocean model, Ocean model of personality)
116. Five forces model (5 forces model)
117. Foraging theory
118. Free market competition model
119. Function point model
120. Fuzzy set theory
121. Game theory (Games theory, Gaming theory)
122. Garbage can model
123. Gender schema theory
124. General equilibrium model (General equilibrium theory)
125. General theory of relativity (Einstein's general theory of relativity, General relativity theory)
126. Genre theory
127. Gestalt theory
128. Goal-setting theory
129. Graph theory (Algorithmic graph theory)
130. Health belief model
131. Herd theory
132. Heuristic-systematic model of information processing (Heuristic-systematic model)
133. Human capital theory
134. Humoral theory
135. Ideal theory
136. Identity theory (Identity theory of mind, Psychoneural identity theory, Type identity theory, Type-identity theory, Type-type theory)
137. Implementation theory
138. Impression management theory (Self-presentation theory)
139. Incentive theory
140. Information foraging theory
141. Information integration theory
142. Information processing theory (Information-processing theory)
143. Information systems theory
144. Information theory (Classical information theory, Shannon information theory, Shannon theory, Shannon's information theory, Shannons theory)
145. Institutional theory
146. Instructional theory
147. Integrative complexity theory
148. Interaction theory
149. Interdependence theory
150. Interdisciplinary theory
151. Interpersonal adaptation theory
152. Interpersonal deception theory
153. Inventory model (Inventory models, Inventory theory)
154. IS success model (Delone and McLean IS success model, Information systems success model)
155. IT interaction model
156. Item response theory
157. Labor process theory (Labour process theory)
158. Lanchester model
159. Language expectancy theory
160. Learning theory
161. Legal theory
162. Literary theory
163. Management theory
164. Marketing theory

165. Matching theory
166. Mathematical theory of communication
167. Mathematical theory (Logic theory)
168. Matrix theory
169. Maturity model
170. Media naturalness theory
171. Media richness theory
172. Media theory
173. Microeconomic theory (Micro-economic theory, Price theory)
174. Middle range theory (Middle-range theory)
175. Model of computation (Computation model, Machine model)
176. Molecular model
177. Monopolistic advantage theory
178. Moral theory
179. Motivation theory
180. Multimedia learning theory
181. Negotiation theory
182. Neoclassical economic theory (Neo-classical economic theory, Neoclassical model)
183. Nested relational model
184. Network data model (Network database model, Network model)
185. Network effects theory (Network effects business model)
186. Network theory
187. Neutral theory of molecular evolution (Neutral allele theory, Neutral mutation theory, Neutral theory of evolution)
188. Neutralization theory
189. News vendor model (Newsboy model, Newsvendor model)
190. Newtonian theory
191. Operations research theory (Quantitative management theory)
192. Optimal control theory (Mathematical theory of optimal control)
193. Optimal distinctiveness theory
194. Optimal foraging theory
195. Optimization theory
196. Organismic theory
197. Organizational communication model
198. Organizational theory (Organization theory)
199. People capability maturity model
200. Personal construct theory (Personal constructs theory)
201. Personality theory
202. Philosophical theory
203. Physics theory (Physical theory)
204. Politeness theory
205. Political theory
206. Population ecology theory
207. Portfolio theory (Markowitz portfolio theory, Modern portfolio theory)
208. Postcolonial theory (Post-colonial theory)
209. Practice theory
210. Probability theory
211. Process theory
212. Production theory
213. Productivity model
214. Prospect theory
215. Protection motivation theory
216. Prototype theory
217. Psychoanalytic theory
218. Psychological theory
219. Psychometric theory
220. Punctuated equilibrium model (Punctuated equilibrium theory)
221. Quantum theory
222. Queuing theory (Queue theory, Queueing model, Queueing models, Queueing theory, Queuing model, Teletraffic queuing theory)
223. Rational choice theory (Rational action theory, Rational actor model, Rational actor theory)
224. Rational expectations theory
225. Regulatory focus theory
226. Reinforcement theory
227. Relational model (Relational data model, Relational database model, Relational model of database management)
228. Relational theory
229. Relationship management theory
230. Relativity theory (Classical theory and special relativity, Einstein's theory, Theory of relativity)
231. Relevance theory
232. Reliability theory
233. Representation theory
234. Resource dependence theory (Resource dependency theory)
235. Reversal theory
236. Risk theory (Collective risk theory, Cramer-Lundberg model, Ruin theory, Sparre-Anderson model)
237. Role theory
238. Routine activities theory (Routine activity theory)
239. Saturated model
240. Schema theory (Schemata theory)
241. Script theory
242. Search theory (Search models, Searching theory)
243. Self-justification theory
244. Self-perception theory
245. Signaling theory (Signalling theory)
246. Singapore model
247. Single index model (Single index modelling, Single index models, Single-index model, Single-index modelling, Single-index models, Singleindex model, Singleindex modelling, Singleindex models)
248. Situational leadership theory (Contingency leadership theory, Hersey-Blanchard situational theory, Situational theory)
249. Social action model
250. Social choice theory
251. Social cognitive theory
252. Social comparison theory
253. Social contract theory
254. Social disorganization theory (Social disorganisation theory)
255. Social facilitation theory
256. Social identity model of deindividuation effects
257. Social identity theory
258. Social impact theory
259. Social information processing theory (Cues-filtered-out theory)
260. Social judgment theory
261. Social learning theory
262. Social network theory (Structural hole theory)
263. Social presence theory
264. Social rule system theory
265. Social theory (Contemporary sociological theory)

266. Sociocultural theory
267. Sociological theory
268. Sociotechnical systems theory
269. Sound theory (O-consistent theory, O-inconsistent theory, Omega-consistent theory, Omega-inconsistent theory)
270. Spatial competition model (Location model)
271. Speech-act theory (Speech act theory)
272. Stability theory
273. Stage theory
274. Stakeholder theory
275. Statistical learning theory
276. Statistical theory
277. Stockholder theory
278. Strategic choice theory
279. Structuration theory
280. Symbolic interaction theory
281. Systems theory (General systems theory, System theory)
282. Technology acceptance model
283. Theory of alienation (Marx's theory of alienation)
284. Theory of communicative action
285. Theory of contestable markets (Contestable markets theory)
286. Theory of education
287. Theory of flow
288. Theory of groups (Group theory, Infinite group theory)
289. Theory of justice (Theory of social justice)
290. Theory of knowledge (Epistemological theory)
291. Theory of measurement
292. Theory of mind
293. Theory of moral development (Kohlberg's moral stages theory, Kohlberg's theory of moral development)
294. Theory of natural selection (Natural selection theory)
295. Theory of perfect competition (Perfect competition model, Walrasian model)
296. Theory of planned behavior (Ajzen's theory of planned behaviour)
297. Theory of production
298. Theory of reasoned action
299. Theory of sexual selection
300. Theory of speciation
301. Theory of sustainability
302. Theory of technology
303. Theory of the firm
304. Theory of value
305. Theory theory (Theory-theory)
306. Three-factor model (Fama-French three factor model, Fama-French three-factor model)
307. Tournament theory
308. Trade theory (International trade theory)
309. Trait theory
310. Truth theory (Epistematic theory of truth, Epistemic theory of truth)
311. Two-factor model (Motivator-hygiene theory, Two factor theory, Two-factor theory, Twofactor model)
312. Uncertainty reduction theory
313. Unified theory of acceptance and use of technology
314. Unified theory of cognition
315. Uses and gratifications theory
316. Utility theory (Money-in-the-utility-function models)
317. Value theory (Goodness and value theory)
318. Viable system model