Communications of the Association for Information Systems

Volume 17 Article 25

April 2006

Tutorial of an Ontological Support System

Gary F. Templeton
Mississippi State University, gtempleton@cobilan.msstate.edu

Cheon-Pyo Lee
Mississippi State University

Follow this and additional works at: https://aisel.aisnet.org/cais

Recommended Citation
Templeton, Gary F. and Lee, Cheon-Pyo (2006) "Tutorial of an Ontological Support System," *Communications of the Association for Information Systems*: Vol. 17 , Article 25.
DOI: 10.17705/1CAIS.01725
Available at: https://aisel.aisnet.org/cais/vol17/iss1/25

This material is brought to you by the AIS Journals at AIS Electronic Library (AISeL). It has been accepted for inclusion in Communications of the Association for Information Systems by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Communications of the Association for Information Systems

TUTORIAL OF AN ONTOLOGICAL SUPPORT SYSTEM

Gary F. Templeton
Cheon-Pyo Lee
Management & Information Systems Department
Mississippi State University
gtempleton@cobilan.msstate.edu

ABSTRACT

This tutorial describes a technology-mediated solution, the ontological support system (OSS), for specifying, organizing, representing and using elements of meaning in a body of knowledge. Theoretically influenced by ontological specification, the OSS was validated through iterative prototyping in a companion *CAIS* research paper. This article reports on how the OSS guides users through several content analysis phases (selection, delineation, transfer and use of content) in the context of academic research. Users typically find the system to be useful, easy to use and compatible with collaborative work when using it for content analysis in academic research.

Key Words: Content Analysis, Ontological Specification, Ontology

I. INTRODUCTION

This paper provides a tutorial for the prototype developed in a companion *CAIS* research article (Volume 17, Article 24; Templeton, Lee and Snyder, 2006). It is our hope that this tutorial and its methods are diffused across IS and other disciplines to facilitate academic research, technical writing and content analysis. We show here that the system provides technological support for the capture, interpretation, prioritization, and presentation of important knowledge. We believe systems such as the prototype illustrated here are of great importance in the current era of accessibility to vast amounts of electronically-mediated qualitative data.

As developed in the companion paper, this prototype has been called an ontological support system (OSS) because it supports a structured ontological specification process (OSP) algorithm. OSP is a structured approach that guides user or researcher interpretation of written content. Thus, OSP is a content analysis approach that may support a wide range of knowledge acquisition and interpretation task domains, including systems analysis and design, technical writing, and environmental scanning. The OSS was a deliverable of an action research study reported on in the companion paper (Templeton et al., 2006). In that study, a collaboration between researchers and aspiring academic researchers (i.e., IS doctoral students) prescribed the use of OSP in the process of interpreting and 'designing' knowledge content. OSS is Excel-based and requires no special downloads or additional software support. Thus, experience with common spreadsheet software is an important requisite for developing and successfully using the OSS as described here.

II. ILLUSTRATION OF SYSTEM

An efficient way to understand OSS is to download and interact with a sample file from the following link:

http://misweb.cbi.msstate.edu/gtempleton/files/OSSTutorial.xls

This downloadable file contains an encoded version of this tutorial which enables a comparison of how the system works with one of its deliverables (i.e., this manuscript).

There are several characteristics of OSS that users should consider before using it in collaborative projects.

Knowledge Content in OSS

It is important to note that the prototype is used for *content analysis* in general. Thus, the unit of analysis represented in each record is a user-defined notion of *knowledge content*, not papers or sentences. In its most general form, knowledge content within OSS is a combination of data (e.g., text, numeric, date), data groups (paragraphs, sections, worksheets, etc.) and models (i.e., functions). The OSS depicted here uses a minimal number of Excel functions, and we encourage users to experiment in order to expand and customize the system to fit their individual needs.

OSS File Organization

One OSS file (which is synonymous with one Excel file) may be designed so that each OSS record (row) represents a sentence fragment, full sentence, series of sentences or paragraph. Each worksheet (combination of rows and columns) may contain a subject area, ontology, list, or other logically related series of information. Further, there is no limit within Excel with regard to the number of worksheets a user may include in an OSS file. Finally, because of its ability to store a wide range of content, the OSS is flexible with regard to the number of sentences, paragraphs, papers and data types it may handle.

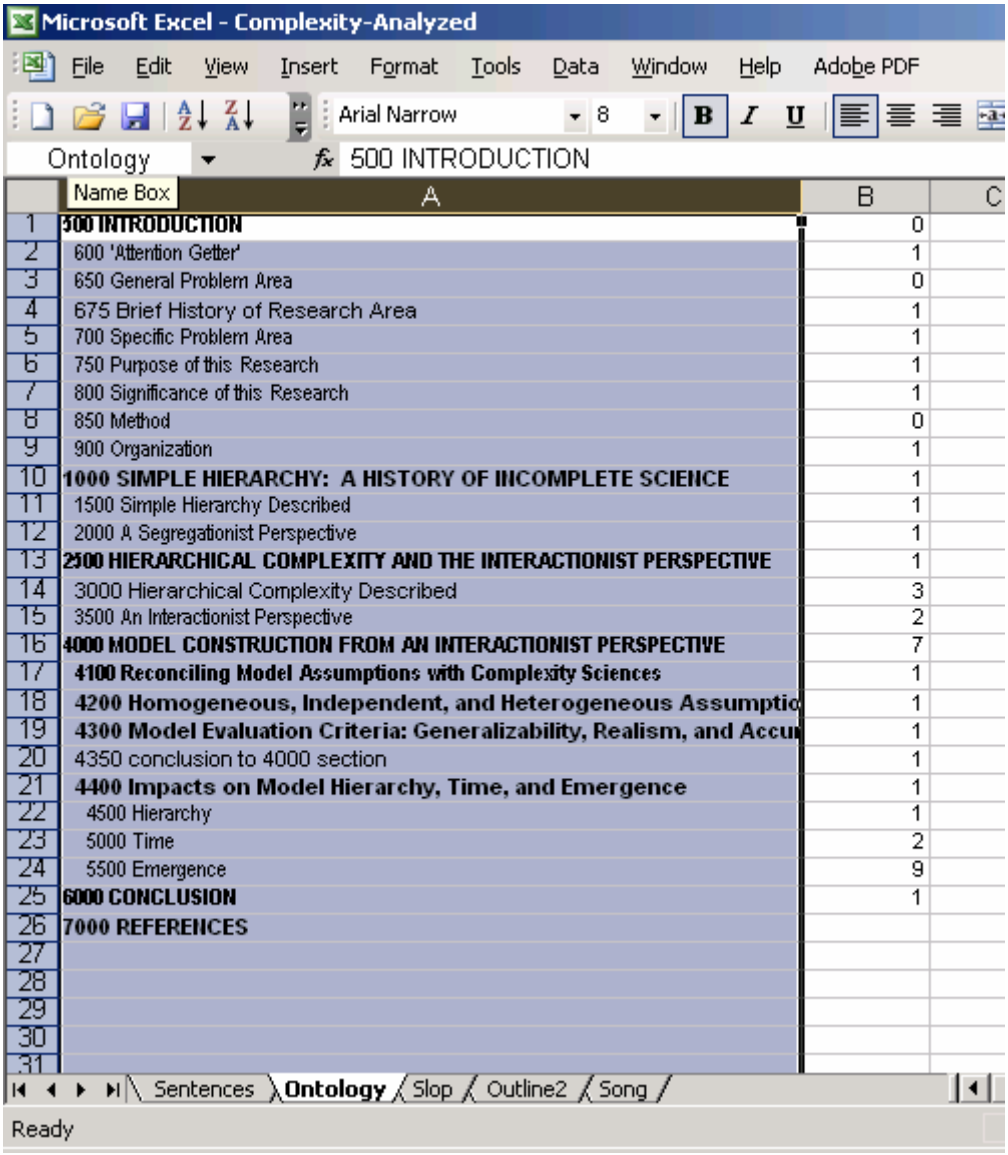
Developing and Using OSS

OSS embodies the convergence of IS use and development: both modes are necessary to reach its full capabilities. Flexibility is enabled by the Excel programming environment and the expertise of the user. Users are only constrained by the rules within the programming environment (Excel and the operating system) and their own imagination. Thus, academic writing is only one use of OSS. Other possibilities in the MIS field include organizing content for systems analysis, designing code models, and organizational redesign.

Figures 1-3 illustrate that the development and use environments of OSS are the typical Excel worksheet view. As implied in its name, the OSS system is distinguished from other systems classifications (e.g., expert, decision support and executive information systems) by its ontology component. The figures show how knowledge elements may be formulated by users into a content hierarchy, which is represented by a user-defined ontology.

The development of an OSS file involves evolutionary refinement of both: 1) the content domain (knowledge representations of interest to users), and 2) the system environment (i.e., the features of Excel). In our applications of OSS, projects involved two core elements, each residing on an individual worksheet: 1) one or more ontologies, and 2) one or more lists of detailed records. Figures 1 and 2 depict how users view each of these elements. As shown, the user applies the system to the development of a single paper, and each row represents one or more sentences. Researchers will typically cycle between these two element types to fit the needs of a given project.

Figure 1. An Ontology in an OSS File



Following Gruber (2006), we define ontology as the "specification of a conceptualization." Figure 1 depicts an ontology of concepts included in an actual paper on complexity sciences that is currently under revision for a management journal. Figures 1 and 2 show how Excel list names and Data Validation, two primary features of OSS, are used to integrate the ontology and knowledge content. Figure 1 shows that selecting the first column reports the name of an identified list in Excel's *Name Box* field (see the word "Ontology" immediately above left of the "A" column heading). Creating this list is an important step in setting up the OSS.

Figure 2 illustrates how the Data Validation wizard in Excel is used within OSS. The user first selects an entire column (e.g., "B") on the "Sentences" worksheet. This column is used to 'link through' to the ontology defined on the 'Ontology' worksheet (compare Figure 1, column A and Figure 3, column B). From the "Sentences" worksheet, the user selects "Data" from the main menu and then the "Validation" menu option, which brings up the "Data Validation" window. The user selects "List" in the Allow field and types "=" and the list name ("Ontology" in this example) in the Source field.

Figure 2. Using Data Validation to Link Detailed Records with Ontology Elements

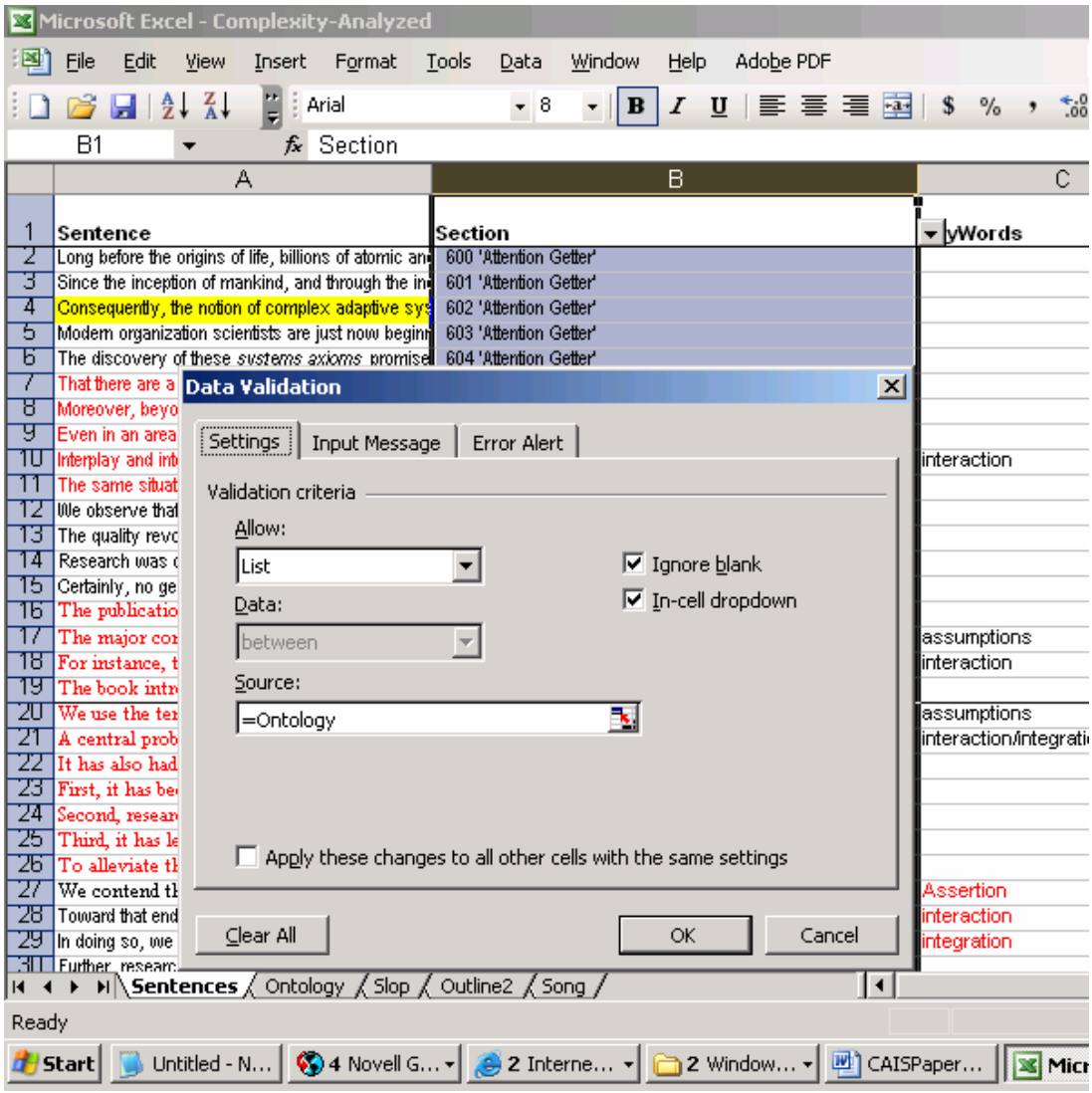


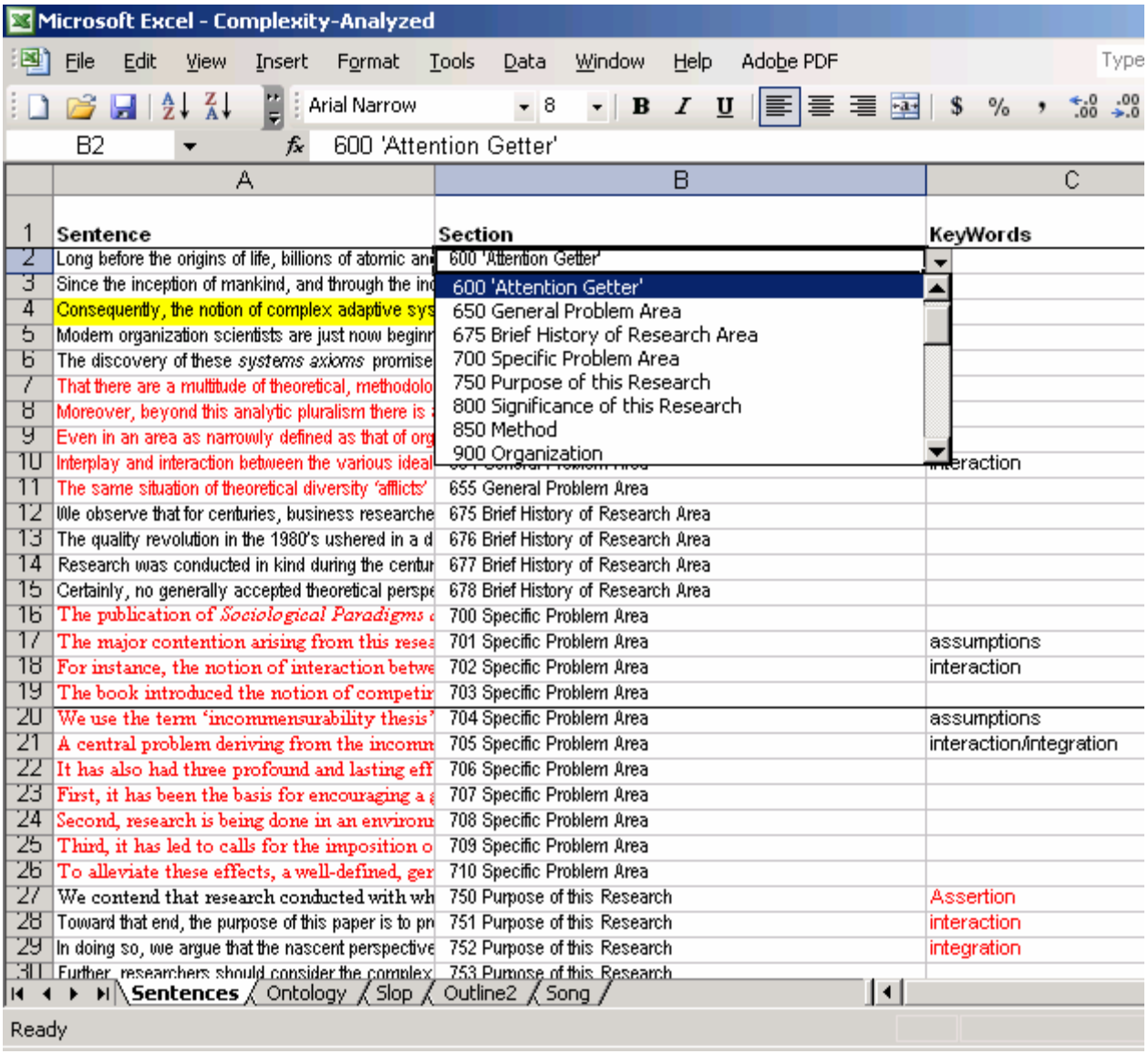
Figure 3 shows that, as a result of using the Data Validation feature in this way, the user may access a drop-down box containing all ontology elements listed on the "Sentences" worksheet. Thus, the two worksheets work in tandem: the 'Ontology' worksheet contains the ontology list being accessed, and the Sentences worksheet allows the user to enter data by accessing this list. Data Validation allows for any change made to the 'Ontology' worksheet (see Figure 1) to be dynamically (i.e., immediately) reflected in the drop down list box that is accessible in Figure 3.

Extending OSS Features

These figures show how users may create entries for ontology elements in separate worksheets. Any user may create, modify or delete ontology elements when using the system. Excel also has a feature to freeze and password protect values, if editing constraints are necessary. Note how we numbered each ontology element with accompanying distinct line numbers (i.e., "*500* INTRODUCTION") so each record in the *detail records* worksheet would be grouped by element. Providing line numbers also provides the ability to continue line counts on the detail record sheet by using Excel's 'Auto Fill' feature. For example, Figure 2 (column B) indicates several records

redundantly tagged with the “Attention Getter” ontology element. Because of the ontology element reference number included in its name, the number increased in increments of one (600 through 604 in the example) when it was copied to subsequent records using Auto Fill. Using this capability allows users to uniquely number detail records. For our purposes, this meant that each sentence had a distinct line number, and all sentences in the document were consecutively ordered (an aspect that facilitated reorganization and sorting). In order to distinguish between hierarchical levels in the ontology, we indented by inserting space characters to the left of the name of a ‘child’ ontological element.

Figure 3. Selecting among Ontology Elements while Editing a Detail Line



Many other features of Excel may be incorporated into the OSS, based on researcher needs. In Figure 1, column B, we used the COUNTIF function to provide counts on the ontology sheet for the number of times ontology elements appear on the *detail records* sheet. This suggests that OSS has promise for providing greater DSS-like functionality to the design and use of ontologies in academic research projects.

Figure 3 illustrates a typical user environment for ongoing use of the OSS. For academic manuscript projects such as ours, we usually placed one sentence in each row. Where several sentences belonged together as a unit, we considered the group a record. Such detailed records were input into column A, while column B was used to tag each record with an ontological element. After typing each sentence, the user simply selects its associated ontology element from the listbox.

Recommendations

We recommend that a single collaborator edit at any one time, just as a word processing file is usually modified by one coauthor at a time during academic research. The best way to learn about the OSS and its capabilities is to use it in projects (such as managing academic writing projects).

The dual (development and use) nature of ongoing projects was found to be integral to success in the context of OSS. Our experience shows that some experience developing in Excel is a fundamental requirement for principle uses of OSS. In addition, more advanced uses will depend on the extent of feature exploitation. We found success to require both types of skill within the OSS environment: 1) the ability to develop, and 2) the ability to use. Those most experienced in developing in the Excel environment will be able to access more of its features and consequentially will be more likely to experience 'information systems success.'

Thus, expertise in both the content domain and Excel is needed to successfully operate the OSS prototype. Excel capabilities we found in developing academic manuscripts included highlighting text, text background, inserting comments in cells, hyperlinking, sorting, functions, macros, printing selections, and cell formatting.

III. CONCLUSIONS

It is our intention that the OSS prototype described here improves the quality of content analysis in work involving a large mass of text data. OSS is an Excel-based environment that depends heavily upon end user development throughout its use. In general, the system supports the production of structural meanings in content domains within knowledge domains. This research demonstrates that the OSS may be used to create and use ontologies from individual concept elements, which were subsequently used to label sentences in the writing of academic manuscripts. We foresee that the OSS will be useful in the development of a single or a series of manuscripts and easily facilitates collaborative research.

Within the context of MIS practice, we foresee two distinct uses of the OSS. First, the OSS can facilitate the OSP, which has significant implications for supporting content analysis. Content analysis is commonly used in the requirements definition phase of systems analysis and design to structure meanings of a problem domain. Therefore, we encourage practitioners to use OSS to support content analysis approaches (such as OSP) to deduct logical structures, commonalties and relationships in conceptual representations found in textual data. Second, the hierarchical nature of ontologies gives the OSS a great deal of promise for database and network design. We suggest that systems architects consider using OSS for early stages of systems development, especially where hierarchy is an apparent aspect of design. The relational tables in Excel enable OSS users to transfer its deliverables to many modern CASE repositories. Based on our experiences, we believe that the most important determinant of 'MIS success' (Delone and McLean, 1992) accompanying the OSS is its *ease of development*, which is offered by the Excel application environment. The adaptive and flexible nature of Excel greatly facilitates ongoing end user development needed to satisfy changing user requirements between and within projects.

REFERENCES

EDITOR'S NOTE: The following reference list contains the address of World Wide Web pages. Readers, who have the ability to access the Web directly from their computer or are reading the

paper on the Web, can gain direct access to these references. Readers are warned, however, that

1. these links existed as of the date of publication but are not guaranteed to be working thereafter.

2. the contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.

3. the authors of the Web pages, not CAIS, are responsible for the accuracy of their content.

4. the author of this article, not CAIS, is responsible for the accuracy of the URL and version information.

Delone, W. H. and McLean, E. R., "Information Systems Success: The Quest for the Dependent Variable," Information Systems Research, Vol. 3, No. 1, March 1992, pp. 60-95.

Gruber, T.R. What is an ontology? Available from the WWW at: http://www-ksl.stanford.edu/kst/what-is-an-ontology.html, accessed 2/27/06.

Templeton, G.F., Lee, C.-P. and Snyder, C.A. Validation Of A Content Analysis System Using An Iterative Prototyping Approach To Action Research, Communications of the AIS, 2006, Vol. 17, No. 24.

ABOUT THE AUTHORS

Gary F. Templeton is Assistant Professor of MIS in the College of Business and Industry at Mississippi State University in Starkville, MS. He teaches MIS administration, office applications and qualitative research in MIS. His research focuses on organizational learning, survey instrumentation, and novel IS. He earned Ph.D. in MIS at Auburn University. His publications appear in the *Journal of Management Information Systems, Communications of the ACM, the European Journal of Information Systems, Information Technology and Management,* and *Information Systems Frontiers.*

Cheon-Pyo Lee is a doctoral student in Information Systems at Mississippi State University. He received his MS/CIS degree from Georgia State University and MBA degree from Morehead State University. His research interests include SME's IT adoption, mobile commerce, and business value of IT. He published in the *Journal of Internet Banking and Commerce* and Information Technology and People. He has presented at such conferences as AMCIS and IRMA.

Copyright © 2006 by the Association for Information Systems. Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and full citation on the first page. Copyright for components of this work owned by others than the Association for Information Systems must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers, or to redistribute to lists requires prior specific permission and/or fee. Request permission to publish from: AIS Administrative Office, P.O. Box 2712 Atlanta, GA, 30301-2712 Attn: Reprints or via e-mail from ais@aisnet.org

.

Communications of the Association for Information Systems

ISSN: 1529-3181

EDITOR-IN-CHIEF
Joey F. George
Florida State University

AIS SENIOR EDITORIAL BOARD

Jane Webster Vice President Publications Queen's University	Joey F. George Editor, CAIS Florida State University	Kalle Lyytinen Editor, JAIS Case Western Reserve University
Edward A. Stohr Editor-at-Large Stevens Inst. of Technology	Blake Ives Editor, Electronic Publications University of Houston	Paul Gray Founding Editor, CAIS Claremont Graduate University

CAIS ADVISORY BOARD

Gordon Davis University of Minnesota	Ken Kraemer Univ. of Calif. at Irvine	M. Lynne Markus Bentley College	Richard Mason Southern Methodist Univ.
Jay Nunamaker University of Arizona	Henk Sol Delft University	Ralph Sprague University of Hawaii	Hugh J. Watson University of Georgia

CAIS SENIOR EDITORS

Steve Alter U. of San Francisco	Chris Holland Manchester Bus. School	Jerry Luftman Stevens Inst.of Technology

CAIS EDITORIAL BOARD

Erran Carmel American University	Fred Davis Uof Arkansas, Fayetteville	Gurpreet Dhillon Virginia Commonwealth U	Evan Duggan U of Alabama
Ali Farhoomand University of Hong Kong	Jane Fedorowicz Bentley College	Robert L. Glass Computing Trends	Sy Goodman Ga. Inst. of Technology
Ake Gronlund University of Umea	Ruth Guthrie California State Univ.	Alan Hevner Univ. of South Florida	Juhani Iivari Univ. of Oulu
K.D. Joshi Washington St Univ.	Michel Kalika U. of Paris Dauphine	Jae-Nam Lee Korea University	Claudia Loebbecke University of Cologne
Sal March Vanderbilt University	Don McCubbrey University of Denver	Michael Myers University of Auckland	Dan Power University of No. Iowa
Kelley Rainer Auburn University	Paul Tallon Boston College	Thompson Teo Natl. U. of Singapore	Craig Tyran W Washington Univ.
Upkar Varshney Georgia State Univ.	Chelley Vician Michigan Tech Univ.	Doug Vogel City Univ. of Hong Kong	Rolf Wigand U. Arkansas, Little Rock
Vance Wilson U. Wisconsin, Milwaukee	Peter Wolcott U. of Nebraska-Omaha	Ping Zhang Syracuse University	

DEPARTMENTS

Global Diffusion of the Internet. Editors: Peter Wolcott and Sy Goodman	Information Technology and Systems. Editors: Alan Hevner and Sal March
Papers in French Editor: Michel Kalika	Information Systems and Healthcare Editor: Vance Wilson

ADMINISTRATIVE PERSONNEL

Eph McLean AIS, Executive Director Georgia State University	Reagan Ramsower Publisher, CAIS Baylor University	Chris Furner CAIS Managing Editor Florida State Univ.	Cheri Paradice CAIS Copyeditor Tallahassee, FL