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## Notes

### Essays on Technology, Interaction and Cognition

The cover art pictures the cyclic struggle of collaborative interaction: Gustav Vigeland, *Tumbling around*, c. 1930, bronze, Vigeland Park bridge, Oslo, Norway. Photo by G. Stahl, 2003. It is taken from a gathering of hundreds of stone and metal artifacts showing a variety of human groupings and individual stances, created by the Norwegian sculptor Gustav Vigeland.

A primordial form of collaboration is that of man and woman, as represented in this sculpture. Throughout the decade covered by this book, I have thrived in the collaboration with my Bliss, who supported me and tolerated my long hours at the computer. She taught me a great deal about the nature and joys of collaboration, in both theory and practice.

### Chapter 1. Share Globally, Adapt Locally

Previously published as: Stahl, G., Sumner, T., & Owen, R. (1995). Share globally, adapt locally: Software to create and distribute student-centered curriculum. *Computers and Education*. Special Issue on Education and the Internet, **24** (3), 237-246.

This chapter was originally published with co-authors Tamara Sumner and Robert Owen. It describes work done at Owen Research with support by DOE and NSF. Michael Wright and Carla Selby also worked on this project. The project received encouragement from Len Scrogan, Technology Specialist in the Curriculum and Instruction Division of Boulder Valley Public Schools, and Jim Spohrer of Apple Computers. The design environment approach grew out of research at the Center for LifeLong Learning and Design, University of Colorado.

The research reported in this chapter and several others was supported in part by the NSF; any opinions, findings, and conclusions or recommendations expressed in this book are those of the author and do not necessarily reflect the views of the National Science Foundation.

### Chapter 2. Evolving a Learning Environment

Previously unpublished manuscript: Stahl, G. (1999). *Evolution of an LSA-based interactive environment for learning to write summaries*. It was originally written for submission as a companion piece to (Kintsch *et al.*, 2000) in the special issue of *Interactive Learning Environments* on LSA. It was never submitted.

The research reported here was supported in part by a grant from the Cognitive Studies in Educational Practice Project of the McDonnell Foundation. The PIs on the grant were Walter Kintsch, Gerhard Fischer and Thomas Landauer. The initial versions of *State the Essence* were developed by the author, with assistance from Rogerio dePaula and David Steinhart. Steinhart developed a later version, named *Summary Street*, as part of his dissertation. In addition, Eileen Kintsch, Darrell Laham and

Maureen Schreiner also participated in this LSA Research Group. Cindy Matthews and Ronald Lamb team-taught the sixth-grade classroom at Platt Middle School, Boulder, Colorado, where the software was used in 1997 and 1998. The teachers were more than helpful, and, as always, the kids were great. The views expressed in this chapter are those of the author, and are not necessarily shared by Walter Kintsch, Tom Landauer and Eileen Kintsch, who provided the primary project leadership.

### **Chapter 3. Armchair Missions to Mars**

Previously published as: Stahl, G. (1996). Armchair missions to Mars: Using case-based reasoning and fuzzy logic to simulate a time series model of astronaut crews. In Pal, S., Dillon, T., Yeung, D. (Eds.) (2000) *Soft computing in case-based reasoning*, London, UK: Springer Verlag, 321-344. This was an extended version of a paper published in *Knowledge-Based Systems* (vol. 9, pp. 409-415).

The research was conducted at Owen Research, Inc. (ORI) in Boulder, Colorado, during a two year SBIR grant from NASA in 1993-1995. ORI is a small research lab founded and run by Dr. Robert Owen. Dr. Owen is a physicist specializing in laser optics. He also has a Ph.D. in anthropology, and his dissertation in that field led to this research in modeling small-group behavior using AI techniques. I developed the technical approach and programmed the system. Dr. Brent Reeves assisted with the fuzzy logic algorithms. To help collect and analyze social science literature related to small groups in isolated conditions, we worked with Professor Russell McGoodwin of the Anthropology Department at the University of Colorado (CU) and his student, Nick Colmenares. In addition, I conducted several interviews of an experienced astronaut, Mike Lounge, and discussed our project with him. I also discussed this work and that of the following chapter with Gene Cernan, the last man to walk on the moon.

This research was sponsored by the Behavioral and Performance Laboratory at Johnson Space Center in Houston, Texas, part of NASA's Astronaut Support Division. We worked closely with NASA researchers Dr. Joanna Wood and Dr. Albert Holland on the design of the software and the data. At the end of the project, we delivered the software to them to continue the work.

### **Chapter 4. Supporting Situated Interpretation**

Previously published as: Stahl, G. (1993). *Supporting situated interpretation*. Paper presented at the annual meeting of the Cognitive Science Society (CogSci '93), Boulder, CO. *Proceedings*, 965-970.

This chapter is indebted to Gerhard Fischer, Ray McCall, Kumiyo Nakakoji, Jonathan Ostwald, and Tamara Sumner, who helped to focus it, and to the Center for LifeLong Learning and Design (L<sup>3</sup>D) research group at the University of Colorado generally, whose ideas and systems it tries to ground theoretically and extend practically. The Hermes system was a re-write of McCall's Phidias system, an object-oriented implementation of his contexts as computational perspectives. The chapter reports on main themes in my computer science dissertation.

## Chapter 5. Collaborative Information Environments for Communities

Previously published as: Stahl, G. (2000). Collaborative information environments to support knowledge construction by communities. *AI & Society*, **14**, 1-27.

The earlier research on CIEs for design is a collaboration of the author with Gerhard Fischer and Jonathan Ostwald. We would like to thank the other members of L<sup>3</sup>D, particularly the “Organizational Memory and Organizational Learning” group, including Jay Smith, Scott Berkebile, Sam Stoller, Jim Masson and Tim Ohara who worked on the WebNet system. Our knowledge of LAN design benefited from our domain investigators John Rieman and Ken Anderson and local informants Kyle Kucson and Evi Nemeth. The more recent research on CIEs for knowledge construction involved the author with Rogerio dePaula, Thomas Herrmann and his students at Dortmund, Ted Habermann and his group at NOAA, Dan Kowal and his middle school students, the collaborators in the “Readings in Cognitive Science” seminar and the researchers in the “Articulate Learners” project. The work reported here was supported in part by grants from ARPA, the McDonnell Foundation and NSF. NetSuite Advanced Professional Design is a trademark of NetSuite.

An early version of this chapter was presented in 1998 as *Collaborative information environments for innovative communities of practice* at the German Computer-Supported Cooperative Work Conference (D-CSCW '98): Groupware und organizatorische Innovation, Dortmund, Germany, *Proceedings*, 195-210.

## Chapter 6. Perspectives on Collaborative Learning

Previously published as: Stahl, G. (2001). WebGuide: Guiding collaborative learning on the Web with perspectives. *Journal of Interactive Media in Education (JIME)*, 2001(1). <http://www-jime.open.ac.uk/2001/1/>.

This chapter grew out of the author's *Readings and Research in Cognitive Science* seminar, Spring 1999, on “Computer Mediation of Collaborative Learning,” with the following participants: Kirstin Butcher, John Caron, Gabe Johnson, Elizabeth Lenell, Scott Long, Rogerio dePaula, Paul Prestopnik, Tammy Sumner. The WebGuide research is a collaboration of the author with Rogerio dePaula and other L<sup>3</sup>D members, Ted Habermann and his group at NOAA, Dan Kowal and his middle school students, the participants in my WebGuide seminars, Thomas Herrmann and his group at Dortmund, and the researchers in the ICS “Articulate Learners” project.

The first major version of this chapter was in response to Ricki Goldman's invitation to submit to an AERA paper session at the 1999 conference in Montreal. Earlier posters, demos and papers on WebGuide were presented at CSCL '97, CILT '98, CSCW '98, ICLS '98, Interaktion in Web: Innovative Kommunikationsformen '98, WebNet '99, GROUP '99, CSCL '99 and CILT '99. While incorporating some of the content of these other presentations, the current chapter is based primarily on the final *JIME* version. The *JIME* reviewers, Helen Chappel-Hayios, Hans van der Meij and Gary Boyd, provided supportive and stimulating reflections; their comments were incorporated in the *JIME* publication and are summarized in the present version.

The research was supported in part by grants from NSF, the McDonnell Foundation and CU's Lab for New Media Strategy and Design.

## **Chapter 7. Groupware Goes to School**

Previously published as: Stahl, G. (2002). Groupware goes to school: Adapting BSCW to the classroom. *International Journal of Computer Applications Technology (IJCAT)*. **19** (3/4). 162-174.

The ITCOLE Project—funded by the European Commission “School of Tomorrow” framework grant IST-00-III.2—was a collaboration of many people from universities and schools throughout Europe. The project was conceived largely by people in the Centre for Research in Networked Learning and Knowledge Building at the University of Helsinki and in the Media Lab at the University of Art and Design Helsinki. Much of the Synergeia user interface was designed by the Media Lab group. MapTool was implemented at the University of Murcia in Spain. The project manager for ITCOLE at FIT was Wolfgang Appelt. The implementation of most of the features described in this chapter was done by the BSCW group at Fraunhofer-FIT, especially by Rudolf Ruland and me. To carry out the adaptation of a complex system like BSCW in a way that takes advantages of the strengths of its design and does not contradict its philosophy would not be possible without detailed guidance from the BSCW development staff, including Thomas Koch, Elke Hinrichs and Gerd Woetzel, in addition to Rudolf. I am grateful to all the people at FIT who made my year there possible, productive and enjoyable.

Parts of this chapter originally formed a User Manual for Synergeia. An early version of this chapter was presented at the International Workshop on Groupware (CRIWG '02) in La Serena, Chile, September 1-3, 2002. A number of CRIWG reviewers and participants made suggestions that significantly improved this chapter.

## **Chapter 8. Knowledge Negotiation Online**

Previously published as: Stahl, G. (2003). *Knowledge negotiation in asynchronous learning networks*. Paper presented at the Hawaii International Conference on System Sciences (HICSS '03), Hawaii, HA.

The concept of knowledge negotiation grew out of discussions at Fraunhofer-FIT, where I had the pleasure of working in 2001/2002. The BSCL system was implemented there with the help of the BSCW development team (especially Rudolf Ruland and Thomas Koch) as part of the European Commission’s ITCOLE Project IST-2000-26249. My concern with negotiation goes back to discussions since 1997 with Thomas Herrmann and his students, both in Boulder and in Dortmund. The chapter has also benefited from personal communications with Volker Wulf, as well as from comments by several HICSS reviewers.

## **Chapter 9. A Model of Collaborative Knowledge Building**

Previously published as: Stahl, G. (2000). *A model of collaborative knowledge building*. Paper presented at the Fourth International Conference of the Learning Sciences (ICLS '00), Ann Arbor, MI. *Proceedings*, LEA, 70-77.

This chapter was motivated by modeling sessions with Thomas Herrmann and Kai-Uwe Loser during a visit to the University of Dortmund in June 1999 and exchanges with Tim Koschmann while he was a visiting professor in Boulder. The alternative models appended to the end of the chapter use the conventions of Herrmann’s SeeMe editor. The

original paper benefited from comments by collaborators in my Fall '99 seminar on KBEs, participants in the CSCL '99 workshop on KBEs and reviewers for ICLS 2000.

### **Chapter 10. Rediscovering the Collaboration**

Previously published as: Stahl, G. (2002). Rediscovering CSCL. In T. Koschmann, R. Hall & N. Miyake (Eds.), *CSCL 2: Carrying forward the conversation* (pp. 169-181). Hillsdale, NJ: Lawrence Erlbaum Associates.

The view of collaborative learning as visible in interaction is itself a collaborative product that has emerged in interactions of the author with Timothy Koschmann as well as with Curtis LeBaron, Robert Craig, Alena Sanusi and other members of a Fall 2000 seminar in CSCL. This chapter was written for the *CSCL 2* volume.

### **Chapter 11. Contributions to a Theoretical Framework**

Previously published as: Stahl, G. (2002). *Contributions to a theoretical framework for CSCL*. Paper presented at the international conference on Computer-Supported Collaborative Learning (CSCL '02), Boulder, CO. *Proceedings*, LEA, 1-2 & 62-71.

The ideas in this chapter grew out of collaborative knowledge building mediated by WebGuide in a series of seminars on CSCL at the University of Colorado. I would particularly like to thank participants Alena Sanusi, Curt LeBaron and Bob Craig from the Communication Department as well as the teachers and students at Platt Middle School in Boulder who were involved with SimRocket.

The Introduction part of this chapter is taken from the *Introduction* to the CSCL '02 *Proceedings* (Stahl, 2002). The remainder was a paper I presented at that conference; Jeremy Roschelle was the discussant.

### **Chapter 12. In a Moment of Collaboration**

Previously published as: Stahl, G. (2002). *Understanding educational computational artifacts across community boundaries*. Paper presented at the International Society for Cultural Research and Activity Theory (ISCRAT '02), Amsterdam, NL.

Thanks to Timothy Koschmann, who has long pushed me in the direction of this kind of analysis, and to Curt LeBaron and Bob Craig who opened up the communication-based micro-ethnographic approach to me. Much of the transcription and insight into the interaction was due to Alena Sanusi. Support for the original research while in L<sup>3</sup>D at Colorado was from the McDonnell Foundation, NSF and Omnicom. The analysis and writing continued while I was in the CSCW group of Fraunhofer-FIT near Bonn, Germany. This work was presented in various formats at ISCRAT '02, ICLS '02, Ethnography in Education '01 and '03.

### **Chapter 13. Collaborating with Relational References**

Previously published as: Stahl, G. (2004) *Collaborating with relational references*. Paper presented at the workshop on representational guidance at the American Educational Research Association (AERA 2004), San Diego, CA.

Rogers Hall made two suggestive observations related to the SimRocket data at a workshop on video analysis at the International Conference of the Learning Sciences (ICLS 2002) where I presented the data from chapter 12: (1) that divergent interpretations of a group discourse might open a space for group creativity and (2) that the deictic relation of “This one’s different” is not to a simple rocket object, but to a more complex relationship among objects, and that such a complexity caused problems for both the students and the analysts. I have attempted to explore these suggestions (1) by trying to understand the interaction of group meaning and individual interpretation in later chapters and (2) by looking at the relational character of the reference in this chapter.

#### **Chapter 14. Communicating with Technology**

A condensed version of this chapter, translated and revised by Angela Carell, was previously published as: Stahl, G. & Carell, A. (2004). Kommunikationskonzepte (The role of communication concepts for CSCL pedagogy). In J. Haake, G. Schwabe & M. Wessner (Eds.) *CSCL-Kompendium*. (pp. 229-237). Munich, Germany: Oldenbourg.

#### **Chapter 15. Building Collaborative Knowing**

Previously published as: Stahl, G. (2004). Building collaborative knowing: Elements of a social theory of CSCL. In J.-W. Strijbos, P. Kirschner & R. Martens (Eds.), *What we know about CSCL: And implementing it in higher education*. (pp. 53-86). Boston, MA: Kluwer.

This chapter was originally written as the theory chapter for the edited volume in the Kluwer CSCL series. As a result of working with Jan-Willem Strijbos on that project, I invited him to work on my research at Drexel for five months in early 2004. During his visit, we celebrated the publication of his book, intertwined our contrasting methodological proclivities and discussed the first draft of this book.

#### **Chapter 16. Group Meaning / Individual Interpretation**

Previously published as: Stahl, G. (2003). Meaning and interpretation in collaboration. In B. Wasson, S. Ludvigsen, U. Hoppe (Eds.) *Designing for change in networked learning environments*. (pp. 523-532). Bergen, Norway: Kluwer.

This chapter was the final plenary presentation at CSCL ‘03 in Bergen Norway, where it was well received. Subsequent comments from students in Dan Suthers’ class and in my CSCL seminar led me to expand several central points.

#### **Chapter 17. Shared Meaning, Common Ground, Group Cognition**

Previously published as: Stahl, G. (2004). Can community knowledge exceed its members’? *ACM SigGroup Bulletin*, **23** (3), 1-13.

Parts of this chapter began life within one of the VMT research proposals co-authored with Stephen Weimar, Wesley Shumar and Ian Underwood of the Math Forum @ Drexel. Early versions were presented at Communities & Technology 2003 in Amsterdam, Netherlands, and at GROUP 2003 on Sanibel Island, Florida.

## **Chapter 18. Making Group Cognition Visible**

The central section of this chapter is based on: Koschmann, T., Stahl, G., & Zemel, A. (2005). The video analyst's manifesto (or the implications of Garfinkel's policies for the development of a program of video analytic research within the learning sciences). In R. Goldman, R. Pea, B. Barron & S. Derry (Eds.), *Video research in the learning sciences*. That document adhered more closely to the terminology of ethnomethodology (Garfinkel, 1967); my co-authors are not responsible for the liberties taken in re-interpreting their ideas here. After so much email-mediated collaboration on the text—let alone the influences of the sources indexed or the effects of re-situating the argument in the context of this book—it is no longer possible to attribute most of the ideas to any one author, and this chapter should particularly be considered a product of group cognition, although my co-thinkers would reject many of the formulations in this text.

The distinction of five perspectives (returned to in chapter 21) originated in a talk I gave at ISCRAT '02 in Amsterdam on *Understanding educational computational artifacts across community boundaries*. (Most of the rest of that talk was presented in chapter 12).

## **Chapter 19. Can Collaborative Groups Think?**

Ideas for this chapter were previously published as: Stahl, G. (2005) *Group cognition: The collaborative locus of agency in CSCL*. Plenary paper presented at the international conference on Computer-Supported Collaborative Learning (CSCL '05), Taipei, Taiwan. Comments by anonymous reviewers for CSCL 2005 prompted minor clarifications in this and the next chapter.

## **Chapter 20. Opening New Worlds of Group Cognition**

Previously published as: Stahl, G. (2003). Keynote talk: The future of computer support for learning: An American/German DeLFIc vision. In A. Bode, J. Desel, S. Rathmeyer, M. Wessner (Eds.), *DeLFI 2003, Tagungsband der 1. e-Learning Fachtagung Informatik, 16.-18. September 2003 in Garching bei München*. 13-16.

I began to explore these themes on the occasion of a keynote talk that opened the first German computer science conference on e-learning, DeLFI 2003 in Munich. Discussions of other chapters from part III with Rupert Wegerif at the Kaleidoscope CSCL Symposium 2004 in Lausanne and with Sten Ludvigsen and his colleagues at InterMedia in Oslo pushed me to extend the considerations. Translations of the Heidegger and Marx quotations have been taken from my philosophy dissertation (Stahl, 1975a), where they are discussed more thoroughly.

## **Chapter 21. Thinking at the Small Group Unit of Analysis**

Previously published as: Stahl, G. (2004) *Thinking at the group unit of analysis*. Paper presented at the CSCL-Sig Symposium of Kaleidoscope, Lausanne, Switzerland.

This chapter is based on a paper delivered at the first Symposium of the CSCL Sig of the Kaleidoscope Network of Excellence of the European Union, in October 2004. It was the final paper presentation there and was well received. Versions of that talk were also

presented at Drexel University in Philadelphia, Knowledge Media Research Center in Tübingen, Intermedia in Oslo, Fraunhofer-FIT near Bonn. The analysis of the chat excerpt was subsequently extended with help from Alan Zemel and his conversation analysis seminar at the VMT project. The VMT project is supported in part by grants from NSF.

### **Group Cognition**

This book benefited in numerous ways from my collaborators at the VMT project and Drexel University while I assembled and refined the text. They provided essential feedback, continuous stimulation and new insights. The series editors and the press staff also gently steered the book's evolution in helpful ways. David Tietjen read the entire manuscript and improved its details. Despite all this help, the book retains a variety of flaws—these are solely my contribution.