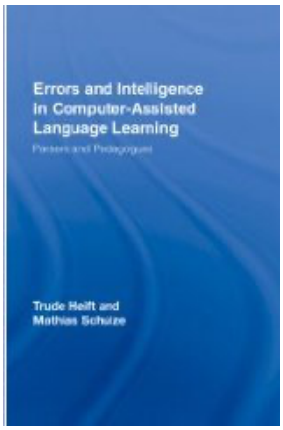
Book review

Errors and Intelligence in Computer-Assisted Language Learning: Parsers and Pedagogues



Heift, T. & Schulze, M. (2007)

Errors and Intelligence in Computer-Assisted Language Learning: Parsers and Pedagogues

Series: Routledge Studies in Computer-Assisted Language Learning

New York: Routledge

ISBN: 978-0-415-36191-0 (304 pages)

For quite sometime now, the Intelligent Computer-Assisted Language Learning (ICALL) community has been waiting for a book that would describe the advances of natural language processing (NLP) technology for CALL and its incorporation into software for language learning and instruction. Heift and Schulze (2008) propose to fill this gap by presenting the major developments in parser-based CALL. The book focuses on core issues of ICALL related to the development of intelligent language tutoring systems (ILTSs) that provide feedback on linguistic structures to foreign language students. Among its many virtues is the fact that the book presents a wide range of relevant bibliographical references and a thorough research of the field.

Chapter 1 presents a general introduction to the book and to some of the terminology used. The authors briefly describe a controversial issue in ICALL: how intelligent and/or helpful ILTSs can be. They provide ample bibliographical references about the studies that have shown the importance of intelligent feedback in CALL, and how this type of feedback can be more advantageous to language learners.

It is also in chapter 1 that Heift and Schulze defend their choice for using the expression "parser-based CALL" to replace ICALL, and "parser-based CALL systems" instead of ICALL systems. They argue that the expert module in ICALL systems is usually based on a parser, and they cite Holland et al. (1993), who explains that "the use of parsers in CALL is commonly referred to as intelligent CALL or ICALL", and that ICALL "might be more accurately described as parser-based CALL, because its 'intelligence' lies on the use of parsing" (Holland et al., 1993, p. 28). It is important to notice that this choice is not uncontroversial. Defining ICALL as "parser-based CALL" may narrow too much the field. There are examples of ICALL systems that use artificial intelligence (AI) technology and natural language processing (NLP) that do not rely on parsers. As the authors explain later in the book (pp. 25-30), parsers are usually the technology of choice when morpho-syntactic errors are targeted. A parser might not be present in systems that target other forms of language deviations. For example, ICALL systems in the form of games that provide intelligent feedback on pragmatically acceptable discourse structures, such as Herr Kommissar (DeSmedt, 1995), do not necessarily need to use parsers to identify morpho-syntactic errors. ICALL systems that use speech recognition to improve pronunciation are another example of NLP technology used in ICALL that is not parser-based (c.f., e.g., Lonsdale et al, 2008). Even when dealing with written language, there are specifically designed NLP components for ICALL to assess

semantically appropriate answers that do not use parsers (c.f., e.g., Bailey, 2008). It is clear, though, that the main focus of the book is on parser-based CALL systems, and not on ICALL systems as a whole.

Heift and Schulze begin chapter 2 reviewing the field of CALL and the influence its development has had from other disciplines, such as behavioral, developmental, cognitive, and learning psychology. They proceed with a general description of human language technology, including a brief look back on the development of computers and its influence on language processing. This section of the book helps the reader understand some of the current trends in CALL, such as the advance of computer-mediated communication (CMC) and web-based applications in language teaching and learning. It also provides a first glimpse on the controversial matters related to the use of AI technology in CALL. Section 2.3 focuses specifically on parser-based technology and CALL. Throughout this section the authors emphasize the notion that parser-based CALL systems can play a significant role in the language learning process, and that ICALL can help in different learning contexts with or without communicative practice. In subsection 2.3.2, the authors discuss the importance of the grammar formalism used by a system. This subsection presents a general overlook of the major grammar formalisms used in NLP. However, due to the nature of the book, it is not possible to describe in detail each one of them. For readers without any NLP background, the discussion that follows may be a little hard to understand. There are enough bibliographical references for an interested reader to search the relevant information in other publications, though.

When presenting the discussion about approaches to deal with ill-formed input, the authors seem a little too biased towards constraint-based approaches. They emphasize the drawbacks of rule-based parsing for ICALL, and highlight the degree of generality achieved by constraint relaxation. Theoretically all arguments presented are relevant, but despite the fact that they acknowledge that efficient disambiguation may be a problem for constraint relaxation approaches, it has yet to be shown that this approach can generate a grammar and a parser robust enough to be used in an ICALL system that deals with a large variety of activities and grammar errors whilst avoiding over-flagging. It is important to notice that Heift and Schulze do present the bibliographical references of the studies that show that constraint relaxation approaches can be problematic for ICALL due to low precision (c.f., e.g., Vandeventer, 2001).

Subsection 2.4 focuses on formalisms and parsing strategies to detect errors. It has five subsections that briefly introduce different notions related to the topic, such as the use of augmented transition networks (ATNs) and definite clause grammars (DCGs) for error detection, as well as a possible adaptation of feature structures and unification procedures to find erroneous constructions. Section 2.5 brings a list of projects and publications using NLP in CALL up to 2005. This list is quite comprehensive, and helps the reader have a better understanding of many different projects in the field. It also brings reference lists of projects by target language, grammatical phenomena, grammar and parsers, and authoring tools, which can be very useful to some readers. Subsection 2.5.2.3 calls the reader's attention to one very important issue in ICALL development nowadays: *evaluation* . The authors remind us that "few projects carried out thus far have been evaluated adequately…" and that "…more independent evaluations conducted either with learner data in form of learner corpus or with real learners in an authentic teaching context are needed." (p.59)

Chapter 3 deals with a central issue in ICALL development: *Error Analysis* . It is refreshing to read a text about Error Analysis by authors that have both the expertise in second language acquisition and ICALL. Heift and Schulze show that they are fully aware of the debate about the usefulness of error analysis in SLA, but they remind their readers that "the advent of electronic learner corpora and the need for elaborate error data in parser-based CALL research has recently sparked renewed interest in the methodologies employed by Error Analysis" (p.83). After presenting a discussion about the importance of designing specific spell and grammar checkers for foreign language learners, the authors present a detailed discussion about the history of Error Analysis. This section can be extremely useful for SLA students who are learning about ICALL, as well as more experienced readers who are interested in the importance of error

classification for processing and research purposes. The chapter continues with a section on empirical studies followed by a section on learner corpus studies and CALL.

Chapter 4 discusses in detail the role of feedback in ICALL. At the beginning of the chapter the authors define feedback, and illustrate how feedback usually works in a CALL system. This illustration is particularly useful for readers who are not familiar with CALL systems and the nature of its feedback messages. They continue with a section on feedback and human-computer interaction. They present an overview of the literature that compares human interaction with human-computer interaction, and focus on topics such as Activity Theory, and the role of dialogue systems in intelligent tutoring systems. Heift and Schulze present a discussion of the literature on feedback and learning in section 4.3, in which they consider some cognitive perspectives on the subject, as well as the role of reinforcement on learning. Section 4.4 briefly describes the role of feedback in SLA, and section 4.5 makes some considerations about feedback and formal grammar. The most important contribution of the chapter, however, is in section 4.6. Based on many empirical studies by Heift with the German Tutor (ICALL system) and her German students at Simon Frasier University, this section summarizes her findings and suggestions regarding: multiple errors, prioritization and individualization of feedback messages, feedback generation, error correction, and learner uptake. For readers who are not familiar with her work, this section provides an excellent overview of her research. The authors finish the chapter with some considerations about system design and feedback, mainly based on Heift's work and the German Tutor.

Chapter 5 introduces the last major topic to ICALL systems: *student modeling*. As the authors acknowledge in the beginning of the chapter, "despite the need for an individualized learning environment, student modeling has not been the strong focus of CALL" (p.171). For a long time ICALL research was divided between those who worked on the development of domain knowledge modules, i.e. NLP for ill-formed constructions, and those who investigated ways to improve student models using systems without NLP. In the first part of the chapter, Heift and Schulze review some general bibliography on student modeling that is not necessarily ICALL related. This review serves as a general introduction to the topic for readers who are not familiar with student models for intelligent tutoring systems. They even include a discussion about initializing and maintaining student models, a topic that can be quite problematic for researchers and developers. Section 5.3 narrows down the presentation to student models specifically used in parser-based CALL systems. This section presents a thorough review of the bibliography in the field, including systems that use student models for improving disambiguation while parsing a student's sentence.

Chapter 6 is the last chapter of the book. It shows the authors' view of the past and future of parser-based CALL research and development. Although Heift and Schulze are aware of the limitations and challenges in the field, they present a very positive view of the future of parser-based CALL. Their main argument is not only based on the development of technology. They believe that the advances in SLA have helped the integration of technology into foreign language teaching and learning.

In general, *Errors and Intelligence in Computer-Assisted Language Learning* is an excellent introduction to parser-based CALL. The book is an accessible source of information to readers that are not fully familiarized with the field, and can be used by students and researchers who search for bibliographical references.

Bibliography

Bailey, Stacy (2008) *Content Assessment in Intelligent Computer-Aided Language Learning: Meaning Error Diagnosis for English as a Second Language.* Ph.D. dissertation. Columbus, OH: The Ohio State University.

DeSmedt, William (1995) Herr Kommissar. An ICALL Conversation Simulator for Intermediate German. In: Holland, V.M., Kaplan, J.D. and Sams, M.R. (eds.), *Intelligent Language Tutors: Theory Shaping Technology* . Mahwah, NJ: Erlbaum Associates, 153-174.

Holland, M., Maisano, R., Alderks, C. and Martin, J. (1993) Parsers in Tutors: What Are They Good For? *CALICO Journal* , 11(1): 28-46.

Lonsdale, D., Graham, C. R., Kennington, C. Johnson, A. and McGhee, J. (2008) Scoring an Oral Language Test Using Automatic Speech Recognition. Paper presented at: *Automatic Analysis of Learner Language: Bridging Foreign Language Teaching Needs and NLP Possibilities* . Pre-conference Workshop. San Francisco, CA: CALICO. https://calico.org/p-378-Program.html

Vandeventer, Anne (2001) Creating a Grammar Checker for CALL by Constraint Relaxation: A Feasibility Study. In: *ReCALL* , 13(1), 110-120.

Luiz A. Amaral
University of Massachusetts Amherst, USA