Book review

Errors and Intelligence in Computer-Assisted Language Learning: Parsers and Pedagogues, Trude Heift and Mathias Schulze. Routledge (Routledge series in computer-assisted language learning), 2007. xviii+283 Pages. ISBN: 978-0-415-36191-0. Price: $115

This book is the latest addition to the still quite small number of monographs in a field that has variously been called Intelligent CALL (ICALL), NLP in CALL, or – the authors' preferred version – parser-based CALL, i.e. CALL that draws on methods developed within computational linguistics to achieve its aim of delivering more intelligent feedback to the user.

The first chapter introduces the topic and gives an overview of the four main chapters and the final outlook. Chapter 2, on NLP (Natural Language Processing) in CALL, starts with the well-known chronologically based categorization of CALL into the three stages of behaviourist, communicative and integrative CALL before briefly summarizing aspects of the fields of psychology that have influenced and informed developments in CALL. The historical perspective is then continued in the section on parser-based CALL, where we also find a clear description of the task parsers have in CALL. The focus on form and the detection and treatment of errors in texts is what distinguishes parser-based CALL both from other types of CALL and from other applications of human language technology. The next section within chapter 2 then describes the formal grammars that have been used in parser-based CALL and their implementation, e.g. ATNs (augmented transition networks) and unification. These computational formalisms can use a number of strategies to reach their (first) goal of finding errors in learner text. In this context it needs to be remembered that the computational grammar formalisms employed for parser-based CALL were originally developed in order to parse correct text, not error-ridden texts produced by learners of the language. Learner text thus presents a major problem for any parsing algorithm (Tschichold, 1999). The three main strategies that have been developed to solve this problem are

a) to expand the grammar used by the parser to include some grammar rules from the learners' native language,
b) to relax grammar constraints, e.g. subject-verb agreement, and
c) to adapt the formalism of the grammar so that the parser records a feature mismatch rather than aborting the whole parsing process.

The chapter ends with an extensive review of almost 120 projects in the field of parser-based CALL. The authors rightly point out that it is difficult to find relevant published literature on many of these projects, as few of them seem to have enjoyed a long life. On this background, all projects are evaluated for language(s) covered and parsing methods used. The authors then conclude that using established grammar formalisms is to be preferred over the use of ad hoc rules. This overview of projects also makes it clear that parser-based CALL has a clear focus on form, with morphological errors one of the main areas. Word order errors are relevant in this perspective as well, but are difficult to detect. Most systems that are able to cope with at least some word order errors use Contrastive Analysis to identify typical word order errors and use a formalism that looks specifically for these errors. But even seemingly simple morphological errors are not always completely unambiguous and simple to detect and correct. In the case of subject-verb agreement errors, it is not necessarily clear whether the subject or the verb has the wrong inflectional ending, for example. Ambiguous errors and sentences with multiple errors remain a problem for ICALL systems. Higher-level errors such as semantics and pragmatics-based errors are considerably more complex for parsers to detect and have so far received little attention, as the authors rightly point out.

Chapter 3 starts with a description of spell and grammar checkers, a well-known type of software that has sometimes been adapted for CALL purposes. Good correction rates can be achieved for misspellings, including those that have a pho-nological source. Competence-based grammar errors are infinitely more difficult to detect and require much more fine-tuning for individual user groups. The main reason for this difficulty lies in the complexity of possible error typologies. Depending on the previously known language(s) and the stage of language learning they are at, learners typically make different errors. While Contrastive Analysis can provide us with some indication of the linguistic distance between two languages, Error Analysis is better at uncovering where learners actually make errors. Both theories have been used to create error classifications for second-language grammar checkers. If these are constructed with sufficient linguistic and pedagogic insight, the error categories can later be used for the production of appropriate feedback to the learner. The recent rise of learner corpora studies (see e.g. Granger, 1998) could provide the field of parser-based CALL with much relevant input, which may eventually contribute to significant improvements in error detection rates of such systems.

Feedback, the topic of chapter 4, has been the subject of much research in human-computer-interaction studies and in theories about learning, but somewhat less in mainstream CALL. We know that positive feedback reinforces learning, while negative feedback is useful for preventing the fossilization of error patterns. The controversial aspect for CALL is not whether a system should give feedback, but rather how much and how often feedback should be given. For parser-based CALL, the quality of the feedback is what distinguishes it from CALL systems that do not use parsing. Intelligent feedback should make the error cause clear to the learner, not be too frequent or too sparse, and concentrate on the most relevant error in case of multiple errors in a sentence. Such a complex task is a challenge for any teacher and clearly a very complex task for a computer program. The authors illustrate both this

complexity and today's state-of-the-art in intelligent feedback with the help of Heift's GERMAN TUTOR, which makes use of an HPSG-based parser.

Chapter 5 deals with student models, i.e. the information a CALL system has on individual learners. Student models can represent aspects of the learner's competence and/or outline their learning style. Good student models are dynamic and adapt to the individual's learning progress, which obviously makes them more complex than static user models, but also much better suited to the CALL context. The description of the computational aspects of student modelling is quite technical, but also offers a good overview of the possible approaches that can be used and combined into more sophisticated systems.

The final chapter provides an outlook on possible developments in ICALL. Struggling with hardware limitations now seems to be largely a thing of the past for the field. Maybe this development will allow CALL developers to focus more clearly on pedagogical aspects than has been the case in the past. However, the difficulty of getting specialists from a number of fields to communicate and collaborate successfully on a common project remains. But the authors are generally optimistic about the future of parser-based CALL, especially when looking at the common tendency within the field to look for solutions that involve reusing existing tools in different applications. Despite some immaturity in these tools, there should be enough interest in producing viable solutions to push the development forward.

The authors have written a book that is sure to be welcomed by anyone with an interest in parser-based CALL. It gives an excellent overview of the field without giving way to the temptation of glossing over problems and presenting an over-confident image. Readers of *ReCALL* will certainly be among the intended audience, but the volume is equally suitable for (graduate) students and aspiring researchers, not least for its historical depth. Depending on readers' background in computational formalisms, a more thorough text might be needed to fully understand the details of procedural and declarative formalisms; but one great advantage of Heift and Schulze's book is that it can also be read while only skimming over the more technical sections. A glossary briefly explaining the technical terms might have helped to make the book more user-friendly for this section of the readership. Further quibbles concern the not-quite-perfect proofreading and the quality of the figures. Some of these are blurred (e.g. the diagram on page 65), others unnecessarily large or too small.

None of these criticisms should detract readers from the value of the book under review. The authors have succeeded in giving a balanced representation of the field of ICALL as we know it today. Because of its interdisciplinary nature, published literature on parser-based CALL is spread over several publication areas not always easily accessible to scholars working in the field, and there is a true danger of good practice being forgotten as soon as the publication describing it is more than a few years old. While previous publications in the field have shown the potential and the range of activities in ICALL (Holland *et al.*, 1995; Jager *et al.*, 1998; Dodigovic, 2005), Heift and Schulze have succeeded in producing an overview which had been missing before. They were able to draw on their intimate knowledge of the field to illustrate their arguments. Parser-based CALL will not be the easy way forward for CALL generally, but it certainly does promise some real progress for languages such as German, which have a rich morphology that learners have to master before they

can feel confident in the use of their foreign language. For other languages and learners, the biggest problem might lie in the word order or in the sheer number of words that need to be learnt in order to become fluent. Whatever the specific problem for a particular combination of learner and language to be learnt, the emphasis on intelligent feedback which is unique to parser-based CALL must be of major interest to anyone working towards improving CALL.

Cornelia Tschichold
Applied Linguistics, Swansea University, UK

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