

# Book Reviews

## Intelligent Language Tutors: Theory Shaping Technology

V. Melissa Holland, Jonathan D. Kaplan, and Michelle R. Sams (editors)  
(U.S. Army Research Institute)

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*Intelligent Language Tutors* is an edited collection of papers on intelligent computer-assisted language learning (ICALL), a young discipline that seeks to apply the technology of natural language processing and intelligent tutoring systems (ITS) to enhance language learning. The result of a 1993 workshop sponsored by the Army Research Institute, the book may be seen as a parry to Swartz and Yazdani's (1992) book on intelligent tutors for foreign language learning; it therefore takes not an EU perspective but a North American one.

ICALL is inherently multidisciplinary, and the editors have sought to include papers with a sound theoretical basis in, for example, linguistics, language pedagogy, and cognitive psychology. The twenty papers are grouped into four sections according to the aspect of student knowledge addressed: text-based tutors and learning environments; dialogue-based tutors and language games; graphics-based tutors and learning environments; and theoretical issues in language tutor design and assessment. There is an introductory chapter that looks at why ICALL has a low profile and what makes it worth doing. In addition, each section is prefaced by a short introduction that headlines the systems covered and draws out the main issues that emerge.

Section 1, text-based tutors and learning environments, examines text-based systems that have a parsing focus and an emphasis on grammar teaching. Systems covered include BRIDGE, CALLE, ALICE-chan, the McGill language-learning environment, and the GPARS suite. The BRIDGE tutor makes use of a Government-Binding parser in a multimedia tutoring system in classroom use, and its NLP component and authoring components are examined in some detail. In the ALICE-chan system, students answer questions by typing in Roman character transliterations. The input is parsed into an LFG-style feature structure by a form of LR-parser before being matched against both correct and buggy parses. The LFG representation used enables the system to cope with a variety of student inputs in a restricted domain in an efficient manner, and the parser is additionally employed to facilitate authoring. The McGill language-learning environment can be compared to the expertise module of a traditional ICALL system but instead of emphasizing the grammatical aspects of language, as many older ICALL systems are wont to do, the system seeks to improve both generic and more domain-specific discourse skills with a focus on situated, communicative learning, subdivided into "modules" which may be used alone or in sets. Pattern-matching techniques are used to handle input and output. The GPARS suite

consists of a transition-network parser, which can be used for student error diagnosis, language development, and competence evaluation.

Issues raised in this section include the compactness and efficiency of the grammars and parsers, the merits of network-based parsers for modeling competence, and error diagnosis and feedback.

Section 2, dialogue-based language games, covers just two systems: SPION and Herr Kommissar. The systems have a focus on text, but also include supporting graphics. Both systems are microworlds involving role-playing, and operate within a restricted domain. It is interesting to note that students using SPION found the non-ICALL version less intimidating, as it did not accept totally free input. Herr Kommissar employs a parser and discourse model with a case grammar. As the system seeks to provide students with practice in language production, it eschews a student model and notions of generative error models in favor of a model of student activity and the engaging of students in communicative practice. The key issue here is that of the importance and nature of feedback required for effective language learning.

Section 3, graphics-based language tutors, covers systems that use graphics to model a physical microworld and, therefore, offer a measure of immersion language learning. Systems covered include FLUENT, MILT, LINGWORLDS, and the related Athena language project. Two papers are devoted to each, so that the pedagogic and computational aspects of each system can be fully covered. FLUENT is a conversational ICALL system with a large NLP component and principled dialogue manager. The system employs sophisticated AI techniques, a student model to guide response production, and a minimalist tutorial component. LINGWORLDS concentrates on aural comprehension, which the student evidences by appropriately manipulating a microworld in response to speech. The system did not, at the time of writing, contain a major NLP component, but the writers of the system had engaged in lesson observation as a motivation for their system; this is still quite unusual in ICALL. In rooting the system in a formalized language-learning pedagogy, the team was able to concretize and evaluate some of the theoretical ideas employed. The Athena papers look in more detail at the NLP heart of FLUENT (e.g., the parser, linguistic theory, and error handling) and the MILT papers look in detail at the NLP component of BRIDGE's successor system, underlining the importance of semantics to ICALL. In MILT, semantics are handled by lexical-concept structures, which offer a uniform, primitive-based, multilingual description of language. While the techniques discussed are ideal for question-answering systems, the issue of inference still needs to be tackled.

Issues arising from this section include the role of the microworld in constraining student input and the complexity of the NLP required, the current lack of formalized theories of language teaching that can be directly employed in ICALL, the extent to which more behavioral language-teaching theories may still have a role to play, the role of graphics in overcoming the need for students to produce the foreign language, and the authorability of intelligent courseware.

The final section, on theoretical issues in language tutor design and assessment, seeks to assess the contributions made to ICALL research by the systems covered in the book. The papers cover some basic questions to be answered in ICALL evaluation studies, the importance and potential benefits of ICALL research to artificial intelligence, linguistics and language learning (with interesting discussion of the potential red-herring debate around grammatical or communicative ICALL), the role of the teacher, and current theories of language learning that ought to be considered in ICALL design.

*Intelligent Language Tutors* suffers from the usual coherence problems associated with collections of papers. Even though there is some cross-referencing, there is little

in the way of introduction to language teaching, ITS, or NLP architectures and terminology, and hence some grounding in ITS as well as AI, NLP, and language teaching is required; we are still awaiting a Wenger for ICALL (*cf.* Wenger 1987). This aside, the book is interesting reading for researchers interested in ICALL, and should provide a good overview of the North American scene in a single volume and pointers to works of interest, as well as provoking new thoughts. The book is in many ways a call to further research.

#### References

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