ADVANCED TECHNOLOGIES FOR LANGUAGE LEARNING: DEVELOPMENTS AT ARI

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The Program in Advanced Technologies for Language Learning at ARI seeks to develop and test foreign language tutors through contractual research by computational linguists and in-house research by ARI psychologists. The program arose out of a technology push to integrate NLP with intelligent tutoring systems, coupled with a need in the U.S. Army for interactive systems to train and sustain mission-critical language skills that involve production as well as comprehension of language. The need for improved foreign language proficiency in functional areas, beyond the core language training provided at the Defense Language Institute, is threefold: (a) to maintain job-relevant language skills by intelligence personnel, (b) to promote communication among multinational forces in coalition operations at command and control and lower levels, and (c) to support peacekeeping missions and operations other than war.

Driven by army requirements, ARI's program imposes the constraints of compactness, accessibility, and extendibility on a language tutor: It must run on readily available PCs, it must be tailorable by instructors to address changing scenarios of language use, and it must be potentially extendible across languages through the use of principled NLP formalisms. Meeting these goals has required a series of tradeoffs with power and depth of analysis in the NLP and tutoring components of ARI's systems. The ARI program is classified as exploratory development (6.2), and while its products are prototypes, they are nevertheless intended for near-term use in language learning labs and research settings.

The program has completed development of a German tutor, equipped with multimedia interface and question-answer exercises overlying a parser and medium-size lexicon. Students' responses to questions are parsed and syntactic errors are reported to the tutor for flexible delivery to students. An authoring front-end enables nonprogrammers (instructors and instructional researchers) to add and change lessons, and to decide how, whether, and when to present grammatical feedback. A second tutor for Arabic and Spanish is now in development that adds immersion-like exercises involving graphics microworlds and constrained dialog. These exercises are supported by lexical conceptual structures (LCSs) for semantic analysis, an LCS editor usable by trained instructors, and a knowledge base and discourse tracker built with tools from ARPA's Planning Initiative. The program has so far demonstrated the extendibility of a principled-based parser from German to Arabic through parameterization of the basic formalism, as well as the scalability of LCSs originally developed for a demonstration machine translation system. All products, including multilingual parsers and lexicons, are available for use in other NLP applications by other developers. In addition, ARI is pursuing dual use development to transfer its language tutoring technology into public schools and universities.

ARI's program is scheduled for completion at the end of FY95. Promising directions for future application of human language technology to language tutors include incorporating continuous speech recognition in a range of target languages and continuing the development of dialog and NLP-driven animated graphics.

In-house work to date includes user trials with army intelligence students and instructors, development of schemas for lesson design to exploit the capabilities and limitations of the NLP, and initiation of joint research with university language labs on the effects of tutoring variables, such as the level of detail and scheduling of grammatical feedback, with respect to individual difference characteristics of learners.