

Introduction

What are they good for?

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Summary

## The Roles of Student Models

- ▶ VanLehen (1988) presents four uses for student models:
  - ▶ Advancement
  - ▶ Offering advice
  - ▶ Adapting explanations
  - ▶ Problem generation
- ▶ In ICALL, Student Models have primarily focused on the acquisition of grammatical structures.
  - ▶ ICALL systems keep track of the students' production in terms of the grammatical accuracy of their performance.

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## Intelligent Computer-Assisted Language Learning

### Part II: Student Modeling

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based on joint research with Luiz Amaral. See: Amaral/Meurers (2008): "From Recording Linguistic Competence to Supporting Inferences about Language Acquisition in Context: Extending the Conceptualization of Student Models for Intelligent Computer-Assisted Language Learning". *Computer-Assisted Language Learning*. 21 (4). <http://purl.org/dm/papers/amaral-meurers-call08.html>

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## ICICLE system (SLALOM, Michaud et al. 2001)

- ▶ The system keeps track of a student's performance for individual so-called **grammar skills**.
- ▶ The numeric performance scores are grouped into three levels: **beginner**, **intermediate**, and **advanced**.
- ▶ When the system identifies a specific grammatical error in the student's input
  - ▶ it checks the relative level of proficiency of that student for the relevant grammar skill
  - ▶ and decides which feedback message to use on this basis.
- ▶ Linguistic or extra-linguistic context where an error occurred does not play a role (e.g., linguistic or task complexity, issues of cognitive load).

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## Beyond Grammar Knowledge

- ▶ Bull et al. (1995) argue for extending the scope of student models to incorporate aspects outside the boundary of the linguistic domain knowledge.
- ▶ They propose to add models of
  - learning strategies
  - analogy
- ▶ Their focus is on a general model of learning processes for different domains, not on the nature of language acquisition or linguistic modelling.

## What needs to be modeled?

1. What kind of student knowledge are we trying to model?
  - ▶ What is being acquired by the student?
  - ▶ What can we observe through analysis of the input?
2. How do we obtain information about the student knowledge?
  - ▶ How can we infer knowledge structures?
  - ▶ How do we guarantee the validity of the inferences?

## Some SLA perspectives

- ▶ Ellis (2003): "the general goal of language learning is the fluent, accurate, and pragmatically effective use of the target language."
- ▶ Canale & Swain (1980): the four major types of knowledge a learner needs to acquire are
  - grammatical competence
  - sociolinguistic competence
  - discourse competence
  - strategic competence
- ▶ Bachman (1990): strategic competence is the set of non-linguistic properties to be acquired by the learner that play a role in language use.

## Ensuring the Validity of the Inferences

- ▶ The system's inferences about a student's state of knowledge must be valid:
  - Content Validity: "extent to which the test content forms a satisfactory basis for the inferences to be made from test performance." (McNamara 2000)
- ▶ ICALL learner modelling usually takes for granted that linguistic errors are caused solely by a lack of linguistic knowledge.
- ▶ To guarantee valid interpretations of students' performance it is necessary to add information about the task environment where it occurs.

## What informs the student model?

Information to draw inferences about student knowledge structures comes from two sources:

- ▶ the input annotation performed by the NLP modules:
  - ▶ meaning-based errors:
    - ▶ missing/extra content words
    - ▶ wrong selection, word choice, or collocation
    - ▶ negative lexical transfer
  - ▶ form-based errors:
    - ▶ agreement (subject–predicate, within NP)
    - ▶ wrong subcategorization, form selection, contraction
    - ▶ missing/extra function words
    - ▶ word order
- ▶ explicit, hand-specified activity models:
  - ▶ level (sequence of the material)
  - ▶ nature of input (string, phrase, sentence)
  - ▶ content manipulation required (little/some/necessary/major)
  - ▶ strategies to perform the task (reading, listening, and writing strategies)

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## Why Task Strategies in Student Model?

- ▶ Setting:
  - ▶ A specific learner repeatedly does not include a key concept in the answers to reading comprehension question requiring scanning a text for specific information.
- ▶ Baseline System:
  - ▶ Inferences:
    - ▶ System determines that the student has problems including all nouns in the answer.
  - ▶ Feedback:
    - ▶ “There is a noun missing in your sentence again.”
- ▶ System with Task Strategies in Student Model:
  - ▶ Inferences:
    - ▶ System determines that the student has problems employing the scanning strategy required by the activity.
  - ▶ Feedback:
    - ▶ “Try to scan the text more carefully to include all the key concepts in your answer.”

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## Why Task Appropriateness in Student Model?

- ▶ Setting:
  - ▶ A specific learner repeatedly realizes correct subject-verb agreement in Fill-in-Blank but not in Reading Comprehension answers.
- ▶ Baseline System:
  - ▶ Inferences:
    - ▶ System determines that student sometimes has problems with subject-verb agreement.
  - ▶ Feedback:
    - ▶ Reporting subject-verb agreement errors receives the same priority no matter where they occur.
- ▶ System with Task Appropriateness in Student Model:
  - ▶ Inferences:
    - ▶ System determines that student has problems with subject-verb agreement in specific types of activities.
  - ▶ Feedback:
    - ▶ Reporting subject-verb agreement errors receives different priority, depending on activity type/level.

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## Why Negative Transfer in Student Model?

- ▶ Setting: A specific learner repeatedly makes lexical transfer errors (uses false cognates), e.g.:
  - ▶ In answering a comprehension question, a Portuguese learner of English writes “assume” instead of “admit” (given Portuguese “assumir” = English “admit”) :
    - ▶ Student: *John assumed Bill was wrong.*
    - ▶ Target: *John admitted Bill was wrong.*
- ▶ Baseline System:
  - ▶ Inferences:
    - ▶ ambiguous whether student expressed wrong meaning or transfer error.
  - ▶ Feedback:
    - ▶ resolve somehow, e.g., report meaning error as the more general case
- ▶ System with Transfer in Student Model:
  - ▶ Inferences/Feedback:
    - ▶ The system is able to prioritize feedback on lexical transfer errors over a general meaning error.

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- ▶ We discussed the use of student models in intelligent language tutors.
- ▶ We argued for extending ICALL student models beyond grammar knowledge, to include
  - ▶ the learner's abilities to use language in context, using appropriate strategies for specific goals
  - ▶ the learner's abilities relative to task type and complexity
  - ▶ the possibility of L1 transfer
- ▶ We are working on extending the TAGARELA system to use such an extended learner model.
  - ▶ Updating the model requires hand-specification of explicit activity models.
  - ▶ These are independently motivated by the need to support valid inferences about the student's state of knowledge.
- ▶ For more discussion, see Amaral & Meurers (2008).

### ICALL: Part II Student Modeling

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