Language and Computers (Ling 384)

Topic 6: Computer-Aided Language Learning

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Outline

Language learning

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Why CALL?

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Why CALL?

Frame-based systems

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ICALL

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Finding Errors and Providing Feedback

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Finding Errors and Providing Feedback

Example System

Language learning

In order to talk about using computers for language learning, we must figure out what we are talking about:

- First language acquisition (L1)
- **Second language acquisition** (L2)

First language acquisition

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- ► Parents generally correct content, not grammar.
- ► Motherese ("baby talk"): different lexicon, intonation, topics, turn-taking
- ► Tune in on relevant distinctions: synapses still taking shape in the brain

Stages of learning

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- utterances of varied length, vocab increasing, etc.

Second Language Learning

Second language learning differs from first language acquisition:

- explicit knowledge of a language

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- conscious of learning process

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Knowing learner stage important for developing CALL systems.

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  4. Regular past tense, third person singular *-s*, possessive *-s*

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  - Immersion: all the learner needs is well-formed input
- Adult learners are susceptible to **transfer errors** = something from L1 interfering with L2.
  - e.g., East Asian speakers typically mix up *a* and *the* in English: no such distinction in their language.

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- ▶ CALL can be used in different setups, in particular:
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    - ▶ supplement to in-class learning
- ▶ CALL is a big business: 106 million Euro (about $120 million) spent on CALL products in Europe in 1994. US market is twice as big. (Nerbonne 2003)

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- exercises for students to complete

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- We'll return to this issue once we've introduced different kinds of CALL systems.

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- One can distinguish several types:
    - linear systems
    - branching systems
    - generative systems
- Typical for early CALL systems.

Linear systems

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$\Rightarrow$ Regardless of the correctness of the answer, linear systems proceed to the next question.

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⇒ Much more arduous to come up with the question sets.

Generative systems

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Generative systems

- Generate new questions each time system is used. Usually don't have the same session twice
- Based on some **algorithm** = sequence of commands, in this case used to generate new questions

Problems with frame-based systems

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- No deep understanding of question domain.
- Merely match answers with questions.
  ⇒ Could be more than one right answer, as with a translation task.

What is a correct answer to an exercise?

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► Today is November 10. What date is tomorrow?
  Tomorrow is _____.

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⇒ Have to allow for multiple right answers.

What is a correct answer to an exercise? (cont.)

▶ Erwin arbeitet in Leipzig, aber seine Familie wohnt in Bad Harzburg. Am Wochenende fährt er nach Hause. Erwin fahrt mit dem ____. ?
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⇒ The definition of what is correct is again too rigid.

Intelligent Computer-Aided Language Learning (ICALL)

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- ▶ Intelligent CALL focuses on using linguistics and natural language processing to make CALL better.
- ▶ Examples include:
    - ▶ Concordancers
    - ▶ Text alignment
    - ▶ Speech recognition and synthesis
    - ▶ Morphological processing
    - ▶ Syntactic processing

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contract to supply voice and	**data**	communications within the Tunnel in
giving control over how much	**data**	is sent over the network
humanists to fit their special	**data**	to the software , rather
27 mm . But these	**data**	are for fourth-year crabs .

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Text alignment

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- ► Advanced learners might benefit by seeing how word
  usage in their native language correspond to word
  usage in L2.
- ► Beginning learners would be overwhelmed.

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If you're using a paper dictionary, you have to base your pronunciations on a phonetic transcription of some sort.

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GLOSSER, for example, is a system that uses morphological processing to speed up dictionary look-up (100 times faster) (Nerbonne 2003)

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Syntactic processing allows us to deal with unrestricted learner input, such as essays, and give sensible feedback for errors.

Morphological and syntactic processing can also help make the learner more aware of what language is made up of. →
meta-linguistic knowledge = knowledge about language.

Problems of Syntactic Processing

Main problem with syntactic processing: too many analyses.
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Main problem with syntactic processing: too many analyses.
I saw the mouse in the house by the garden.
→ *by the garden* can modify *saw*, *mouse*, or *house*.
When learners type in incorrect sentences, you may have to allow for even more analyses.

Error analysis

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- ► So, we have a lot of different technology we can use.
- ► For many of the exercises we will want to use, the user types in something, and, using some technology, we want to find the error(s) in it.
- ► Two main issues:
    - ► Error recognition: What is the error?
    - ► Feedback: What do you do about the error? (What do you tell the learner?)

Types of systems for error recognition (and feedback)

Heift (Intelligent Language Tutoring Systems for Grammar Practice)

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- systems which anticipate wrong answers (mal-rules)
- systems which use NLP and provide linguistic analysis of sentence

Error recognition issues

- ▶ How do we adapt our technologies to find errors?
- ▶ Do we tailor the system to a particular kind of learner?
- ▶ Do we tailor the system for an individual learner?
- ▶ What is the exact error?
- ▶ How many errors are there?

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Concordancers
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Speech
Morphological analysis
Syntactic analysis

Finding Errors and
Providing Feedback
User and task specific
feedback

Example System
System architecture
Feedback
Exercise types

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- Use so-called **mal-rules** = rules which are added to your grammar that handle error cases.
    - e.g., A singular noun and a plural verb are allowed to combine, but it is marked as an error.
- Modify your technology: a parser can be reworked to handle ill-formed input. (Parsers normally just "die" when handling bad input.)
    - e.g., I'll parse *John are big*, but I'll tell you that I didn't like it and the linguistic reason why not.

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- Can look at corpora and find the most common errors → can create an **error typology** = a classification of errors into different groups.
- Main problem is a lack of generality.

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- ▶ Allows us to give different feedback based on the learner's abilities.

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- ⇒ Finding an error is one thing. Figuring out what the learner meant is another (similar to spell checking).

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- ▶ Don't want to overwhelm students with too much feedback.
- ▶ Can present one error at a time. Instructors can divide the errors into primary errors and secondary errors – or rank them somehow.

An example system

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- ► Punctuation check

More on system architecture

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  - Problem: sometimes a "misspelled" word is a sign of lack of grammatical competence, e.g. *runned* is "misspelled", but it might show a lack of knowledge about the English past tense.
- Example check
- Missing word check
- Extra word check
  These 3 steps (example, missing word, and extra word checks) all are based on the notion that the exercise has *pre-defined* all the words which are acceptable for this answer.

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Note:

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- ▶ Modularity of the approach.

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Feedback = response to the learner based on their input.
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There are differences between human and computer feedback

- ▶ humans aware of exact student situation.
- ▶ humans can infer intentions.

Feedback (cont.)

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- ▶ Feedback needs to be accurate.
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- ▶ Explanations should be short.

Kinds of feedback

- ► **Explicit correction** = explicitly giving the correct form, indicating that this is a correction.
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  STUDENT: Yo halba español.
  TEACHER: Yo hablo español tambien. (I speak Spanish also.)

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- ▶ **Clarification request** = asking for a clarification.
  What? What did you mean?

Kinds of feedback (cont.)

- **Metalinguistic feedback** = comments, information, or questions about the correctness of the student's utterance, but not giving the correct form.
  Now, if you're speaking in the first person, is that the verb form you want?

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  - STUDENT: Yo habla.
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- **Repetition** = repeating the student's utterance, usually marking the error intentionally.
  - Yo habl**a**?

Kinds of exercises

Here are some example exercises from a German system (Heift), outlined in http://www.spz.tu-darmstadt.de/ projekt ejournal/jg 06 2/beitrag/heift2.htm

- ► Dictation
- ► Build a Phrase
- ► Which Word is Different
- ► Word Order Practice
- ► Fill-in-the-Blank
- ► Build a Sentence

Dictation

Student hears a sentence in German and types it in. They are told if they are correct, and if not, why.

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Bad points:

- ► Requires multimedia resources.
- ► Takes a long time to prepare.

Build a Phrase

Build up a complete phrase (e.g. NP, but not a whole sentence) based on a given picture (i.e. provide your own vocab).

Which Word is Different

Given 4 words, pick the one which differs from the others.

Word Order Practice

Take all the given words and arrange them into a sentence.

Fill-in-the-Blank

Give the learner a lemma or choice of lemmas, and they have to fill in the blank.

Build a Sentence

Use all the given words (lemmas) and create a grammatical
German sentence.

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Use all the given words (lemmas) and create a grammatical German sentence.
Advanced learner output ("There is an error in gender with the subject."):

Build a Sentence (cont.)

Beginning learner output ("No, DER of DER ZEIT is incorrect. ZEIT is not masculine"):

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  Compare teaching people subject-verb agreement vs. teaching them counterfactual clauses in English.

- ► All the pre-processing steps (before the grammar check) allow the grammar checker to assume well-formed input.

Demos

- ► Tools:
    - ► Concordancer
    - ► Morphological Analyzers XEROX online Demo (English)
    - ► Parser
- ► ICALL demos:
    - ► GLOSSER