

How about Meaning in Intelligent Computer-Assisted Language Learning?

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Meaning in ICALL

Detmar Meurers

Introduction

Motivation

Current CALL and ICALL
Exercises Types
Loosely restricted reading
comprehension: An example

Our CAM approach

Basic idea behind approach
Alignment Types
Alignment Levels
Putting it all together
Results

Future work

Integration in Context
Question Classification
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Conclusion



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Motivation

- ▶ Contextualized, meaningful interaction in the foreign language is an important part of language learning.
- ▶ Can ICALL systems provide a range of such activities?
 - Requires content assessment: Analysis, diagnosis, and feedback regarding the appropriateness of the meaning of a learner response.
 - For what kind of tasks/activities can this be done?

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Current CALL and ICALL

- ▶ Within the CALL domain, the majority of systems do not provide content assessment beyond string/token matching.
 - If the learner response is not identical to the target response, it is marked as incorrect.
- ▶ Existing ICALL systems (German-Tutor, Heift 2001; BANZAI, Nagata 2002) successfully avoid the need for sophisticated content assessment.
 - They control expected student input using specific activity types, limiting the variation of form expressing the same meaning (e.g., build-a-sentence, translation).

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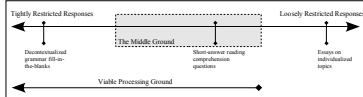
Conclusion



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Language-learning Exercises

- ▶ Where can ICALL provide content assessment, without world knowledge representation?



- ▶ Loosely restricted reading comprehension questions are an exciting middle ground.
 - It is possible to specify target answers.
 - Responses can exhibit variation on lexical, morphological, syntactic, semantic levels.
 - Common activity in real-life foreign language teaching.

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Loosely restricted reading comprehension

An example

Question: *What are the methods of propaganda mentioned in the article?*

Target: *The methods include use of labels, visual images, and beautiful or famous people promoting the idea or product. Also used is linking the product to concepts that are admired or desired and to create the impression that everyone supports the product or idea.*

Sample Learner Responses:

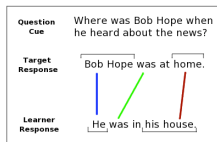
- ▶ *A number of methods of propaganda are used in the media.*
- ▶ *Positive or negative labels.*
- ▶ *Giving positive or negative labels. Using visual images. Having a beautiful or famous person to promote. Creating the impression that everyone supports the product or idea.*

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Basic Idea: Comparing Responses and Targets



- ▶ We can distinguish between
 - ▶ different **types** of alignment at
 - ▶ different **levels**.

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Types of Alignment

Alignment Type	Example Match
Token-identical	advertising advertising
Lemma-resolved	advertisement advertising
Spelling-resolved	campaign campaign
Reference-resolved	Clinton he
Semantic similarity-resolved	initial beginning
Specialized expressions	May 24, 2007 5/24/2007

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Levels of Alignment

Alignment can take place at different levels of representation:

Level	Example	Alignment
Tokens	The explanation is simple. The reason is simple.	explanation reason
Chunks	A brown dog sat in a nice car. A nice dog sat in a car.	a brown dog a nice dog
Dependency triples	Rose knows the doctor. Rose knows him.	obj(knows, doctor) obj(knows, him)

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Putting it all together

- ▶ We built our automatic error detection on 13 features:
 - ▶ Number of Overlapping Matches:
 - ▶ keyword (head word)
 - ▶ target/learner token
 - ▶ target/learner chunk
 - ▶ target/learner triple
 - ▶ Nature of Matches:
 - ▶ % token matches
 - ▶ % lemma matches
 - ▶ % synonym matches
 - ▶ % similarity matches
 - ▶ % sem. type matches
 - ▶ match variety

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Results

- ▶ We used machine learning (TIMBL, Daelemans et al. 2007) to learn the diagnosis based on these features.

Detection	Accuracy
Random Baseline	50%
Development Set (leave-one-out testing)	87%
Test Set	88%

- ▶ Diagnosis with 5 codes (correct; missing concept, extra concept, blend, non-answer): 87% accuracy
- ▶ The 2.7 form errors per sentence in the learner corpus used do not negatively impact results:
 - ▶ 68% of **correctly** diagnosed items had form errors.
 - ▶ 53% of **incorrectly** diagnosed ones did as well.

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Towards Interpretation in Context

- ▶ The reading comprehension question task provides an explicit context in form of
 - ▶ the text, and
 - ▶ the question asked about it.
- ▶ CAM currently takes this context into account for basic anaphora resolution for the target and learner answers.
- ▶ Making more of the context is an important next step:
 - ▶ How should information in the answers that is **given** in the question be interpreted?
 - ▶ Idea: use the occurrence of *given* information to distinguish between partially incorrect answers (additional/missing units) and non-answers (totally missing the topic).
 - ▶ What is the **nature of the questions** and which **task strategies** do they require?

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Question Classification

- ▶ Features to be investigated include
 - ▶ **Learning Goals:** Targeted cognitive skills and knowledge (e.g., Anderson and Krathwohl 2001)
 - ▶ **Knowledge Sources:** The implicit/explicit answer source (Irwin 1986; Pearson and Johnson 1978)
 - ▶ **Text Type:** The rhetorical structure of the text (Champeau de Lopez et al. 1997)
 - ▶ **Answer Type:** The kind of answer expected (Gerbault 1999)

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Diagnosis categories for comparing meaning

- ▶ Content assessment in the CAM currently distinguishes five diagnosis categories:
 - ▶ correct
 - ▶ missing concept
 - ▶ extra concept
 - ▶ blend
 - ▶ non-answer
- ▶ What are suitable and obtainable diagnosis categories for content assessment?
 - ▶ E.g., more detailed categories based on answer typing

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- ▶ A range of activities in current foreign language teaching practice support meaningful, contextualized interaction.
- ▶ Loosely restricted reading comprehension questions are an interesting activity type for exploring content assessment approaches in ICALL:
 - ▶ Common activity in real-life foreign language teaching.
 - ▶ Automatic content assessment is sufficiently reliable to integrate it into ICALL systems.
 - ▶ Push the boundary of the activity types for which automatic feedback supporting self-editing skills is possible.
- ▶ We identified a range of research avenues, including
 - ▶ increased integration of task and context information
 - ▶ more detailed diagnosis categories for meaning comparison

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