

## Tapping into the synergy between SLA, Foreign Language Instruction and Natural Language Processing in ICALL

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Tapping into the synergy between SLA, FLT and NLP in ICALL

Detmar Meurers & Luiz Amaral

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## Introduction

- ▶ The idea of this talk is to make explicit where ICALL research requires interaction between
  - ▶ FLT practice
  - ▶ SLA research
  - ▶ NLP research and development.
- ▶ Following the workshop topic, we focus on
  - ▶ **instruction**: relating ICALL and FLT practice
  - ▶ **modeling**: motivating the need for explicit activity models and learner models
- ▶ Background: Development of the TAGARELA system, an intelligent web-based workbook for learners of Portuguese – and our current research directions there.

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## Instruction and ICALL

- ▶ What is the connection between ICALL research and real-life instruction, i.e., Foreign Language Teaching?
  - ▶ Why should FLT practitioners and ICALL researchers care about establishing such a connection?
- ⇒ FLT perspective: Find new ways to address currently unmet pedagogical needs (to improve learning outcomes)
- ⇒ ICALL perspective: Obtain real-life data to
- ▶ make learner input **analyzable**: training of NLP tools
  - ▶ make learner input **interpretable**: disambiguation using explicit learner and activity models
  - ▶ evaluate algorithms and test systems

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## Instruction and TAGARELA

- ▶ We conducted interviews with OSU foreign language instructors (Amaral 2004, 2007), who reported:
  - ▶ Students often fail to achieve the communicative goal of a class activity if they cannot use the appropriate language forms and patterns.
    - ▶ But class activities that focus on grammar patterns are perceived as problematic (reduce pace of lesson).
  - ▶ Individual differences make it impossible to have all students do the same tasks in exactly the same time – a general problem for some activities, e.g., listening.
- ⇒ There is a real-life FLT need for tools which
- ▶ provide opportunities for students to practice their listening, reading, and writing skills
  - ▶ provide individual feedback on learner input to system
  - ▶ foster learner awareness of language forms and categories

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# Instruction and TAGARELA

## Current activity and feedback types

### ▶ TAGARELA currently offers six types of activities:

- ▶ listening comprehension
- ▶ reading comprehension
- ▶ picture description
- ▶ fill-in-the-blank
- ▶ rephrasing
- ▶ vocabulary

Similar to traditional workbook exercises, plus audio.

### ▶ The system provides on-the-spot feedback on

- ▶ orthographic,
- ▶ syntactic, and
- ▶ semantic errors.

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## Instruction and TAGARELA

General issues, conclusions so far, avenues for research

- ▶ What should the system interfaces look like?
  - Use L2 as far as possible (needs careful interface design).
- ▶ What type of activities are appropriate and useful for fostering awareness (and fit into the FLT approach)?
  - Activities ideally involve both form and meaning, such as listening/reading comprehension questions.
  - investigate activity types satisfying FLT needs and providing sufficient constraints for NLP analysis and interpretation (activity models)
- ▶ What role does an ICALL system play in teaching?
  - Self-guided activities accompanying teaching
  - investigate more guidance by system (learner models)

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## Instruction and TAGARELA

General questions, conclusions so far, avenues for research

- ▶ Which forms of feedback are (most) successful in fostering awareness of forms/categories – and, ultimately, in influencing learning outcomes?
  - Meta-linguistic feedback, highlighting (cf. Heift 2004)
  - more research needed into range of feedback types
    - ▶ what is appropriate for human-computer interaction/GMC (cf., e.g., Sachs & Suh 2007; Petersen in preparation) including evaluation using
    - ▶ learning outcomes
    - ▶ online measures of noticing, e.g., using eye tracking, since no learning without noticing (Schmidt 1995)

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## Instruction and TAGARELA

General questions, conclusions so far, avenues for research

- ▶ What can/should feedback be provided on?
  - ▶ TAGARELA provides on-the-spot feedback on
    - ▶ orthographic errors (non-words, spacing, capitalization, punctuation)
    - ▶ syntactic errors (nominal and verbal agreement)
    - ▶ semantic errors (missing or extra concepts, word choice)
  - ▶ Providing **feedback on meaning** becomes crucial for activities such as reading and listening comprehension.
    - automatic meaning comparison can be effective (Bailey & Meurers 2008)
    - more research needed on when and how this is the case and what constitutes good diagnosis categories

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THE TAGARELA SYSTEM @ THE OHIO STATE UNIVERSITY ICALL RESEARCH GROUP

Listening Reading Description Fill-In-Blanks Rephrasing Vocabulary Home Logout

Modulos: 1 2 3 4 5 Atividades: 1 2

### Leitura

Instrução

Leia o texto e responda às questões usando frases completas e o vocabulário apresentado no texto.

Quem é você?

Eu me chamo Patrícia Mattos, tenho quinze anos e moro em São Paulo. Eu estudo em uma escola pública e tenho muitos amigos.

Eu moro com minha mãe. Seu nome é Marta. Ela tem quarenta anos e é cozinheira em um restaurante de luxo.

Eu tenho um irmão. O nome dele é Claudio. Ele mora nos Estados Unidos e é músico. Ele toca Jazz e Blues. Ele é um excelente guitarrista.

Questões: 1 2 3 4 5 7 8

Próxima Questão (3)

Questão 2

Quantos anos ela tem?

Ela tens quinze anos.

Input: Ela tens quinze anos.

There is an agreement error in person between the subject and the verb in the sequence elle tens from your answer.

To see a possible answer, click here.

Enviar!

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## Feedback on Agreement

stões: 1 2 3 4 5 6 7 8

última Questão (3)

Enviar

### Análise:

*Input:* Ela tens quinze anos.

There is an agreement error in person between the subject and the verb in the sequence *ela tens* from your answer.

To see a possible answer, click [here](#).

Report Errors & Suggestions

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Listening Reading Description Fill-In-Blanks Rephrasing Vocabulary Home Logout

Módulos: 1 2 3 4 5 Atividades: 1 2 3 4 5

## Leitura

### Instrução

Leia o texto e responda às questões usando frases completas e o vocabulário apresentado no texto.

**Quem é você?**



Eu me chamo Patrícia Mattos, tenho quinze anos e moro em São Paulo. Eu estudo em uma escola pública e tenho muitos amigos.  
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Eu tenho um irmão. O nome dele é Claudio. Ele mora nos Estados Unidos e é músico. Ele toca Jazz e Blues. Ele é um excelente guitarrista.

Questões: 1 2 3 4 5 6 7 8  
Próxima Questão (3)

**Questão 2**  
Quantos anos ela tem?

Elá és quinze anos.

Quantos anos ela tem?  
Input: Ela és quinze anos.  
I am not expecting the verb *ser* for this answer. Try using *ter* instead.  
To see a possible answer, click [here](#).

Enviar

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## Feedback on Word Choice

stões: 1 2 3 4 5 6 7 8

última Questão (3)

Enviar

### Análise:

*Input:* Ela és quinze anos.

I am not expecting the verb *ser* for this answer. Try using *ter* instead.

To see a possible answer, click [here](#).

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Listening Reading Description Fill-In-Blanks Rephrasing Vocabulary Home Logout

Módulos: 1 2 3 4 5 Atividades: 1 2 3 4 5

## Descrição

### Instrução

Descreva uma frase completa usando a informação apresentada pela gravura e as palavras entre parênteses.

**Questão 1**  
chamar-se - Ana e Beatriz



Elas se chamam Ana e Maria.

Quantões: 1 2 3 4  
Próxima Questão (2)

**Análise:**  
Input: Elas se chamam Ana e Maria.  
I think there is a problem with the proper noun you have chosen.  
Are you sure you want to use Maria instead of Beatriz?  
To see a possible answer, click [here](#).

Report Errors & Suggestions

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## The three models

- ▶ The TAGARELA architecture includes
  - ▶ model of domain knowledge (linguistic knowledge)
  - ▶ student model
  - ▶ instruction/activity model
- ▶ What is the point of learner and activity models?
- ▶ Providing feedback involves
  - ▶ **identifying** linguistic properties of the learner input and
  - ▶ **interpreting** them in terms of likely (mis)conceptions of the learner
    - ▶ This interpretation goes beyond linguistic form as such.
    - ▶ It needs to model the learner's use of language for a specific task in a specific context (Amaral & Meurers 2007).

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## Interpreting learner language: an example

- (1) *He sat with looking at the liver.* (From HELC, Miura 1998)
- ▶ Doctors reporting about work in operating room?
  - ▶ Cooks discussing in kitchen?
  - ▶ Chinese learner of English translating sentence on rivers?
- **activity** and **learner** information needed to interpret data
- ▶ The **learner** model relevant for analysis even for interpreting apparently well-formed expressions.
  - ▶ Activities in current ICALL systems are tightly controlled, e.g., build-a-sentence or translation, so that processing can implicitly rely on knowing which words should occur.
- 🌈 For a wider range of meaning-based activities with more variation in learner input, research into constructing and using explicit learner and activity models is needed.

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## Mismatches in the interpretation of learner input

- ▶ Learner Input: *O vaso esta em cima de mesa.*
- ▶ TAGARELA's interpretation:
  - ▶ The word *esta* in the learner input is a determiner.
  - ▶ There is no form of the verb *estar* in the answer.
  - ⇒ The student did not include the main verb.
- ▶ Student's interpretation:
  - ▶ I included *esta* as a form of the verb *estar*.
    - ▶ (The correct spelling is *está*.)
  - ▶ There is a verb in the sentence.
  - ⇒ The lack of an accent is a spelling error.
- ▶ Linguistic analysis ≠ student intention.
  - ▶ So what can the analysis rely on?
  - ⇒ Learner model needed for analysis/interpretation
  - ⇒ Information from the learner model should be taken into account by the NLP (cf., ICICLE, Michaud & McCoy 2004).
  - 🌈 more research needed on how learner models can define the space to be checked by the NLP

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## From diagnosing errors to over-/underuse Phrasal verbs in EFL

- ▶ English learners make errors in particle placement:

(2) a. *so they give up it*  
b. *food which will build up him*

Examples from the Chinese Learner English Corpus (CLEC 2004)
  - ▶ Learners also avoid using phrasal verbs:
    - ▶ Liao & Fukuya (2002) show that Chinese learners of English avoid phrasal verbs; similar research for other L1.
    - ▶ We confirmed patterns of avoidance in the CLEC (2004):
      - ▶ heavy use of pattern that is always grammatical (verb + particle + full NP)
      - ▶ little use of patterns restricted to certain verb & object types
- ⇒ Diagnosis of over- and underuse of language patterns only possible based on production history for a learner
- ▶ analyzing a corpus (cf., e.g., Borin & Prütz 2003)
  - 🌈 in ICALL system: interpreting extended learner model

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## Using ICALL to enhance learner corpora

- ▶ Most learner language corpora consist of essays.
- ▶ Yet learners produce language in a wide range of environments, and errors often are correlated with
  - ▶ specific **language tasks** performed by the learner, e.g.,
    - ▶ answering reading or listening comprehension questions
    - ▶ asking questions in information gap activities
  - ▶ specific **strategies** needed to complete specific tasks, e.g.,
    - ▶ skimming, scanning, . . .
- ▶ To obtain corpora representative of learner language, they should include language produced in a variety of tasks.
- ▶ ICALL systems provide an ideal setup for collecting task-specific learner language.
  - ▶ support explicit meta-information on learner and task
    - ▶ particularly helpful for annotating learner corpora
    - ▶ easier to infer what learner wanted to say if one knows the text they are answering questions about

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## Summary

- ▶ A strong connection between FLT, ICALL, and SLA is mutually beneficial, to obtain
  - ▶ better tools for FLT
  - ▶ more varied learner corpora and a valuable experimental testbed for SLA research
  - ▶ practically relevant ICALL systems, including a wide range of activities and effective NLP
- ▶ ICALL systems need more extensive learner models to
  - ▶ interpret the language as intended by the learner
  - ▶ make processing feasible by constraining it to the relevant interlanguage
  - ▶ detect patterns of over-/underuse, an important feature of interlanguage as studied in SLA.

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## Our next steps

- ▶ Fully modularize interface (apache2), activity specifications (xml), and NLP (UIMA) to support
  - ▶ exploring range of activity types and feedback strategies
  - ▶ NLP integrating learner and activity model information
  - ▶ reuse for languages other than Portuguese (IU Bloomington: Russian, Hebrew, UMass: Spanish)
- ▶ Extend learner model to take into account specification provided in Amaral & Meurers (2009).
- ▶ Integrate content assessment approach of Bailey & Meurers (2008) and extend it:
  - ▶ Which type of answers to what type of question given which context support reliable content assessment?
  - ▶ What are reliable and useful diagnosis categories?
- ▶ Extend logging facilities so that the system can produce XML-based learner corpora from the log, including meta information on activity and learner model.
  - ▶ Use the nicely controlled environment for experimental SLA research (e.g., addressing language transfer, models of second language acquisition).

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Tapping into the synergy between SLA, FLT and NLP in ICALL

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