

Introduction

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Real-life needs

- ▶ The time a student can spend with an instructor/tutor typically is very limited.
- ▶ In consequence, work on form and grammar is often deemphasized and confined to homework so that the time with the instructor can be used for communicative activities.
- ▶ The downside is that the learner has relatively few opportunities to gain awareness of forms and rules and receive individual feedback on errors.

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Intelligent Computer-Assisted Language Learning

Part I: Individualized Feedback in Intelligent Tutoring Systems

Detmar Meurers
(Universität Tübingen)

based on joint research with
Luiz Amaral (UMass Amherst)

European Summer School in Language, Logic, and Information
Bordeaux. July 27–31, 2009

Real-life needs

OSU practice confirming dilemma

A series of interviews with Spanish/Portuguese language instructors (cf., Amaral & Meurers 2005) finds that

- ▶ it can be difficult to achieve the communicative goal of an activity when students have problems using the appropriate language forms and sentence patterns.
- ▶ But class activities that focus on form or grammar patterns are perceived as problematic since
 - ▶ they reduce the pace of a lesson, and
 - ▶ individual differences make it impossible to have all students do the same tasks in exactly the same time.
- ▶ While instructors were very sceptical of CALL tools aiming to replace human interaction, they support tools
 - ▶ practicing receptive skills
 - ▶ reinforcing acquisition of forms
 - ▶ raising linguistic awareness in general

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An opportunity for CALL

- ▶ The situation seems like an excellent opportunity for developing Computer-Assisted Language Learning (CALL) tools to
 - ▶ provide individual feedback on learner errors and
 - ▶ foster learner awareness of relevant language forms and categories.
- ▶ But existing CALL systems which offer exercises
 - ▶ typically are limited to uncontextualized multiple choice, point-and-click, or simple form filling, and
 - ▶ feedback usually is limited to yes/no or letter-by-letter matching of the string with a pre-stored answer.
 - ▶ Example: "Spanish Grammar Exercises" (B. K. Nelson)

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Making CALL tools aware of language: NLP

- ▶ String matching is the most common technique used in CALL to analyze student input, which works well when
 - ▶ correct answers & potential errors are predictable & listable
 - ▶ there is no grammatical variation
 - ▶ envisaged errors correspond directly to intended feedback
- ▶ But what if
 - ▶ possible correct answers are predictable but not (conveniently) listable for a given activity
 - ▶ errors can occur throughout a recursively built structure
 - ▶ individualized feedback is desired which requires information about the learner input that can only be obtained through linguistic analysis⇒ Use NLP to analyze student input in such cases!

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Aspects of Linguistic Modeling

- ▶ A range of potentially relevant aspects of linguistic analysis
 - ▶ tokenization: identify words
 - ▶ morphological analysis: identify/interpret morphemes
 - ▶ syntactic analysis: identify selection, government and agreement relations and word order requirements
 - ▶ formal pragmatic analysis: identify coreference relations, information structure partitioning, . . .
- ▶ Computational tools identifying such linguistic properties need to be integrated into CALL systems to obtain language-aware "Intelligent" CALL (ICALL).
- ▶ What architecture can the NLP analysis be integrated in?
⇒ An Intelligent Tutoring System

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Intelligent Tutoring Systems

- ▶ An Intelligent Tutoring System (ITS) is a computer program that intelligently interacts with the learner.
- ▶ An ITS should be able to:
 - ▶ accurately diagnose the knowledge structures and skills of the student
 - ▶ adapt instruction accordingly
 - ▶ provide personalized feedback
- ▶ Since Hartley & Sleeman (1973) an ITS is recognized as consisting of at least three components:
 - ▶ the expert model
 - ▶ the student model
 - ▶ the instruction model

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Components of an ITS

- ▶ Expert Model:
 - ▶ the knowledge that the ITS has of its subject domain, in our case the linguistic knowledge
- ▶ Student Model (= Learner Model)
 - ▶ the component of the system keeping track of the student's current state of knowledge
 - ▶ It allows the ITS to infer the student's understanding of the subject matter and to adjust the feedback to the student's needs.
- ▶ Instruction Model:
 - ▶ the component that stores pedagogical information, how to conduct instruction
 - ▶ It helps define strategies to deliver appropriate feedback.

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An example ITS: TAGARELA

- ▶ A concrete example for an ITS
 - ▶ 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

⇒ TAGARELA: Teaching Aid for Grammatical Awareness, Recognition and Enhancement of Linguistic Abilities

- ▶ An intelligent web-based workbook for beginning learners of Portuguese (Amaral & Meurers 2006, 2007a,b, 2008, 2009; Amaral 2007; Ziai 2009).
- ▶ Designed to satisfy the real-life FLT needs identified at OSU (Amaral & Meurers 2005)

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OSU Project Context
Research Groups
ICALL research group
Computational Linguistics
OSU Departments
Linguistics
Spanish and Portuguese
Centers & Support
Foreign Language Center
Humanities Info. Systems



Tagarela
The Ohio State University

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System role, Activity types, Interface

- ▶ What role does the system play in teaching?
 - Self-guided activities accompanying teaching
 - ▶ 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.
 - ▶ TAGARELA offers six types of activities:
 - ▶ listening comprehension
 - ▶ reading comprehension
 - ▶ picture description
 - ▶ fill-in-the-blank
 - ▶ rephrasing
 - ▶ vocabulary
- Similar to traditional workbook exercises, plus audio.
- ▶ What should the system interfaces look like?
 - Use L2 as far as possible (needs careful interface design).

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Listening Reading Description Fill-in-blanks Rephrasing Vocabulary Home Logout

PROGRESS: 1 2 3 4 Atividades: 1 2

Compreensão Auditiva

Instrução
Ouçá o vídeo e responde às perguntas abaixo.



Questão 1
Qual bebida ela pede?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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BRASIL está política e geograficamente dividido em cinco regiões. Os limites de cada região (leste, nordeste, sudoeste, sul e centro-oeste) coincidem sempre com os limites das estações que as compõem.

A região norte ocupa a maior parte do território brasileiro, com uma área que corresponde a 40,2% da área total do País. Formada por onze Estados, tem sua área quase totalmente dominada pela bacia do Rio Amazonas.

A região Nordeste pode ser considerada a mais homogênea do País. Delimita em quatro grandes zonas - meridional, zona da mata, agreste e sertão - ocupa 18,26% do território nacional e tem nove estados.

O Sudeste é formado por quatro Estados. Dada a região de maior importância econômica do País, onde está concentrado também a maior índice populacional - 42,8% da brasileira.

Já o Sul, região mais fria do País, com ocorrência de geadas e neve, é o que apresenta menor área, ocupando 6,78% do território brasileiro e com apenas três Estados. Os rios que correm sua área formam a bacia do Paraná em quase toda sua totalidade e são de grande importância para o País, principalmente pelo seu potencial hidroelétrico.

Finalmente, a região Centro-Oeste tem sua área delimitada basicamente pelo Planalto Central Brasileiro e pode ser dividida em três grandes regiões administrativas: bacia de sedimentação do Paraná e do Paraguai, Rio e formado por quatro Estados e uma esta é a capital do Brasil.

Questão 1
Quantas regiões tem o Brasil?

Resposta:

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Descreva a foto usando as palavras apresentadas no exercício e uma das preposições abaixo.

em cima de - entre - embaixo de - ao lado de

Questão 1
Análise:



Resposta:

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Preencha as Lacunas

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Complete as lacunas com os verbos listados abaixo. Não repita o mesmo verbo mais de uma vez. Conjugue os verbos no pretérito perfeito do Indicativo.

Questão 1
Semana passada eu _____ com meu vizinho que queria vender meu carro. Eu _____ o carro pra ele. Hoje de manhã ele _____ o carro.

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Escreva uma frase comparando os dois elementos apresentados na tabela. Siga o exemplo abaixo.

emolascar
cozinha 1: só todo o dia
cozinha 2: só só pela manhã

Resposta: A cozinha 1 é mais emolascar que o cozinha 2.

caro
apartamento 1: R\$150.000
apartamento 2: R\$230.000

Questão 1
Análise:

Resposta:

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Módulo: 1 2 3 4 5 Atividades: 1

Vocabulário

Instrução

Observe a figura e complete a descrição com as palavras que está faltando.

Questões: 1 2 3 4 5 6 7 8 9 Próxima Questão (P)

Análise:

Questão 1



No banheiro tem _____.

A A A A A E E E E E O O O O O C C

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Nature of the feedback

- 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 is needed into range of feedback types
 - what is appropriate for human-computer interaction/CMC (cf., e.g., Sachs & Suh 2007; ?)
- 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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What to provide feedback on?

- 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 analysis can be effective → Lesson III

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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 6 7 8 Próxima Questão (P)

Questão 2

Quantos anos ela tem?

Ela tens quinze anos.

A A A A A E E E E E O O O O O C C

Enviar

Análise:

Input: Ela tens quinze anos.

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

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

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Feedback on Agreement

stões: 1 2 3 4 5 6 7 8

última Questão (3)

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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](#).

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Quem é você?



Eu me chamo Patricia 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 é quinze anos.

Quantos caracteres faltam para completar a frase? (3)

A A A A E E I I O O O O C C
A A A A E E I I O O O O C C

Enviar

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

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

Enviar

Report Errors & Suggestions

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Feedback on Word Choice

stões: 1 2 3 4 5 6 7 8

última Questão (3)

Enviar

Análise:

Input: Ela é 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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THE TAGARELA SYSTEM @ THE OHIO STATE UNIVERSITY ICALL RESEARCH GROUP

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

Módulo: 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.

Questões: 1 2 3 4
Próxima Questão (2)

Questão 1
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](#).



chamar-se - Ana e Beatriz

Elas se chamam Ana e Maria.

Quantos caracteres faltam para completar a frase? (3)

A A A A E E I I O O O O C C
A A A A E E I I O O O O C C

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Feedback on Wrong Word

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THE TAGARELA SYSTEM

THE OHIO STATE UNIVERSITY
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Listening Reading Description Fill-In-Blanks Rephrasing Vocabulary Home Logout

Module: 1 2 3 4 5 Atividades: 1

Reescreva

Instrução

Reescreva a frase abaixo usando a expressão entre parênteses.

Questões: 1 2 3 4 5 Próxima Questão (4)

Questão 3

Como você se chama? (nome)

Qual o seu nome?

A | A | A | A | A | E | L | O | O | O | O | C | C |
A | A | A | A | A | E | L | O | O | O | O | C | C |

Enviar

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Feedback on Missing Verb

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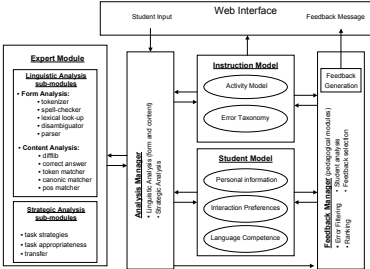
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General Architecture of TAGARELA



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Questões: 1 2 3 4
ma 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](#).

e Beatriz

Questões: 1 2 3 4 5
Próxima Questão (4)

Análise:

Input: Qual o seu nome?

Your answer is close, but there is a verb missing in
your sentence.

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

Enviar

Report Errors & Suggestions

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 2007a).
→ Lesson II on Learner Modeling

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NLP analysis modules in TAGARELA

- ▶ Form Analysis:
 - ▶ tokenizer: takes into account specifics of Portuguese (cliticization, contractions, abbreviations)
 - ▶ lexical/morphological lookup: returns multiple analyses based on CURUPIRA lexicon (Martins et al. 2006)
 - ▶ disambiguator: finite state disambiguation rules narrow down lexical information, in the spirit of Constraint Grammar (Karlsson et al. 1995; Bick 2000, 2004)
 - ▶ parser: bottom-up chart parser establishes relations to check agreement, case and global well-formedness
- ▶ Content Analysis:
 - ▶ shallow semantic matching strategies between student answer and target, cf. Content Assessment Module (Bailey & Meurers 2006, 2008)
→ Lesson III on Content Assessment

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How to plug it all together?

- ▶ Allow the analysis manager to flexibly employ NLP modules relevant to a particular activity.
 - ▶ Flexible control also relevant from NLP perspective, to support interleaving of contributions from modules, e.g.:
 - ▶ part-of-speech ambiguity in Portuguese: a can be a
 - ▶ preposition (*to*)
 - ▶ pronoun (*her*, clitic direct object)
 - ▶ article (*the*, feminine singular)
 - ▶ abbreviation (*association, alcoholic, etc.*)
 - ▶ tokenization can resolve some part-of-speech ambiguities:
 - ▶ $da = de + a$ (article)
 - ▶ $vê-la = ver + a$ (clitic pronoun)
 - ▶ $\hat{a} = a$ (preposition) + a (article)
 - ▶ A.A.A. = *Associação dos Alcolólicos Anônimos*
- TAGARELA tokenizer annotates some part-of-speech

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Annotation-based processing

- ▶ To support a flexible control structure, the data structures serving as input and as output for the analysis modules need to be uniform and explicit.
- ▶ NLP analysis = a process of enriching the learner input with annotations
 - ▶ parallel to XML-based corpus annotation → Lesson V
- ▶ The same data structure, the learner input annotated with information, is accessed throughout.
 - ▶ Closely related idea: Common Analysis System (CAS, Götz & Suhre 2004) of the Unstructured Information Management Architecture (UIMA).
 - ▶ UIMA-based reimplementation of TAGARELA's NLP (Ziai 2009)
- ▶ In addition to the information obtained by analyzing the input, we need information about the activity.

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General Characteristics of Activities

Activities can be characterized and differ in:

- ▶ task specification
 - ▶ e.g.: listen, read, write, comment, complete
- ▶ level
 - ▶ e.g.: basic, intermediate, advanced
- ▶ expected input
 - ▶ e.g.: word, phrase, sentence
- ▶ nature and availability of target responses and type of variation from target that is permitted
- ▶ required skills and abilities, e.g.:
 - ▶ strategies needed (e.g., scanning, summarizing, grouping)
 - ▶ amount of content manipulation required
 - ▶ required awareness of linguistic categories and rules
- ▶ pedagogical goals behind activity and feedback provided:
 - ▶ generally: improve the required skills and abilities

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Where it matters for processing

- ▶ General claim: The NLP analysis and feedback generation depend on the specific activity (type).
- ▶ The information from the activity model has an impact on
 - ▶ **Property Identification:**
 - ▶ Which linguistic properties (incl. errors) of the learner input **can actually be observed** in a given activity?
 - ▶ **Property Selection:** Which of the observed properties to **select as likely error cause** (or other relevant aspect)?
 - ▶ Which of the identified errors should be the focus of the feedback given activity and its specific pedagogical goals?
 - ▶ Which of the identified properties is most likely to provide a reliable assessment?
 - ▶ **Feedback Strategy:** Which strategy does it chose? E.g.:
 - ▶ explicit feedback on form for FIBs
 - ▶ scaffolding for reading comprehension (i.e., encouraging the use of required strategies)

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Property identification in TAGARELA

- ▶ In TAGARELA, different activity types require different linguistic information to analyze student's input:
 - ▶ FIB: spell-checking, lexical information
 - ▶ Rephrasing: as above + syntactic processing and basic content assessment (correct answer, token matcher)
 - ▶ Reading: as above + all content analysis modules
- ▶ Why not always run everything?
 - ▶ "Don't guess what you know."
 - ▶ The more we know the linguistic properties, the types of variation, and the potential errors NLP needs to detect,
 - ▶ the more specific information we can diagnose
 - ▶ with higher reliability

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Challenge 1: Constraining Learner Input The issue

- ▶ Processing completely free production input, allowing any number and type of errors, is not tractable.
- ▶ Systems must control/limit the type of input received.
- ▶ Current ICALL systems typically control input using outdated activity design: translation, dictation, etc.
 - ▶ Constraining activities in this way also circumvents need for semantic analysis of task appropriateness of input.
- ▶ Some consequences of this choice are:
 - ▶ limited number of activity types
 - ▶ decontextualized activities that do not fit communicative purposes (as used in current FLT)
 - ▶ lack of real-life data to evaluate and improve systems

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Example: Decontextualized Translation Task System "Spanish for Business Professionals" (Hagen 1999)

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Challenge 1: Constraining Learner Input Towards a solution

- ▶ How to control the input and be pedagogically sound?
 - ▶ Free vs. controlled input is a continuum, not a dichotomy.
 - ▶ Modify types of exercises so that they become communicatively significant.
 - ▶ Constrain form and content of input through communicative setup of the activity.
- ▶ The activity design and explicit learner models needed here serve double duty:

- ▶ make activities and feedback pedagogically sound
- ▶ constrain which language expressions and learner errors the NLP needs to be able to deal with.

Example:

- ▶ Vocabulary practice in Spanish for Business Professionals vs. in the TAGARELA system

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Example: Vocabulary practice in Spanish for BP

- ▶ While *Spanish for BP* contextualizes activities with texts and audio, it only does so for multiple choice activities.
- ▶ Vocabulary practice:

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Challenge 2: Task specification (L1 vs. L2)

The issue

- ▶ ICALL systems rely heavily on L1 to provide instructions
 - ▶ Should L1 be avoided completely?
 - ▶ What is the right measure?
- ▶ Instructions used in ICALL systems often are
 - ▶ too long for students to actually read them
 - ▶ too complex to be given in L2.
- ▶ Interface design is typically not used to help students identify different exercise tasks.

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Example: Long instructions in Spanish for BP

Ejercicio 6
Conjugación

Welcome to your verb conjugation exercises!

In each of the SBP dialogs, certain verb forms or tenses are emphasized. For example, in Unidad 1, (regular -ar verbs and the present verbs are emphasized in Unidad 3. Your conjugation exercises give you the opportunity to work with this material in context.

Read the instructions on this card, then click **Continue** to start from where you left off last time or **Initialize** to start over from a clean slate and erase any previous work in the conjugation exercise.

Note: The **Continue** button will work only if you are running your exercises from your hard drive. If you run SBP from the CD-ROM, all answers

Continue **Initialize**

Previous Other Exercises

Ejercicio 6
Charadas

En este ejercicio se le presentan las frases paragrafo en español en su forma original, desordenadas.

These sentences themselves form a cohesive paragraph, but only when they are placed in the proper order. And not only do **Charadas** scramble the letters inside words, it also scrambles sentences inside paragraphs. You have to reorganize the sentences into a paragraph that makes sense and flows smoothly. You do this by clicking directly on a sentence inside the field near the top of the window. When you click on a sentence, it will move towards the top.

Charadas 1 **Charadas 2**

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Challenge 2: Task specification (L1 vs. L2)

Towards a solution

How to provide instructions without or limiting the use of L1?

- ▶ Make activity types clear (list types of activities)
 - ▶ If exercise types are consistent, students experience with a given type of exercise can help avoid the problem.
- ▶ Use specific designs to indicate tasks
 - ▶ colors and icons identifying each activity type
 - ▶ page layout supporting task
- ▶ L1 can be used as a resource, but in a demand-driven way
 - ▶ provide buttons that allows students to look at
 - ▶ illustrating examples
 - ▶ instructions in L1

Example:

- ▶ Activity page design for the TAGARELA system

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Example:

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Listening Reading Descriptions Cloze-Tests Highlighting Vocabulary

Leitura

Atividade 1

Instrução: Leia o texto e responda as questões usando o vocabulário apresentado pelo texto.

Correr bem no Rio de Janeiro não é problema. Aqui você encontra excelentes restaurantes das mais diferentes culinárias. Desfrute pratos de franceses, italianos e portugueses, ou melhores da cidade. Não se esqueça de provar um feijão carioca.

Charascaria Mários: Refeição de Carne, Bife com farinha de salada, acompanhamento, comida japonesa e lanche de mar. A unidade do Leme se destaca pelo ótimo ambiente e decoração. Excelente variedade de carnes, que inclui Jorjê, jacaré e o de entre outros. Rua Francisco Ottonário, 96, Ipanema (tel. 2521-2500) / Av. Atlântica 290-B, Leme (tel.2542-2393), 55

Cafeteria: Pízza de massa fina e recheio saboroso. Forno a lenha. A pízza é preparada no pédo do restaurante e são dois horários. Grande variedade de sabores. Desfrute também com a massinha de brioche. O preço é um pouco elevado. Rua Velha de Norair 124, Ipanema (tel. 2523-3286), Oudon Filhas no Jardim, Jardim Botânico e Copacabana, 55

Questão 1:
Que tipos de restaurante você encontra no Rio de Janeiro?

Análise:

Ajuda: Dicionário Gramática

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Example:

THE TAGARELA SYSTEM THE OBSERVABLE EXPERTS INSTITUTE OF TECHNOLOGY

Listening Reading Description Fill in Blanks Practising Vocabulary

Compreensão Auditiva

Atividade 1

Instrução: Clique e arraste o conteúdo a ficha com o que cada cliente pediu.



Complete

ENTRADA:

ACORDA:

PRATO PRINCIPAL:

QUANTIDADE:

SOBREMESA:

Aplicar:

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Challenge 3: Appropriate Feedback

The issue

- ▶ ICALL system design has made little use of SLA research on different types of feedback and their effectiveness. The systems
 - ▶ rely heavily on L1 to provide feedback,
 - ▶ mostly focus on explicit, meta-linguistic error feedback,
 - ▶ using linguistic terminology which students are not necessarily familiar with.
 - ▶ When should linguistic terminology be avoided?
 - ▶ When does it help?
 - ▶ Does it depend on the student?
- ▶ Most systems have no student model:
 - ▶ Feedback is only based on type of error.
 - ▶ No adaptation of feedback messages to student needs.

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Example: Feedback in Spanish for BP

Ejercicios 6 (50)

Expresión 1

Unitad 6 DICTATION

Not a complete sentence. Word 6 (e) doesn't agree in GENDER with word 7 (farmacia).

▶ 1.1 The RELATIVE PRONOUN (word 4, que) is used with verbs which take a DIRECT OBJECT. Check the verb (word 5, es). ▶ 1.12

The verb 2 (veo) doesn't agree in PERSON with SUBJECT (cf. word 3 times). ▶ 1.6, ▶ 1.0

Use the words to the right to type in any Spanish sentence in the form below. Press ENTER to check your sentence.

primero yo tienes que ir al farmacia

Anterior Menores Mayor Stop

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Challenge 3: Appropriate Feedback

Towards a solution

- ▶ The role of meta-linguistic feedback for student uptake in ICALL (Heift 2004)
 - ▶ Exploration limited to few, decontextualized exercise types.
 - ▶ Integrate SLA research results on types of feedback and their effectiveness, e.g.:
 - ▶ Predominant role of noticing (cf., e.g., Robb et al. 1986)
 - ▶ Take developmental stages into account, e.g., feedback on agreement errors less effective for beginners (Pienemann 1984)
 - ▶ The context influences the effectiveness of different types of feedback, so the transferability to the ICALL context needs to be tested (cf., e.g. Sagarra 2007).
- ⇒ Well defined learner and activity/instruction models can help us determine better feedback strategies.

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TAGARELA meets real life language learners

- ▶ The system was used by beginning Portuguese students at The Ohio State University.
- ▶ Studying the system logs, we identified two aspects where feedback based on the linguistically correct analysis did not seem to be helpful for learners:
 - ▶ interpretation of tokens with accented characters
 - ▶ tokenization of compounds

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Interpreting tokens: Accents (I)



Descrição

Módulos: 1 2 3 4 5 Atividades: 1

Instrução

Descreva a foto usando as palavras apresentadas no exercício e uma das preposições abaixo.
em cima de - entre - embaixo de - ao lado de

Questão 1

Questões: 1 2 3 4
Próxima Questão (2)



vaso - mesa

O vaso está em cima da mesa.

A A A A A E E I I O O O O O S C

Enviar

Report Errors & Suggestions

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Interpreting tokens: Accents (II)



Descrição

Módulos: 1 2 3 4 5 Atividades: 1

Instrução

Descreva a foto usando as palavras apresentadas no exercício e uma das preposições abaixo.
em cima de - entre - embaixo de - ao lado de

Questão 1

Questões: 1 2 3 4
Próxima Questão (2)



vaso - mesa

O vaso está em cima da mesa.

A A A A A E E I I O O O O O S C

Enviar

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Properties of Portuguese

Accents and their importance for lexical distinctions

- ▶ Accents in Portuguese encode important linguistic distinctions.
- ▶ Part-of-speech differences:
 - ▶ pronoun vs. verb
 - ▶ *esta* (this) – *está* (is)
 - ▶ conjunction vs. verb
 - ▶ *e* (and) – *é* (is)
 - ▶ verb vs. noun
 - ▶ *para* (stop) – *Pará* (state's name)
- ▶ Other differences:
 - ▶ gender
 - ▶ *avó* (grandfather) – *avó* (grandmother)
 - ▶ meaning
 - ▶ *coco* (coconut) – *cocô* (poop)

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Mismatches in the interpretation of accents

- ▶ **Learner Input:** *O vaso esta em cima de mesa.*
- ▶ **System'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.

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Addressing the Interpretation of Accents

- ▶ Learners perceive the unaccented and accented versions of a character as orthographically similar and in consequence confuse linguistically unrelated forms.
 - ▶ The system needs to capture the confusability of accented with unaccented characters.
 - ▶ Treat accented and unaccented characters parallel to common L1-transfer phonological confusions.
 - ▶ *está* and *esta* are confused just like
 - ▶ *liver* and *river* are by Japanese learners of English
- ⇒ Develop a module that compares whether different (un)accentuated variants of input words are more likely.
- ▶ Where this is the case, provide dedicated feedback alerting learner of this confusion.

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Identifying tokens (I)

Regiões do Brasil



O Brasil está política e geograficamente dividido em cinco regiões. Os limites de cada região (Norte, Nordeste, Sudeste, Sul e Centro-Oeste) coincidem sempre com as fronteiras dos estados que as compõem.

A região Norte ocupa a maior parte do território brasileiro, com uma área que corresponde a 45,27% da área total do País. Formada por sete Estados, tem sua área quase totalmente dominada pela bacia do Rio Amazonas.

A região Nordeste pode ser considerada a mais heterogênea do País. Dividida em quatro grandes zonas - meio-norte, zona da mata, agreste e sertão -, ocupa 18,26% do território nacional e tem nove estados.

O Sudeste é formado por quatro Estados. Esta é a região de maior importância econômica do País, onde está concentrado também o maior índice populacional - 42,63% dos brasileiros.

Já o Sul, região mais fria do País, com ocorrências de geadas e neve, é a que apresenta menor área, ocupando 6,73% do território brasileiro e com apenas três Estados. Os rios que cortam sua área formam a bacia do Paraná em quase toda sua totalidade e são de grande importância para o País, principalmente pelo seu potencial hidrelétrico.

Finalmente, a região Centro-Oeste tem sua área dominada basicamente pelo Planalto Central Brasileiro e pode ser dividida em três porções: maciço goiano-mato-grossense, bacia de sedimentação do Paraná e as depressões. Ela é formada por quatro Estados e nela está a capital do Brasil.

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

Análise:

Input: O Amazonas fica na região norte.

Excellent!

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Identifying tokens (II)

Regiões do Brasil



O Brasil está política e geograficamente dividido em cinco regiões. Os limites de cada região (Norte, Nordeste, Sudeste, Sul e Centro-Oeste) coincidem sempre com as fronteiras dos estados que as compõem.

A região Norte ocupa a maior parte do território brasileiro, com uma área que corresponde a 45,27% da área total do País. Formada por sete Estados, tem sua área quase totalmente dominada pela bacia do Rio Amazonas.

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

Análise:

Input: O Amazonas fica na região norte.

There is an agreement error in gender between the determiner and the noun in the sequence *a região norte* from your answer.

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

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Properties of Portuguese

Tokenization

- ▶ Certain Portuguese words are syntactically complex.
- ▶ Contraction: preposition + determiner/pronoun
 - ▶ *no* = *em* (in) + *o* (the)
 - ▶ *nela* = *em* (in) + *ela* (it)
 - ▶ *destes* = *de* (of) + *estes* (these)
 - ▶ *às* = *a* (to) + *as* (the)
- ▶ Encliticization:
 - ▶ *comprá-lo* = *comprar* (to buy) + *o* (it)
 - ▶ *compram-nas* = *compram* (buy) + *as* (them)
 - ▶ *comprei-a* = *comprei* (bought) + *a* (it)

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Mismatches in the identification of tokens

- ▶ Learner input: *O Amazonas fica no região norte.*
- ▶ System's interpretation: *no* = *em* + *o*
 - ▶ tokenized input: [em, o, região, norte]
 - ▶ syntactically analyzed: [_{PP} em [_{NP} O_{MASC}, região_{FEM}, norte]]
⇒ Agreement error between *o* and *região*.
- ▶ Student's interpretation:
 - ▶ There is no *o região norte* in the sentence I wrote.
 - ▶ I used the 'preposition' *no*.⇒ So *no* seems to be the wrong preposition?

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Addressing the Identification of Tokens

- ▶ The system needs to connect the surface form provided by the student with the system analysis of this input.
- ▶ An annotation-based NLP architecture (→ UIMA) readily supports this with multiple parallel layers of annotation for the learner input.
- ▶ The tokenization mismatch can be addressed by representing both surface and deep tokenizations of the learner input, and the mapping between the two.
 - ▶ Refer to surface form when generating the feedback.

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Wrapping up: Token Identification & Interpretation

- ▶ In an ICALL system, problems can arise from mismatches between:
 - ▶ the identification and interpretation of the learner input by the system
 - ▶ how the learner perceives and conceptualizes the input
- ▶ Where such mismatches arise, the feedback produced by the system is inadequate.
- ▶ We discussed two such mismatches for Portuguese tokens in TAGARELA:
 - ▶ interpretation of tokens: accented characters
 - ▶ identification of tokens: contraction, encliticization
- ▶ We argued that these problems can be addressed
 - ▶ by treating accented and unaccented characters parallel to common L1-transfer phonological confusions.
 - ▶ using an annotation-based NLP processing architecture supporting a rich representation of the learner input, including surface and deep tokenizations.

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- ▶ Integration of computational, linguistic, and FLT/SLA expertise opens up opportunities for ICALL research
 - ▶ ICALL Intelligent Tutoring Systems can address specific needs of real-life FLT:
 - ▶ provide opportunities for students to practice their listening, reading, and writing skills
 - ▶ provide individualized feedback to learner
 - ▶ foster learner awareness of language forms and categories
 - ▶ provide contextualized activities integrating meaning and form
 - ▶ TAGARELA: its architecture and the relevance of its expert, learner, and activity models
- learner modeling (Lesson II)
- analyzing meaning (Lesson III)

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