

An ITS CALL system based on active lexeme-agents

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Abstract. We briefly describe an ITS CALL tool in which the domain (L2) is modeled in terms of its lexemes and their usual interrelations. Each L2 lexeme behaves as an autonomous agent that attempts to be learned in a multi-agent environment. So as to be learned, it competes for a limited resource, the course interface, where it can present its meaning by means of images and other cues. Once presented, the lexeme helps other lexemes with which it can form valid syntagms to create example sentences. Each agent's individual goal is subject to global goals which, depending on the adopted teaching strategy, may prioritize some agents, and then favor them in an action selection mechanism. We discuss the lexeme-agent structure and advance some implications of such approach.

Keywords: CALL, ITS, multiagent, domain model, NLP.

1 Introduction

We introduce here an ongoing research in the area of ITS language teaching. Its main contribution is the approach in which every L2 lexeme (pedagogical unit) acts as an autonomous agent whose goal is to be learned. This creates a bottom-up arrangement that is very flexible to adapt to changes in the pedagogical goals and that reflects the incremental nature of the L1 acquisition [1]. Furthermore, the relations among the agents simulate the typical dependencies that the lexemes present in the L2 grammar. We briefly describe the implementation and its implications.

2 Overall strategy of the teaching environment

The ITS CALL tool described herein is aimed to teach about 2700 L2 lexemes: 1500 nouns, 800 verbs, 300 adjectives, and 80 connectors (prepositions and conjunctions). Each lexeme is programmed to act as an autonomous agent that seeks to be learned, in an action selection process as defined in [2]. In other words, each lexeme-agent has the individual goal of teaching its own meaning to the learner, both in isolation and in combination with other lexemes. A presentation on the screen is a necessary condition

for the learner to apprehend the meaning of any particular lexeme, and the sequence of presentation needs to be coherent to meet the pedagogical criteria and goals.

The learning of a lexeme in response to its presentation on the screen can occur:

- 1) Due to the help of an illustrative image (drawing or photo)
- 2) By the similarity that the lexeme has with the corresponding lexeme in L1
- 3) Due to relation with other lexemes in the context of example-sentences
- 4) By means of a formal definition of its meaning

To account for all four possibilities, every lexeme-agent has (1) an associated image; (2) a metric indicating how similar it is regarding the corresponding lexeme in L1 [3]; (3) a list of lexemes with which it can form valid syntagms and sentences in L2; and (4) a formal definition of its meaning (written with the help of other L2 lexemes).

Since the screen is a limited resource, the lexeme-agents need to compete to access it. Thus, an agent stay hidden most of the time, and at any given moment the majority of the agents do not appear, i.e., their textual form or illustrative image are not shown. Only one or a few (forming a scene) agents are presented at a particular moment, and the presentation sequencing results from action selections modulated by global goals of the pedagogical strategy or the given topic. If the context, for instance, requires the exploration of themes such as “traveling” or “eating”, lexemes pertinent to such areas gain more activation and then are more likely to be shown first. Furthermore, an agent’s individual goal is not incompatible with the goals of other agents, it indeed depends on them because the construction of meaningful sentences and texts implies cooperation of the correct lexemes in an appropriate order. In the environment this occurs autonomously and resembles the coalitions as defined in [4] and [5]. Hence, besides competing for space on the screen, every agent also helps (sends activation to) those other agents with which it needs to associate to form valid and usual sentences. These candidate partner-agents are listed within every agent. If the agent is a noun, possible partners are adjectives and verbs, and conversely. So the use of the lists of partner-agents as the condition-lists and add-lists of an action selection mechanism is a way to translate such linguistic relations into computationally tractable terms. Such lists can be seen in Table 3, a shortened example of the data carried by lexeme-agents.

Table 1. Example of Fields of the Lexeme-Agent “Luno” (moon in L2).

Field	Type	Example
Substantive	text	luno
Image	image	G:\Images\luno.png
Activation level	double	100
Themes	list	[Nature; Science]
Similarity to L1 lexeme	double	0.75 (Note: the supposed L1 is English, which has “lunar”)
Frequency in the corpus	integer	10 (Note: from 1 to 10 means a decreasing level of frequency)
Possible adjectives	list	[bela, blua, flava, ronda, nova, plena, kreskanta, malkreskanta]
Can be subject of	list	[esti, brili, aperi, lumi, ravi, kaŝiĝi]
Can be direct object of	list	[vidi, observi, rigardi, admiri, atendi, viziti, esplori]
Hypernyms	list	[satelito, astro]
Hyponyms	list	[lunbrilo, lunradio, lunfazo, lunmonato]
Synonyms	list	[]
Antonyms	list	[]
Definition	text	La natura satelito de la Tero.

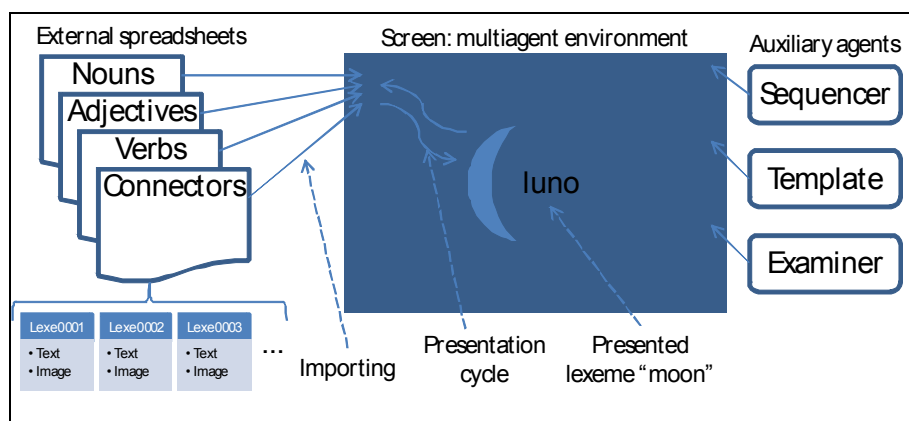


Fig. 1. Scheme of the ITS CALL tool with autonomous lexeme-agents.

As depicted in Figure 1, there is an initial phase during which all lexeme-agents are imported from external spreadsheets (which, by the way, can be updated or corrected by human tutors if necessary). Once imported, the agents start competing for space on the screen, and this creates subsequent presentation cycles. The application also uses some specialized auxiliary agents, which are responsible for monitoring the access to the interface, for providing some templates for the construction of sentences and also for assessing the learners' progress through exercises and tests.

3 Conclusion

The described ITS CALL tool has features well suited to a language-teaching context. Firstly, it combines a capacity of managing the lexical contents at their atomic level to the offering of higher-level resources to direct the teaching process to meet specific needs and cover specific themes. Secondly, it facilitates the assessment of the learning process by granting to the human tutors a direct access to the teaching life-cycle of any particular lexeme. Finally, the resulting flexibility enables the application to cope with the complexity of the language-teaching area and with the diversity of learners.

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