

# Software Agents Supporting Second Language Learning as a Personalized, Collaborative and Lifelong Activity

**Gerardo AYALA**  
*[ayalasan@mail.udlap.mx](mailto:ayalasan@mail.udlap.mx)*

***TLATOA Speech Processing Group***

Research Center on Information Technologies and Automation, CENTIA  
Universidad de las Américas, Puebla, MEXICO.



# 1. Second language learning is a *social activity*

1.1 Collaborative learning as an appropriate method.

1.2 **Computer supported collaborative learning (CSCL):**

*"the use of the computer as a mediational device that helps the learners to communicate and collaborate in joint activities through a network, providing assistance in their coordination and application of knowledge in certain domain" (Ayala & Yano, 1998).*

1.3 **Individual knowledge frontier:** based on the predictable learning order of grammar structures.

1.4 **Social knowledge frontier:** based on the domain knowledge elements already acquired by other learners in the community.

1.5 Both knowledge frontiers can be interpreted as Vygotsky's **zone of proximal development** of the learner in a group, which must be generated in order to maintain learning opportunities to the individual.

## **2. Second language learning is a *lifelong activity***

2.1 Throughout our lives, we continue learning a second language.

2.2 In Japan 5% among all lifelong learning activities in 1999 was second language learning (Hall, 2000).

2.3 Lifelong learning **market can be expected to increase in the near future.**

2.4 Learning communities are emerging in the Internet, bringing together people who have real and genuine learning interests.

2.5 In the SALLE (Software Agents for a Life-long Learning Environment in Japanese)

## 2.6 Lifelong learning environment:

*"an Internet based environment that supports self-directed, generative and intentional learning, where software elements assist the learner in planning her/his learning activities, in order to meet changing society demands, supporting her/him to collaborate in the social construction of knowledge in a community" (Ayala, 2003).*

**2.7 Supporting *self-directed learning*:** a software agent keeps the learner aware of second language knowledge resources believed to be relevant for her/him.

**2.8 Supporting *generative learning*:** a software agent supports the social construction of knowledge in a virtual community, providing

assistance to the learner in the organization and presentation of her/his ideas, beliefs and knowledge of the second language use of vocabulary, grammar rules and expressions.

**2.9 Supporting *intentional learning*:** a software agent helps the learner in the maintenance of a personalized learning plan and assistance in the configuration of discussion groups, based on the learning interests of the other members in the community.

### **3. Second language learning is a *personalized activity***

3.1 Motivation in a collaborative or a lifelong learning environment depends on personalization, and this requires a *learner model*.

3.2 **Learner model:** *a set of beliefs held by the system about the learner* (Self, 1994).

3.3 The role of the learner model in a collaborative learning environments should not be to support tutoring or diagnosis, but to *enhance awareness and the relevant collaboration between learners*.

3.4 We propose to model the learner as a set of beliefs about the learner's...

- a) *capabilities*: both actual and potential capabilities, considering both, the structural and the social knowledge frontiers.
- b) *learning goals*: in terms of situations or speech acts.
- c) *constructions*: as examples of correct and incorrect application of second language domain knowledge elements (grammar structures, expressions and vocabulary).

d) **commitments**: to assist other learners in a specific situation or speech act.

3.5 Learner model for a lifelong learning environment is used to maintain a learning plan, based on the capabilities and the **interests** of the individual learner and her/his peers in the community (Ayala, 2003).

## 4. Domain agent: *applying NLP technologies*

4.1 Assists the learner in both, **recognizing a sentence** given by the learner presenting a grammar analysis of it, and helping her/him in **constructing a valid sentence**, for an specific situation or speech act.

4.2 It works based on a **knowledge base in Prolog representing grammar structures and expressions**, being able of natural language processing for short sentences in a limited domain.

4.3 The **sentences constructed and analyzed by the domain agent** are provided to the *interface agent* (see below) for the generation of speech synthesis of them.

4.4 In a comprehensive input environment there will always be a correct model to imitate, because advanced learners can check the actions of the others, correct them when necessary and self-correct their own.

4.5 We have organized second language domain knowledge in **situations, corresponding to speech acts**, that appear in **dialogs**, for Japanese language (Ayala & Yano, 1998).



4.6 This organization of the domain knowledge (grammar rules and expressions) allows the generation of a syllabus that consists of communicative goals.

4.7 **The structural organization of language patterns** (grammar and expressions) in the **domain knowledge, grouped in situations representing speech acts**, gives a partial reference in the construction of the **individual learner's structural knowledge frontier**, considering that grammar learning has a predictable order.

4.8 **Generative learning** is supported when the learner, assisted by the domain agent, constructs short sentences and expressions, in order to communicate with others.

## 5. Mediator agent: *maintaining learning possibilities*

5.1 Assists the learner in finding other users of the system in the Internet, proposing the **configuration of learning groups** based on the learner models of the users of the learning environment.

5.2 Using the information contained in their learner models, the mediator agents can support the awareness in the group allowing the communication of the learners' goals, commitments and capabilities.

5.3 Based on this representation the mediator agents are able to propose to their learners a set of learning tasks which imply the application of knowledge elements considered *internalized* (acquired) by other learners, as well as ***feasible, relevant, popular and frequently used*** in the group.

5.4 This results in an increment of the collaboration and assistance possibilities between learners, which implies the creation of ***zones of proximal development*** and therefore more learning possibilities (Ayala & Yano, 1998).

5.5 In this way, the mediator agent generates **zones of proximal development that correspond to those knowledge elements that can be acquired by the learner with the collaboration of other members in the group.**

5.6 Using a learner model, the syllabus can be generated based on an assessment of student needs, considering her/his social context.

5.7 The mediator agent proposes the learner a personalized communicative based syllabus that assures a zone of proximal development, maintaining her/his learning possibilities.

5.8 In order to generate the syllabus, as a proposal of task corresponding the application of knowledge elements in a given situation or speech act, the mediator agent **considers not only the individual structural knowledge frontier, but also the social knowledge frontier of the learner.**

5.9 **Intentional learning** is supported when the learner has a learning plan, maintained with the assistance of the mediator agent.

## **6. Information agent: *awareness of real learning resources***

6.1 During second language learning the learner is continuously processing linguistic information, noticing *regularities* in the structure of the second language.

6.2 A language regularity may be a new vocabulary item or a new grammatical construction that appears in a sentence which is understood and occurs in a particular situation (Carrol, 86).

6.3 In the SALLE (Software Agents for a Life-long Learning Environment in Japanese) project we modeled an information agent, that works in order to **determine real, relevant and truly useful material in web sites**, for the study of the Japanese language, motivating the discovery, use and sharing of language patterns, vocabulary and expressions by the learners in a learning community in the Internet (Ayala, 1999).

6.4 The *information agent* travels into the Internet **recovering sentences to be analyzed and registered as a valid examples** by the domain agent, visiting those web sites believed of the interest of the particular learner.

6.5 In this way, we provide **awareness of knowledge resources considered relevant for the learner**, guiding her/him towards a self-directed lifelong learning attitude.

## **7. Interface agent: *applying speech technologies***

7.1 Second language learning is based on communication and situations.

**7.2 Language acquisition occurs only by understanding messages, obtaining comprehensible input.**

7.3 The focus is on the acquisition of the ability to communicate messages using the target language.

7.4 Language is better acquired when it is being used to transmit messages, not when it is explicitly taught for conscious learning (Krashen & Terrel, 1983).

**7.5 Acquisition takes places when people understand messages, real ideas, in natural, communicative situations.**

7.6 An *interface agent*, as **an animated talking head, applies speech technologies in the interaction with the learner.**

7.7 It allows immersive, emotional and personal interaction, anytime.

7.8 The learner can practice the pronunciation of words and sentences constructed based on the domain agent's knowledge base or obtained in the Internet by the information agent.

7.9 This interface agent is based on speech technologies adapted to Mexican Spanish by the [TLATOA Speech Processing Group](#) of our University (Kirschning, 2001).

## 8. Conclusions

8.1 We have presented our experiences in the modeling of software agents for second language learning, considering it a personalized, collaborative and lifelong activity.

8.2 By developing educational technologies for second language learning, our final objective must not be just to improve human-computer interaction techniques, but to *provide technologies that support human-human communication, collaboration and learning.*



## References

1. G. Ayala, & Y. Yano. 1996. **Learner Models for Supporting Awareness and Collaboration in a CSCL Environment**, *Intelligent Tutoring Systems*, Claude Frasson, Gilles Gauthier and Alan Lesgold (Eds.), Lecture Notes in Computer Science 1086, Springer Verlag, 158-167
2. G. Ayala, & Y. Yano. 1998. **A Collaborative Learning Environment Based on Intelligent Agents**, *Expert Systems with Applications*, Vol. 14, No. 1/2, Pergamon Press, 129-137
3. G. Ayala. 1999. **An Agent based Life-long Learning Environment for Japanese Language**, *Proceedings of ED-MEDIA 99*, Seattle, USA, 1117-1122
4. G. Ayala. 2003. **Towards Lifelong Learning Environments: agents supporting the collaborative construction of knowledge in virtual communities**, *Designing for Change in Networked Learning Environments*, International Conference on Computer Support for Collaborative Learning CSCL 2003, Bergen, Norway, 141-148.
5. J. B. Carrol. 1986. **Second Language**, *Cognition and Instruction*, Dillon, R. F. and Sternberg, R. J. (Eds), Academic Press, London, pp. 83-125.

6. R. Cole. 2003. **Roadmaps, Journeys and Destinations: Speculations on the Future of Speech Technology Research**, *INTERSPEECH-2003/ Eurospeech 2003*, panel, Geneva, Switzerland.
7. W. Hall. 2000. **Yearning for Lifelong Learning: Desire for self-improvement in Japan presents major business opportunities**, J@pan Inc. [www.japaninc.net/mag/comp/2000/10/oct00\\_reports\\_js.html](http://www.japaninc.net/mag/comp/2000/10/oct00_reports_js.html)
8. ISEB. 2004. **Foreign Languages**, Illinois State Board of Education [www.isbe.state.il.us/ils/foreignlanguage/foreignlang.html](http://www.isbe.state.il.us/ils/foreignlanguage/foreignlang.html)
9. I. Kirschning. 2001. **Tlatoa: Developing Speech Technology & Applications for Mexican Spanish**, *Second Int. Workshop on Spanish Language Processing & Language Technologies*, Jaén, Spain, 115-119
10. S. D. Krashen & T. D. Terrel. 1983. ***The Natural Approach: Language acquisition in the classroom***. Pergamon Press. Germany.
11. D. Renié, D. & T. Chanier. 1995. **Collaboration and computer-assisted acquisition of second language**, *Computer Assisted Language Learning*, Vol. 8, no. 1, pp. 3-29

12. J. Self. 1994. **Formal Approaches to Student Modelling**, *Student Modelling: The key to individualized knowledge-based instruction*, Greer, Jim E. and McCalla, Gordon (eds.) NATO ASI Series, Springer Verlag, 295-352
13. L. S. Vygotsky. 1978. ***Mind in Society: the Development of Higher Psychological Processes***, Harvard University Press, London.