Research Traineeships 2015

1. Title of the Project:
A Cross-linguistic Study in Processing Auditory Recursive Structures

2. Coordinators

Dr. Jun Lai (Tilburg Center for Logic and Philosophy of Science; Tilburg Center for Cognition and Communication)

Prof. dr. Emiel Krahmer (Tilburg Center for Cognition and Communication)

Prof. dr. Jan Sprenger (Tilburg Center for Logic and Philosophy of Science)

3. Project Summary

3.1. Research question

Human learners display remarkable abilities in mastering complex structures of language. Especially, children show learning amazingly even when they are exposed to limited input. It remains a fundamental issue in language acquisition how children develop their understanding about grammatical rules (Chomsky, 1957). A number of recent studies have focused on a critical aspect of syntax, i.e. hierarchical structures with center embeddings nested (De Vries, Monaghan, Knecht, & Zwitserlood, 2008; Fitch & Hauser, 2004; Perruchet & Rey, 2005). Center-embedded recursion appears in different languages, such as English, German, Japanese, etc. For example, "*The rabbit that the fox chased ran away*." is a typical center embedded sentence.

Center-embedded recursion has been claimed to be the distinguishing property of human language (Fitch, Hauser, & Chomsky, 2005; Hauser, Chomsky, & Fitch, 2002). Plenty of studies used artificial grammar learning (AGL) paradigm to explore the learnability of resursive structures such as *AA…BB*. Currently, most of the AGL studies have used visual material in training the participants to learn the recursive strutures (Bahlmann, Gunter, & Friederici, 2006; De Vries et al., 2008). By contrast, only a few experiments have adopted auditory materials (Conway, Ellefson, & Christiansen, 2003; Gentner, Fenn, Margoliash, & Nusbaum, 2006; van Heijningen, de Visser, Zuidema, & ten Cate, 2009). Nevertheless, these studies yielded diverging results on whether center-embedded recursion could be learned in the auditory modality. Therefore, in the current project, we are planning to investigate under which conditions the auditory recursive structures could be learned.

Secondly, due to the nature of artificial languages, the AGL paradigm is often critized that it cannot reflect the richness of natural languages (Arciuli & Torkildsen, 2012). Indeed, previously, most studies used auditory materials generated by speech synthesizers (Conway et al., 2003), which did not represent the real language. Therefore, in the current project, we are planning to make a closer link between the AGL paradigm and the properties of natural lanaguages. We adopt recorded human voice and add acoustic properties which would resemble the phonology of natural languages. We have manipulations in three aspects: consonants, vowels and tones.

Thirdly, we are planning to carry out a cross-linguistic comparison: Would participants with different first language (L1) process the auditory center-embedded structures differently? Previous studies showed that Finnish, Dutch, and French speakers performed different to an articial language, and they scored highest when the artificial language was closest to their L1 (Vroomen, Tuomainen, & de Gelder, 1998). Currently, we are planning to test two groups of participants, i.e. Dutch- and Chinese- native speakers. We expect a difference in performance when the center-embedded ariticial language is more similar to Dutch, which has the word-initial stress, or more similar to Chinese, which is a tonal language.

In summary, in the present project we are aiming to test: 1) under which conditions the auditory center embedded recursion can be learned; 2) whether the phonological cues, i.e. tones etc, would facilitate processing; 3) whether there is any cross-linguistic difference (L1 Dutch/Chinese) in processing auditory recursion.

3.2. Methodology

Artificial grammar learning (AGL), introduced by Reber (1967), is a classical paradigm in implicit learning fields. Nonsense symbols or sounds are composed according to certain underlying rules (Figure 1). AGL trains and tests the participants' ability in learning this "novel" language.

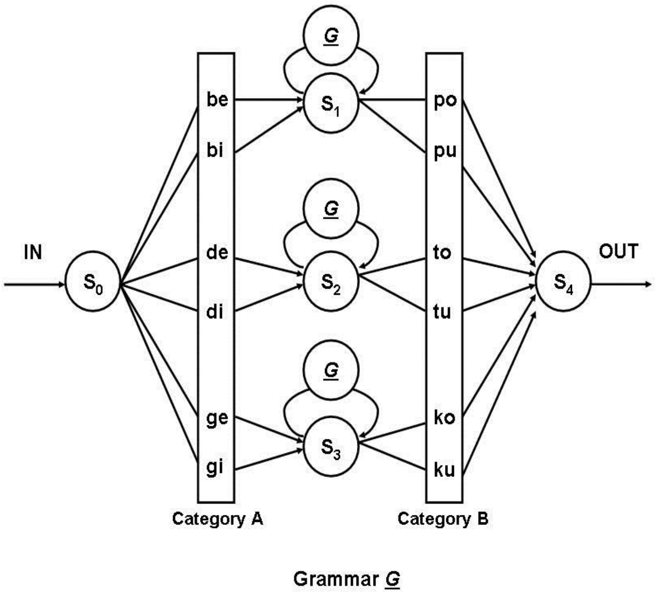

Figure 1. The schema of an artificial grammar

It contains two phases: One is the learning phase (Figure2), in which participants are trained intensively with certain number of items generated by an artificial grammar; the other is the test phase (Figure 3), in which participants would be tested with novels items, which are different from learning items.

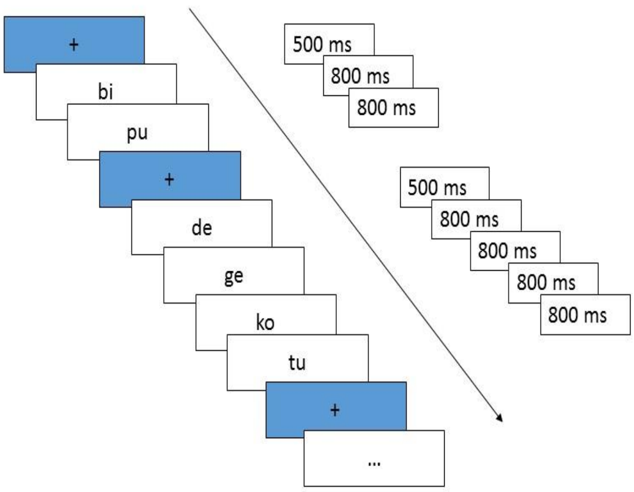

Figure 2. Example for the experimental procedure in the learning phase.

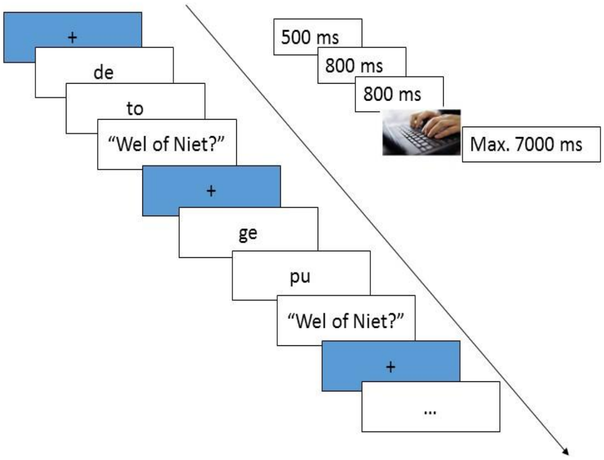

Figure 3. Example for the experimental procedure in the testing phase.

The highlighted point of AGL in the current study lies in three aspects: it controls for vocabulary, phonological and also syntactical factors which influence the processing in natural languages (Friederici, Steinhauer, & Pfeifer, 2002).

3.3. The collaborative aspects

It is a joint project between TILPS and TICC. The project aims to provide more insights and explanation to the language processing and learning.

3.4. The objective

With regard to the first aim of the present project, we have collected some preliminary results which showed that the frequency distribution of the learning material affected the processing of auditory center-embedded recursion significantly.

With the help of a research trainee, we would focus on the second and the third goals. We aim to test four groups of participants (25 participants each group, as in Table 1), collect data and report the results.

Table 1. Groups of the Experiment

Groups	**Auditory material**
Dutch L1 speaker	Artificial language + Dutch acoustic property
Dutch L1 speaker	Artificial language + Chinese acoustic property
Chinese L1 speaker	Artificial language + Chinese acoustic property
Chinese L1 speaker	Artificial language + Dutch acoustic property

Through the project, the research trainee would get basic hands-on experience on preparing and conducting psycholinguistic experiments.

4. Project timeline

Table 2. Summary for scheduled stages of the project.

Planning	Task category	Work description
Pre-stage		
		Overview of the project progress
Stage 1		
1.1	***Completed***	Test under which conditions participants could learn auditory center-embedded recursion
1.2	***Completed***	Analyse data
Stage 2		
2.1	Preparation	Construct artificial materials for learning and testing
2.2	Preparation	Record Dutch/Chinese sounds with Audacity
2.3	Preparation	Program the experiment with Eprime
Stage 3		
3.1	Data collecting	Conduct the AGL experiment in the lab
3.2	Data collecting	Conduct the working memory test for each participant
Stage 4		
4.1	Report	Analyse data
4.2	Report	Write up the results in a manuscript
Summary		
		Submit for publications

5. Research Trainee Profile

5.1. The general tasks of the research trainees:

1) assist in preparing the experimental material
2) assist in conducting the experiments and collecting data

5.2. Who can apply:

Ba, Ma, ReMa

5.3. How to apply:

Please send the application (resume, motivation letter) to Dr. Jun Lai (J.Lai@uvt.nl).

Reference

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