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Mixing Words and Emotions - New Natural Methods for Artificial Language Tutors

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In this paper we present the idea of an English tutoring system aimed to bring a new standard in language teaching. The Co-Mix project concentrates on second language vocabulary acquisition that is central to language itself and of high importance to the typical language learner. We compare some existing methods of teaching vocabulary and present the usefulness of our sentential context-learning method based on the phenomenon of code mixing. Since such a method has not yet been fully explored, we would like to progress with the research in the fields of natural language processing and artificial tutor systems. We also perform a preliminary experiment to our hypothesis on sentences with certain emotional loads. We investigate the effect of emotion on the learner's performance in studying and propose how this method can be applied in a casual conversation system with the purpose of teaching English as a second language.

1. Introduction

In recent years English has become a dominant language in over 60 countries and as an international language it is represented in every continent. Its role as a tool for cross-cultural communication cannot be neglected. With a growing necessity to study English comes problem with finding qualified teachers that would give student a chance to practice language skills and improve. However, it is not only difficult but also expensive to get such assistance on a daily basis. One of the potential ways to approach this problem is to apply conversational tutoring system that would act as a partner in discussion and serve English learners when contact with a native speaker is difficult. If such assistance is provided, the growing demand for language partners could be fullfiled. Chatterbots have been widely used in the human-computer interaction and in learning they can potentially serve not only as a task-oriented tools, but also as a companions that would build students' self-confidence in English communication. In our research we aim to design a system that would perform both functions and give students not only a chance to expand their language knowledge, but also practice with a language partner that would respond to their needs.

2. General Information

2.1 Teaching Vocabulary Methods

Human languages can be divided into two parts: one is its grammar, and the other is vocabulary. The dictionary of words is constantly expanding and growing larger every year. The problem of vocabulary acquisition is probably the biggest drawback that has to be faced in order to master the foreign language. In spoken language about 1800 words make up about 80% of the spoken corpus [McCarthy, 2004]. Because some frequent words are often repeated it is said that learners can understand a large quantity of foreign language conversation with a relatively small vocabulary [McCarten, 2007]. According to Wilkins [Wilkins, 1972] "without grammar very little can be conveyed, without vocabulary nothing can be conveyed".

During English conversational classes teaching vocabulary is a significant part of course. There have been many existing method of teaching second language vocabulary, e.g. the "diglot method" invented by Burling [Christensen et al., 2007]. In this approach foreign language ingredients are introduced gradually by using a native language storybook. This method requires a human translator that manually prepares the book and reader is exposed to more and more words and phrases expressed in foreign language. The shortcoming of this method is that student has to look up for new words in a dictionary to understand the contents of a book.

Teaching vocabulary is mostly about making students remember new language units by presenting words many times before students can succesfully memorize them. Repetition is one of the popular techniques, along with actively recalling a word to be learned. It is also important to organize words in meaningful ways to make it easier to learn just like it is often presented in textbooks, as thematic sets to benefit the memory. The other popular way to teach vocabulary is personalization, e.g. using the vocabulary meaningfully to form statements about student's everyday life, as presented in the work by Schmitt [Schmitt, 2000]. It is common to encourage students to make their own vocabulary notebooks which consist mostly of written translations of single words in list, but this method seems to be very limited without true sentences and dialogs that represents the meaning of words [McCarten, 2007].

Following Celic's belief [Celic, 2004] we assume that learners' second language vocabulary and other linguistic components are organized in the same way the synonymic expressions are organized in the first language. To be precise, there might be a link between two languages by associations and semantics; therefore it is possible to consciously switch elements between two different languages.

2.2 Code Mixing

Code mixing often occurs as as stage of bilingual children development, when they naturally mix elements of different languages and move from one system to another without

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noticeable discrimination [King, 2006]. This phenomenon reflects the transition between linguistic units (words) of one language into another, within one sentence, when original grammar of native language is usually preserved unchanged.

Code mixing occurs when a speaker takes some components of one language to use it while speaking another. Sridhar explains it as a kind of transition of units of one language (L1; mother language) to using those of another (L2; foreign language) within a single sentence [Sridhar et al., 1980], e.g. "Let's have a lunch together in the **shokudou** (cafeteria)" (English-Japanese code-mixed phrase; a real life example).

Our interest centers on using a code-mixing effect to introduce new linguistic items. The units such as words, phrases or clauses can be interchanged and by understanding the context of the whole phrase a student would be able to understand a foreign word without knowing the direct translation. By inserting a single L2 words into the L1 sentence it is possible to guess the meaning by L2 - L1 word association. Some of existing works on teaching vocabulary through code mixing, especially the one by Celic [Celic, 2004], show that this phenomenon can be effectively used during EFL (English as a Foreign Language) classes. Code mixing brings a chance for students to think deeply about new linguistic units and may bring the chance of L2 vocabulary expansion.

2.3 Emotions and Learning

Among different existing classifications of emotions we decided to follow Ekman's [Ekman, 1999] list of six basic emotions: happiness, surprise, sadness, disgust, anger and fear to make sentences in our preliminary experiment. Craig et al. [Craig et al., 2004] provides evidence for a link between learning and some affective states like confusion and boredom and points to an existing connection between emotions and learning. It has been proved that emotions modify thinking and problem solving. Some research suggested that emotional stimuli tend to be better remembered than unemotional stimuli [Bower, 1992]. There are also psychological evidences for the existence of emotional selectivity in human memory. For example, items associated with emotional reactions tend to be learned better, depending how strong was the reaction. There seems to be a memorizing advantage for affective material [Parrot et al., 2000].

We conveyed preliminary experiment to examine how emotive language with sentences that appeal to emotions will affect the learning process of test subjects and their performance. We present our findings in the fourth section of this paper.

3. Idea of English Tutoring System

3.1 Our system

In our research we are using two different baseline chatterbots. So far we have been using casual conversation system using modality and word association retreived from the Web (Modalin), developed by Higuchi et al. [Higuchi et al., 2008] in creating the baseline of our project. The basic idea is to combine a few independent modules that cooperate with each other in order to create a functional system able to perform its main function (teaching) but also to deal with other related problems. We will also implement an emotion recognition module that will recognize emotive sentences with ML-Ask, a system for affect analysis, developed by Ptaszynski et al. [Ptaszynski et al., 2009]. We are assuming that functioning emotion recognition system will help us deal with shifting attitude of users towards the system, as well as the problem of keeping user engaged and eager to continue the discussion with conversational system. The other aspect we take into consideration is humor that can be used to enchance positive and reduce negative engagement. We intend on using pun generation system made by Dybala et al. [Dybala et al., 2009]. Finally, we would like to aid non-native speakers' reading comprehension of informal English with language normalization module by Clark et al. [Clark et al., 2011].

The idea of using the other chatterbot was a consequence of occuring problems with the former one highly dependent on search engines such as Google to answer the user's utterance. For each turn of the dialogue multiple queries has to be made and it leads to overuse of search engine and, in consequence, treating the system as potential spam sender. Therefore, we consider using the second conversational agent that, unlike Modalin, uses limited amout of queries. A conversational system called Maru-Chan [Takahashi, 2009] extracts keywords from the user's utterance (nouns and adjectives) and uses them to perform fewer queries in the Google search engine.

3.2 Co-Mix Project

We started the Co-Mix project with a motivation to create a solid foundation for further research on artificial tutors. We aim to provide a functional chatterbot that would teach user a foreign language using code mixing method. We currently work on Japanese and English sentences, because Japanese are quite familiar with borrowing foreign words and using them in their own language. The popularity of katakana, one of Japanese writing systems often used to represent foreign words, indicates that such hybridization of languages may be a way to expedite students' foreign language vocabulary. Our previous experiment proved the Co-Mix method to be effective way of acquiring new vocabulary, and most of the participant succesfully remembered and recreated test sentences [Mazur et al., 2010].

4. Preliminary Experiment

We conducted preliminary experiment with 15 Japanese students (age 10-13) from local elementary and junior high schools. Test subjects were selected as a target age group that represented our future system users. The subjects were mostly males (73,3%). In this section, we will describe the purpose of the experiment, method, present the results and discuss our findings.

4.1 Purpose

The purpose of the experiment was to teach students new English vocabulary using our code mixing method. We wanted to test if the subjects are able to understand the meaning of a whole sentence in a natural way, e.g., by associating English word with its Japanese counterpart. Test subjects had to guess the meaning of new words by context of the whole sentence, without any help from dictionary. They were not told the purpose of the experiment, just simply asked to follow teacher's instructions.

For purpose of this experiment we limited our interest to replacing nouns. Gibbons's research [Gibbons, 1987] confirmed that nouns make up the most often code mixed word class, so in the first step we decided to follow that general trend.

4.2 Method

The experiment consisted of two phases:

1) Learning phase

Four pattern sentences in Japanese with English word inside were presented to test subjects. Each experiment introduced two English words. In the first round we decided to use "culture" and "sightseeing". In the second round two more, "relationship" and "announcement" were used to form sentences. The selection of the words was not accidental. We used the vocabulary list from Sunshine textbook (for third grade students), the official course book used at Junior High School in Japan, to assure that our test subjects were not familiar with this words before the test. Sentences were presented on tablet and subjects were asked to read them loud from the screen. The learning phase took approximately 1 minute for each subject (about 20 seconds for each question).

We double-checked by asking our subjects after the test whether they knew presented vocabulary. 87% of subjects never heard any of presented words before the experiment and 13% mentioned they may have heard it before, but they were not sure of the meaning. The participants were asked to memorize Japanese sentences with English nouns replacing Japanese counterparts. All the pattern sentences in the learning phase were used in a correct context that corresponded to the presented vocabulary.

2) Testing phase

We performed two separate tests to check the effect of emotions on problem solving: one with plain sentences without emotional load and the other one with sentences that convey emotions to see to what extent they can modify participants thinking and influence the test results. The order of questions was randomized. Each set consisted of 8 sentences. Half of the sentences were semantically correct and the rest were wrong, i.e., they used the English noun in the wrong context. The subjects were given two minutes to read sentences and decide if they are correct or not ("O" for yes and "X" for no). After the second turn of the experiment we checked students' understanding of presented vocabulary to assure if they properly learned the new lexic.

Example sentences:

Sentences with no emotional load:

- Kaigai ni sunde iru indojin ni totte wa, boukoku no **culture** wo ikasu no ga juuyou desu.

(Translation: For Indians who live overseas, keeping their home culture (alive) is important.)

- Kyoto **sightseeing** wa aki ga ichiban yoi to omoimasu.

(Translation: As for sightseeing in Kyoto, I think that autumn is the best.)

Sentences that convey emotions:

- Gakkou no tomodachi ga tenkou ni naru to iu **announcement** ga kite, ima wa kanashii desu.

(Translation: There was an announcement that my friend will transfer schools, so I'm lonely.)

- Shiawase to okane wa amari **relationship** ga nai no de, kyuuryou no hikui hito de mo ureshiku naremasu.

(Translation: There's not much relationship between money and happiness, so even people with low income can be happy.)

Wrong sentences with a semantic mistake.

- Resutoran de **announcement** wo chuumon shitara, oishikunakatta no de kanashikatta desu.

(Translation: I ordered announcement in the restaurant, but it was not tasty, so I was sad)

- Kare no **sightseeing** ga warukatta no de, jugyou wo yasumimashita.

(Example: Because his sightseeing was bad, he was absent in the class.)

4.3 Results

We present the results of the preliminary experiment in understanding the sentences using our context learning method based on code mixing phenomenon.

The results of both tests are compared in Table 1. Numbers 1 and 2 indicate the particular test phase, with emotive and non-emotive sentences. The maximum score the participants could receive was 120. We also present the percentage of correct answers for each question in Table 2 in both experiment phases Highest and lowest scores are indicated in bold.

Test number	Number of correct answers	Percentage of correct answers
1	99 out of 120	82.5%
2	95 out of 120	79.1%

Table 1: The results of preliminary experiment compared in both phases and presented by number and percentage of correct answers.

Test number	Question number (8 – 1)							
	8	7	6	5	4	3	2	1
1	86.6	86.6	**93.3**	80	**93.3**	80	80	60
2	80	86.6	**93.3**	**40**	**93.3**	66.6	80	**93.3**

Table 2: The percentage of correct answers for each question in both phases.

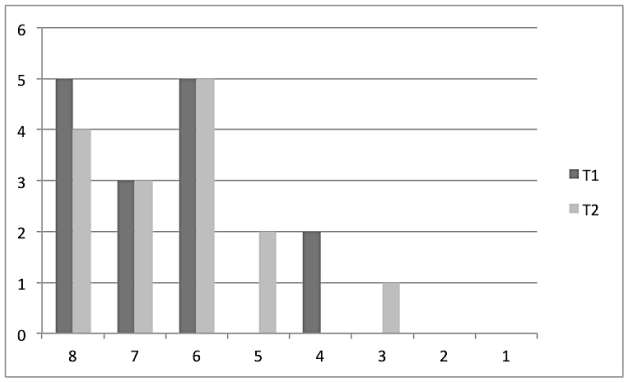

Figure 1: Comparative user results of target vocabulary comprehension for all participants in both tests. Horizontal axis shows the number of participants (out of 15) and vertical axis represents the number of correct answers.

4.4 Discussion

After analyzing the result we came to the conclusion that: a) the percentage of correct answers in both phases were relatively high which proves that code mixing method may be the effective way of presenting new vocabulary units; b) since 87% of subjects were not familiar with presented vocabulary before the test, we can assume that they succesfully linked two languages by associations and semantics, thereby understood the foreign word without the direct translation; and c) by getting a higher percentage of correct answers for each question in the second phase and a larger variety of scores compared to the first phase, it can be interpreted that sentences with emotions have an impact on participants' responses.

Although we expected that emotional sentences will be easier to memorize and results will be higher, there was a 3.4% difference between the number of correct answers in both phases, in favor of non-emotional sentences. We speculate that this may be due the fact that sentences in second phase were significantly longer and thus perhaps more difficult to process and rationalize. After further analyzing the participants results we found out that one of the presented sentences in the second phase caused a particular comprehension difficulties, with only 40% of correct answers. As a result, this question negatively influenced the final score. It is also worth noticing that the percentage of correct answers for three questions in second phase was higher than in the first phase, as it has been shown in results.

In an attempt for further investigation of results we decided to see how excluding of the question with the lowest score will influence the overall percentage of correct answers. To keep the balance between both tests we also excluded the corresponding question from the first phase. As an outcome we noticed that the second phase had 1.8% higher score than the first phase (77.6% correct answers in first test and 79.4% for second test).

In spite of the gap between the scores received by the participants in two phases, the ambiguity of scores in the second phase shows that this matter should be a subject of further investigation. This gives us an insight about the influence of emotions on the process of human reasoning and motivation to further investigate that matter.

5. Conclusion and Future Works

In this paper we described the idea of an English tutoring system aimed to bringa new approach in language teaching. With the results of our preliminary experiment in understanding the code mixed sentences, we have shown that our method might be an effective way of expanding students' second language vocabulary.

The high percentage of correct answers, making succesful connection between meanings of words in two languages and finally the ambiguity of results gave us the motivation for further study of this matter. In the next step we plan to carry on another experiment on a wider scale for more conclusive results. We will also test our method on sentences with emotions expressed by emoticons. By doing so, it will be possible to shorten the test sentences. Then, we plan to implement this method into the chatterbot to see how it would function in casual conversation.

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