Motivational Strategies Enhanced Conversational Agent to Increase L2 Learners’ WTC

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Abstract: In this paper, we implement and discuss the effectiveness of an embodied conversational agent enhanced with two strategies, namely Affective Backchannels (AB) and Communication Strategies (CS), dedicated to enhance L2 learners’ willingness to communicate in a second language. An evaluation of the proposed method led to two main findings. First, combining CS and AB empowers the conversational agent, making possible highly significant WTC gains among L2 learners in English as a foreign language context. Secondly, even a single implementation of AB proved to have the potential to enhance L2 learners’ WTC to some extent. Moreover, most of learners after interacting with both single (CS or AB implemented) and hybrid implementation (CS and AB implemented) of the system revealed that they preferred the hybrid version.

1. Introduction

In many countries especially in Japan, although more attention is being given to speaking by emphasizing the importance of communicative skills in a second language, most students hesitate to speak in English even after studying it for six years in secondary school. MacIntyre et al. [1] suggested that the key factor predicting frequency of L2 use is the willingness to communicate (WTC) in L2, defined as a “readiness to enter into discourse at a particular time with a specific person or persons, using an L2”. Moreover, they proposed a pyramidal heuristic model of variables affecting WTC in which it appears that the environment where learners experience or practice the L2 plays an important role in motivating them to actively take part or not in L2 conversation. However, many learners feel a genuine anxiety about performing in front of others, and many classrooms do not, as a result, offer learners much in the way of communicative practice as would be desirable [2].

Following our previous work [3] in which we showed that a dialogue agent based conversational environment might be effective to increase L2 learners’ WTC, we propose and evaluate a dialogue management model based on a set of strategies dedicated to foster conversational agents ability to carry on WTC effective conversations with L2 learners in English as a Foreign Language (EFL) context.

2. Related Works

L2 learners’ apprehension towards communication in L2 may arise from a variety of factors. According to MacIntyre et al. [1], anxiety, self-perceived communicative competence as well as the desire to communicate in a specific context are important affective factors directly influencing individuals’ readiness to communicate in the L2. Many studies have investigated the relationship between L2 WTC and those affective factors and it was found that in general, the combination of a low level of anxiety about L2 communication and a sufficient level of self-perceived communicative are strong predictors of WTC in the L2 (MacIntyre & Charos [4]; Yashima [5]; Clément et al. [6]). These consistent findings indicate that learners who experience a lower level of communication anxiety and who have a higher perception of their communicative competence tend to be more willing to take part into L2 communication [2].

Furthermore, WTC studies have shown that learners displaying high WTC are more likely to show more improvement in their communication skills [7] and to acquire higher levels of language fluency [8]. Thus, not only increasing learners’ WTC should be considered as a suitable goal for L2 learning, but also any attempt to enhance L2 learners’ WTC should include an effective support to the affective variables mentioned above.

However, it is interesting that even though research investigating computer-mediated communication in the
context of second language acquisition (SLA) has proliferated since more than two decades now, only few of them have actually investigated or proposed practical ways to enhance L2 learners’ WTC. Compton [9], for example, revealed that chatting helped students to feel confident and consequently, willing to participate orally in class discussions. However, its impact on WTC varied from learner to learner and was dependent on a number of factors, particularly the topics of discussion and the attitudes of their partners. Among the few research studies dedicated to propose a computer-based approach to increase levels of L2 WTC, less effort has been expended on investigating usage of virtual realistic interfaces such as embodied conversational agents, which yet seem to have the potential to be an efficient alternative to real interactions.

In our previous work, we proposed an embodied conversational agent based on MacIntyre’s WTC model to help increase L2 learners’ WTC by providing learners with opportunities to naturally simulate daily conversations in various social contexts [3]. Our evaluation of the system demonstrated its potential to simulate efficiently natural conversations in a specific context as well as the feasibility of improving learners’ WTC using a computer-based environment. Nevertheless, conversation opportunities alone are not enough to motivate learners towards communication in L2. It also requires a good level of empathetic and communicative support, to be achieved by implementing specific strategies to keep the conversation going on especially when learners face some difficulties.

3. Conversational Strategies to Increase WTC

3.1 Philosophy

In order to enhance L2 learners’ willingness to interact, it is important to increase their self-confidence and reduce their anxiety since there is much evidence that if communication apprehension recedes, an individual’s perceived competence is likely to be higher, leading to a greater level of WTC [10]. The model that we propose aims to enable conversational agents to motivate adequately L2 learners by the way of a set of two conversational strategies namely Communication Strategies (CS) and Affective Backchannels (AB).

<table>
<thead>
<tr>
<th>Table 1 Examples of CS implemented</th>
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<tbody>
<tr>
<td><strong>Strategy</strong></td>
</tr>
<tr>
<td>Simplification or Approximation</td>
</tr>
<tr>
<td>Code switching</td>
</tr>
<tr>
<td>Ask clarification</td>
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</table>

3.2 Conversational Strategies

Communication Strategies (CS): CS are “a systematic technique employed by a speaker to express his or her meaning when faced with some difficulty” [11]. These difficulties might arise either from the speaker (lack of linguistic resources) or from the interlocutor (impossibility to understand the speaker). It is worthwhile for learners to have a repertoire of such strategies at their disposal, whereby they achieve a degree of communicative effectiveness beyond their immediate linguistic means [12]. Nevertheless, in the case of learners with a low WTC, mastering such strategies does not necessarily guarantee that learners will be able to use them when they face some trouble during conversation since they are more likely to remain silent.

The alternative and indeed interesting approach that we propose is to foster the dialogue agent’s own strategic competence. Mastering of CS might help dialogue agents not only to overcome their own difficulties (impossibility to understand the learner…) but also and more importantly to anticipate or handle more effectively communication pitfalls (difficulty in understanding or answering) that learners may encounter during conversations. When learners feel that they are able to engage in more or less smooth conversations without fearing communication pitfalls, we think that their reticence towards communication might be reduced. As stressed by Clément et al. [6], although actual competence might encourage communication, it is the
perception of that competence that will ultimately determine the choice of whether to communicate or not.

In the present study, we targeted about 9 strategies among those defined in the comprehensive review of definitions and taxonomies of CS [11]. The selected strategies were chosen according to two criteria: (i) their effectiveness towards encouraging WTC and (ii) the feasibility of their implementation from the technical standpoint. Table 1 shows a non-exhaustive list of the selected strategies as well as examples of their usage in this study.

We expect that using CS might contribute to enhance L2 learners’ perceived communicative competence or self-confidence.

**Affective Backchannels (AB):** Backchannels are generally defined as a type of short utterances or feedbacks such as uh-huh, yeah… given by the listener to show interest, attention or a willingness to keep the communication channel open. They play an important role in human agent conversation [13]. Moreover, previous works by Kopp et al. [14] as well as Morency et al. [15] have amply demonstrated the importance of such backchannels in human-agent conversation. As pointed out by Lambertz [16], backchanneling skills are important in order to function as supportive and engaged listeners in conversation. According to McCroskey et al. [17], the degree of attention from others that a learner gets, might be one of the causes of the communication apprehension that he/she feels. Thus, L2 learners who don’t get enough supportive feedbacks from their interlocutors may easily perceived themselves as being incompetent communicators and therefore tend to be reticent to communication. All this gives much evidence that it might be effective for a conversational agent intending to enhance learners’ WTC, to function as supportive and engaged listeners by conveying a sufficient amount of interest or sympathy to learners during the interaction. In order to achieve such empathetic support to L2 learners in a computer-mediated interaction, we identified and defined a set of backchannels that we call Affective Backchannels (AB).

Table 2 shows the different categories of AB that we defined in order to cover a wide range of situations the learner can be in during the interaction. When learners know that they can rely on a supportive dialogue partner (conversational agent), they may feel a “sense of security” that can reduce their anxiety, leading to a lower level of communication apprehension.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congratulatory AB</td>
<td>Employed when the conversation with the learner is going well as expected.</td>
<td>Okay, that’s nice!</td>
</tr>
<tr>
<td>Encouraging AB</td>
<td>Employed when the learner seems to hesitate to the extent that he/she remains silent.</td>
<td>Come on, you can do it!</td>
</tr>
<tr>
<td>Sympathetic AB</td>
<td>Employed when the learner’s utterance does not match the agent expectations.</td>
<td>Sorry I couldn’t get you dear</td>
</tr>
<tr>
<td>Reassuring AB</td>
<td>Employed when the learner seems to face much difficulties in the conversation.</td>
<td>Don’t worry dear!</td>
</tr>
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</table>


The core architecture of our conversational agent was developed in our previous work [3] and is composed of two main components (the dialogue manager and the multimodal response generator) connected to several external web-services and resources as shown in fig. 1(top). The overall conversational flow is under the supervision of the dialogue manager, which controls the various phases of dialogue and their timing, as well as the level of system initiative, in an integrated fashion. As described in fig.1 (bottom), the dialogue strategies management routine goes from **Start** to **End** (top to bottom of the figure) passing through checking of the different possible dialogues states represented in the diamond symbols. The occurrence of each of such dialogue states automatically leads to triggering of adapted conversational strategies (as indicated in square symbols) that are pull out from their respective databases (as indicated by dotted lines) in order to keep the learner motivated using AB (represented in “double line” database symbols on the left of the figure), and try to move the dialogue forward using CS (represented in database symbols on the lower part of the figure). The decision to engage a specific conversational strategy is mainly based on the following triggering events or dialogue states:

- **The learner is silent:** when the system is expecting some input from the learner but cannot get any after a certain amount of time is elapsed. In such case, the system will first apply a set of Reassuring and Encouraging AB and then investigates the reason why
The learner remains silent.

- **The learner is NUNA (Not able to Understand, Nor to Answer):** when the learner is not able to get what the agent is expecting from him. In such cases, the system will fire up specific CS such as Simplification in order to let the learner understand and hopefully utter the expected information.

- **The learner is UNA (able to Understand but Not able to Answer):** when the learner understands what is being requested from him but can’t or don’t know how to answer. In this case, CS such as Suggest an Answer Pattern will be applied in order to help the learner overcome his current difficulty.

- **The learner is asking for help:** when the learner expresses that he is NUNA, UNA or specifically requests a CS such as Repetition or Simplification. In this case, the system will fire up a Reassuring AB and then apply appropriate CS according to the nature of the help requested by the learner.

- **The agent is NUNA:** when the system is unable to detect the learner’s intention due to a very low confidence score or the occurrence of a recognition error.

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**Figure 1** System architecture showing interface (top), Dialogue management model based on AB and CS (bottom)
error of the learner’s utterance. In this case, the system will first output a Sympathetic AB and then try to recover by applying CS such as Ask repetition in order to give the learner another chance to express his intention. 

**The agent is UNA:** when the system is able to detect the learner’s intention with an acceptable confidence rate but is not expecting such intention in the current dialogue context (for example, the learner asking for the nearest supermarket while the agent is expecting him to make an order in a restaurant context). In this case, the agent will first apply a Sympathetic AB and then try to get the learner reformulate his intention by using CS such as Ask confirmation in order to make sure that what the system understood from the learner’s utterance is actually what the latter meant.

We expect that the modular and domain independent nature of the proposed dialogue management model will not only facilitate its reusability across different dialogues domains, but will also make easier the development of conversational spoken languages interfaces that are fully adapted to L2 learners from the WTC standpoint.

### Experimental Study

We conducted an evaluation of the proposed dialogue management model in this paper to clarify the following preoccupation: Does the usage of CS and AB really have the potential to empower the conversational agent to the extent to foster L2 learners’ WTC?

#### 5.1 Procedures and Materials

We used a conversational agent based on the system architecture proposed in our previous work [3], and enhanced it with the management model described above. The system makes possible spoken dialogues between the conversational agent personified as Jack, on one hand and learners on the other. For this study, the participants were 40 Japanese undergraduate and graduate students currently attending a Japanese university. The evaluation was conducted following 5 procedures as described in Table 3.

**Table 3 Overview of the evaluation flow**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Group 1 (n=10)</th>
<th>Group 2 (n=10)</th>
<th>Group 3 (n=10)</th>
<th>Group 4 (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure 1</td>
<td>First WTC questionnaire (Pretest)</td>
<td>CS+AB¹</td>
<td>CS+AB²</td>
<td>CS</td>
</tr>
<tr>
<td>Procedure 2</td>
<td>CS+AB²</td>
<td>CS</td>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>Procedure 3</td>
<td>Second WTC questionnaire (Posttest)</td>
<td>CS</td>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>Procedure 4</td>
<td>CS</td>
<td>AB</td>
<td>CS+AB</td>
<td></td>
</tr>
<tr>
<td>Procedure 5</td>
<td>System preference survey</td>
<td>CS+AB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 shows an excerpt of conversation between a learner and the agent depicting how AB and CS are called into action according to the different dialogue states. As shown, the successive interventions of the system are successful in gradually helping the learner overcome his initial breakdown following the question “Would you prefer smoking or non smoking table?” As illustrated, it is the successful detections of the occurring pitfalls combined with the help provided by the agent through usage of appropriate AB and CS that finally led to a conceivable answer “Non-smoking please” from the learner. Without the use of such strategies, the conversation would have probably ended up just after the agent’s first question since the learner seemed to be unable to go further into the interaction. It is this kind of support that our dialogue agent aims to provide to L2 learners through usage of AB and CS.

Figure 2 Excerpt of actual dialogue between the agent and a learner illustrating use of AB and CS
pretest) they interacted with the system in procedure 2. The WTC questionnaires targeted three variables: confidence, anxiety and desire to communicate considered as the immediate precursors of WTC [4]. In the WTC questionnaires, participants were asked to rate each of these variables in 30 scenarios (e.g., Making a telephone call in order to make a reservation at a hotel in an English speaking country) related to using English in various circumstances with a four-point Likert scale.

The WTC questionnaire used in Procedure 3 (Posttest) was similar to the questionnaire described above but differed in that participants were asked to rate the same scenarios imagining how high their confidence, anxiety, and desire would be if they were able to frequently interact with our conversational agent. All participants were given as much time as required to complete the questionnaires. Data were collected anonymously via an online survey service and participants were told that their answers would be kept confidential.

In order to minimize order effects, we carefully designed learners’ interactions with the system in each group applying the counterbalancing method proposed by Howitt and Cramer [19].

Procedure 2 (First Interaction with Jack): All the participants were initially asked to interact with Jack, who would teach them how to pronounce some words in English. They were requested to listen and repeat the words according to Jack’s instructions. In reality, our intention here was to let all the learners sympathize with Jack and understand how the system works. Then, participants were divided in four groups (Group 1 to Group 4) of 10 participants each, and asked to interact with the system, the conversation being held this time in a restaurant context with Jack interacting with them as a waiter. It is important to mention that each participant interacted individually with the system in a room specially prepared for the evaluation and were given as much time as they wish to enjoy the conversation with Jack until they were requested to pay the bill by the waiter. They were also informed that they were free to interrupt the interaction at anytime in case they feel to do so. We prepared 3 different versions of the system: the CS+AB version (with both CS and AB implemented), the CS version (with only CS implemented) and finally the AB version (with only AB implemented). Participants interacted with a version of the system according to their group. For example, participants in Group 1 interacted with the CS+AB version, those of Group 3 with the CS version and so on, as indicated in Table 3.

Procedure 4 (Second Interaction with Jack): After taking the second WTC questionnaire (posttest) in procedure 3, participants were asked again to interact with the system in a restaurant context. As in Procedure 2, participants interacted with different versions of the system according to their groups but were not informed that the system is different from the one they used in their first interaction.

Procedure 5 (System preference survey): After procedure 4 described above, all participants were asked to choose which one of the two interactions (i.e.: which version of the system) they preferred the most as well as the reason supporting their choice. For example, participants in Group 1 had actually to choose between the CS+AB and the CS version, those of Group 2 between the CS+AB and the AB version, and so on for participants in Group 3 and Group 4.

From the WTC standpoint, we assume that the results would be viewed as positive if the interaction with the conversational agent led to improving participants’ confidence and desire to communicate while reducing their anxiety since those variables have been identified to have a direct influence on L2 learners’ WTC [4].

5.2 Results

Figure 3 shows WTC variations observed across the 4 groups before and after participants’ interactions.

First of all, by just comparing means of pretest scores with posttest scores as shown in fig. 3, we notice that WTC gains (increase in confidence and desire to communicate with decrease in anxiety) were observed across all groups, irrespective of the system version (CS+AB, CS or AB). Then, we performed paired samples t-tests to evaluate how significant were the WTC gains according to each group. The obtained results are as follows:

There were statistically highly significant differences between the first and the second WTC questionnaires administrated to participants in Group 1 and Group 2 after they interacted with the CS+AB version. Actually, their confidence and desire to communicate increased respectively by +0.60 [t(9) = -8.91, p<.001] and +0.63 [t(9) = -5.80, p<.001] in group 1, +0.70 [t(9) = -4.53, p<.01] and +0.64 [t(9) = -8.05, p<.001] in group 2, while their anxiety decreased by -0.64 [t(9) = 4.42, p<.01] in group 1 and by -0.80 [t(9) = 6.63, p<.001] in group 2.
There were not statistically significant gains in terms of WTC among participants in Group 3.

There were statistically significant differences between the two WTC questionnaires among learners in Group 4 after they interacted with AB version. Actually, their confidence and desire to communicate increased respectively by +0.50 [t(9) = -2.82, p<.1] and +0.33 [t(9) = -2.35, p<.1] while their anxiety decreased by -0.58 [t(9) = 3.48, p<.01].

Besides, the preference rate of the CS+AB version was constantly high across all the 4 groups being preferred by 32 participants out of 40 (80%) in total, while the CS and AB version have been preferred respectively by 5 participants out of 20 (25%) and 3 participants out of 20 (15%) as shown in fig. 4. It is important to mention that this tendency has been observed across all the 4 groups no matter the order in which learners interacted with the CS+AB version. Participants who preferred the CS+AB version actually mentioned that they found natural and warm the way Jack showed some empathy throughout the interaction and also appreciated the help they got from him when facing difficulties in understanding or expressing what they have got to say.

5.3 Discussion and Limitations

The results above allow us to draw a number of preliminary conclusions. Firstly, the combination of CS and AB proved to be really effective in motivating L2 learners, much more than just implementing CS or AB alone. This is supported by both the statistically highly significant WTC gains observed among groups of participants that interacted with the CS+AB version of the current system, and the positive feedbacks that we got from them regarding the reason why they preferred the CS+AB version. This confirms our initial beliefs that making possible smooth and interactive conversations by using CS is not, by itself sufficient to increase effectively L2 learners’ WTC, which also requires the ability to convey a sufficient amount of warmness or sympathy to learners during the interaction via AB. The proposed dialogue management model in this paper covered both of these requirements and the results obtained are meaningful in terms of validating the proposed model.

More interestingly, the results suggest that even a single implementation of AB could be quite effective in significantly reducing not only learners’ anxiety but also in increasing their WTC. This is a really interesting finding since it seems to reveal that the support that learners get in terms of reducing their communication anxiety during interactions might be a very important key factor influencing their WTC.

Nevertheless, a possible limitation of this study is that the current version of our system is limited to conversations in only one context (restaurant context). We understand that learners’ WTC, of course, do not increase overnight and a certain amount of continuous usage of the current system with the possibility for learners to converse in various contexts is certainly necessary before we can collect more reliable data to support our findings.
6. Conclusion

This paper has described a dialogue management model based on a set of two conversational strategies (CS and AB) aiming to empower conversational agents in order to foster L2 learners’ WTC in EFL context.

The evaluation results showed that the combination of CS and AB as proposed here is particularly effective considering the high WTC gains observed among participants who interacted with the CS+AB version of the system. We also found that even a single implementation of AB has the potential to enhance L2 learners’ WTC to a certain extent.

Future research should be directed to propose an authoring framework allowing an easy implementation of several daily conversation contexts in the current system. Also, we will confirm the tendencies evoked above by evaluating in more details effects associated with each strategy (CS or AB), and finally carry out mid-long term evaluations about the outcomes of our approach on learners’ actual involvement in communication.

References


