

# A chatbot for a dialogue-based second language learning system

Jin-Xia Huang<sup>1</sup>, Kyung-Soon Lee<sup>2</sup>,  
Oh-Woog Kwon<sup>3</sup>, and Young-Kil Kim<sup>4</sup>

**Abstract.** This paper presents a chatbot for a Dialogue-Based Computer-Assisted second Language Learning (DB-CALL) system. A DB-CALL system normally leads dialogues by asking questions according to given scenarios. User utterances outside the scenarios are normally considered as semantically improper and simply rejected. In this paper, we assume that raising the freedom of dialogue can stimulate the user's interest in learning. For this, a chatbot based on a search engine with a dialogue corpus has been developed to deal with conversations out of the scenarios. We evaluate the chatbot separately in two different cases: as an independent bot and as an auxiliary system. The results showed that, unlike the independent chatbot system, the chatbot as an auxiliary system showed a much lower turn success ratio.

**Keywords:** chatbot, computer-assisted second-language learning system, dialogue-based CALL, dialogue system.

## 1. Introduction

Dialogues between a user and a DB-CALL system normally need to follow given scenarios on chosen topics. It is a system that leads dialogues by asking questions. The language learner needs to answer the questions (Lee et al., 2011). The system evaluates the answers to see if they are appropriate for the given question (Kwon et al., 2015). Such evaluation is totally based on the given scenarios and so utterances outside the scenarios would be considered as semantically improper

---

1. Electronics and Telecommunications Research Institute/Chonbuk National University, Daejeon, Korea; hgh@etri.re.kr

2. Chonbuk National University, Jeonju, Korea; selfsolee@chonbuk.ac.kr

3. Electronics and Telecommunications Research Institute, Daejeon, Korea; ohwoog@etri.re.kr

4. Electronics and Telecommunications Research Institute, Daejeon, Korea; kimyk@etri.re.kr

**How to cite this article:** Huang, J.-X., Lee, K.-S., Kwon, O.-W., & Kim, Y.-K. (2017). A chatbot for a dialogue-based second language learning system. In K. Borthwick, L. Bradley & S. Thouéšny (Eds), *CALL in a climate of change: adapting to turbulent global conditions – short papers from EUROCALL 2017* (pp. 151-156). Research-publishing.net. <https://doi.org/10.14705/rpnet.2017.eurocall2017.705>

and rejected by the system. This means that even meaningful conversations are perceived as errors.

In this paper, we present a DB-CALL system which adopts a chatbot to enable free conversations between the learner and the system. We also investigate what preparation a chatbot needs to assist a DB-CALL system.

## 2. GenieTutor – a task-oriented dialogue system for second-language learning

We developed GenieTutor, a DB-CALL system for English learners in Korea several years ago. At first, it was a role-play dialogue system for second language learners (Kwon et al., 2015). After that, an upgraded version of GenieTutor was developed. Our goal was to increase the freedom of the user's conversation so that it would become more like a conversation between people. In order to achieve this, topics were considered as tasks, which could be separated into several smaller subtasks; the execution of some of the subtasks could, in turn, be independent of the orders. As a result, a certain degree of freedom in the order of utterances was allowed (Choi, Kwon, Kim, & Lee, 2016; Kwon, Kim, & Lee, 2016). For example, for a task of 'ordering food', which consisted of subtasks '[greeting] >> choose main dishes > choose side dishes > pay the bill >> [greeting]', the sub-task [greeting] can be skipped, and the user can choose side dishes with the main dishes at once and then just ask for the bill.

Despite a greater degree of freedom, user utterances could still be rejected – the reason might be a lack of keywords which are necessary for the user utterances, or the utterances might be outside the scenarios. In either case, the system would treat them as “unknown utterances”, and ask the user to re-utter their responses again. Here is an example - the system simply repeats its previous utterance of “Your total comes to 160 dollars”, when the user answers with “I don't have money” which is an utterance outside the scenario:

System: Your total comes to 160 dollars.

User: I don't have money.

System: Your total comes to 160 dollars.

User: Here you go.

We performed a user evaluation on this system, where a question was asked: “Do you think the out of topic conversation (free talking) function is necessary for a DB-CALL system?”. About 66.7% of 30 participants answered with “necessary” or “very necessary”. This percentage increases to 86.7% for intermediate level learners. Considering only 46.7% of the elementary level learners were positive, higher level learners prefer to learn language through free dialogue (Table 1).

Table 1. User evaluation on GenieTutor: “Is out of topic conversation necessary?”

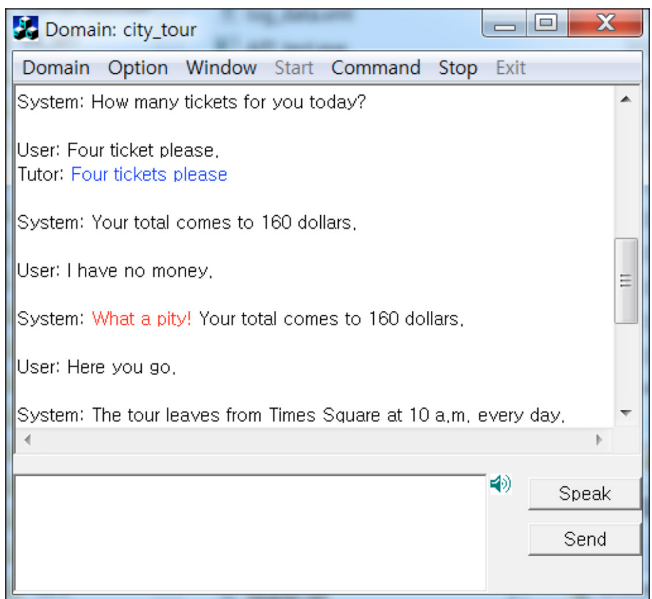
Answer	Elementary level learners	Percentage	Intermediate Level learners	Percentage	In total
5: Very necessary	5	33.3%	5	33.3%	33.3%
4: Necessary	2	13.3%	8	53.3%	33.3%
3: Not sure	3	20%	0	0%	10.0%
2: Not necessary	3	20%	2	13.3%	16.7%
1: Very unnecessary	2	13.3%	0	0%	6.7%
In Total	15	100%	15	100%	100%

### 3. GenieTutor Plus – allows free conversations with chatbot

To meet the user needs shown in Table 1, a chatbot was considered necessary for the DB-CALL system. A search-based chatbot was developed to assist GenieTutor to allow users to have free conversations with the system. The dialogue is still mainly based on scenarios. However, if the semantic correctness evaluation module determines that the user utterance cannot be classified to any predefined dialogue acts, it would be considered as an out-of-task utterance, and responded to as such by the chatbot.

The main purpose of the DB-CALL system is to help learners practice given dialogues. To fulfill this purpose, right after the chatbot response, the system would induce the user to return to the topic conversation by speaking in accordance with the scenario. For example, when a user presents “I have no money”, the system will utter “What a pity!” with the chatbot, and then repeat “Your total comes to 160 dollars” according to the scenario (Figure 1). The sentences presented by the chatbot are highlighted in red.

Figure 1. GenieTutor with chatbot



The search engine Indri (Strohman, Metzler, Turtle, & Croft, 2005) was adopted to retrieve the most similar dialogue examples from a dialogue corpus. Each dialogue example contains two utterances, called a turn in the dialogue system: a query uttered with a reply. As most of the dialogues consist of short sentences (which is different from document retrieval), a rescoring function was adopted to re-rank similar examples. In the case of a lack of a similar example, an utterance was randomly output to the user, which was supposed to be similar to a topic change in human conversation.

About 410,000 turns are contained in the corpus, of which 18,000 were developed by human developers, 237,000 were extracted from the MovieDic corpus (Banchs, 2012), and another 155,000 were collected from various educational or traveling materials, which have been developed over the recent decades for dialogue machine translation purposes.

#### 4. User evaluation

Firstly, the chatbot was evaluated as an assistant module of GenieTutor Plus. The learners were required to have conversations with the system. The users were

---

allowed to enjoy free talking with the system (non-topic related conversation), while all subtasks had to be finished to achieve the task. The turn success ratio was evaluated as the ratio of system responses which were evaluated as ‘proper’ to user utterances. Twenty English learners participated in the evaluation on topics including ‘buying city-tour tickets’ and ‘ordering food’. An evaluation on the independent chatbot was also performed. The users were required to chat with the chatbot freely, with at least twenty turns being uttered.

Table 2. User evaluation on the chatbot as an auxiliary system of DB-CALL versus as an independent system

Topic	Turn success ratio (topic and non-topic)	Non-topic user utterances	Turn success ratio (non-topic)
Chatbot for GenieTutor Plus	71.30%	8.38%	33.33%
Independent chatbot	-	100%	52.78%

From Table 2, we can see that, compared with an independent bot, the chatbot has a lower success ratio as an assistant bot for a DB-CALL system. The reason is that users tended to evaluate a non-topic response in the context of the topic conversation on a more stringent basis. For example, the following system utterances would be acceptable if they were uttered by an independent chatbot, but would be considered as improper if they happened during a food ordering task, in which the DB-CALL system acted in the role of waiter:

System: Would you like something to drink?

User: Nothing.

System: It is a damned ugly nothing.

## 5. Conclusion

In this paper we introduced a chatbot to a DB-CALL system to deal with out of topic user utterances, so that the conversation could be more natural, like a conversation between people. However, the turn success ratio of such free-talking in a DB-CALL system was lower than with an independent chatbot. We would like to continue our research to extract small but more suitable dialogue corpus for each topic in the DB-CALL system.

## 6. Acknowledgements

This work was supported by the Institute for Information & communications Technology Promotion (IITP) grant funded by the Korea government (MSIT) (R0126-15-1117, core technology development of the spontaneous speech dialogue processing for language learning), and Electronics and Telecommunications Research Institute (ETRI) grant funded by the Korea government (17ZS1210, strengthening competitiveness of automatic translation industry for realising a language barrier-free Korea).

## References

- Banchs, R. E. (2012). MovieDic: a movie dialogue corpus for research and development. *Proceedings of ACL* (pp. 203-207).
- Choi, S.-K., Kwon, O.-W., Kim Y.-K., & Lee, Y. (2016). Using a dialogue system based on dialogue maps for computer assisted second language learning. In S. Papadima-Sophocleous, L. Bradley & S. Thoušny (Eds), *CALL communities and culture – short papers from EUROCALL 2016* (pp. 106-112). Research-publishing.net. <https://doi.org/10.14705/rpnet.2016.eurocall2016.546>
- Kwon, O.-W., Kim, Y.-K., & Lee, Y. (2016). Task-oriented spoken dialog system for second-language learning. In S. Papadima-Sophocleous, L. Bradley & S. Thoušny (Eds), *CALL communities and culture – short papers from EUROCALL 2016* (pp. 237-242). Research-publishing.net. <https://doi.org/10.14705/rpnet.2016.eurocall2016.568>
- Kwon, O.-W., Lee, K., Roh, Y. H., Huang, J. X., Choi, S. K., Kim, Y. K., Jeon, H. B., Oh, Y. R., Lee, Y. K., Kang, B. O., Chung, E., Park, J. G., & Lee, Y. (2015). GenieTutor: a computer assisted second-language learning system based on spoken language understanding. *Proceedings of the 2015 International Workshop on Spoken Dialogue Systems* (pp 257-262). [https://doi.org/10.1007/978-3-319-19291-8\\_26](https://doi.org/10.1007/978-3-319-19291-8_26)
- Lee, S., Noh, H., Lee, J., Lee, K., Lee, G. G., Sagong, S., & Kim, M. (2011). On the effectiveness of robot-assisted language learning. *ReCALL*, 23(1), 25-58. <https://doi.org/10.1017/S0958344010000273>
- Strohm T., Metzler, D., Turtle, H., & Croft, W. B. (2005). Indri: a language model-based search engine for complex queries. *Proceedings of the International Conference on Intelligence Analysis*.

Published by Research-publishing.net, not-for-profit association  
Contact: [info@research-publishing.net](mailto:info@research-publishing.net)

© 2017 by Editors (collective work)  
© 2017 by Authors (individual work)

**CALL in a climate of change: adapting to turbulent global conditions – short papers from EUROCALL 2017**  
Edited by Kate Borthwick, Linda Bradley, and Sylvie Thoušny

**Rights:** This volume is published under the Attribution-NonCommercial-NoDerivatives International (CC BY-NC-ND) licence; individual articles may have a different licence. Under the CC BY-NC-ND licence, the volume is freely available online (<https://doi.org/10.14705/rpnet.2017.eurocall2017.9782490057047>) for anybody to read, download, copy, and redistribute provided that the author(s), editorial team, and publisher are properly cited. Commercial use and derivative works are, however, not permitted.

**Disclaimer:** Research-publishing.net does not take any responsibility for the content of the pages written by the authors of this book. The authors have recognised that the work described was not published before, or that it was not under consideration for publication elsewhere. While the information in this book are believed to be true and accurate on the date of its going to press, neither the editorial team, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, expressed or implied, with respect to the material contained herein. While Research-publishing.net is committed to publishing works of integrity, the words are the authors' alone.

**Trademark notice:** product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

**Copyrighted material:** every effort has been made by the editorial team to trace copyright holders and to obtain their permission for the use of copyrighted material in this book. In the event of errors or omissions, please notify the publisher of any corrections that will need to be incorporated in future editions of this book.

Typeset by Research-publishing.net

Cover design based on © Josef Brett's, Multimedia Developer, Digital Learning, <http://www.eurocall2017.uk/>, reproduced with kind permissions from the copyright holder.

Cover layout by © Raphaël Savina ([raphael@savina.net](mailto:raphael@savina.net))  
Photo "frog" on cover by © Raphaël Savina ([raphael@savina.net](mailto:raphael@savina.net))

Fonts used are licensed under a SIL Open Font License

ISBN13: 978-2-490057-04-7 (Ebook, PDF, colour)

ISBN13: 978-2-490057-05-4 (Ebook, EPUB, colour)

ISBN13: 978-2-490057-03-0 (Paperback - Print on demand, black and white)

Print on demand technology is a high-quality, innovative and ecological printing method; with which the book is never 'out of stock' or 'out of print'.

British Library Cataloguing-in-Publication Data.  
A cataloguing record for this book is available from the British Library.

**Legal deposit:** Bibliothèque Nationale de France - Dépôt légal: décembre 2017.