Effects of Game on User Engagement with Spoken Dialogue System

Hayato Kobayashi, Kaori Tanio, Manabu Sassano, Yahoo Japan Corporation

Introduction

Background

- **Making users actively utter queries** is important in a spoken dialogue system.
  - There have been several studies based on gamification for addressing this problem (Gustafson et al., 2004; Bell et al., 2005; Hjalmarsson et al., 2007; Rayner et al., 2010; Rayner et al., 2012; Jurgens and Navigli, 2014).
  - However, it takes much time and effort to gamify a whole system.

Purpose

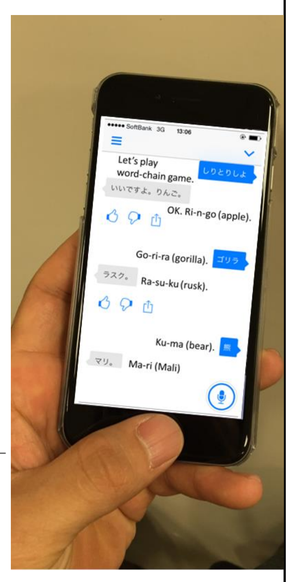
- To explore the possibilities of using of a small game module instead of gamifying a whole system.
  - **Can a dialogue game make users actively use the whole system?**

Contribution

- Analyzed vast amounts of dialogue data, i.e., **more than tens of millions of user utterances** cumulated via a running app of a spoken dialogue system.
- Discovered that **game plays increased the average number of utterances by about 150%**, despite excluding utterances about the game.

Onsei-Assist

- Japanese spoken dialogue Android/iOS app.
  - Siri-like personal assistant developed by Yahoo Japan Corporation.
  - Produced more than 20 million of utterances within a year via pre-installs to smartphones and downloads (more than one million) in Google Play.



Log of user and system utterances

Time Stamp	User ID	Type	User Utterance	System Response
2014-8-1 12:34	UserA	Weather	今日の天気 (Today's weather)	晴れです (It's sunny)
2014-8-2 22:22	UserB	Chat	こんにちは (Hello)	こんにちわ (Hello)
2014-8-3 23:00	UserC	Chat	ありがとう (Thank you)	いえいえ (Your welcome)

Word-chain game

Rules of Japanese word-chain game, Shiritori

- The principle of the word-chain game, called Shiritori in Japanese, is to say a word based on rotation so that its head character is the same as the tail character of the previous word, e.g., (appl**e**, **e**el, l**i**p, **p**ine, ...).
- Each player must say a word satisfying the following four conditions:
  1. The head of the word must be the same as the tail of the previous word.
  2. The word must not be a word already said in the game
  3. The word must be a noun.
  4. The tail of the word must not end with "ん(n)".

Failed by Cond. 2

りんご → ごりら → らすく → くすり → りんご

RI-N-**GO** → **GO**-RI-**RA** → **RA**-SU-**KU** → **KU**-SU-**RI** → **RI**-N-GO

（apple）（gorilla）（rusk）（drug）（apple）

Natural dictionary by crowdsourcing

- Prepared 1,150 seed words from dozen of employees in our company by using a simple word-chain game program developed only for this purpose.
- Created a crowdsourcing task asking workers to answer an appropriate word for each seed word based on the above rule.
- Obtained a sufficient amount of words (6,148) with their frequencies after repeating the task three times
- Extracted the top 20 words based on frequency for each of the 66 Japanese head characters in the extracted words.

Results of crowd sourcing task

Stage	#Words	#Answers	#Errors
1	1,403	3,379	71
2	2,951	9,314	826
3	6,148	25,645	2,285

- #Words: # of obtained words
- #Answers: # of user answers
- #Errors: # of answers breaking the above rules

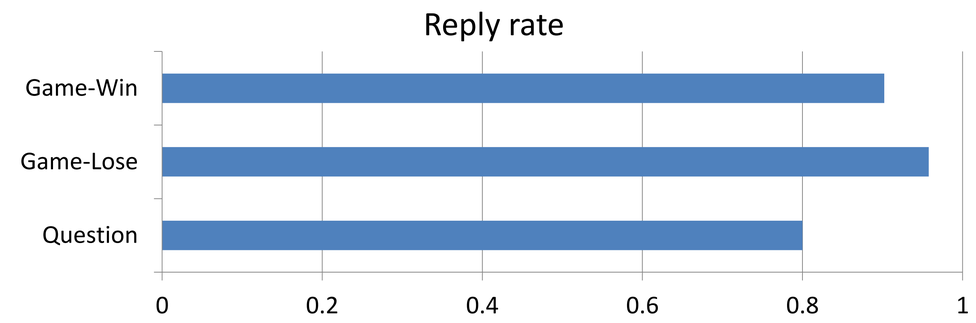
Log analysis

Comparison of reply rates after game's win/lose

- Reply rate (by users) of a system response R is defined as follows.
  - How frequently do users continue to use the system after receiving R?

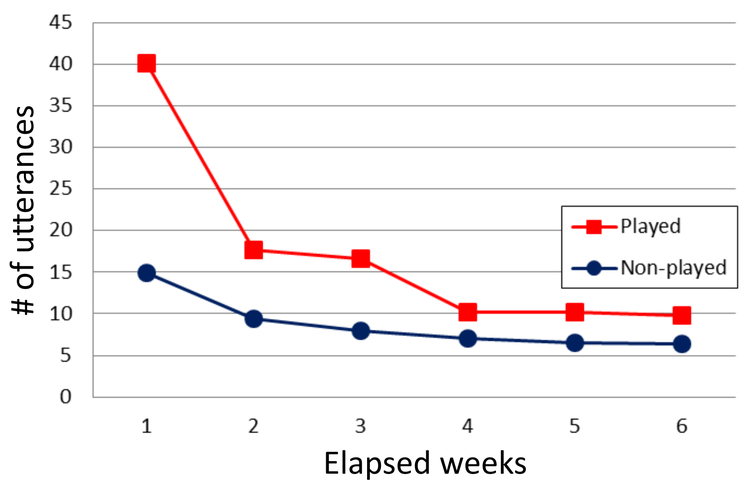
$$(\text{Reply rate of } R) := \frac{(\#\text{ of user replies to } R)}{(\#\text{ of } R \text{ in the log})}$$

- Reply rates after a user won or failed (especially for saying a word already said) were 0.90 and 0.96, respectively.
  - This clearly indicates that **users tend to retry to win after they failed**.
- Those reply rates are quite high, considering the fact that even a question-type system response "どうしました？ (What's happening?)" is 0.80.
  - This implies that **the game leverages users' natural desires for competition**



Comparison of new users (played/non-played)

- Average number of utterances over new users versus elapsed weeks.
  - **Played** and **Non-played** represent users who had played and had not played the game on the first day, respectively.
- The figure clearly indicates that **Played tended to use the system more frequently than Non-played**.



Comparison of existing users before/after each play

- Average number of utterances over game plays of existing users a week before and after each game play.
- **Game plays increased the average number of utterances by about 150%** (24.60 → 43.61) despite the fact that we excluded utterances about the game.
  - A possible reason is that users have become more familiar with this assistant agent through playing the game. Thus they began to use non-game modules more frequently.

	Before	After
(a) # of game plays	29,448	
(b) # of utterances	724,416	1,491,125
(c) # of game utterances	0	206,940
((b) − (c))/(a)	24.60	43.61

Average number of utterances w/o game utterances

Conclusion

- Discovered a fact that a game can help increase user engagement with a spoken dialogue system.
  - This suggests it is important to consider adding an entertaining module, such as a game, when developing a spoken dialogue system, as well as a useful module such as a route search.
- Future research includes to examine other games such as a word association and quiz games.