An Empirical Analysis of Human-Bot Interaction on Reddit

Ming-Cheng Ma
mma4@alumni.nd.edu

John P. Lalor
john.lalor@nd.edu

University of Notre Dame

Introduction

Will bot comments sentiment have an effect on human user sentiment and word selection?
In this work, we have utilized sentiment analysis and textual overlap as two different aspects to answer the question.

Data

In this work we focus on interactions between humans **and a single-purpose Reddit entertainment bot**. We analyze interactions between Reddit users and bobby-b-bot, a Reddit bot inspired by the Game of Thrones books and TV series. Bobby – b bot **posts are randomly selected quotes** from a Game of Thrones character, Robert Baratheon. We selected the bobby-b-bot for our analyses because the bot is a purely "entertainment" bot, in contrast to many Reddit bots that perform some utility (e.g., text summarization or subreddit moderation). To collect all bobby-b-bot comments from Reddit, we pulled the bot comment data as comment triples from the Pushshift Reddit API. **In each triple**, there is a **human post ("parent")**, followed by the **bobby-b bot reply**, and finally another **human post ("child")**. We extracted 126,329 bot comments, spanning from 2017/10/23 GMT-4 to 2020/06/14 GMT-4. When accounti for those bots comments where another user replied, we were left with 16,124 parer bot-child comment triples.

Discussion

The bobby-b bot we studied uses a simple random text selection algorithm to "interact" with users on Reddit. We have shown that even a simple bot can have an effect on the way individuals communicate on the platform. Understanding human-bot interaction when bots are simple is key for building theories of interaction for when the bot technology improves.
In this wok:

- **We have observed that the bot sentiment does affect human comment sentiment.**
- **We find evidence of entrainment in short interactions with a technically simple bot.**

While our sample is limited, the number of such social entertainment bots is only going to increase with more advanced text generation capabilities. The bobby-b bot we studied uses a simple random text selection algorithm to "interact" with users on Reddit. We have shown that even a simple bot can have an effect on the way individuals communicate on the platform. Understanding human-bot interaction when bots are simple is key for building theories of interaction for when the bot technology improves.

Future work to investigate this on a larger bot data set is needed to determine if this behavior is wide-spread on Reddit. Even beyond Reddit, bots on other social media platforms such as Twitter may be able to influence human responses without an extended back-and-forth to establish trust.

Textual Overlap

We next consider how Reddit users modify the text of their comments in response to the bot (**lexical entrainment**).

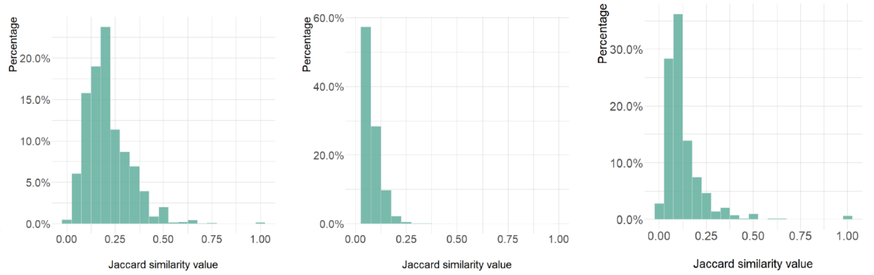
- **Lexical Entrainment:** When speakers use words that overlap with words of their conversational partner.

For our entrainment metric we use **Jaccard similarity**.

- **Jaccard Similarity**: It is a ratio of overlapping tokens to total tokens between two comments, and from 0 (no overlap) to 1 (perfect overlap).

We measure entrainment in our comment triples across three comment pairs: (see Figure 1)

a) Between parent and child comments
b) Between bot and child comments
c) Between parent and child comments without trigger phrase (bot activation words)



(a) Parent-child entrainment. (b) Bot-child entrainment. (c) Parent-child entrainment with bot triggers removed.

Figure 1: Histograms of Jaccard scores for the three comment pairs in our analyses.

For case 1 & 3, we observed some degree of overlap; however, once we removed the trigger phase, the similarity dropped but still have certain overlap. That there are positive amounts of overlap between humans is interesting but not surprising. More surprising is the presence of entrainment between the bot and the child comment user in case 2.

Furthermore, **with the awareness of talking to a bot, users still overlap with bot texts to some positive degree even though there is no need for them to modify their speaking behavior in the conversations.**

Sentiment Analysis

In order to perform the sentiment analysis, we have utilized **VADER lexicon** as our sentiment tool and fitted a linear regression model to predict the sentiment score of the child comments in our data set.

- **VADER:** A specific sentiment tool that is designed for analyzing and labeling social media texts.

Our **three independent variables** were: the **parent sentiment score**, the **bot sentiment score**, and an **indicator variable** for whether the parent and child in the triple are the same user.

Results

Variable	M1	M2	M3
Parent Sentiment	-0.008 (0.011)	0.077 (0.012)***	-0.008 (0.011)
Bot Sentiment	0.039 (0.009)***	0.084 (0.009)***	0.039 (0.008)***
Parent Child Same User	0.036 (0.006)***	-	-
Parent Sentiment x Bot Sentiment	-0.022 (0.023)	-0.042 (0.023)*	-0.022 (0.022)
Parent Sentiment x PC Same	0.085 (0.016)***	-	-
Bot Sentiment x PC Same	0.046 (0.013)***	-	-
PS x BS x PC Same	-0.020 (0.032)	-	-

Table 1: Regression results. Standard errors in parentheses. $^*p < 0.1$, $^{***}p < 0.001$

We have performed there different linear models to observe the results.
(see Table1)

- **M1:** We included all interactions between independent variables in this model. **Parent comment sentiment** is **not** having **significant** effect on the child sentiment. **Bot comments & indicator variables** is **significant** effect.

- **M2:** Only include the data with **author is the same** in both parent and child comment. Both **parent & bot sentiment** have a **significant positive** effect on the child comment sentiment.

- **M3:** Only include the data with **author is different** in both parent and child comment. **Parent comment sentiment** has **no significant** effect but the **bot comment sentiment** is still **significant**.