Facilitating Continuous Text Messaging in Online Romantic Encounters by Expanded Keywords Enumeration

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ABSTRACT

An increasing number of people are looking for romantic partners online. Many of them first converse online before deciding whether or not to meet in-person. However, it is often challenging to have smooth and continuous conversations online with someone who they have never met in person. To handle this problem, we built a proof-of-concept system, *Tomi*, that dynamically suggests various conversation topic seeds related to the latest received messages in real-time. It selects a keyword from an incoming message and returns five contextually relevant topic seeds. In a qualitative study with eight dyads that simulated the common setting of online matchmaking, users could continue their conversations either by directly or indirectly utilizing the suggested topic seeds. Also, our system boosted their confidence during the chat. Lastly, we analyzed the trade-offs between several design alternatives and presented our reflections on a system supporting continuous conversations with diverse topics.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; *Empirical studies in collaborative and social computing*.

KEYWORDS

Chatting; Interpersonal communication; Romantic relationships; Text messaging; Topic suggestion

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1 INTRODUCTION

The growth of social media (*e.g.,* Facebook, Instagram) and online dating platforms (*e.g.,* Tinder, OkCupid) has increased the opportunities for people to look for their romantic partners [10, 17, 23]. While there are various types of information (*e.g.,* profile images, descriptions) to evaluate their potential dates partners online, the online conversation through text messaging still plays a crucial role in determining whether to meet in-person [9, 30]. However, online conversations through text messaging with new romantic encounters is often frustrating. For example, some users just copy-and-paste the same messages to multiple people, or change their topics randomly within the conversation hoping to get more responses [28, 29]. However, female users might find such messages awkward and unnatural [21].

Prior studies introduced writing supporting tools providing static suggestions in various scenarios (*e.g.,* creative writing [6], email composition [11], etc.). However, users found it distracting to have a static list of topic suggestions in real-time conversation [22]. Recent studies showed that systems with dynamic suggestions (*e.g.,* recommending romantic expressions [16] or providing images [15]) fed by the message content in real-time made users more engaged in the conversation. In this regard, we were motivated to design a system that provides diverse topic suggestions dynamically based on the latest user input to prompt contextually relevant content in real-time. We designed and implemented a proof-of-concept system called *Tomi* (**To**pic re**mi**nder) that first retrieves a noun keyword from an incoming message and then elicits its associated words from a word association dataset [7] as relevant topical cues. Also, the system utilizes a dating question dataset [5] to prioritize suggested candidate words that are likely to appear in online romantic encounters. We conducted a qualitative study with 16 participants to investigate how our system would affect users' behaviors and perceptions when conversing with their partners in romantic encounters online. Our key contributions are three-fold: i) the introduction of Tomi, a proof-of-concept system to support users with inspiration for diverse topics derived from a received message, ii) the discovery that topic suggestions can enhance users' perceived self-confidence and mitigate their mental burdens, and iii) a discussion about the trade-offs between design alternatives.

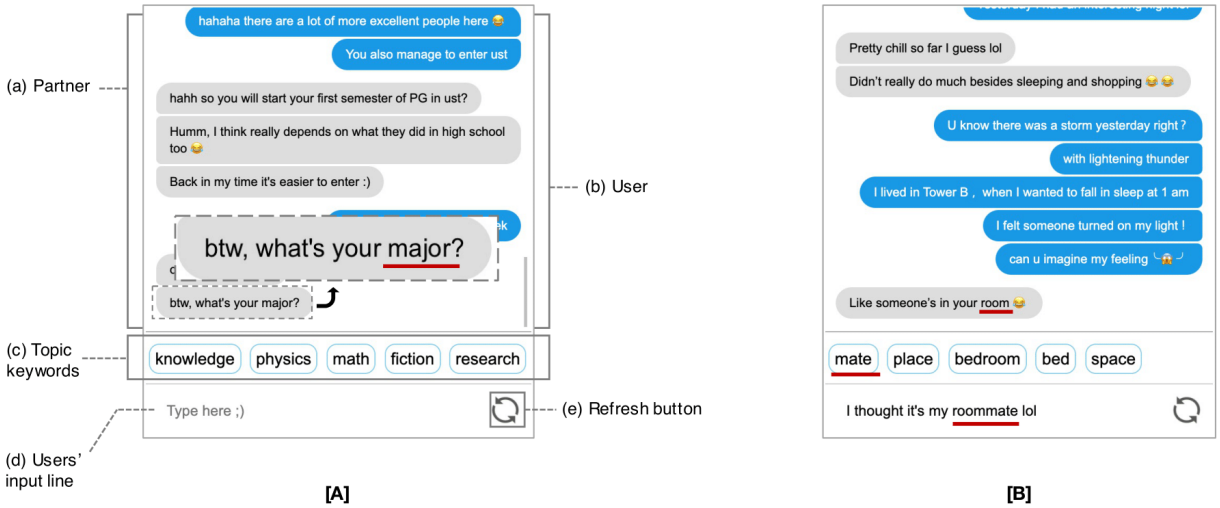

Figure 1: When a user receives a message (*"btw, what's your major?"*) in [A], *Tomi* detects a noun (*major* in this example). Then the system returns five associated keywords based on the seed noun (*major*) as displayed in (c). The keywords in (c) only appear to the message receivers, not the senders. A user can explore more diverse suggestions by touching/clicking (e) the refresh button. As shown in [B], a user can compose a sentence (*"I thought it's my roommate lol"*) by utilizing a suggestion (*mate*) that is triggered by room.

2 TOMI: A SYSTEM ENUMERATING TOPICS

We implemented the research prototype, *Tomi* (Fig. 1), to explore users' acceptance of and concerns about design choices regarding this type of continuous conversation support tool in online romantic encounters. We built the basic chatting functionality, allowing users to see their partner's utterances (Fig. 1(a)) and their own messages (Fig. 1(b)) in the chat window. One of Tomi's most distinct features is the topic prompting bar (Fig. 1(c)) located right above the users' input line (Fig. 1(d)). A user can refer to five keywords that appear on the topic bar during the chat. These suggested keywords can be updated by clicking the refresh button (Fig. 1(e)). Our design follows three considerations:

- **Dynamic suggestions**: Provide dynamic suggestions since static suggestions can be contextually unfriendly [22].
- **Serendipity**: Induce serendipity because it is a part of creativity, discovery, and innovation [2].
- **Keywords**: Provide words, not sentences to have users make effortful writing for sincerity [12–14].

2.1 Keyword Extraction from a Sentence

In order not to overwhelm users with too many options while chatting, we designed our natural language processing (NLP) pipeline to extract nouns – the part of speech that plays a central role in sentences [1] – from the last message received by utilizing the Stanford CoreNLP toolkit [19]. The pipeline extracts one core noun from the latest incoming message and retrieves five associated words from the pre-processed dataset [7]. While it is straightforward to identify the key noun from a sentence containing a single noun (*e.g., I have a* ***cat***), that is not the case if a sentence has multiple nouns (*e.g., I sometimes cook* ***snacks*** *for my* ***cat***). In this case, we designed the pipeline to find the one more likely to be the centric topic in the given context. For example, the conversation with *cat* related topics (*e.g., "Wow, do you have a cat? What is his/her name? How old is he/she?"*) indeed sounds more natural compared to *snacks* related ones (*e.g., "I like snacks, too! Do you want some snacks?"*). Borrowing the concept of *degree centrality* [8], we assumed that a higher degree node in a dependency tree would be the more centric one in the sentence. Hence, we assigned the weighted probability by leveraging the degree of each noun within a dependency tree in a sentence (see Fig. 2). Given a sentence containing n nouns in total, we define d_i as the degree of the i-th noun entity, and set P_i to be the weighted probability that the i-th noun would be selected among all n candidates ($0 < i \leq n$):

$$P_i = \frac{d_i}{\sum_{k=1}^{n} d_k} (i = 1, 2, 3, ...n)$$

The dependency tree in Fig. 2 shows that the degree of ***snack*** is 1, while that of ***cat*** is 3. In this case, the weighted probability of each noun is $P_1 = \frac{1}{4}$ and $P_2 = \frac{3}{4}$, respectively, meaning that ***cat*** will be selected with a 75% chance.

3 QUALITATIVE STUDY ON USER PRACTICES

We conducted a qualitative study with 16 participants (P1-P16: 8 females and 8 males; see Table 1) from a local university to investigate how users would use and perceive our tool. This study obtained IRB approval. Participants' ages are in the range of 20-26 years (M = 22.7, SD = 1.3). They are all single and hoping to initiate a romantic relationship. We asked participants to register through a Google Form first to provide the following basic information: 1) relationship status, 2) willingness to meet dating partners online, 3) gender preferences for matches, and 4) preferred age group for matches. Participants were allowed to meet their matches after the study only when it was mutually agreed.

Figure 2: Our computational pipeline combines Part-of-Speech tagging and dependencies to select a noun by assigning weighted probabilities based on the degree (*i.e.,* the number of edges) of each noun.

Table 1: Based on interview responses and chat log analysis, we counted the number of utterances, received suggestions, actual usage of the suggestions, clicks of the refresh button (Ref. Btn.), and the awkward moments during the chat. Also, we identified if participants would like to meet their partners in person. We finally show the users' stances on Tomi as either positive or negative. *Based on pre-study survey results, those whose scores are higher than the mean are extroverts, while the lower are introverts. †P14's number of usage cannot be specified because she claimed that she used at least 30–40% of entire utterances.

#	ID	Age	Gender	Nationality	Personality*	Utterances	Suggestions	Usage	Ref. Btn.	Awkward mnt.	In-person	Stance
1	1	23	Male	France	Extro.(42)	29	10	0	1	2	Y	Pos.
	2	23	Female	Korea	Extro.(47)	26	10	3	0	0	Y	Pos.
2	3	26	Male	Korea	Intro.(27)	40	12	2	1	1	Y	Pos.
	4	23	Female	China	Intro.(32)	30	21	0	2	0	Y	Neg.
3	5	23	Male	China	Intro.(27)	29	11	0	3	0	Y	Pos.
	6	21	Female	Indonesia	Intro.(26)	31	13	0	0	3	Y	Neg.
4	7	24	Male	USA	Extro.(37)	62	21	1	0	10	Y	Pos.
	8	24	Female	Russia	Extro.(35)	32	39	1	1	0	Y	Pos.
5	9	22	Male	China	Extro.(33)	36	7	3	8	2	Y	Pos.
	10	22	Female	Bulgaria	Intro.(28)	18	25	0	0	1	N	Pos.
6	11	23	Male	Korea	Intro.(26)	33	22	1	5	3	Y	Pos.
	12	20	Female	China	Extro.(36)	31	23	0	5	1	Y	Neg.
7	13	22	Male	Korea	Extro.(50)	89	24	0	0	0	Y	Neg.
	14	22	Female	Hong Kong	Intro.(23)	69	36	†10+	0	0	Y	Pos.
8	15	22	Male	Korea	Intro.(25)	26	7	3	80	2	Y	Pos.
	16	22	Female	China	Intro.(29)	24	11	0	3	0	Y	Neg.

3.1 Procedure

Participants first responded to the pre-study survey including demographic, preferred conditions of partners, and personality. Then we paired the participants based on their indicated preferences and let them chat with each other using Tomi. We gave them at most 30 minutes to chat since the successful conversation in online dating mostly lasts about 25 minutes [27]. We first introduced Tomi's UI (see Fig. 1) to them and explained that they may receive suggestions on Fig. 1(c) and could click Fig. 1(e) to receive other suggestions if necessary (in Fig. 1). We assured them that i) the suggestions carried no obligation, and ii) they can quit the study at any time. With consent, we recorded the chat history including a user ID, timestamp, utterances, five keyword suggestions, and clicks of the refresh button. Upon completing the conversation via Tomi, we conducted a follow-up interview for half an hour. We asked them to describe how they used the tool (*e.g., how many times they looked at the suggestions, if and how they used suggestions during the chat, and whether they clicked the refresh button*). Participants were allowed to review their chat logs to recall those moments. Furthermore, they were allowed to replace any entries with *** marks to avoid revealing any sensitive information prior to our analysis. For interview analysis, three of the authors applied the thematic analysis method [4] to the transcripts.

4 RESULTS AND DISCUSSION

As shown in Table. 1, the overall users' stances towards Tomi is positively correlated with the usage of the suggestions (Spearman correlation, $\rho = 0.63$, $p < .001$). Users who used the suggestions hold a positive opinion of Tomi, implying that people who leveraged any suggestions in the study found Tomi useful. However, the stances were not significantly different between introverts and extroverts. Female users reported a significantly (Mann–Whitney $U = 16.5$, $p < 0.05$) smaller number of awkward moments (M: 0.626, SD: 1.06) compared to male users (M: 2.5, SD: 3.21). Six male participants experienced awkward moments at least once during the chat, while only three female participants did. Despite such discrepancies, all but one participant (P24) wanted to meet their matches in-person.

Direct and indirect use of the suggestions. P2, P7, and P9 directly applied some suggestions to compose a message when they had no idea how to respond. As shown in Table 2 [a]: *"When he said that*

Table 2: The table shows several examples of the usage. [a] shows the direct usage of a suggestion, while [b] shows the indirect usage when responding. The last one [c] shows an exceptional case where a user was inspired to change her word choices.

	ID	Received messages	Tomi's suggestions	Responding messages
[a]	P2	*But I went to **China***	plate, red, **food**, population, country	*How was **food** there?*
	P7	*I am from **Russia***	snow, Putin, cold, **Moscow**, Soviet	*oh yeah, are you from **Moscow**?*
	P9	*Don't tell **anyone***	you, everyone, **someone**, me, all	*But haven't got **someone** to go with*
[b]	P3	*I like jazz **music***	sound, **play**, song, band, **piano**	*Do you play any **instrument**?*
	P11	*Yep I heard you're from **Korea***	Asia, south, peninsula, **war**, **country**	*I just finished my **army***
	P15	*You're an undergraduate **student***	school, teacher, college, **study**, learn	*I came back from my **study break***
[c]	P8	*...the **kind** of people you'd invite*	**generous**, sweet, **caring**, **giving**, nice	*I **share** this one*

*he went to China, I had no idea how to respond but said 'oh, cool...' But I saw the [word] **food** in the suggestions. So I asked him 'How was the **food** there?' "* [P2, F, 23]. In other cases, P3, P11, and P15 showed indirect usage when they ran out of ideas on what to say. As described in Table 2 [b]: *"She said she likes jazz. I know nothing about jazz. But, the system suggested to me **instrument**. So I asked 'Do you play **instrument**?' "* [P3, M, 26]. Interestingly, the suggestions did not contain *instrument* but instead showed *sound, play, song, band, and piano*. P3 came up with **instrument** by looking at *play* and *piano*. We found that *indirect* usage facilitates smooth topic transitions that deviate from the original conversation topic in a non-intrusive manner.

Perceptions of senders and receivers. **Sender: boost in confidence**. P9, P14, and P15 felt more confident during the chat due to the suggestions. For example, *"Whenever I did not know how to reply to her, I relied on Tomi. The suggestions boosted my confidence in continuing the conversation with her as I always had Tomi at my back."* [P9, M, 22]. Also, P14 mentioned that she is very shy and generally not talkative in mobile messaging, particularly when interacting with new acquaintances. However, she could keep up with her interlocutor's (*i.e.,* P13) pace and chime in naturally, and thus felt more assured about having an enjoyable conversation due to Tomi's assistance. **Receiver: imperceptible use of the suggestions**. We wondered whether using suggestions during the online conversation would be noticeable from the receivers' perspectives. Four participants (P2, P3, P6, and P12) tried to identify the senders' use of the suggestions. However, none of them guessed correctly. For example, P2 picked two possible cases from her matched partner's (P1) messages, while P1 did not use any suggestions (false-positive). The rest of the participants reported that they had no idea which one would be their partners' use cases of suggestions. The overall received message did not make them feel noticeably weird or uncomfortable.

Trade-offs of design alternatives. **Dynamic versus static**. P8 suggested we have another set of static, pre-compiled suggestions as references. We could incorporate both features to accommodate diverse user needs. For example, a system can provide a static list of popular topics when opening a text chat window [22], and recommend new ones dynamically as the conversation unfolds. **Accuracy versus serendipity**. Some other participants demanded a more accurate mapping of Tomi's suggestions in the context. However, this can be challenging, considering that the interpretation of speaker intention for given contexts and data is often rather subjective [3, 18, 20, 25]. One possible way is to build a model that can be aware of the contexts of the conversation (*e.g.,* [24]), so that the system can generate more contextually accurate suggestions (*e.g.,* [26]). **Keywords versus sentences**. Six participants argued that the keywords do not provide sufficient ideas to apply during a chat. In contrast, the rest of them appreciated the suggestions in the form of a keyword because it allows them to freely elaborate on a selected topic in their own words. Also, providing a full sentence as a recommendation might hamper the effortful writing, which is critical to fostering relationships [12–14]. Eventually, it might cause users to suspect the sincerity of any of the received messages.

5 CONCLUSION

We proposed a proof-of-concept called *Tomi* that gives users inspiration for conversational content in an online romantic encounter by dynamically suggesting five topic seeds derived from the last message received. Through a qualitative study with eight dyads, we found that users utilize the suggestions both directly and indirectly for topic inspiration. In this process, *Tomi* affects users' chatting experiences such as boosting the senders' confidence. Receivers, on the other hand, did not notice if senders used any suggestions, indicating that the chats seemed natural. Based on participant feedback, we discussed the trade-offs of different design considerations to enhance the quality of conversations in online romantic encounters. We hope that our work can shed light on further research in this direction.

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