Why should we care about register? Reflections on chatbot language design

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ABSTRACT

This position paper discusses the relevance of register as a theoretical framework for chatbot language design. We present the concept of register and discuss how using register-specific language influence the user's perceptions of the interaction with chatbots. Additionally, we point several research opportunities that are important to pursue to establish register as a foundation for advancing chatbot's communication skills.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Natural language interfaces**.

KEYWORDS

chatbots, language design, register

INTRODUCTION

In task-oriented interactions, chatbots often assume social roles traditionally associated with a human service provider, for example, tutor [26], salesperson [13], and tourist assistant [7]. When a chatbot uses unexpected levels of (in)formality or incoherent language style, the interaction may result in frustration or awkwardness [11, 17]. To convey competence and be recognized by human-interlocutors for the role they stand in, chatbots' language must cohere with the situation in which the interaction takes places and the social role they aim to represent. To this date, there is no formal techniques to

Register according to Biber [2]: the language variety associated with a particular situation of use.

Register in this paper: the *core linguistic features* in a conversation, given the *context*, where the linguistic features consist of the set of words or grammatical characteristics that occur in the conversation, and the context consists of a set of *situational parameters* that characterize the situation in which the conversation occurs, e.g., the participants, the channel, the production circumstances, and so on.
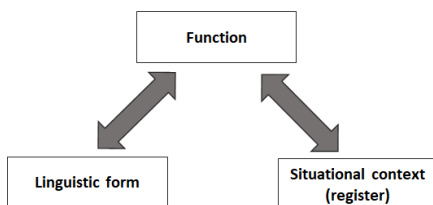
Sidebar 1: Definition of Register

Figure 1: Representation of register

guide the design of a chatbot's language, which is often based on the designer's personal linguistic habits or an ad-hoc analyses of personas and user characteristics.

Language can often be accounted for by factors such as style (e.g., [18]), dialect (e.g. [25]), genre (e.g., [16]), and register (e.g., [9]). Style is by far the factor that receives more attention from researchers on conversational agents [12, 15, 19, 24, 27]. In sociolinguistics, style is defined as the linguistic variation that reflects *aesthetic* preferences, usually associated with particular speakers or historical periods [9] (e.g., archaic vs. modern English). However, studies emphasize that the *"core linguistic features, like pronouns and verbs, are functional"* rather than aesthetic [9], which points to the concept of **register**.

According to the register theory, language variation is situationally-defined, meaning that every utterance in a conversation is influenced by situational parameters, such as the relationship between participants, the purpose of the interaction, and the topic of the conversation [9, 16]. Register theory aims to link the occurrences of certain linguistic features in utterances to the situational parameters of the conversation [9]. Figure 1 illustrates the relationship among language variation, register, and function [10].

Register is an established theory in the sociolinguistics domain (see e.g., [2, 3]), and has been shown as a reliable predictor of language variation across conversational contexts [3]. Despite its importance for understanding language variation in human-human communication, it has not been widely explored in the context of human-chatbot interactions. In this position paper, we argue on the applicability of register theory as a theoretical foundation for tailoring chatbot linguistic choices to a particular interactional situation.

REGISTER FOR CHATBOT LANGUAGE DESIGN

A variety of factors influence how people perceive a chatbot's social skills [8] and, as user expectations of proficiency increase, one important way to enhance chatbot interactions is by carefully planning their use of language [8, 14, 17]. User perceptions of chatbot conversational skills are important because chatbots are targeted to fluidly interact using natural language. Chatbots are often deployed to perform social roles traditionally associated with humans, particularly in contexts where there may be consequences for a human if they choose to act on the chatbot's information. This means that user perceptions of chatbot competence and credibility are crucial for a chatbot's success [28].

Previous studies have found that appropriate language style is not relevant for determining user satisfaction as long as the user can understand the chatbot's answer, only advising that the chatbot's language style should be "mildly appropriate to the service the chatbot provides" [1]. In a previous study [6], however, we found evidence that user experience goes beyond merely comprehending a chatbot's utterance to whether the user perceives the chatbot's language as appropriate and credible. In that study, we explored the applicability of register to human-chatbot interactions by developing a rationale for accounting for register in chatbot design, and providing a mechanism for implementing

theory into design practice. The results demonstrated that register characteristics are more relevant than individual preferences or personal habits for perceived appropriateness of language, credibility, and overall user experience. Thus, register characteristics can be seen as primary drivers for perceptions of language, and designers should consider register to foster chatbot acceptance and success.

Therefore, we argue that user perceptions are also shaped by *how* information is conveyed–as characterized by the conversational register–and register theory can provide a sound theoretical framework for concretely characterizing the language use and analytically exploring how variations in the patterns of language impact user perceptions of the quality of a chatbot, including critical factors, like appropriateness and credibility.

IMPLICATIONS FOR CHATBOT DESIGN

In this position paper, we argue that register analysis should be used as a technique for providing a theoretical basis for chatbot language design, grounded on the results presented in Chaves et al. [6]. To design register-specific language for chatbots, we need to enrich chatbots with computational models that can adapt the utterances to conform with the expected register, in an effort to mimic the subconscious humans' language production process.

When retrieving text from external sources, utterances should be adapted to the new conversational situation in which the chatbot is embedded. This is not generally done in the current generation of chatbots; it is common to find chatbots that extract and present information directly from websites, books, or manuals without any linguistic adaptation to the new context. For example, Golem[1] is a chatbot designed to guide tourists through Prague (Czech Republic); its utterances are extracted from an online travel magazine[2] without any adaptation to the new interactional situation (which differs in production, channel, and setting).

New generations of chatbots will be expected to generate their own custom-constructed utterances dynamically, which will require sophisticated natural language engines that are able to adapt dynamically their conversational register to changing situational parameters. In this context, baseline corpora for training the conversation models will be required at the heart of such natural language engines. Recent studies [5] showed that using corpora in the same domain is not enough to account for language appropriateness, as differences in the interlocutor's social role and communication purpose result in varying patterns of language [5]. Designers should carefully ensure that the register found in a corpus used to train such models matches the register implied by the situational parameters, or they need to use algorithms to adapt the language accordingly.

Using register analysis to characterize different situations and how they map to the most appropriate register profiles can provides a way forward in the design of the next generation of chatbots; one could imagine a chatbot language engine that, given a particular situational profile for planned conversations, could automatically configure its language to present information in the most appropriate register.

[1]Available in Facebook Messenger at http://m.me/praguevisitor. Last accessed: June, 2020

[2]https://www.praguevisitor.eu

The work presented by Chaves et al. [6] is a first step toward the applicability of register theory in chatbot language design. In the next section, we point out some research opportunities.

RESEARCH OPPORTUNITIES

There are open challenges that need to be addressed in future work to formalize register as a theoretical basis for chatbot's language design:

Text modification automation: when a chatbot retrieves information from external sources, it is necessary to adapt the utterance to the new situational parameters, which requires modifying the distribution of particular linguistic features in the sentence. This process can be achieve through text modification, which consists of changing the language of a text while preserving the text's content and integrity [4, 22]. Research on style transfer has made progress on reproducing the patterns of language in a new corpus (see e.g., [24]; however, most algorithms assume parallel data with similar content distributions. To fully automate text modifications, we would need to develop algorithms that, given the frequencies of words expected in a register, perform text modifications in an utterance to approximate the frequency of words to the frequencies in the expected register.

Extensibility of register characteristics to similar domains: register characterization is situational-dependent. Identifying the register characteristics for every possible interaction context may be over-whelming. Thus, it is crucial to understand how register characteristics can be extended to different domains. We expect that, as we reduce the differences in situational characteristics, we minimize the language variation across registers. In this sense, one interesting future research includes performing situational analysis of several domains where chatbots are commonly used and find the intersections in the situation parameters. Then, one can empirically evaluate the extent to which the generalization to similar domains would apply.

Influence of sentence structure: the study presented in Chaves et al. [6] analyzed the influence of linguistic features individually without considering the position where they occur in the sentence or the frequent co-occurrences with other features. We are not aware of a methodology that automatically weighs the features according to their place in the sentence. Developing such methodologies would potentially improve the ability to detect the factors that influence user perceptions, which likely include sentence structure and flow.

Ranking sentences according to the register: to allow machine generation of register-specific language, it is crucial that we develop statistical models that, given a set of candidate sentences for a particular situation, rank them according to their coherence with the expected register. This model would select the sentence that has the highest frequency of preferred features and lowest frequency of unfavored features as the top rank position. This is still unexplored in the current literature.

Corpus selection automation: Section pointed out the importance of finding a register-specific reference corpus for chatbot language generation. As a consequence, it is important to create a tool that allows practitioners to find the appropriate reference corpus when designing chatbot utterances. We suggest a search platform in which researchers and practitioners could publish corpora of conversations that could be used for particular situations as well as search for a reference corpus for designing their own chatbot. The search would consider the situational parameters in which the conversation takes place to suggest a corpus for training that complies with the expected register. Such platform would be relevant not only for the chatbot industry but also for researchers in several domains such as Natural Language Processing and Generation, Corpus Linguistics, and Computational Linguistics.

Fairness of language: this paper suggests that chatbot language can be designed by training a chatbot using a corpus of register-appropriate conversations. Corpus-based language generation must, however, consider ethical concerns, such as the fairness of language. Scholars [20, 21, 23] have pointed out the risks of using biased contents of databases to generate language. Unlike style, register focuses on the distribution of linguistic features associated with the context rather then personal linguistic habits. Nevertheless, future research could focus on identifying possible biases introduced by register-specific language generation in order to avoid negative implications of using biased language.

In conclusion, we expect that this position paper open new research avenues that bring together researchers in computer science, machine learning, and linguistics to design chatbots that use register-specific language and, consequently, provides an enriched user experience.

REFERENCES

[1] Divyaa Balaji. 2019. *Assessing user satisfaction with information chatbots: a preliminary investigation*. Master's thesis. University of Twente. https://essay.utwente.nl/79785/1/Balaji_MA_BMS.pdf

[2] Douglas Biber. 1988. *Variation across speech and writing*. Cambridge University Press, Cambridge, UK.

[3] Douglas Biber. 2012. Register as a predictor of linguistic variation. *Corpus Linguistics and Linguistic Theory* 8, 1 (2012), 9–37.

[4] Susan Bosher and Melissa Bowles. 2008. The Effects of Linguistic Modification on ESL Students' Comprehension of Nursing Course Test Items-A collaborative process is used to modify multiple-choice questions for comprehensibility without damaging the integrity of the item. *Nursing Education Perspectives* 29, 4 (2008), 174.

[5] Ana Paula Chaves, Jesse Egbert, and Marco Aurelio Gerosa. 2019. Chatting like a robot: the relationship between linguistic choices and users' experiences. In *ACM CHI 2019 Workshop on Conversational Agents: Acting on the Wave of Research and Development*. https://convagents.org/, Glasgow, UK, 8.

[6] Ana Paula Chaves, Jesse Egbert, Toby Hocking, Eck Doerry, and Marco Aurelio Gerosa. 2021. Chatbots language design: the influence of language variation on user experience. *arXiv preprint* arXiv:2101.11089 (2021), 1–34.

[7] Ana Paula Chaves and Marco Aurelio Gerosa. 2018. Single or Multiple Conversational Agents? An Interactional Coherence Comparison. In *ACM SIGCHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 191:1–191:13.

[8] Ana Paula Chaves and Marco Aurelio Gerosa. 2020. How Should My Chatbot Interact? A Survey on Social Characteristics in Human–Chatbot Interaction Design. *International Journal of Human–Computer Interaction* 0, 0 (2020), 1–30. https:

//doi.org/10.1080/10447318.2020.1841438 arXiv:https://doi.org/10.1080/10447318.2020.1841438

[9] Susan Conrad and Douglas Biber. 2009. *Register, genre, and style.* Cambridge University Press, New York, NY, USA.

[10] Jesse Egbert and Douglas Biber. 2016. Do all roads lead to Rome?: Modeling register variation with factor analysis and discriminant analysis. *Corpus Linguistics and Linguistic Theory* 14, 2 (2016), 233–273.

[11] Ela Elsholz, Jon Chamberlain, and Udo Kruschwitz. 2019. Exploring Language Style in Chatbots to Increase Perceived Product Value and User Engagement. In *Proceedings of the 2019 Conference on Human Information Interaction and Retrieval.* ACM, New York, NY, USA, 301–305.

[12] Jasper Feine, Ulrich Gnewuch, Stefan Morana, and Alexander Maedche. 2019. A Taxonomy of Social Cues for Conversational Agents. *Int. J. Hum.-Comput. Stud.* 132 (2019), 138–161.

[13] Ulrich Gnewuch, Stefan Morana, and Alexander Maedche. 2017. Towards Designing Cooperative and Social Conversational Agents for Customer Service. In *International Conference on Information Systems 2017, Proceedings 1.* Association for Information Systems, South Korea, 13.

[14] Eun Go and S Shyam Sundar. 2019. Humanizing Chatbots: The effects of visual, identity and conversational cues on humanness perceptions. *Computers in Human Behavior* 97 (Aug. 2019), 304–316.

[15] Ana Jakic, Maximilian Oskar Wagner, and Anton Meyer. 2017. The impact of language style accommodation during social media interactions on brand trust. *Journal of Service Management* 28, 3 (2017), 418–441.

[16] George Kamberelis. 1995. Genre as institutionally informed social practice. *J. Contemp. Legal Issues* 6 (1995), 115.

[17] Jurek Kirakowski, Anthony Yiu, et al. 2009. Establishing the hallmarks of a convincing chatbot-human dialogue. In *Human-Computer Interaction.* InTech, London, UK.

[18] Geoffrey N Leech and Mick Short. 2007. *Style in fiction: A linguistic introduction to English fictional prose.* Number 13 in English language series. Pearson Education, London, UK.

[19] Grace I Lin and Marilyn A Walker. 2017. Stylistic Variation in Television Dialogue for Natural Language Generation. In *Proceedings of the Workshop on Stylistic Variation.* Association for Computational Linguistics, Copenhagen, Denmark, 85–93.

[20] Mark Christopher Marino. 2006. *I, chatbot: the gender and race performativity of conversational agents.* Ph.D. Dissertation. University of California, Riverside.

[21] Mark C Marino. 2014. The racial formation of chatbots. *CLCWeb: Comparative Literature and Culture* 16, 5 (2014), 13.

[22] E Sato. 2007. A guide to linguistic modification: Strategies for increasing English language learner access to academic content.

[23] Ari Schlesinger, Kenton P O'Hara, and Alex S Taylor. 2018. Let's Talk About Race: Identity, Chatbots, and AI. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal QC, Canada). ACM, New York, NY, USA, 315:1–315:14.

[24] Bakhtiyar Hussain Syed. 2020. *Adapting Language Models for Style Transfer.* Master's thesis. International Institute of Information Technology Hyderabad.

[25] Benedikt Szmrecsanyi. 2011. Corpus-based dialectometry: a methodological sketch. *Corpora* 6, 1 (2011), 45–76.

[26] Stergios Tegos, Stavros Demetriadis, and Thrasyvoulos Tsiatsos. 2016. An Investigation of Conversational Agent Interventions Supporting Historical Reasoning in Primary Education. In *International Conference on Intelligent Tutoring Systems*, Alessandro Micarelli, John Stamper, and Kitty Panourgia (Eds.). Springer International Publishing, Cham, 260–266.

[27] Paul Thomas, Mary Czerwinski, Daniel McDuff, Nick Craswell, and Gloria Mark. 2018. Style and Alignment in Information-Seeking Conversation. In *Proceedings of the 2018 Conference on Human Information Interaction&Retrieval.* ACM, New York, NY, USA, 42–51.

[28] Darius Zumstein and Sophie Hundertmark. 2017. Chatbots–an interactive technology for personalized communication, transactions and services. *IADIS International Journal on WWW/Internet* 15, 1 (2017), 96–109.