Designing Curated Conversation-Driven Explanations for Communicating Complex Technical Concepts

April Y. Wang
University of Michigan
Ann Arbor, MI, USA
aprilww@umich.edu

Parmit K. Chilana
Simon Fraser University
Burnaby, BC, Canada
pchilana@sfu.ca

***Abstract*— The need for learning about emerging technologies and technical concepts among the general population is increasing, but formal explanations from online encyclopedias, textbooks, and articles are often rich in technical jargon and can be challenging to grasp. In this paper, we explore a novel approach for explaining technical concepts to non-technical users through the design of JargonLite, an interactive dictionary that shows how technical concepts can be used in everyday conversations. We evaluated curated conversation-driven explanations with 12 users who had little or no technical training and wanted to learn about big data concepts. We found that users perceived conversation-driven explanations to be easy to understand and these explanations helped them to maintain focus. We discuss the potential of using conversation-driven explanations as a learning tool for non-technical users and reflect on the advantages and disadvantages of this approach.**

Keywords—technical conversations; conversation-driven explanations; learner-centered design

I. Introduction

The need for learning about emerging technologies and technical concepts among the general population has increased manyfold in recent years [7,10]. From understanding hardware configurations of laptops to figuring out privacy settings for social media accounts to devising strategies to beat AI bots in eSports games, users from all backgrounds and contexts frequently need to look up and understand technical information.

Being able to understand and talk about technology and technical concepts has several benefits—for example, when interacting with complex AI algorithms, non-technical users can demonstrate more trust, awareness, acceptance, and confidence if they are able to better grasp the underlying techniques [8,11,15]. Similarly, non-technical users in professional settings who learn basic programming-related concepts may be able to better participate in technical conversations with software developers and other colleagues [6,17].

Although the web offers a plethora of formal and informal resources to learn about technical concepts, users face a number of challenges in successfully using these resources [17]. For example, users rarely find conversational-level examples and often end up struggling with unfamiliar jargon and complex definitions in resources that largely target users who already have some level of technical acumen.

In recent years, several efforts been made to explore overviews and "skimmable" explanations for technical concepts (e.g., *SimpleWikipedia* [19], *TenwordWiki* [21], *Tech Terms Computer Dictionary* [22]). Although these explanations tend to offer shorter and more concise explanations, they do not make any explicit effort to reduce technical jargon and do not necessarily target non-technical users. Another class of tools offer visual explanations of algorithms and other concepts (e.g., *Tableau* [23], *Tensorflow Playground* [3], *CS Unplugged* [20]) by using animation and interaction techniques that allow users to explore algorithms without writing code. However, these tools often focus on explaining specific algorithms rather than explaining the more general concepts around software engineering processes or comparisons between different concepts that could be useful for non-technical users [17].

In this paper, we explore a novel approach for explaining technical concepts to non-technical users: through the use of curated *conversation-driven explanations*. The key idea here is to explain a complex technical concept by providing an example of how the concept can be used in a conversation. Building on findings from past research that has pointed to the value of providing examples in the learning process for novices [1,2,4,9,12,13,16], we designed *JargonLite*, a novel interactive dictionary (Figure 1) that allows users with no or little technical knowledge to look up definitions and explanations with accompanying dialogue-style conversation examples. Furthermore, JargonLite is a community-driven platform such that any user can add and/or edit the explanations or examples to facilitate understanding for non-technical users.

To investigate the strengths and weaknesses of curated conversation-driven explanations, we conducted a task-based in-lab usability study with 12 users with little or no technical training. Our key findings indicated that users perceived JargonLite to be easy to use in understanding the conversation-driven explanations. Users also indicated that the dialogue style of the conversation-driven explanations helped them maintain focus and engage better with the unfamiliar complex technical concepts. In our discussion, we reflect on the value of conversation-driven explanations for non-technical users and discuss how this method could work in practice and scale in other expert domains, such as medicine where such conversational-level explanations could be useful.

The main contributions of the paper are: 1) the design of JargonLite, an interactive dictionary that introduces the idea of curated conversation-driven explanations and, 2) insights into advantages and disadvantages of curated conversation-driven explanations for users who have little or no technical knowledge.

978-1-7281-0810-0/19/$31.00 ©2019 IEEE

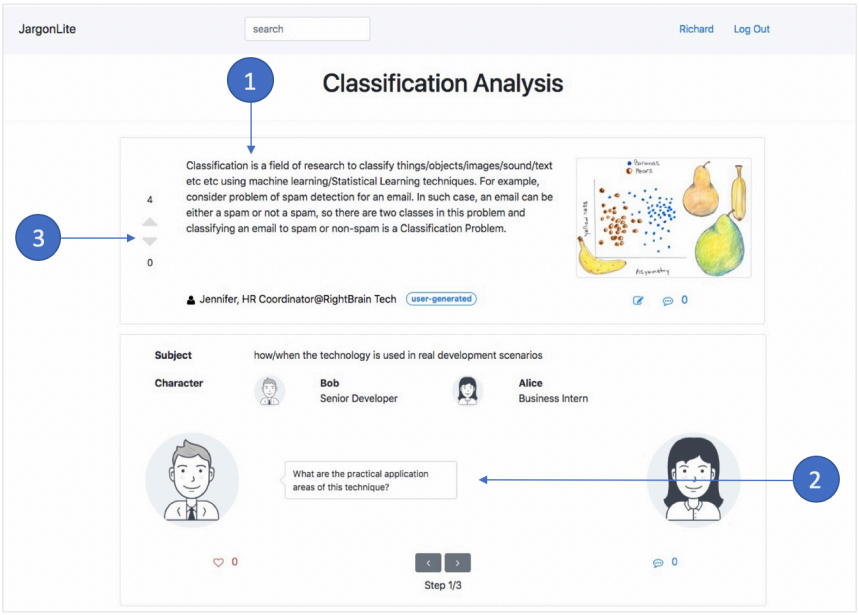

Fig. 1. JargonLite provides curated conversation-driven explanations that are (1) added by other users using minimal jargon in a Wiki-style interface; and, (2) include a dialogue-style interactive component that explains how the technical concept can be used in a real-world conversation. JargonLite also (3) displays the relevance of the explanations determined by community feedback

II. Design of Conversation-Driven Explanations

To inform the design of JargonLite, we considered the following problem scenario:

Alex is a business intern who has no computer science (CS) background nor any familiarity with big data concepts. He is preparing for an internal meeting about the launch of a new data analytics tool by the business and development teams. He wants to understand key big data concepts so that he can follow along and participate in the technical conversation with his seniors.

To help non-technical users like Alex quickly get familiar with technical concepts and be prepared for using these concepts in conversations, we explored the design of JargonLite (Figure 1) with three key design goals based on insights from prior studies (e.g., [5,6,17]).

Explain Technical Concepts with Minimal Jargon: JargonLite encourages technical explanations to use minimal jargon, be concise and easily "skimmable" in a few minutes (Figure 1.1). We added instructions for content contributors to consider that the target users are people with little or no technical knowledge and encouraged them to use real-world examples.

Demonstrate How to Use the Concept in Everyday Conversations: As shown in previous studies, non-technical users find it useful to have real-world development scenarios when trying to understand complex technical concepts [17]. JargonLite introduces a dialogue-style mechanism such that a user can explain a technical concept by showing how it is being used in a real-world conversation (Figure 1.2). We provide contributors with a list of potential conversational subjects to consider (e.g., the pros and cons of using certain technology, comparison of multiple terminologies).

Incorporate Community Feedback: JargonLite incorporates social features such as voting and commenting (Figure 1.3) so that non-technical users can evaluate the relevance of explanations from the perspective of their own domain and learning needs. JargonLite also includes a wiki-editing feature to help content contributors and end users clarify and improve each other's explanations and examples based on their own experiences.

JargonLite was implemented using standard web technologies: HTML5, JavaScript with a NodeJS back-end server connecting to the database.

III. Evaluating Conversation-Driven Explanations

To evaluate the strengths and weaknesses of conversation-driven explanations, we carried out a user study with 12 non-technical participants and observed their interactions with JargonLite. Before explaining the study details, we first describe the context of our study and our process for seeding JargonLite with community-curated explanations.

Seeding Community-Curated Content: We recruited 6 graduate students from a professional data science program as contributors to simulate community-curated content for big data concepts. To help contributors construct the dialogue-style examples, we encouraged them to recall recent conversations with colleagues or friends and provided them with a list of potential conversational subjects to consider. We also carried out a brief semi-structured interview about contributors' general perceptions on usability of the tool. Each contributor was offered a $15 Amazon gift card in return of participation.

Usability Study Setup: Once we had content in JargonLite, we designed a user study consisting of different data sources: questionnaires, observations, and interviews. We initially

recruited participants from our university who were not from CS or engineering programs, but interested in learning about big-data concepts. We selected additional participants through word-of-mouth and snowball sampling, ending up with 12 undergraduate and graduate students (6M/6F) studying nine different majors (e.g., Accounting, Economics, Biology).

Each participant was assigned 6 concepts randomly selected from a list of 12 common big data related concepts (e.g., *Hadoop*, *MapReduce*, and *Neural Networks*) and had up to 3 minutes to consult JargonLite. They were asked to familiarize themselves with the given concepts as if they were going to need to use these concepts in a conversation. To measure participants' perceptions and utility of the explanations, we asked them to fill out a post-task questionnaire (Figure 2). We also carried out a brief semi-structured interview which probed into participants' general perceptions of JargonLite (e.g., elements within the explanation, why they would/would not want to use the tool in real life). The study lasted around 45-60 minutes in total. Each participant was offered a $15 Amazon gift card.

IV. Key Findings

Based on our analysis of the different data gathered during the study, we synthesized key findings about users' perceptions and engagement with conversation-driven explanations.

A. Ease-of-Understanding Explanations

Overall, participants found conversation-driven explanations to be easy to understand (*avg* = 3.97, *sd* = 1.11) and helpful (*avg* = 4.00, *sd* = 1.22) for improving their conceptual understanding and engaging in technical conversations. Participants further reported in post-test interviews that the conversation-driven explanations made it easy to understand the concept because the language in conversations was "*more informal*." The conversation-driven explanations provided a way for users to see how the concept was applied in real life, as explained by a participant from an Economics background:

> *It [the conversation-driven explanation] provides a way to see how it is used in conversation in real life, so it's more practical. (U4)*

Another participant from business mentioned how she appreciated explanations with minimal jargon:

> *We are trying to communicate [technical] stuff in a simpler way, in a way that general people will understand…they [Wikipedia contributors] seem [to be] already educated in CS for so many years… they may not even realize it themselves, but they are using so many words that people who are not from tech background would [not] understand. (U3)*

B. Maintaining Focus

Next, we found that the dialogue style of the conversation-driven explanations helped participants maintain focus (*avg* = 3.78, *sd* = 1.38). Participants further explained why the conversation-driven explanations helped them maintain focus compared to formal explanations:

> *I lost focus after reading the first few words from textbook explanations and had to restart from the beginning… [the conversation-driven explanation] … it really kept my interest to read and think. (U1)*

C. Trusting the Explanations

Our results also indicated that overall participants trusted the conversation-driven explanations (*avg* = 4.11, *sd* = 1.01). Still,

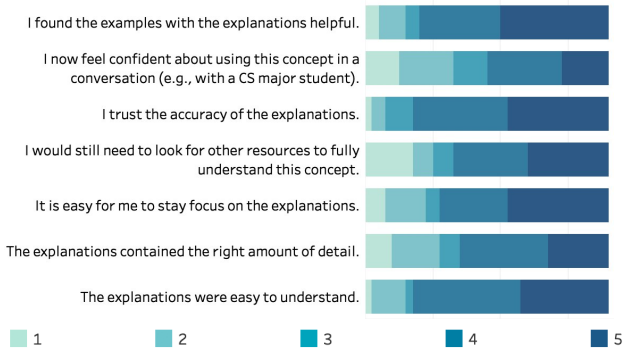

Figure 2 Participants' perceptions and subjective feelings on the explanations, 1 as strongly disagree, 5 as strongly agree.

participants mentioned that these explanations could be even more trustworthy if more information about the contributors could be included as part of the explanations:

> *I wish this system could connect to websites like LinkedIn…to provide me more background of the other users who write the examples. (U6)*

D. Perceptions of Conversation-Driven Explanations

Qualitative feedback from participants pointed to various reasons why they found it useful to read through different conversation-driven explanations:

> *Compared to asking [someone], the person may not be well-prepared to give you a good example… but, on the system, I might have a better understanding and I could read through different examples. (U1)*

In particular, participants appreciated the conversations because they felt like they could relate to them as personal stories they had already experienced. For example, one participant from economics said that the conversation-driven explanations were more useful than standard Wikipedia explanations because they combined other people's experiences:

> *[Here] it's about other people's experience… It's different from a standard explanation by Wiki [Wikipedia]. (U4)*

Another participant from Molecular Biology found the conversation about "Hadoop" relevant to a confusion she had actually recently experienced:

> *[For text-based explanations], I just passively went through it. But for the dialogue-style conversation, the questions asked by the non-technical people happened to be the questions I was thinking about. I felt motivated to read and digest the dialogue. (U8)*

In addition, we observed different opinions on the style of conversation-driven explanations: some users preferred the intuitive metaphors and long stories that encouraged them to think, while others enjoyed the shorter, one-sentence "what/why" conversation. Overall, most participants found the curated nature of JargonLite's explanations to be more useful than general online search for definitions of technical concepts.

Despite the overall positive response, one limitation of JargonLite that some participants pointed out was that it does not provide opportunities to ask follow-up questions. For example, one participant explained why he preferred talking to friends in person: *"it's face-to-face, you could always ask*

follow-up questions, and really dig in deep into the matter (U8)". Other participants suggested adding synchronous chat features where they could have such conversations with the authors of the explanations.

E. JargonLite in Practice: Content Contributors' Perspective

In addition to end users' perspective, we probed into how contributors perceived the content creation process. Overall, contributors found the process of adding example conversations in JargonLite to be easy (*avg* = 4.17, *sd* = 0.94, on a scale of 5, 1 as extremely difficult, 5 as extremely easy). They were also willing to contribute towards such a system in real life. For example, one contributor reflected on his experience of using Quora, a knowledge Q&A site:

> *I [build] online reputation when I am answering domain-specific questions on Quora. So, I would totally be willing to contribute to this tool (JargonLite) to enhance my online reputation with other business people, who might be my potential customer or collaborator. (C3)*

However, generating an appropriate example conversation for a technical concept can be challenging and open-ended. Although we provided contributors with a list of potential conversational subjects, we observed contributors using different mechanisms to construct the example conversation. For example, some contributors wrote long and intuitive stories to unfold the concept into an example conversation, while some contributors used shorter, one-sentence conversations. One contributor explained how the style of the conversation depended on the concept needing an explanation:

> *For some concepts, it is easy to make comparisons, for example, Hadoop and Spark. Some concepts (e.g., data mining) are very general. It is not clear what the pros, and the cons should be. (C6)*

V. Discussion

This paper has introduced the idea of curated conversation-driven explanations for helping non-technical users understand unfamiliar technical jargon. Unlike other Q&A platforms, JargonLite requires a structured dialog format to show how a technical concept can be used in a conversation. We now reflect on the strengths and weaknesses of using JargonLite and conversation-driven explanations in practice.

A. Improving Conversation-Driven Explanations

Although the non-technical participants in our study found the conversation-driven explanations to be easy to understand, there needs to be more investigation into how to generate higher quality explanations. Given the nature of differences between topics and concepts, we believe that there is no perfect formula to construct the explanation that adapts to all the concepts. However, we noticed that constructing the example conversations was not always an intuitive process for content contributors. Although we provided example topics to start with, the style and quality of each conversation-driven explanation (e.g., degree of jargon usage) still varied.

While we expect that the quality of the conversation-driven explanations would improve in the long run with more community control and moderation [14], it would be worth exploring different formats of instructions or tutorials that contributors could use as a guide to initially add high-quality explanations. Future research could investigate whether different categories of technical concepts would require different levels of explanations. Templates that provide guidance on what level of detail to provide for different concept categories could also be explored.

In addition, future research can explore how to complement text-based conversations with animated examples or graphics. When it comes to explaining complex algorithm-related concepts, allowing contributors to add more visual elements can lower the cognitive costs for both contributors to explain and end users to perceive the example conversations.

B. Conversation-Driven Explanations in Other Domains

Outside the domain of CS and technology-related concepts, there are other cases where people may want to build common ground to understand domain-specific jargon. For example, patients may want to warm up about medical-related terminologies before seeing a doctor; general users may want to know some rules and sports-related terminologies when watching a sports event that they are not familiar with; novice video game players may want to get familiar with the game community's language style to talk to more expert players; and, there are many other such examples in other domains.

In the above scenarios, non-domain experts often feel stressed when faced with unfamiliar terminologies and situations and need someone to explain the concept in a simple and understandable way. For example, studies have looked into self-diagnosis applications that educate the general public about health issues [18]. We believe that the conversation-driven mechanism of JargonLite could be scaled more broadly for such users (e.g., by building a medical version of JargonLite to help patients improve their conversations with doctors).

Limitations and Future Work

A limitation of the study is that we collected data mainly on participants' perceptions of conversation-driven explanations and did not measure retention or learning improvements. At this early stage, our goal was not to show learning gains, but to help non-technical users build confidence with an unfamiliar concept. Future work can analyze the actual explanations written by participants to assess their comprehensibility. Since we used a lab study approach and provided participants with a pre-defined problem scenario, we were not able to observe patterns of real-world use. Future field deployments can help assess the utility of conversation-driven explanations in practice.

Conclusions

In conclusion, we have presented a novel approach for explaining technical concepts to non-technical users through the design of conversation-driven explanations. Our evaluation identified benefits of using conversation-driven explanations to lower the barrier for understanding and helping non-technical users maintain focus. We highlighted the potential of using conversation-driven explanations as a method to explain domain knowledge to non-domain experts in other domains and discussed the advantages and disadvantages of our approach.

Acknowledgements

We thank the Natural Sciences and Engineering Research Council of Canada (NSERC).

REFERENCES

[1] R. K. Atkinson, S. J. Derry, A. Renkl, and D. Wortham, "Learning from Examples: Instructional Principles from the Worked Examples Research," *Review of Educational Research*, vol. 70, no. 2, pp. 181–214, Jun. 2000.

[2] J. Brandt, M. Dontcheva, M. Weskamp, and S. R. Klemmer, "Example-centric Programming: Integrating Web Search into the Development Environment," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2010, pp. 513–522.

[3] S. Carter and D. Smilkov, "Tensorflow — Neural Network Playground." [Online]. Available: http://playground.tensorflow.org. [Accessed: 10-Jul-2019].

[4] K. S.-P. Chang and B. A. Myers, "WebCrystal: Understanding and Reusing Examples in Web Authoring," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2012, pp. 3205–3214.

[5] P. K. Chilana, C. Alcock, S. Dembla, A. Ho, A. Hurst, B. Armstrong, and P. J. Guo, "Perceptions of non-CS majors in intro programming: The rise of the conversational programmer," in *2015 IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC)*, 2015, pp. 251–259.

[6] P. K. Chilana, R. Singh, and P. J. Guo, "Understanding Conversational Programmers: A Perspective from the Software Industry," in *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2016, pp. 1462–1472.

[7] Y. Eshet, "Digital Literacy: A Conceptual Framework for Survival Skills in the Digital era," *Journal of Educational Multimedia and Hypermedia*, vol. 13, no. 1, pp. 93–106, Jan. 2004.

[8] M. Eslami, S. R. Krishna Kumaran, C. Sandvig, and K. Karahalios, "Communicating Algorithmic Process in Online Behavioral Advertising," in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2018, pp. 432:1–432:13.

[9] S. R. Herring, C.-C. Chang, J. Krantzler, and B. P. Bailey, "Getting Inspired!: Understanding How and Why Examples Are Used in Creative Design Practice," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2009, pp. 87–96.

[10] M. Hoffman and J. Blake, "Computer Literacy: Today and Tomorrow," *J. Comput. Sci. Coll.*, vol. 18, no. 5, pp. 221–233, May 2003.

[11] R. F. Kizilcec, "How Much Information?: Effects of Transparency on Trust in an Algorithmic Interface," in *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2016, pp. 2390–2395.

[12] R. Kumar, J. O. Talton, S. Ahmad, and S. R. Klemmer, "Bricolage: Example-based Retargeting for Web Design," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2011, pp. 2197–2206.

[13] B. Lee, S. Srivastava, R. Kumar, R. Brafman, and S. R. Klemmer, "Designing with Interactive Example Galleries," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2010, pp. 2257–2266.

[14] L. Mamykina, B. Manoim, M. Mittal, G. Hripcsak, and B. Hartmann, "Design Lessons from the Fastest Q&a Site in the West," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2011, pp. 2857–2866.

[15] E. Rader, K. Cotter, and J. Cho, "Explanations As Mechanisms for Supporting Algorithmic Transparency," in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, New York, NY, USA, 2018, pp. 103:1–103:13.

[16] K. VanLehn, "Cognitive Skill Acquisition," *Annual Review of Psychology*, vol. 47, no. 1, pp. 513–539, 1996.

[17] A. Y. Wang, P. J. Guo, and P. K. Chilana, "Mismatch of Expectations: How Modern Learning Resources Fail Conversational Programmers," in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems,* New York, NY, USA, 2018, pp. 511:1–511:13.

[18] J. C. Zhao, N.-M. Cheung, R. Sosa, and D. C.-I. Koh, "Design Self-Diagnosis Applications for Non-Patients," in *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems*, New York, NY, USA, 2015, pp. 1433–1438.

[19] "Simple English Wikipedia," *Wikipedia, the free encyclopedia*. [Accessed: 10-Jul-2019].

[20] "CS Unplugged." [Online]. Available: https://csunplugged.org/en/. [Accessed: 10-Jul-2019]

[21] "TechWiki | The Future Is In Your Hands." [Online]. Available: http://tenwordwiki.com/. [Accessed: 10-Jul-2019].

[22] "The Tech Terms Computer Dictionary." [Online]. Available: https://techterms.com/. [Accessed: 10-Jul-2019].

[23] "Tableau Software," *Tableau Software*. [Online]. Available: https://www.tableau.com/. [Accessed: 10-Jul-2019].