CONEY: A CONversational survEY Toolkit

Damiano Scandolari
Cefriel
Milano, Italy
damiano.scandolari@intern.cefriel.com

Gloria Re Calegari
Cefriel
Milano, Italy
gloria.re@cefriel.com

Mario Scrocca
Cefriel
Milano, Italy
mario.scrocca@cefriel.com

Irene Celino
Cefriel
Milano, Italy
irene.celino@cefriel.com

ABSTRACT

Coney is an innovative toolkit designed to enhance the user experience in surveys completion. Coney exploits a conversational approach: on the one hand, Coney allows modelling a conversational survey with an intuitive graphical editor; on the other hand, it allows publishing and administering surveys through a chat interface. Coney allows defining an arbitrary acyclic graph of interaction flows, in which the following question depends on the previous answer provided by the user. This offers a high degree of flexibility to survey designers that can simulate a human-to-human interaction, with a storytelling approach that enables different personalized paths. Coney's interaction mechanism exploits the advantages of qualitative methods while performing quantitative research, by linking questions to the investigated variables and encoding answers. A preliminary evaluation of the approach shows that users prefer conversational surveys to traditional ones.

CCS CONCEPTS

• **Human-centered computing** → *User interface toolkits*; *Natural language interfaces*; *Web-based interaction.*

KEYWORDS

Conversational Interface, Survey Tool, User Engagement

1 INTRODUCTION

Surveys are a fundamental means for researchers and companies to gather opinions and data from participants. To ensure meaningful conclusions and insights, it is fundamental to collect a relevant number of reliable answers from users. For this purpose, it is not sufficient to reach a high number of people, but important attention shall be paid to the user experience design to ensure the participants will complete the survey providing truthful answers.

Digital interaction already improved the classic paper-based mechanism, and many web-based tools like *SurveyMonkey*[1] and *TypeForm*[2] focus on user experience to differentiate from their market competitors and to improve the data collection process. Moreover, intelligent agents and chatbots are gaining increased attention in many fields and are demonstrating the potentialities and benefits of a dialogue-based approach in human-computer interaction.

The idea behind Coney is to offer a complete toolkit implementing a *conversational interface* for surveys. Coney aims at providing to survey designers the possibility of building an interactive storytelling, and at offering users with a different experience in questionnaires completion, making the question-answer process more natural, engaging and similar to human-to-human interaction.

2 BACKGROUND

Survey research methods can be classified in two areas: *qualitative* and *quantitative* research. Qualitative research is based on the analysis of non-numerical data often collected through direct interviews with participants. On the other hand, quantitative research applies statistical, mathematical, or computational techniques to a set of numeric values collected through questionnaires administered to users. Both techniques present positive and negative aspects, and their commonalities and interplay are widely analyzed in the literature. As highlighted by Ongena and Dijkstra [9], in designing and analyzing interviews it is important to consider the cognitive processes that both the interviewer and the participant experiment. On the other hand, a quantitative approach often based on closed questions introduces a set of biases that Gobo [5] suggests to overcome through the adoption of the technique proposed by [3], named "conversational survey", as a mixed qualitative-quantitative method considering pros and cons of the two techniques.

[1]SurveyMonkey https://www.surveymonkey.com/
[2]TypeForm https://www.typeform.com/

Intelligent agents are gaining increasing attention, and it is important to classify the various proposed solutions to understand similarities and differences. As discussed in [4], we can identify: question-answering agents (single shot interaction, complex query), task-oriented dialogue agents (slot-filling or form-filling), chatbots (end-to-end conversation). The growing interest in these type of agents encourages researchers to find techniques able to simulate credible question/answer conversation patterns [12]. However, Badiu [1] claims that today's chatbots are far from being "intelligent" since the behaviour is often not defined when the user deviates from defined flows. To address this problem, Jain et al. [6] propose to minimize the user input offering a mix of text/buttons/media.

Enhancing user engagement is extremely important in designing and administering surveys, and we select some possible techniques from the literature. Celino et al. [2] classify user engagement approaches in the area of citizen participation. Lambert [8] describes the power of (digital) storytelling as a mean to enhance engagement in communication. In the area of survey design, a company named *Upinion* highlights the market interest towards conversational survey to obtain better user engagement [10].

3 SOLUTION DESIGN

The main objectives in designing and administering surveys are: (i) to ensure users will complete the survey providing truthful answers, and (ii) to obtain significant data that can be manipulated and analyzed to answer latent questions. To address these needs, a solution for surveys should be designed to obtain machine-processable data without neglecting the positive aspects of an approach based on human-to-human interaction to enhance user engagement. Therefore, our research effort aims at providing a set of tools to set up a quantitative questionnaire involving also characteristics and advantages of qualitative research methods.

We designed our solution starting from the concept of *conversational survey*. This approach is based on questionnaires disguised as a conversation and proposing qualitative answer options which, however, are automatically quantitatively coded for numerical analysis. The proposed solution aims at providing a set of tools to digitally design, administer and analyze results of conversational surveys.

Chat-like form to mix qualitative and quantitative approaches. We decided to adopt a chat-like form to let users experience questionnaires as a message conversation with another human (qualitative research-style), still collecting quantifiable data on user responses (quantitative research-style). It is important to notice that the proposed solution adopts an opposite interaction pattern with respect to chatbots (see Figure 1). In the devised conversational survey, the agent

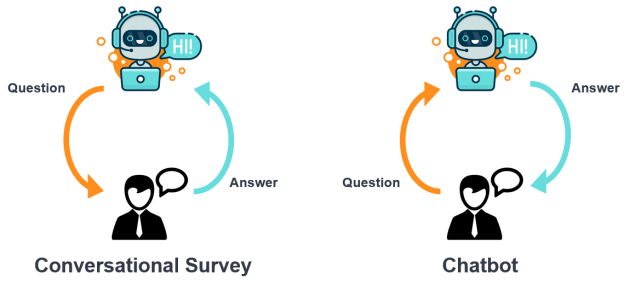

Figure 1: The figure shows the difference in the interaction paradigm between a conversational survey agent and a typical chatbot.

administering the survey has control over the conversation flow, it asks questions and the user replies. Therefore, the agent does not encounter the main challenges of chatbots that should grasp questions made from the user to provide the correct answer. Nonetheless, we considered the literature on the user experience of chatbots to model the interaction mechanisms and the interface.

Storytelling approach to enhance user engagement. To enhance user engagement, the proposed solution allows questionnaire designers to build an interactive storytelling that may result in a natural chat experience for survey compilers. For this purpose, it should be possible to send not only questions to the user but also different types of messages, like text, images and links. Moreover, it should be possible to model an arbitrary sequence of message exchanges that may diverge creating different branches with respect to interactions, i.e. answers, provided by the user (see Figure 2).

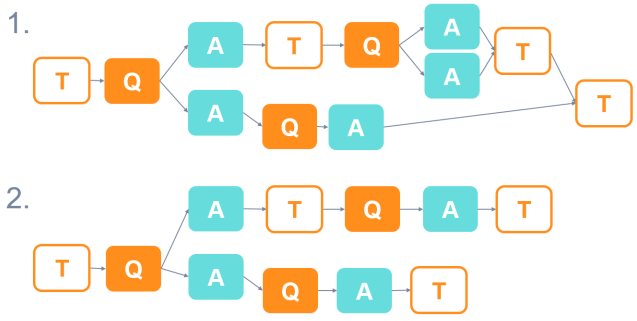

Figure 2: The conversation survey editor should allow to design an arbitrary acyclic graph to specify the possible branches and paths for the conversation. *T* indicates *Talk* elements, *Q* indicates *Question* elements, *A* indicates *Answer* elements. The graph *1)* shows convergence to the same end point, graph *2)* shows divergent branches with different end points.

4 THE PROTOTYPE

Coney is a complete toolkit addressing the design, evaluation, and analysis of questionnaires for survey research[11]. To the best of our knowledge, Coney is the first solution providing a complete instrument to submit surveys via a conversational interface.

Coney toolkit is composed by four different components: *Coney Create* is a graphical editor to design conversational surveys, *Coney Chat* provides the user interfaces to administer the surveys, *Coney Inspect* offers a set of pre-computed analysis on data gathered, *Coney Collect* is the backend solution empowering all other components.

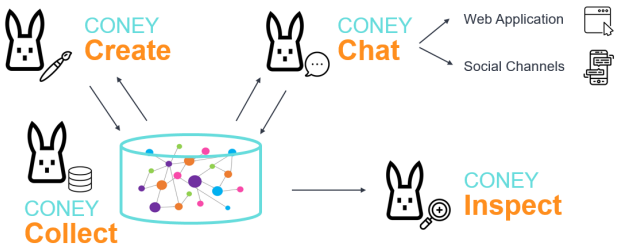

Figure 3: The components in the Coney toolkit.

Coney Create

Coney Create is a drag-and-drop web-based editor which allows for the graphical design of a conversational survey. Coney offers a generic model for surveys and allows the designer drawing an arbitrary acyclic graph to specify the possible branches and paths the conversation may follow with respect to answered questions. *Coney Create* allows building the survey by interconnecting three basic elements: *question* blocks (Q) to model questions and to select their visualization (star rating, options, emoji, slider, open), *answer* blocks (A) to model each available predefined option offered to the respondent, *talk* blocks (T) to model conversational/storytelling elements (messages, images or links). The graph-based model is very flexible but has some obvious constraints, e.g., only answer blocks can follow a question block. To support a quantitative research method, in *Coney Create* it is possible to transparently annotate the survey elements, by linking questions to the latent variables they refer to and by coding answer options with numerical values.

Figure 4 shows the graphical interface offered by the component. To facilitate the composition of large conversations it also provides a mini-map to navigate easily the built graph, and a template mechanism to store and retrieve commonly used blocks or set of blocks.

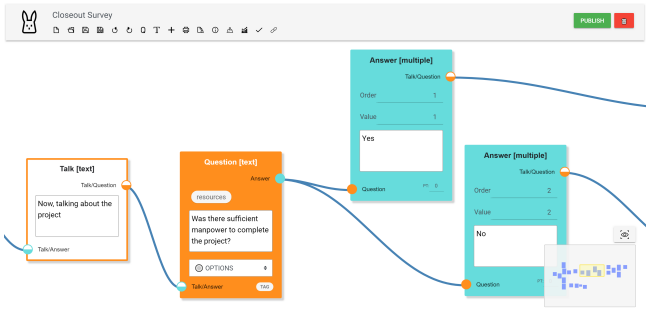

Figure 4: The Coney Create interface.

Coney Create is implemented with Angular[3] and it is supported by the Rete.js[4] library.

Coney Chat

Coney Chat is a web-based user interface to administer the designed surveys through a chat-based interaction. *Coney Chat* simulates a message exchange by texting users and posing questions according to the defined flows and collects the provided answers from users' replies. The interface is similar to one of instant messaging services and adapts itself giving to the user different possibilities of interaction with respect to the type of question, e.g. displaying emoji options instead of the usual textual area (see Figure 5). In our design, it is possible to ask users open questions, but we decided to limit other user interactions with options selection to provide guided and consistent conversations, as suggested in the literature.

Coney Chat is currently implemented with Angular and supports most popular web browsers. We are also evaluating the feasibility to administer our conversational surveys through existing chat channels, like Messenger, Telegram or Slack.

Coney Inspect

Coney Inspect is a component implementing an interactive dashboard to simplify the statistical analysis and visualization of the answers collected through the conversational survey. Given the possibility to tag questions with the investigated latent variable and to tag answers with their numerical coding, *Coney Inspect* facilitates the basic analysis on collected data (e.g., frequency statistics on answers, coherence of questionnaire items, potentially also hypothesis testing on the interplay between the latent variables). Moreover, *Coney Inspect* allows visualizing common paths followed by survey compilers and drilling down to an individual user's followed path.

[3]Angular https://angular.io/
[4]Rete.js https://github.com/retejs/rete

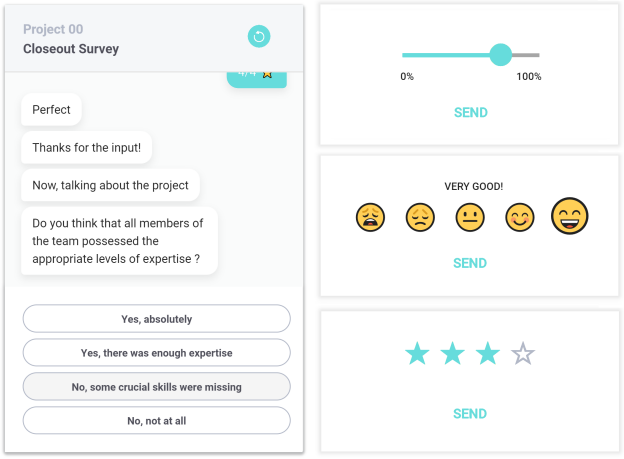

Figure 5: The figure on the left shows an example question administered through the Coney Chat interface. The figure on the right shows examples of other visualizations available for answers.

Coney Inspect is currently implemented as a dashboard for PowerBI[5], but we are planning to build a dedicated component independent from third-party applications.

Coney Collect

Coney Collect is the backend implementation supporting the other components. *Coney Collect* allows storing and retrieving the graph-based data model, used to describe surveys, and the answers collected from participants completions. The first *Coney Collect* implementation was based on *MongoDB*[6], but this approach didn't scale well with increasing complexity of modelled surveys. The necessity to store an high number of branches demands for a graph-based database, and for the current implementation we selected the *Neo4j*[7] property graph. This choice also has positive implications on queries performances.

5 EARLY EVALUATION

To start assessing the proposed approach, we performed an early evaluation of our toolkit. We proposed to a set of 200 users the same questionnaire in two different formats, a traditional survey (via *SurveyMonkey*) and a conversational survey designed and administered with Coney. The collected feedback show users clearly and strongly prefer the conversational survey over the traditional one (81%). The main influencing factor reported is the *"enjoyability"* of the interaction mechanism. Users think the conversational approach is more interesting and intuitive, less boring and confusing. They also have the impression that the completion of the conversational survey takes less time, even if actual timing does not confirm it.

An interesting aspect we should investigate in more details is related to a systematic bias towards higher response values in the conversational survey with respect to the traditional one. This can be related to the fact that Coney resembles the interaction between the respondent and a human interviewer (even if in this case it's an automated agent); this can influence the provided responses, e.g. because of satisficing [7].

The preliminary results obtained are encouraging and we are planning a deeper evaluation together with an analysis of the user interfaces, both for the editor and the chat.

6 CONCLUSIONS

In this paper, we presented Coney, a complete toolkit for survey research. Coney exploits a conversational interaction paradigm, typical of qualitative approaches, to implement a quantitative research method. Survey designers are given the opportunity to model different and personalized messages flows in the conversational survey improving the user experience and enhancing the user engagement. A preliminary evaluation of the approach showed users clearly prefer conversational surveys to traditional ones. Further investigations should be made also taking into account that this method introduces a further degree of freedom for survey designers. To evaluate a survey, not only the formulation of the questions should be considered, but also the overall interaction flow. Future works will: (i) test and consolidate the user interfaces of Coney components, (ii) design conversational surveys addressing different use cases to further investigate the effectiveness of the approach and the possibly introduced bias, and (iii) study which patterns in the conversation graph help more in enhancing users engagement.

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