

Towards a typology of questions for requirements elicitation interviews

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Abstract—Interviewing is known to be one of the most common requirements elicitation techniques. Interviews are driven by a series of questions asked for the purpose of receiving responses that can help understanding the domain and the needs of stakeholders. However, what constitutes a successful choice and ordering of questions continues to be more of an art than a systematic process. We review literature from a broad range of disciplines in which interviewing is widely applied, in order to identify a set of categories for characterizing interview questions. The resulting typology aims at offering an initial coding language for qualitatively analyzing interview content. Such coding language can be further validated for its reliability to enable standardization and community-wide reuse. We offer examples of how such an instrument would help researchers develop and evaluate both descriptive and normative theories of interviewing.

Index Terms—Requirements Engineering, Requirements Elicitation, Interview

I. INTRODUCTION

Interviewing is considered to be one of the primary methods for information gathering during requirements analysis [1]–[3]. It is known to be useful for a variety of requirements analysis situations including for efficiently gathering initial background information about a project and for understanding and resolving political issues and conflicts [1].

In a typical interview, an interviewer poses questions to an interviewee allowing the latter to respond as they wish [2]. In requirements analysis, such interaction primarily serves the analyst’s purpose to gather information of various kinds about the domain and problem at hand. The level to which this information is effectively gathered can be seen as dependent on the interviewee’s responses, which are, in large part, dependent on the questions that the interviewer asks. Thus, the choice and organization of questions is the primary tool available to the interviewer for controlling the outcome of the interview.

Despite the importance of question selection, there seems to be little evidence about what kinds of questions, asked in what order, and phrased in what style are conducive to better interview outcomes. Yet, an evidence-based body of knowledge for informing systematic development and execution of interview plans could be of help for both seasoned and aspiring interviewers. For such a body of knowledge to be developed, a strongly empirical research program is required whereby interview data can be studied and characterized with

respect to the factors that affect the interviewer’s questioning strategy or the effect that such strategy has on interview success. However, to be able to study interviewer choices and strategies we need a vocabulary for meaningfully and reliably characterizing interview data (i.e., interview recordings and/or their transcriptions).

In this paper, we offer some highlights from a broad literature review we are conducting across various disciplines in an effort to identify types of questions that can be used for the analysis of interview data. Our review revealed that several dimensions can be identified as a basis for organizing such question types, including question content, style and probing style, sequence, and objective. Based on these dimensions we develop a draft typology of interview questions, sketch how such a typology can be evaluated, and demonstrate how, once found reliable, it can be used for qualitatively analyzing interview material for informing theoretical work in the field.

We present key findings of our review and offer a draft typology in Section II. In Section III we describe strategies for evaluating and using the proposed typology in empirical studies. We discuss related work in Section IV and conclude in Section V.

II. QUESTION TYPES

A. Overview

In this section, we report highlights from our ongoing effort to study theories and practices of interviewing in various domains that use it as the main method for information seeking. The following disciplines were selected: software engineering, psychology, sociology, knowledge management, library science, journalism, health care, and judicial and criminal investigation. To identify relevant literature, the electronic databases of IEEE, Proquest, Pubmed, and Factiva have been used so far. A variety of query strings were tried such as (“*library science*” and “*reference interview*”; “*sociology*” and “*interview question**”; “*psychology*” and “*interview question**”). Snowballing was used to find additional sources from key documents identified in every discipline.

This review aims at understanding how questions and questioning strategies are characterized in various domains and collect these characterizations in a comprehensive classification scheme – the typology. Figure 1 offers a partial view of

a first-cut such typology, organized around dimensions such as question content, style, and objective. We next discuss these dimensions and how the relevant literature informs the development of the typology.

B. Question Content

Content is concerned with what the interviewer is interested in finding out about when asking a question. The type of content sought necessarily depends on the purpose of the interview: different kinds of interviewers have different content in mind when asking their questions. For example, an accident investigator might be interested in finding out about a sequence of events, an occupational therapist in learning about what obstructs a client from living a fulfilling life, and a librarian in finding out what information exactly their client is looking for. Likewise, a requirements analyst has her own special kind of content that she needs to elicit through the interview.

R. Derr [4], inspired by the philosophical work of Aristotle and Kant, characterize question content based on the concept that the question presupposes. Thus, in reference to an *object*, e.g., in our RE case, an event, a process, a requirement, a goal etc., one can question its *existence*, its *identity*, its *properties*, its *relations* to other objects, the *number* of the objects, if they are many, its *time* and *location* as well as whether the object is performing an *action*.

The question that emerges in the context of requirements elicitation is what precisely should be the main “objects” of questioning. One relevant attempt is due to Burnay et al. [5], and the Elicitation Topic Map (ETM) they propose. ETM consists of six topic sets, three of which (*items*, *rules* and *localization*) deal with the scope of the project/context and another three (*activities*, *connections*, and *granularity*) deal with the depth of the context i.e. details to which scope topic sets are described. The authors go on to identify around 30 topics within those sets collected from interviews with requirements engineers and business analysts. Elsewhere, L.E. Wood et al. [6], influenced by the contextual inquiry practice [3], propose a semi-structured interview scheme, whereby question types for identifying *objects*, *processes*, and relationships thereof are proposed, along with styles by which to ask them. Theory-based identification of content has also been promoted, including activity theory [7], sociotechnical systems theory [8] and viewpoints [9].

In general, it can be assumed that the theoretical inclination of the interviewer/analyst, often exhibited by a preferred modeling practice, will affect the topics they will include or emphasize in their elicitation sessions. Analysts of the goal-oriented RE culture will perhaps focus on understanding high-level technology-independent goals and asking “*why*” questions, object-oriented inclined analysts may ask about objects in the domain and examples of future system use, while others may consider current and future business process understanding as the primary goal.

Likewise, some analysts may be strongly focused on understanding the current system, asking questions about the current and past situation and processes, while others, apprehensive of

the biases excessive study of the current suboptimal situation can create, may focus on questions about the system-to-be and its desired properties. Hence, the *time* of the object of inquiry can be seen as an additional dimension along which questions can be classified: it may ask about a *past*, an ongoing (*present*) or a *future* state of affairs and this concern can be seen as generally orthogonal to the other aspects of the state of affairs we are interested in.

C. Question Styles

In parallel to what a question is asking, i.e., the content it tries to elicit, there is variability in *how* a question is asked, which we refer to as *style*. One aspect of question style concerns how *ample* or how *rigid* it is. Ample questions are open-ended and broad and their intent is to acquire a content of high variety based on what the interviewee considers to be important or chooses to disclose [10]. According to Mann [11], questions that produce ample content include: *catchall* questions which give space and opportunity to find out about issues that prepared questions did not cover, *introducing questions*, for opening a topic, and *tour questions*, where the respondent is invited to offer a tour to a context, domain, process, etc. [10]. Finally, whenever questions ask for more details and depth from the interviewee, we can call them *elucidative* questions [12].

As opposed to ample questions, which leave substantial freedom to the interviewee to answer from a point of view that they choose, *rigid* questions leave no room for self-expression or additional comments. Questions that can be seen as rigid include *specifying*, *bipolar*, *check-reflect*, *declarative*, *forced-choice*, and *multiple-choice questions*. Rigid questions are often used for the verification of previously stated facts. A similar category, *explicit* questions, ask for something specific (e.g. *what*, *where*, *when*, *who* questions). Questions that are *closed*, *ready reference*, *instructional ready reference*, and *directional questions* can be seen as explicit questions.

Examples of some of the above types are shown in Fig. 1. All these styles appear to have a use in the RE context. For example, ample questions might be most useful in initial scoping interviews, while rigid styles seem to be suitable for later-stage requirements validation.

D. Probing

A type of question of particular importance in open-ended and semi-structured interviews is *probing* questions, i.e. questions that are asked due to a response to a previous question. The majority of literature sources examined in our work (e.g. [11], [13]–[17]) claim that probing is one of the most efficient question types.

We found more than ten types of probing questions [11], [14], [15]. The most obvious types of probing are *elaboration/informational*, *interpreting*, *reason-seeking*, and *consistency* probes, each of which aims at getting the interviewee to offer more information and clarification on something they previously said, as well as, in the case of consistency probes,

offering them an opportunity to correct and offer a more accurate picture. Further, in *clearinghouse* probes, the interviewer simply asks if there is anything else that was not covered in previous questions. The question allows respondents to think outside of the frame that the interviewer has created in the previous line of questioning, or simply share information that they would otherwise not have the opportunity to share.

A series of other categories such as *mirror probing*, *echo probing*, *reformulation*, and *paraphrasing* probing focus on restating in some form a previously given response, in order for confirmation, correction, or elaboration to be inspired. On the other hand, *reflecting* probing inspires the interviewee to more deeply think and talk about their earlier response through, for example, an invitation to think counter-factually (as in, “what if the opposite were true” [14]–[16]). Finally, *silent probing* relies on the expectation of self-generated answers without an explicit question [16]. Following this technique, the respondent is given space to reflect, gather their thoughts, and possibly say something important that requires some thinking to be framed properly before the response is articulated [17].

As with question styles, most probing types appear to be relevant to the RE process. For example, check-reflect, consistency, and echo probes are suitable for validating requirements, elaboration probes aim for expansion and completeness, while reason-seeking probes – asking the “*why*” questions [18] – seem to be an important tool for goal-oriented elicitation.

E. Interviewer Objective and Content Maneuvering

While we understand the RE interview as a fact-finding process in which the interviewer would want to keep the elicited responses uninfluenced by their own biases, it is conceivable that such biases may emerge unnoticed by the interviewer or often be deliberately part of their interviewing strategy. There are certain kinds of questions that allow the interviewer to engage in *content maneuvering*, i.e., strategic question phrasing so that a preferred response is elicited [14]. In *forced-choice* questions, for example, interviewers ask a multiple-choice question imposing the assumption that the answer must be one of the offered options, even if the interviewee would answer outside this set if given the chance. Likewise, *declarative* questions offer a proposition and force interviewees to either accept or reject it, framing thereby their response. A *negative balance* question aims at steering the interviewee from a path in which they praise the positive aspects of a system, process, etc., to thinking about deficiencies and issues with it. Finally, the choice of a *direct* question, in which the personal experiences of the interviewee are asked, versus an *indirect* one, in which the interviewee is kept at arms-length from the described affairs, can be used to steer the response to one or the other direction of admission to a pathology or undesired pattern of behavior.

In the RE context, content maneuvering appears to be detrimental to the quality and validity of the identified requirements. However, it is easy to see how it can be used to serve political ends [19], including promoting a specific solution

or winning acceptance of a *fait accompli*, adding thereby a persuasion element to the interview.

F. Sequencing Questions

Our concern so far has been the building blocks of an interview, i.e., the individual questions. However, another aspect where patterns may emerge is the sequence of questions within a single interview: which question precedes or follows which other question(s) in the course of an interview.

A number of sequencing patterns based on how the interviewer intends to cover the scope of content that needs to be elicited is offered by Keats [20]. In a *simple structure* interview there is no connection between questions. In contrast, in a *chain structure* the next question is adapted based on the response to a previous question, making therefore heavy use of probes. A more elaborate structure is the *branching structure with channeling effects*, whereby the interviewer selects one aspect of the answer for further exploration and ignores the rest. In the *sequential structure with simple feedback loops*, the interviewer does not just ignore these parts but returns to them once a chain of questions relating to the focal part is over. More complex structures in Keats’ typology include *branching structure with complex loops*, whereby the interviewer returns to previously asked questions and replies by relating later parts to earlier parts of the interview, and *constellated structures*, in which questions are clustered around subjects, and once one subject is exhausted, the interviewer moves to the next one through entering a different constellation of questions.

In terms of question content and sequence, there appears to be agreement in the literature that a good practice is putting general, open questions at the beginning of the interview and leaving more specific questions for the end [21], [22]. Questions that are helpful for interviewees to orient themselves in the interview, such as explicit [21] and neutral [23] questions, are also good for inclusion at the start of the interview.

III. TOWARDS EMPIRICAL ANALYSIS OF RE INTERVIEWS

A. Question Type Classification as a Research Instrument

Our review so far and the resulting typology of Table 1 indicate that interviewers have many options with regards to the type, purpose, content, and order of questions they can ask. The natural research question that arises is what combinations of question types make for a more successful interview and in what sequences.

The typology we are developing aims at exactly offering to empirical researchers a toolset for qualitatively analyzing interviews for the purpose of exploring such research questions. In the area of qualitative content analysis [25] such a list of categories corresponds to a *data language*, i.e., a set of *variables* that are used to characterize units of qualitative content. Although such data languages can be discovered from data, especially in methodologies akin to grounded theory [26], there is reliability and replicability value in developing standard sets of variables that can be used across studies.

In content analysis, two or more *raters* classify collected samples of qualitative units to one or more of the available

| | | |
|---------------|--------------------------------------|---|
| Time | Past | <i>"How was the current process designed and approved?"</i> |
| | Present | <i>"Tell me how you go about ____ [process]?"</i> |
| | Future | <i>"Will ____ [stakeholder] be one of the users?"</i> |
| Content | Users/Stakeholders | <i>"Who are the main users?"</i> |
| | Needs/Evaluations | <i>"What goals do you have on ____ [aspect]?", "What are some issues with the current system?"</i> |
| | Processes | <i>"How is the process organized?", "What happens after ____?"</i> |
| | Objects/Data | <i>"Can you show me how a typical application for admission looks like?"</i> |
| | Required Functions | <i>"Should the system allow you to ____?", "Should you be able to ____?"</i> |
| | Technology | <i>"Are you looking at a hosted or an on-premise solution?"</i> |
| | Pragmatics | <i>"When is the deadline for ____?", "What is your budget on ____?"</i> |
| ... | ... | ... |
| Form | Open | <i>"Can you tell me about ____."</i> |
| | Bipolar | <i>"So, would you say that ____ is required or not?"</i> |
| | Multiple Choice | <i>"These statements should be produced monthly, quarterly, or annually?"</i> |
| Style | Catchall | <i>"Is there anything else that you think I should know about and we haven't yet discussed?"</i> |
| | Comparison/Contrast | <i>"Can you tell me about the situation in department X when you worked there? How is it the same or different from what happens in your department?"</i> |
| | Declarative | <i>"That didn't work, right?"</i> [Invites confirmation.] |
| | Introducing | <i>"Can you (now) describe/tell me about ____?"</i> [Used to introduce new topic.] |
| | Specifying | <i>"So what kind of information do you exactly ask the patients to share with you?"</i> [Trying to find out more specific details.] |
| | Structuring | <i>"Can we now turn to [different subject]"</i> [Used for signaling shifts and stages of the interview] |
| | Ready Reference | <i>"Who are the members of that committee?", "Is there a VP marketing?"</i> [requires short, factual answers] |
| | Instructional Ready Reference | <i>"How do you [enroll a student to class]/[cancel an order]?"</i> [starts with how] |
| | Directional | <i>"Where is the data center located?", "Which application are you using for ____?", "What time do you open?"</i> [where things are and how things are done] |
| | Tour | <i>"Could you tell me about what you do here?"</i> or <i>"Could you explain to me the process step-by-step?"</i> |
| | Targeted – Minitour | As above but focussed on a specific area: <i>"What happens once an application has been received?"</i> |
| Probing Style | Elaboration/ Informational Probe | <i>"Could you tell me more about that?", "Why exactly do you say that?"</i> |
| | Reason Seeking Probe | <i>"Why do you think ____?", "Why are you saying that ____?"</i> |
| | Clearinghouse Probing | <i>"What have I not asked that is important in this process?", "Is there anything else I should know?"</i> |
| | Consistency Probe | <i>"You said earlier that ____ but then you told me ____ . How do you explain that?"</i> |
| | Interpreting | <i>"You then mean that...?", "Is it correct that ...?", "Does this imply that...?"</i> |
| | Check-reflect | <i>"So it takes a lot of effort to query the information, is that what you say?"</i> [probe an interpretation when unsure about interviewee's earlier response] |
| | Echo Probing | <i>"So, you copy the information from the application form to the screen, and then what do you do?"</i> [repeating what has just been said for confirmation and placement in the timeline]. |
| | Question Reformulation Probe | <i>"What do you find most problematic in this process?"</i> [and later] <i>"So back to our earlier question, which part of the process requires a change the most?"</i> |
| | Restatement Probe | <i>"So you're saying that ____"</i> |
| Leading Probe | <i>"Isn't it the case that ...?"</i> | |
| Objective | Forced Choice | <i>"Do you need the tabulation or also the visualization feature?"</i> [assumes at least one of the two is needed] |
| | Leading | <i>"Given your clear need to do away with this approval process, how do you think this could be done?"</i> [assumes a need] |
| | Direct | <i>"Have you personally made such a data-entry mistake?"</i> [centered on the interviewer] |
| | Indirect | <i>"Do you believe many colleagues make such data entry mistakes?"</i> |
| | Negative Balance | <i>"You seem to be very efficient. Do you remember of any occasions in which you had problems that slowed you down?"</i> [helps elicit a more balanced approach] |

Fig. 1. A typology of interview questions with examples. Sources: [11], [13]–[17], [24]

data variables, expressing thereby that the chosen variable adequately describes or characterizes the unit in question. In our context, content units are questions or blocks thereof within interview transcriptions or recordings, and the identified question types can serve as the data language to be used in the coding process.

For the outcome of such a coding exercise to be useful for theoretical inferences, it has to be *reliable*, i.e., the outcome must be the same independent of who conducts it, when, and under what circumstances [25]. Measures such as *intra-* and *inter-rater reliability* have been introduced that quantify the level to which raters agree with each other and/or with themselves at different times as to how units must be coded [27]. Low reliability may be due to a number of problems, including an inappropriate data language vis-à-vis the domain it is meant to characterize. Such low reliability would motivate revision of the language, aimed at removing disagreement-inducing variables or adding missing ones.

Thus, one way by which our interview question typology can be empirically validated is to utilize it over real interview content and observe which of its items succeed in evoking agreement among and within raters.

B. Designing Studies

Assuming a validated instrument for characterizing interview questions emerging from this evaluation process, it is worthwhile to explore what kinds of empirical studies can be designed to investigate research questions relating to requirements elicitation interviews.

Studies that are *descriptive* with regards to how interviewers actually conduct interviews in the field are a first step in such an investigation program. One research question is what kinds of interview questions are most prevalent among practicing requirements elicitation interviewers and how the questions are sequentially organized within the interview session, following, e.g., Keat's sequencing patterns [20]. If patterns emerge, are there specific question types that are utilized in special places within the sequencing patterns? Further, it may be of interest to understand factors that affect the utilization of question types within an interview. Interviewer experience (e.g. professional vs. students – see [28]), domain and type of project, stage in the analysis process (first or subsequent interview) are examples of such factors. Moreover, an exploration for correlations between individual differences of interviewers – e.g., cognitive style [29] – and the utilization of certain kinds of questions and orderings thereof may also be of interest.

A more challenging enterprise is that of developing empirically-informed *normative* theories of interviewing, i.e., theories that would tell us how we *should* be conducting interviews. A challenge in even beginning to conceptualize such empirical work lies in the definition of a good and effective interview. In the empirical literature, appeal to the opinion of experts seems to be the preferred method for such measurement (eg., [28]). A more direct approach would be based on the assumption that good quality interviews are ones that enable the acquisition of large amounts of information

with a minimum number of questions and stakeholder time investment. This gives rise to the theoretical construct of *interviewing efficiency*, referring to the amount of useful information elicited per question or unit of effort. Quantitatively operationalizing this construct is a major challenge, in that it requires an unbiased measure of useful information and a method to confirm the acquisition of such.

Problems such as the above emerge due to the presence of a host of contextual factors that may affect the behavior of the interviewer and the information provided. The most obvious is the behavior of the interviewee and how their responses affect the choice and style of the next interviewer question. Type of project and domain, prior knowledge of the domain and the problem, or mode of interaction (e.g., remote, online, phone, in-person) are factors that should affect the choice of questions as well. Careful controlling, large sample and randomization will be required for such studies to produce useful results.

IV. RELATED WORK

There is a wealth of work in the requirements engineering literature on the topic of interviewing for eliciting requirements. Davis et al. [30] perform a deep analysis of the literature that compares elicitation techniques with regards to their relative effectiveness. The analysis, which includes various techniques beyond interviewing, compares interview styles at a high level – for example, structured vs. unstructured – without looking into the specifics of questions or, e.g., sequencing patterns, which is our focal point here.

Focusing on interviews specifically, Cohene and Easterbrook [31] perform an empirical study in which various interviews with the same objective were conducted using different choices of question types (e.g. “personal experience” vs. “hypothetical experience” questions). In qualitatively analyzing responses they found that the type of question indeed affected the response offered by the interviewees in a way that can be used to help the analyst address interview risks.

Some of the literature has focused on domain expertise. Niknafs and Berry [32] experimentally study the hypothesis that domain expertise may actually be detrimental to the effectiveness of an elicitation exercise. A similar study is reported by Hadar et al. [22] where the analysis of the experimental data includes grounded-theoretic development of categories. Ambiguity has also been studied in the analyst-stakeholder interactions – e.g., [33], [34].

Further, Bano et al. [28], [35] report on a study in which novice interview data are analyzed for mistakes. The study is qualitative and conducted through thematic analysis in which the categories of mistake characterization appear to be generated from data – a methodology similar to the one used by Hadar et al. [22]. Our work aims at exactly assisting such kinds of studies, through offering qualitative analysts a validated set of categories to analyze successful and unsuccessful patterns and mistakes in the interviewing strategy taken by the interviewer. A similar effort is reported by Scheinholtz and Wilmont [36], where a 4-tag system is proposed that also covers a number of probe types. Our so-far literature review

has revealed many more category possibilities. We, hence, believe an evaluative step will be necessary for generating a definitive set of categories to be reliably used for empirical analysis of interviews.

V. CONCLUSIONS

Using insights from various disciplines in which interviewing is widely researched and practiced, we examined the variety of ways by which interview questions can be characterized. We saw that dimensions such as content, style (incl. probing), and objective can be used to organize such question types. The goal of such question type collection effort is to use the result as a standardized instrument for performing reliable and replicable qualitative research over interview data. We offered a first-cut typology and sketched how subsequent versions can be evaluated on the basis of the inter- and intra-rater reliability it evokes over real interview data. We then envisioned the kinds of empirical projects that such an instrument could support for both descriptively (how it is currently done) and normatively (how it should be done) studying interviewing practices.

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