

# Asking Questions about Asking Questions in Collaborative Enterprise Modelling

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**Abstract.** In this paper we explore the subject of question asking as an inherent driver of enterprise modelling sessions, within the narrower context of the ‘dialogue game’ approach to collaborative modelling. We explain the context, but mostly report on matters directly concerning question asking and answer pre-structuring as a central issue in an ongoing effort aiming for the practice-oriented development of a series of dialogue games for collaborative modelling. We believe that our findings can be relevant and helpful to anyone concerned with planning, executing or facilitating collaborative modelling sessions, in particular when involving stakeholders untrained in systems thinking and modelling.

**Keywords:** Collaborative Modelling, Modelling Process, Question Asking, Answer Structuring, Enterprise Modelling, Collaboration Systems

## 1 Introduction

In the field of collaborative enterprise modelling [1, 2], in particular in combination with information systems and service engineering, an increasing industrial and academic interest is becoming visible in the combining of advanced collaborative technologies with various types of modelling [3], e.g. for business process modelling, domain modelling, business rules modelling, or enterprise architecture modelling. This includes support for well established, even traditional setups for modelling sessions (like workshops, interview-like sessions, and multi-participant model reviews) but also more innovative, on-line incarnations thereof, both synchronous and asynchronous, both facilitated and unfacilitated, often related to social media, and often geographically distributed [4]. In addition, collaborative modelling is increasingly interwoven with operational (in addition to development) processes in enterprises; it may be initiated as part of a development project but will often become integrated with long-term, persistent ‘maintenance’ processes realizing enterprise model evolution. This shift in the context of application for enterprise modelling entails increasingly intense collaboration with business stakeholders not trained in established forms of systems modelling [5].

Collaborative enterprise modelling, as positioned above, includes a small number of approaches focusing on the understanding and support of the *process of modelling*. Specific approaches to this very much reflect views of what such a process essentially is, which may vary greatly. In most cases, emphasis is on ‘collaborative *diagram drawing*’ (for example [6]). A different (though not unrelated) approach chooses to view collaborative modelling as a model-oriented *conversation* in which propositions are exchanged and discussed [7, 8].

Beyond theories concerning the nature of collaborative modelling lies the question *how to support collaborative model conceptualisation efforts* (other than merely by providing some model editor), either by means of software or by less high-tech means. Our own, ongoing attempt to devise an effective practice-oriented framework for the structuring and guiding of modelling sessions has led us to develop something called ‘dialogue games for modelling’: game-like, open procedures in which explicit rules govern the interactions allowed and required within a structured conversation-for-modelling ([9-11]; see section 2 for more on this). For some time it has been clear to us that the questions underlying models and modelling efforts are (or should be) an explicit driving force behind the conversations that constitute modelling processes [12]. In this paper, we directly address the issue of questions asking, as well as the pre-structuring and guiding of answers to be given.

This paper is written more from a design point of view than from an analytical or observation (descriptive) point of view. It works directly towards application of the results presented in the design of operational dialogue games. We therefore work under the Design Science paradigm [13]. The ideas presented are a result of some experimental designs that were empirically validated on a small scale, but they yet have merely a heuristic status; they are not established practices, nor have they been exhaustively validated. And yet, we believe that the presented approach to question asking, and answer pre-structuring and guiding, is approximately ‘right’ as well as simply ‘useful’ since it was not ‘just thought up’ but carefully distilled through a focused and multifaceted effort to understand, guide and support the systematic asking of questions in detailed conversations-for-modelling.

The main problem addressed thus is that of ‘how to ask particular questions in order to guide and drive a conversation for modelling’, down to the level of structuring and aiding the actual phrasing of questions. To our best knowledge, this matter has never been addressed with a similar, dedicated and detailed design focus in the field of enterprise modelling, or anywhere else. Purposeful question asking in general has received plenty of attention in the context of interviewing skills (see for example [14], Chapter 18), but an adequately content-related, generative approach we could not find. In the field of speech generation, some attention has been given to model-based question generation (see for example [15]), but here results are too theoretical and too limited to be of help for our purpose.

This is why we took a grassroots design approach grounded in observation and reflection on what modellers and facilitators do (or should do) when they formulate questions to drive and guide a modelling process. The result is a small but useful set of concepts and heuristics that can help participants in and facilitators of modelling sessions to think about and make explicit the questions to be asked, from the main questions behind the session as a whole, down to specific questions asked in highly focused parts of the session. While (as discussed) the results have not been tested at

great length, they do reflect a focused effort to come up with generally useful concepts and heuristics, spanning several years and a fair number of experimental projects (only some of which have been published; most were graduate projects). For a considerable part, these experiments and studies were conducted in the wider context of the Agile Service Development project as reported in [16], and are now continued under the flag of the Collaborative Modelling Lab (CoMoLab) [17].

## 2 Dialogue Games for Collaborative Modelling

Our approach to developing means of guiding and structuring conversations-for-modelling has led to the design and use of Dialogue Games. Previous to this, it was already theorized [7, 18] (backed up by analysis of observed collaborative modelling sessions [8]) that collaborative modelling as a conversation involves the setting and use of Rules constraining both the Interactions of the conversation as well as its chief outcome (the Model). The Interactions include both the stating of propositions and discussion of those propositions, leading to acceptance of some propositions by the participants. Accepted propositions at a given time constitute the Model at that time [8]. Apart from the primary result of modelling (the Model), results may be social in nature, e.g. reaching some level of understanding or consensus, or achieving a sense of ownership of the model. Such goals can also be part of the rules set, and they are also achieved through Interactions. The notions of Rules, Interactions and Models (the basics of the ‘RIM framework’) can be used for analysis of any modelling session, but they can also be used as a basis for designing support and guidance for such sessions –which is what we did next.

Dialogue Games initially are a theoretical notion from Argumentation Theory going back to [19]. A more operational incarnation of dialogue games, an educational tool, was devised in the form of the InterLoc system as reported in [11, 20]. The core of this tool is an augmented ‘chatbox’ in which every contribution of the participants in a chat has to be preceded by an ‘opener’ chosen from a limited, preset collection (for example “I think that ...”; “I want to ask a question: ...”; “I agree, because: ...”). Thus, the argumentation/discourse structure of the chat is constrained, and users become more aware of the structure of their conversation as it emerges. Also, the resulting chat log (available to the participants throughout) reflects the discourse structure quite transparently, including who said what, and when; this has proved useful both during the conversation and for later reference.

We took this concept and added to it the use of openers to constrain not only the type of contribution to the conversation, but also the format of the answer, for example “I propose the following Activity: ...”. This blended syntactic constraints with conversational constraints, and gave us access to introducing into dialogue games conceptual elements stemming from modelling languages. In addition, we showed that diagram techniques could easily and naturally be used in parallel to the chat, augmenting the verbal interaction step-by-step (as is common in most types of collaborative modelling) [11].

Some new ground was broken by our growing awareness that most conversations-for-modelling did not have one continuous and undivided focus: one big dialogue

game (the whole modelling session) typically consists of number of successive smaller dialogue games focusing on small, easily manageable problems/questions [8]; the ‘divide and conquer’ principle. This principle is confirmed in the literature [21, 22]. It led to the introduction of the notion of ‘Focused Conceptualisation’ or FoCon [12]: ‘functional requirements’ for modelling sessions (and parts thereof) including the expected type of ‘input’ (e.g. people; documents, conceptual structures) and desired ‘output’ (models in some modelling language, for some specific use; also, social results) as well as ‘means to achieve the output’: focus questions, sub-steps, and possibly some ‘rules of the game’. Thus FoCons can help define highly focused dialogue games, with small sets of openers dedicated to answering focus questions that are just a part of the modelling conversation as a whole. Within such limited scopes of interaction, it is much easier to harness known principles from collaboration and facilitation technology (e.g. from brainstorming, prioritizing, problem structuring) to guide and support people in generating relevant and useful answers to questions [3]. Importantly, this combines the ‘information demand’ of the general modelling effort with the HCI-like ‘cognitive ergonomics’ of the tasks set for the participants, which has to match their skills and expertise [23].

Part of the FoCon approach also is the distinction between the *pragmatic* goal/focus of a modelling effort and its *semantic-syntactic* goal/focus. As explained in [12], pragmatic focus concerns the informational and communicational goal of the model: its intended use. One process model, for example, is not the other, even if it is drawn up in the same language (say, BPMN). What are the questions that the model needs to answer? Do they work towards, for example, generation of a workflow system? Process optimization? Establishing or negotiating part of an Enterprise Architecture? Do they concern an existing situation, or a future one? And so on.

Semantic-syntactic focus concerns the conceptual constraints on the model: typically, its modelling language. In some cases, such constraint may actually hardly be there, in which case constraints are perhaps those of some natural language, or a subset thereof (controlled natural language). Practically speaking, a real life modelling effort may or may not have a clearly preset semantic-syntactic focus, but it should *always* have a reasonably clear pragmatic focus –if not, why bother about the model in the first place? In any case, the pragmatic focus is (or should be) leading with respect to the semantic-syntactic focus.

The pragmatic and semantic-syntactic goals are crucial for identifying and setting questions for modelling.

### **3 Questions and Answer Types as Drivers and Constraints**

Perhaps the most central argumentation underlying this paper is this: ‘if models are meant to provide information, then they aim to answer questions [24] –explicitly or not. In that case, in order to provide pragmatic focus to a conversation-for-modelling, it seems quite important to *be aware of what questions are to be asked* in the specific modelling context; if people are not aware, how can they be expected to model efficiently and effectively?’ This suggests that making ‘questions asked’ explicit (before, during or even after the event) seems at the least a useful exercise for any

modelling session. There is of course a clear link here with standard preparations for interviews and workshops. Yet it transpires that in some of the more extreme (and unfortunate) cases, the explicit assignments given or questions asked remain rather course grained, like ‘use language L to describe domain D’ (setting only the semantic-syntactic focus clearly). If experienced, context-aware experts are involved, perhaps the right questions are answered even if they are left implicit. However, if stakeholders are involved who have little or no modelling experience, and who generally feel insecure about what is expected of them, then leaving all but the most generic questions implicit seems suboptimal, to say the least. Disaster may ensue – and in many cases, it has. We certainly do not claim that modellers ‘out there’ never make explicit the lead questions underlying and driving their efforts. We do feel confident, however, in stating that in many cases, a lot can be gained in this respect. This is not just based on a ‘professional hunch’, but also on focused discussions with practitioners on this topic, and on a considerable number of research observations of modelling sessions in the field.

Once the importance of questions as a driving force behind conversations for modelling became clear, we became interested in the structures and mechanisms of question asking. It was a natural choice for us to embed this question in the context of dialogue games, where questions are one of the chief Interactions, following Rules, and directly conveying the goals underlying the assignment to create a Model (see section 2).

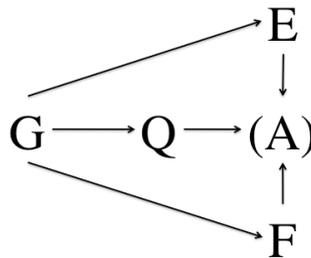
Questions are a prominent way of both *driving* and *constraining* conversations. They coax people into generating or at least expressing propositions aimed to serve a specific purpose (fulfil an information need), but they are also the chief conversational means by which ‘answer space’ is conceptually restricted, by setting limits of form (syntax) or meaning (semantics) that the answers have to conform to. As explained in Section 2, modelling languages put a ‘semantic-syntactic focus’ on the expressions that serve to fulfil the pragmatics goal of a modelling effort. Thus, even the demand or decision to use a modelling language is closely related to the asking of questions, and can be actively guided by them.

In the FoCon approach [12] (Section 2), only some minimal attention was paid to the subject of ‘focus questions’. We now are ready to address this subject in more depth, and head-on.

## 4 Structuring Questions and Answers in Dialogue Games

In our ongoing effort to better understand and structure ‘dialogue games for modelling’, we have developed a number of prototype dialogue games, still mostly in unpublished bachelor’s and master’s thesis projects (but also see [10, 11], as well as [4]). Recently, these prototypes and studies have explicitly confronted us with questions about question asking. This has led us to define the following heuristic Question Asking Framework for coherently combining questions and answers, which is put forward in an integrated fashion for the first time in this paper. The following main concepts are involved:

- Main conceptualization *Goal(s)* behind the questions to ask (G); pragmatic and possibly also semantic-syntactic goals underlying the creation of the model.
- The *Questions* to ask (Q); the actual, complete phrases used in asking focus questions within the conversation-for-modelling
- The *Answers*, which are the unknown variable: the result to be obtained (A)
- Possibly, *Form/Meaning* constraints on the answer (F): an intensional description of the properties the answer should have (for example, that it should be stated in a modelling language, or that it should be an ‘activity’ or ‘actor’).
- Possibly, one or more *Examples* (E) of the kind of answer desired: an extensional suggestion for the answer.



**Fig. 1.** Concepts of the heuristic Question Asking Framework (QAF)

In Fig. 1., we show the basic concepts plus an informal indication (the arrows) of how the elements of the QAF are related in view of a generative route from Goal to Answer: based on the pragmatic and possibly also the semantic-syntactic goal of the effort at hand, a set of questions are to be asked. For each Question, and also very much dependent on its Goal, auxiliary means are both intensional (F) and extensional (E) descriptions of the sort of answer fulfilling Q. Combinations of Q, F and E should lead to A: the eventual Answer (which as such is out of scope of the framework).

While the QAF is by no means a big theoretical achievement, it does provide a good heuristic for the analysis and design of ‘question structures’ in dialogue games. It is helpful in systematically and completely identifying and phrasing questions and related items (the latter being rather important in view of active facilitation).

Below we will proceed to discuss the concepts of the QAF in more detail, as well as matters of sequence and dynamic context. We will use an explanatory example throughout, taken from our previous work in ‘Group Model Building’ (GMB), an established form of collaborative modelling in the field of Problem Structuring. Space lacks here for an elaborate discussion of GMB; we will very briefly provide some information below, but for more have to refer to [11].

#### 4.1 Illustration: Group Model Building

GMB is rooted in System Dynamics and involves the collaborative modelling of causal relations and feedback loops. It aims for the shared understanding between

participants of the complex influences among system variables in some system (typically, a business situation calling for an intervention). The process of group model building aims to gradually tease out quantitative variables (providing an abstract analysis and representation of the problem focused on), causal relations between the variables (cause-effect, positive and negative), and feedback loops consisting of sets of circularly related variables. For our current purposes, we will only refer to some basic items in GMB, and show how the QAF items can be deployed in this context.

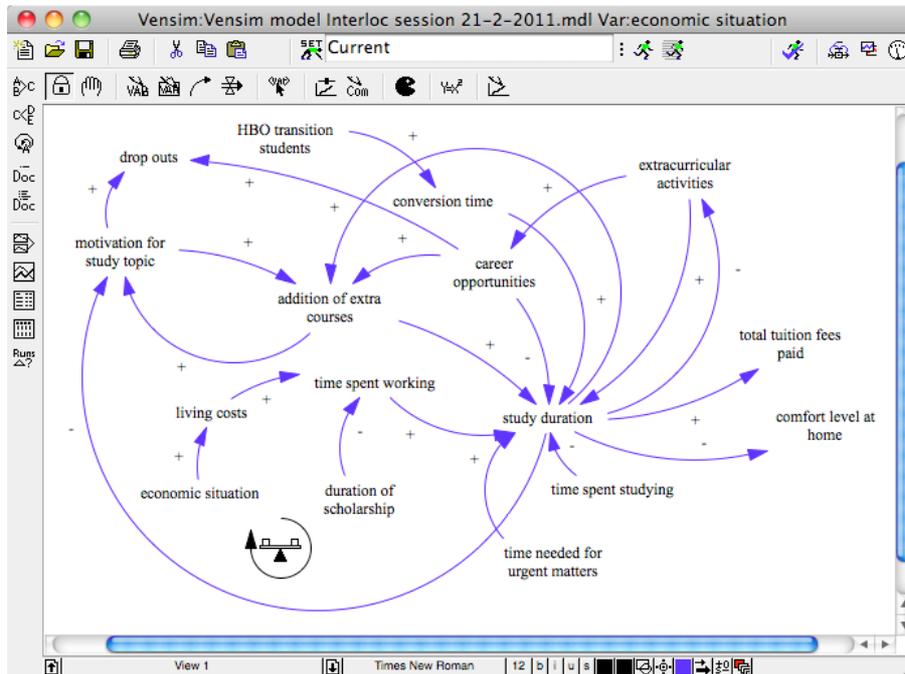


Fig. 2. Example of a causal loop diagram resulting from a GMB dialogue game

## 4.2 Goals Questions

As drivers of modelling session as a whole, Goal Questions can be posed. These should clearly describe the pragmatic goals of the session. Semantic-syntactic goals may in principle also be posed here, but things are more complicated for such goals: whether or not they should be explicitly communicated to the participants depends on whether the participants will or will not be directly confronted with the models and modelling language in the session. If not (and in many approaches, including ours, this is common enough), the semantic-syntactic goal is a covert one that is implicitly woven into the operational focus questions and answer restrictions (i.e. openers) of the Dialogue Games (Sections 4.3 and 4.4). This is in fact one of the main points of the dialogue game approach. We will therefore assume here that the semantic-

syntactic goals are not explicitly communicated to the participants, though it is certainly always necessary that the over-all semantic-syntactic goals of the modelling effort are *established* (not communicated) as well as possible and known to the organizers of the session.

Typically, Goal Questions consist of two parts: the *main question* (of an informative nature), and the intended use that this information will be put to, the *purpose*. For example:

*Main question*: “Please describe what factors play a role in increasing the number of students enrolling in the Computer Science curriculum, and how they are related”.

*Purpose*: “This description will be used to identify possible ways of taking action that could solve the problem.”

Typically, the main question has a ‘WH word’ (why, what, how, who, etc.) in it, but this is no requisite. Clearly formulating the main questions is important, and may be hard in that the question may be difficult to formulate (a language issue) but in principle the main question as an item is straightforward. There may be more main questions or assignments (for example expressing social goals like ‘reach consensus’), but obviously too many questions will blur the pragmatic focus. As for explicitly stating the purpose, as argued in [12], very much influences the way people conceptualise the model, even at a subconscious level; this is why we advocate including it. Again, it is possible to include more than one purpose here, but this may decrease clarity of focus and can easily reduce the quality of the conceptualisation process and its outcome.

Importantly, main questions and purposes are not reflected in the openers of a Dialogue Game. They give a clear general context for the whole session, i.e. of the entire set of ‘minigames’ (FoCons) constituting the conversation-for-modelling. The Goal questions should be clearly communicated (if not discussed) before the session starts, and perhaps the participants should be reminded of them occasionally (possibly by displaying them frequently, if not continuously).

### 4.3 Focus Questions: Guiding the Conversation

The focus questions are by nature the most crucial item in the QAF. Without exception, they should be covered by at least one opener in their dialogue game, meaning that they are explicitly available as an interaction type to at least one type of participant (role) in at least one dialogue game. In most cases, focus questions will be posed by the facilitator; whether or not they can also be asked by other participants depends on the further game design.

We found that it is helpful to explicitly distinguish two parts of focus questions: the *question* part, and the *topic* part. Questions, for example “What might influence ...?” are of course incomplete without also mentioning a (grammatical) object of the sentence: what specific entity or domain the main question is applied to. This may seem trivial, but it is crucial in view of actual ‘generation’ of questions because the topic part of a focus question is as important as the question part, and is highly context dependent. The topic part may be derived from an answer to a previous question that was given only seconds before. Also, the topic part is typically much more context-dependent with respect to terminology: whereas the question part

phrasing may be generically useful in diverse contexts (fields, enterprises, departments; situations) the topic will require accurate knowledge of the way participants talk about their enterprise and refer to bits of it. The set of possible topic descriptions is most safely assumed to be infinite, or at least to be quite unpredictable and situational, and therefore ‘open’.

As for the more generic ‘question part’: here too, many questions (being open questions more often than yes/no questions) will be started off with a phrase including a WH-word (often accompanied by a preposition, as in “for what”, “by who”, etc.).

Clearly many questions are possible, but we do believe that for a particular set of topics/dialogue game types, their number is limited (‘closed’ sets seem possible, at least at a practical level). Points of view reflected by questions can be based on many different concepts and sources, for example:

- Meta-models (the syntax of a modelling language may dictate, for example, that every ‘variable’ should be at least a ‘cause’ or an ‘effect’ of another variable; causal relations should be marked as either positive (+) or negative (-), and so on)
- Aspects of enterprise systems (e.g. following the Zachman framework: *why-how-what-who-where-when* combined with the *contextual-conceptual-logical-physical-detailed* ‘levels’)
- Methods (e.g. questions based on intervention methods: brainstorming, categorizing, prioritizing, and so on).
- The classic ‘current system’ versus ‘system-to-be’ distinction

In fact, it is largely through the asking of focus questions that participants make explicit how they look at and conceptually structure the domains and systems under scrutiny, and also it is the way their ‘world view’ is imposed upon the conversation, and on other participants.

For all the QAF items, but for the focus questions in particular, great care must be taken that they are phrased clearly and above all understandably *in view of the participants’ capacities, skills, and expertise* [4]. This requires quite a high level of language awareness, proficiency and instinct on behalf of, at least, the facilitator. Standard questions (or partial questions), that may have been tested and improved throughout a number of games, may offer some foothold here, but also one must be very much aware that question phrasings fit for one situation may be less appropriate and effective for others.

#### **4.4 Forms: Constraining the Answer**

Forms are the conceptual frames (in both the syntactic and the semantic sense) in which the answers are to be ‘slotted’. The term refers to the ‘form’ (shape, structure) of the answer but also, and perhaps even more so, to the type of form that needs ‘filling in’ (template). Importantly, it is possible the form is in fact not there, meaning that in such cases the Goal and Focus questions do all the constraining. However, in particular in cases when some conceptual constraint (modeling language) is involved, offering a Form can be extremely helpful. If indeed we deal with collaborative ‘modelling’ (instead of, for example, ‘decision making’ or ‘authoring’ or ‘brainstorming’), some conceptual constraining by means of some structured

language seems as good as mandatory, per definition. Yet this does not mean such restricting Forms should necessarily accompany all focus questions: it is quite possible that in earlier phases of conceptualization, no strict form constraint is imposed, but that such constraint is introduced only as the effort is driven home to its end goals. Thus, some (sub) DGs may include Forms, while others may not.

In the basic Dialogue Game designs we have discussed so far, ‘answer-openers’ are provided that restrict the answer textually, as in “I propose the following variable: ...”. However, more advanced types of interfacing have always been foreseen here in addition to the basic opener [25], for example the use of GUI-like forms [10], and even interactive visualizations (simple diagrams). In principle, we can include good old ‘model diagram drawing’ here as well, though admittedly this does not fit in too well with our general FoCon approach and the verbal nature of conversations. Yet in the end, our credo is: whatever works, works.

Checking and enforcement of form-conform answering can be implemented in degrees. Below we suggest some (increasing) levels of forms checking:

- Unrestricted except by goal and focus questions
- Mere textual constraint (e.g. by using simple openers)
- Using typed fields for individual words
- Using typed fields and checking the fields syntactically
- Using typed fields and checking the fields semantically
- Offering a limited set of (checked) choices

Note that such checking/enforcing mechanisms are of course already well known in common information- and database system interfaces and functionality (data integrity checks, etc.) and in various kinds of advanced model and specification editors.

In addition to offering template-like forms, we found that it is a good idea to add some explicit verbal description and explanation of the conceptual constraints, for example: “A ‘variable’ is described as a short nominal phrase, preferably of no more than four words, describing something that causes changes in the problem variable, or is affected by such changes. Variables should concern things that are easily countable, usually a ‘number’ or ‘quantity’ of something”.

A final note on openers: while in this section we focused on conceptually constrained answer-openers, in view of Dialogue Games at large it is important to realize that more generic, conversation-oriented openers can be used alongside Forms, e.g. “I don’t think that is a good idea, because ...”, “I really don’t know what to say here”, “I like that proposition because ...”, and so on. This makes it possible to blend discussion items and highly constrained/focused content items. Based on our experience with and observations of real life modelling sessions, such a blend is required to mirror and support the typical nature and structure of conversations-for-modelling. Given that a chat-like interface and log is present underlying the whole modelling process, advanced interfacing can still produce chat entries (automatically generated) while conversational entries can be more directly and manually entered in the chat.

#### 4.5 Auxiliary Examples of Answers

The last QAF item is perhaps the least crucial one, and certainly an optional one, but still it can be of considerable help in effectively communicating constraints on answers. Examples of answers are complementary to Forms, where in logical terms Examples offer more of a (partial) ‘extensional definition’ than the ‘intentional definition’ which can be associated with Forms. In addition, it is possible to provide some (clearly marked!) negative examples: answers that are not wanted.

Generally it seems to work well enough to give examples that are illustrative rather than totally accurate. For example, ‘variables’ in GMB need to be quantifiable, i.e. should concern ‘*things that can be easily counted*’ (a phrasing typically used in constraining answers suggesting variables). Positive examples for ‘variables’ thus could be”

- “Number of items produced”
- “Time spent on preparations”
- “Number of kilometres travelled”
- “Number of rejections recorded”,

whereas negative examples could be:

- NOT “willingness to cooperate”
- NOT “liberty to choose alternatives”
- NOT “aggressive feelings towards authority”

The need for the use of Examples varies. In general, they will be most useful when participants are confronted with some Question-Form combination for the first time, leaving them somewhat puzzled and insecure. Experience shows that it is often recommendable to remove examples as soon as ‘the coin drops’, but to keep them close at hand in case confusion strikes again.

#### 4.6 Dynamic Sets and Sequences of Questions

When analysing, describing and supporting structured processes, it is always tempting to picture them as deterministic flows. As reported in [8, 26], actual dialogues structures are far too unpredictable to capture by such means, switching often between various foci and modes. This is one of the main reasons why we have opted for a rule-based, game-like approach from the start. However, this does not mean that modelling sessions and dialogue games are wholly unstructured. There certainly can be a logic behind them, reflecting the way they work towards their Goals in a rational fashion (often by means of interrelated sub-goals). Our way out of this is indeed to define a number of complementary FoCons (DGs) that cover all ‘interaction modes’ to be expected in a particular modelling session. The participants, and especially the facilitator, are then free (to a greater or lesser degree) to choose when they go to which DG, and thus also in which order. However, there may be some input required to start a certain FoCon; for example, in GMB it is no use trying to determine the nature of a feedback loop if its variables have not been adequately defined. Thus, a simple logic does present itself. In our experience, this logic is best operationalized by the plain mechanism of preconditions on DGs, making them available (or not) given

the presence of some minimal information they need as ‘input’. In addition, the facilitator has an important role to play in switching between DGs: determining both when to switch, and where to jump to. The definition of heuristic or even rules for making such decisions is a main interest for future research. Besides the simple input-based logic mentioned above, we expect that other aspects and best practices will be involved here, but we cannot put our finger on them yet.

The above implies that the sequence in which questions are to be asked cannot be predicted, nor does it need to be. Which questions are asked in which order is determined by:

- Which questions are part of a particular DG (with some specific focus)
- In what order the questions are asked within that DG, which depends on active question choosing by the facilitator, but equally so on the highly unpredictable conversational actions taken by the participants
- In what order the session jumps from one DG to another, as mostly determined by the facilitator.

In this sense, a modelling session has the character of a semi-structured interview rather than that of a structured one.

Finally we consider the challenge of generating, dynamically and on the spot, the detailed content of each question item during a series of interrelated DGs. We believe that in many cases, a manageable number of basic interaction modes can be discerned beforehand, i.e. in the preparatory phase of organized modelling sessions, and perhaps even as part of a stable ‘way of working’ in some organizational context. Thus, DGs can be designed, including:

- the *question* parts of Focus Questions
- the Forms
- the Examples

However, this excludes some more context-dependent items:

- both the *main question* and the *purpose* parts of the Goal questions
- the *topic* parts of the Focus Questions

These items will have to be formulated for and even during every specific DG. Some of them may be predictable, since they may be based on specific information about the domain available before the session is initiated. However, a (large) part of the domain-specific information may emerge directly from the actual session, and also ‘previously available information’ may change because of this. The *main question* and the *purpose* parts of the Goal questions at least can be determined in preparation of a particular session, typically in project context [4, 5], and will usually remain pretty stable during a modelling session. This leaves the *topic* parts of the Focus Questions: what topic the individual, opener-born question phrasings are applied to.

As discussed in Section 4.3, such topic phrasings are highly context specific. If they are to be inserted on the spot by facilitators or other participants in an unsupported environment, they will demand a lot from the domain awareness and language capacity of those involved. Fortunately, such capacity is usually quite well developed, and the task is challenging but not unfeasible –as has often been shown in practice. Yet let us also consider tool support. If partially automated support is involved (DGs as a case of collaboration technology [3]), close interaction will be required between the question generator and the structured repository of information

available so far. Needless to say this poses rather high demands on accessibility, performance, and well-structuredness of such a repository. Yet not in all cases will generation of questions (based on the knowledge repository) be fully automatic: in many cases, the facilitator or other participants may be offered a choice from the (limited) number of items relevant in the present context.

## 5 Conclusion and Further Research

We have presented a discussion of a number of issues with respect to ‘asking questions’ in context of collaborative modelling sessions in enterprise engineering. Central in this discussion was the Question Asking Framework (QAF), a heuristic construct of which the concepts can help analysis and design of question-related aspects of (in particular) highly focused sub-conversations. Our discussion was set against the background of ‘Dialogue Games for modelling’. The findings have already been used, to a greater or lesser extent, in the design of prototype Dialogue Games in various modelling contexts.

We are now collaborating with two industrial parties who have taken up the challenge of bringing the Dialogue Game idea to life in real projects. We work towards the creation of a reasonably coherent set of support modules that enable the rapid development and evolution of Dialogue Games for many different purposes and situations, involving a number of different flavours of modelling –both in view of the modelling languages and techniques involved, and of the style and setup of collaboration [16]. Most of the ideas and concepts put forward in this paper have already played a role in design sessions, in which they turned out extremely helpful. Together with other concepts from the Dialogue Game approach, they enabled us to create a good and clear focus for talking about modelling sessions in a highly specific, support-oriented way. While further validation of the presented concepts certainly needs to be pursued in the near future, we do claim that a first reality check and operational validation has in fact been performed, with satisfactory results.

Among many possible topics for further research, we mention some interesting ones:

- Effective capturing of generic rules for facilitation in DGs
- Decision making for jumping between DGs
- Optimal ways of communicating rules, goals, assignments and directives in DGs
- Interactive use of advanced visualisations blended with chat-like dialogues
- Limitations and advantages of on-line, distributed collaborative modelling using DGs
- Using DGs in system maintenance and as an extension of helpdesks
- Making intelligent suggestions based on design and interaction patterns and using AI techniques
- Automatically generating questions and guiding statements for use in DGs, based on natural language generation and advanced HCI techniques

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## References

1. Renger, M., G. Kolfshoten, and G. De Vreede, *Challenges in collaborative modelling: a literature review and research agenda*. International Journal of Simulation and Process Modelling, 2008. 4(3): p. 248--263.
2. Barjis, J., *Collaborative, Participative and Interactive Enterprise Modeling*, in *Enterprise Information Systems*, J. Filipe and J. Cordeiro, Editors. 2009, Springer Verlag: Berlin, Heidelberg.
3. Hoppenbrouwers, S.J.B.A. and W.v. Stokkum, *From Dialogue Games to m-ThinkLets: Overview and Synthesis of a Collaborative Modeling Approach*. International Journal of E-Collaboration (IJeC), special issue on Collaborative Usage and Development of Models and other Visualizations, 2012.
4. Hoppenbrouwers, S.J.B.A., et al., *Stakeholder Communication*, in *Agile Service Development - Combining Adaptive Methods and Flexible Solutions*, M.M. Lankhorst, Editor 2012, Springer Verlag: Berlin Heidelberg London New York Johannesburg Mumbai Punta Arenas Wladiwostok.
5. Zoet, M.M., et al., *An Agile way of Working*, in *Agile Service Development: Combining Adaptive Methods and Flexible Solutions*, M.M. Lankhorst, Editor 2012, Springer Verlag: Berlin Heidelberg London New York Johannesburg Mumbai Punta Arenas Wladiwostok.
6. Pinggera, J., et al., *Tracing the process of process modeling with modeling phase diagrams*, in *Business Process Management workshops: BPM 2011 international workshops, Clermont-Ferrand, France, August 29, 2011, revised selected papers, part I*, F. Daniel, K. Barkaoui, and S. Dustdar, Editors. 2011, Springer Verlag: Berlin Heidelberg. p. 370-382.
7. Rittgen, P., *Negotiating Models*, in *Advanced Information Systems Engineering, 19th International Conference, CAiSE 2007*, J. Krogstie, A. Opdahl, and G. Sindre, Editors. 2007, Springer: Berlin, Heidelberg. p. 561-573.
8. Ssebugwawo, D., S. Hoppenbrouwers, and E. Proper, *Interactions, Goals and Rules in a Collaborative Modelling Session*, in *2nd IFIP WG8.1 Working Conference on the Practice of Enterprise Modeling (PoEM 2009)*, A. Persson and J. Stirna, Editors. 2009, Springer: Berlin, Heidelberg.
9. Hoppenbrouwers, S., B. Schotten, and P.J.F. Lucas, *Towards Games for Knowledge Acquisition and Modeling*. International Journal of Gaming and Computer-Mediated Simulations, Special issue on AI and Games, 2010. 2(4): p. 48-66.
10. Hoppenbrouwers, S., et al., *A Dialogue Game Prototype for FCO-IM*, in *On the Move to Meaningful Internet Systems: OTM 2011 Workshops; Object Role Modeling ORM 2011, Hersonissos, Crete, Greece, October 19-21, 2011*, R. Meersman, T.S. Dillon, and P. Herrero, Editors. 2011, Springer: Berlin. p. pp339-49.
11. Hoppenbrouwers, S. and E. Rouwette, *A Dialogue Game for Analysing Group Model Building: Framing Collaborative Modelling and its Facilitation*. International Journal of Organisational Design and Engineering, special issue on Collaborative Modeling, 2012. 2(1) p19-40.

12. Hoppenbrouwers, S. and I. Wilmont, *Focused Conceptualisation: Framing Questioning and Answering in Model-Oriented Dialogue Games*, in *The Practice of Enterprise Modeling*, P. Bommel, et al., Editors. 2010, Springer: Berlin, Heidelberg. p. 190-204.
13. Hevner, A.R., et al., *Design Science in Information Systems Research*. MIS Quarterly, 2004. 28: p. 75-106.
14. Bryman, A., *Social Research Methods*. Third ed. 2008, Oxford: Oxford University Press.
15. Olney, A.M., A.C. Graesser, and N.K. Person, *Question generation from Concept Maps*. Dialogue and Discourse, 2012. 3(2): p. 75-99.
16. Lankhorst, M.e., *Agile Service Development: Combining Adaptive Methods and Flexible Solutions*. The Enterprise Engineering Series, ed. J.L.G. Dietz., E. Proper, and J. Tribolet. 2012, Berlin Heidelberg: Springer-Verlag.
17. HAN University of Applied Sciences, Radboud University Nijmegen., Everest. *Collaborative Modelling Lab (CoMoLab)*. 2012; Available from: <https://sites.google.com/site/collaborativemodellinglab/>.
18. Hoppenbrouwers, S., H.A. Proper, and T.P. van der Weide, *Formal Modelling as a Grounded Conversation*, in *Proceedings of the 10th International Working Conference on the Language Action Perspective on Communication Modelling (LAP'05)*, G. Goldkuhl, M. Lind, and S. Haraldson, Editors. 2005, Linköpings Universitet and Hogskolan I Boras, Linköping, Sweden, EU: Kiruna.
19. Mann, W., *Dialogue Games: Conventions of Human Interaction*. Argumentation, 1988. 2(4): p. 511-532.
20. Ravenscroft, A. and S. McAlister, *Designing interaction as a dialogue game: Linking social and conceptual dimensions of the learning process*, in *Interactions in Online Education: implications for theory and practice*, C. Juwah, Editor 2006, Routledge: New York. p. 73-90.
21. Prilla, M. and A. Nolte, *Fostering Self-direction in Participatory Process Design*, in *11th Biennial Participatory Design Conference*. 2010, ACM: New York. p. 227-230.
22. Andersen, D. and G.P. Richardson, *Scripts for Group Model Building*. System Dynamics Review, 1997. 13(2): p. 107-129.
23. Wilmont, I., et al., *Abstract Reasoning in Collaborative Modeling*, in *Proceedings of the 45th Hawaiian International Conference on the System Sciences (HICSS-45)2012*: Maui, Hawaii, USA.
24. Hoppenbrouwers, S., H.A. Proper, and T.P. van der Weide, *A Fundamental View on the Process of Conceptual Modeling*, in *Conceptual Modeling - ER 2005 - 24 International Conference on Conceptual Modeling*. 2005, Springer: Berlin. p. 128-143.
25. Hoppenbrouwers, S., E. Rouwette, and H. Weigand, *Exploring Dialogue Games for Collaborative Modeling*, in *E-Collaboration Technologies and Organizational Performance: Current and Future Trends*, N. Kock, Editor 2011, IGI Global: Hershey PA. p. 292-317.
26. Hoppenbrouwers, S., P.v. Bommel, and A. Järvinen, *Method Engineering as Game Design: an Emerging HCI Perspective on Methods and CASE Tools*, in *Proceedings of the 13th International Workshop on Exploring Modeling Methods for Systems Analysis and Design (EMMSAD 2008)*, T. Halpin, H.A.E. Proper, and J. Krogstie, Editors. 2008, CEUR: Montpellier, France.