A serious gaming approach to content elicitation for FCO-IM

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Chapter 1: Introduction

The following research is part of the Master education program for Information Science at the Radboud University Nijmegen. It follows a line of research that has been started by Stijn Hoppenbrouwers within the Department of Model Based System Development (MBSD) of the Institute for Computing and Information Sciences (iCIS) and has been extended to HAN University of Applied Sciences. The research focuses on applying dialogue games in activities such as conceptual modelling. The focus is on supporting the highly creative part of content generation, not the actual model building. Building an actual working tool is not part of the scope. We will focus on supporting and structuring elicitation in general.

As part of the bachelor thesis we previously did a small research project on applying dialogue games in the field of requirements engineering, specifically pertaining to eliciting the contents of Use Cases. This proved to be challenging. Literature has examples of so-called "serious games", games not meant primarily for entertainment, and dialogue games, but none tailored to requirements engineering. We designed a very simple dialogue game (or rather, a game-like procedure) and tried it with a few test subjects. The dialogue game provided a framework to guide the requirements engineer (in this case the author) in the dialogue with a domain expert.

The research used the so-called *Focused Conceptualisation* (FoCon) framework, brought forward by Hoppenbrouwers in recent publications. FoCons aim to bring structure and focus in conversations, which is exactly what we need when we try to generate content for a Use Case.

Results proved interesting. The setup was crude and the test basis small, but we managed to pull off some simple sessions using our own framework built with FoCons in mind.

Problem statement

The aforementioned work for the bachelor thesis proved to be highly interesting, so we decided to continue in that line of research. Students of the HAN University of Applied Sciences have made two attempts to build a dialogue game for FCO-IM, *Fully Communication Oriented Information Modelling*, a technique for building conceptual models. These works focused on the more structured stages of FCO-IM, where the modeller already possesses a document with relevant information about the domain to be modelled. No attention was given to the highly creative and difficult part of actually creating this document.

We feel that this is the most crucial, and probably most neglected, phase in modelling. It is crucial as this information is the very foundation of all later stages, such as the conceptual model and maybe the databases generated from it. If things are overlooked here, they can have enormous consequences in later stages when the shortcomings are detected while the model already stands.

We do not think anyone will deny the importance of this phase. Yet this phase is easily ignored or omitted. One reason is the fact that this phase is actually very hard. Content generation requires a great deal of creativity and flexibility and it has hard to do this according to fixed rules or frameworks. Given the complex nature of the task there are no flashy tools that can assist a modeller. Especially novice modellers can have a hard time. Strict rules can help but they also inhibit participants in sessions and cut off certain flow of thoughts that might prove to be useful.

The existing work also assumes that all participants in a modelling session are at the very least familiar with FCO-IM. In reality this will hardly ever be the case. Typical the modeller will be but we cannot assume our domain experts have even heard of FCO-IM or have any experience in modelling in general.

Support for these kinds of processes can greatly aid novice modellers in modelling sessions. The support should take into account that domain experts might or might not be modellers themselves. This was the setting for our research.

For this research thesis we only consider the first phase of FCO-IM, since some research into dialogue games and applying constraints has already been done. Since the elicitation phase has no clear cut rules, in contrast

to the constraints phase, we feel that the elicitation phase benefits most from a structured dialogue gaming approach and hence we wish to focus on this.
In this research we tackle the following design problem: *"design a set of rules and guidelines that can aid and guide a modeller in a game focused on eliciting the contents of a starting document for a FCO-IM modelling session".*

Once we have achieved this, we aimed to devise a simple generic conceptual model for dialogue games, based on the FCO-IM game. This could serve as a template for further dialogue games in other contexts.

Thus we formulated a second design problem: *"design a conceptual model for dialogue games based on the experiences gained in the dialogue game for FCO-IM".*

Method of work

The first phase of the research consisted of literature research to find out what has been done so far. We used literature written in the context of FCO-IM, serious gaming, dialogue games and conceptual modelling.

To get introduced to FCO-IM we used the book written by Bakema et al.[BAK001], the creators of the FCO-IM modelling approach. This book was supplemented with some lecture notes and material. It served the purpose to learn FCO-IM to a degree necessary to understand the requirements of the game.

Next to FCO-IM we looked at literature concerning serious gaming, dialogue games, collaborative modelling and conceptual modelling. This research formed a background for developing a dialogue game for conceptual modelling. We leaned on the work of the aforementioned bachelor's thesis. The literature foundation consisted mainly on papers written by Hoppenbrouwers et al. who have done research in this kind of field. It focused on what they call "Focused Conceptualisation" (FoCon). The FoCon approach served as the foundation for the game.

Other literature included two master theses, written by students from the HAN University of Applied Science and one written by a student from the Radboud University Nijmegen. The HAN theses attempted to create dialogue games for FCO-IM. They mainly served as background as they focused on an aspect of FCO-IM that we will not be focusing on.

The next phase in the research was designing the dialogue game. The focus was on the gaming mechanisms, the rules and guidelines. The aim was not to develop a fully functioning tool. We looked at existing tools to decide whether we could use them or not

Once the game was designed and a workable version was made, we started to play the game with a test audience. These were aimed to test the rules and guidelines and improve upon them. After each test we analysed the results and modified the rules and guidelines and the way we play the game. After two iterations we felt confident enough to write down our final design.

The end product is this thesis providing background information from literature, the design process of the game and choices made, culminating in the final design. We were exhaustive in the description of the final design. We supplemented this with an abbreviated manual, which can be seen as a "rulebook" for the game, with the design serving as an almanac for reference.

Based on this we derived a conceptual model that can serve as a generic template. This conceptual model started to take shape while designing the FCO-IM dialogue game. We kept Järvinen's Game Design Theory elements in mind and made links between the conceptual model and the FCO-IM dialogue game.

Structure

This thesis report is structured as follows. After this chapter of introduction we present a theoretical background. We introduce the FCO-IM modelling methodology and some of the short comings we perceive. Next we introduce some theories. First we introduce the notion of serious gaming. Then we move on to the Game Design Theory as proposed by Järvinen, augmented by a view on goals for serious gaming. These theories helped us generating the framework for a serious game. Next we introduce the concept of Focused Conceptualisation. This theory helped us shaping the contents of the game. In the final section of this chapter we will discuss some previous attempts by students to design a serious game for FCO-IM and how we want to make a new contribution towards this field.

In chapter 3 we unified the theories by creating a first design. We do not exhaustively describe these first designs, but only the genesis and design choices made at the start and during the process.

This work culminates into a final design in chapter 4. The final design consists of a global description of the game, a more detailed description and an abbreviated “rulebook”. The rulebook can be compared to the rulebook of a board game. It is intended for someone already familiar with the game. The detailed description can be viewed as a thorough reference guide for first time players or players seeking clarification. This final design was subjected three test sessions. We realize this is not a whole lot. But the objective was to see whether the approach is workable. Exhaustive testing was not part of the scope. We gained some valuable insights nonetheless.

In chapter 5 we derived a generic conceptual model for dialogue games. We present a framework that can be used to create dialogue games for a number of different purposes. We hand one the basic tools, make one’s own game. This can be viewed as a basic game engine as it is found in the video gaming industry.

Chapter 6 will recap our design question and discuss if and how this design question has been answered. This includes insights gained from the final test sessions. We analysed our design and reflected on the game, pointing out flaws and share our views on how this work could be improved upon. We also highlighted some recommendations for future research in general. We conclude with a list of references.

Chapter 2: theoretical background

This chapter introduces a theoretical background, necessary to start designing a serious game for FCO-IM. The chapter starts with a short description of FCO-IM. Next the topic serious gaming is introduced with a section dedicated to serious gaming for information modelling. Next we mention the Game Design Theory which is used for designing (serious) games. This is supplemented with a section on goals for modelling. Then we introduce the concept of Focused Conceptualisation, which was used to create methods and rules. Next we take a look at the Question Asking Framework, which is important for serious games that depend on communication and interaction. In the final sections we work towards the goal of this thesis and take a look at things that we find shortcomings in FCO-IM and how a serious game might help. In the last sections we quickly review work that has been done in this field so far.

FCO-IM

FCO-IM is a modelling method developed from Natural language Information Analysis Method (NIAM) on the Hogeschool Arnhem Nijmegen by Bakema et. al.[BAK001]. In contrast to NIAM it does not try to model the Universe of Discourse (UoD) but communication about this UoD. The FCO-IM approach aims to provide a well-structured methodology to draw information grammar diagrams (Information Grammar Diagrams). These diagrams show a lot of resemblance to NIAM models. An Information Grammar Diagram should be directly translatable into a relational database. The authors of FCO-IM also developed a tool, CaseTalk, to be used while modelling to draw Information Grammar Diagrams.

FCO-IM has five basic principles:

- FCO-IM does not try to model reality but communication about this reality.
- FCO-IM must model all conceptual aspects of this communication that will support the information system and only this communication, nothing else.
- Domain experts must be able to validate the correctness of the Information Grammar Diagram to ensure that their communication has been properly modelled.
- It must be possible to represent FCO-IM Information Grammar Diagrams and relational schemas using the same diagramming technique.
- FCO-IM must be able to model soft semantics and preserve them as supplement to the relational database schemas.

Typical modelling is done between an information analyst and one or more domain experts. The information analyst must be an expert in FCO-IM modelling. The domain expert does not need to have any relevant knowledge to FCO-IM or modelling in general. Modelling starts with a verbalization phase where the relevant information to be modelled is identified and verbalized as facts. In the next phase these facts are used to construct the Information Grammar Diagram. In the last phase, constraints are added if necessary. Throughout the process the information analyst asks the domain expert to validate.

Starting document and the information perspective

The verbalization phase starts with a description given by the domain expert. He writes down in plain language what communication takes place and what information he needs and what processes are used on that information. The information analyst then underlines the information perspective. Only the involved information is relevant, not processes on this information. This can be done in the starting document.

Exemplifying the information with concrete examples

Once this is done, the next phase starts. The information analyst has identified relevant information and now asks for concrete examples. If, for instance, the information analyst identified three lists of information, he will ask the domain expert for some concrete example per list. If one of these lists is a list of student names and their home town, then the domain expert for instance would give some concrete examples of this, like "Student Peter Jacobs lives in Nijmegen".

It is not necessary to provide a complete list of data that eventually will be entered, just enough entries to exemplify the information concerned. As a guideline we would suggest to ask in this stage already if certain conditions might apply here. In this case we could ask "may multiple students live in Nijmegen" or "may a student have more than one home town" or "must every student have a home town" and generate examples for these cases if necessary. Questions like this might seem obvious in this simple example but might not be so obvious in more abstract cases. The reason for asking now will make the process of finding constraints easier as examples like "Student Peter Jacobs lives in Nijmegen" and "Student Peter Jacobs lives in Arnhem" will already exemplify that a student may live in more than one town. Each identified piece of information should have some examples to exemplify the information. Each concrete example is called a *fact*.

Verbalization into facts

Once enough examples have been generated they need to be transformed into so-called *fact expressions* (FE for short), preferably *elementary fact expressions*. A fact expression is a short sentence expressing a concrete fact. Elementary fact expressions are fact expressions that contain exactly one fact. For instance, a fact expression might be "Student Peter Jacobs attends course I00035 which is coordinated by Stijn Hoppenbrouwers". This sentence verbalizes a concrete fact. It is not elementary and can be split into two elementary fact expressions: "Student Peter Jacobs attends course I00035" and "Course I00035 is coordinated by Stijn Hoppenbrouwers". No information is lost by splitting this fact. It is recommended to group the fact expression by *fact type*, facts of the same type.

Verbalization does not have to be done for every single fact as long as all fact types are represented. Fact types do not need to be elementary as composite (not-elementary) fact types can be detected at a later stage and be reduced to elementary facts. But every reduced composite fact type at this stage saves work later on. The verbalization can be done by the information analyst in certain cases but it is recommended to let the domain expert perform this task under guidance by the information analyst. This ensures correctness.

Classification and Qualification

The next step is classification and qualification. Classification puts facts into classes (groups), qualification gives meaningful names to these classes. For instance, facts verbalizing the home towns of students (Student Peter Jacobs lives in Nijmegen) are all grouped together and named "Home town". This is the first stage of the classification and qualification step.

The next step, viewed as an intermediate step, analyses the structure of the fact expressions and yields preliminary *elementary fact type expressions* (FTEs). For example, the fact expression "Student Peter Jacobs lives in Nijmegen" would be written as "Student ... ... lives in ... .". The three dots represent a blank that needs to be filled in, only the common parts of the fact expression are written down. In case of the student name, there are two blanks, first name and last name. These blanks need to be filled by values, called labels. The blanks can be given a meaningful name, label types (another qualification step). We can write the sentence above as: "student <first name> <last name> lives in <city>". This is called a *fact type expression at the label type level* (LTL-FTE). FTEs are numbered and denoted with a capital F, for instance F1.

The second step focuses on object types. Fact expression in the likes of "There is a student Peter Jacobs" are called *existence postulating fact type expressions* for the object Student. It states the existence of an object in the UoD, a student with first name Peter and last name Jacobs. The part 'student Peter Jacobs' also identifies this object in the UoD, namely said student (apparently in this UoD two or more students cannot have the first name Peter and the last name Jacobs). This is called an *object expression*, which is defined as *the largest connected (unbroken) part of a fact expression with the exclusive purpose of identifying an object in the UoD*.

Object expressions are given a name similar to FTEs, but starting with the capital O. We could for instance define O1 as follows. O1: 'student <first name> <last name>'. Note that object expressions use a single quotation mark (') while FTEs use double quotation marks ("). We can now rewrite F1 as follows. F1: "<Student:O1> lives in <city>." We call these *fact type expressions at the object type level* (OTL-FTE). An important role regarding object types pertains to existence postulating facts: "in an existence postulating fact type for a certain object type, there may not occur an object type expression for the same object type." Thus we will not define an existence postulating fact, say F2, as: F2: "there is a <Student:O1>." The LTL-FTEs can be obtained by filling in the OTL-FTEs.
The following rule needs to be remembered when classifying: sentence parts that identify meaningful objects in the UoD are object types (for instance "student Peter Jacobs"), parts that do not identify any meaningful objects are labels (for instance "Peter", becoming the label "first name"). Questions that can be asked to verify if something should be an object or label could be: "does this identify a meaningful object?" or "does this refer to a meaningful object in the real world?".

Object expressions can be the result of a transformation of an existence postulating fact expression, for instance "There is a student Peter Jacobs". However, not all object expressions need to have an existence postulating fact. The fact "Student Peter Jacobs attends the course IS2" identifies two possible object expressions (student and course) without explicit existence postulating facts expressions (for instance "There is a student Peter Jacobs" and "There is a course IS2"). This could be worked into a dialogue game for verifying the existence of fact expressions. When presented with the fact "Student Peter Jacobs attends course IS2", the information analyst could ask the domain expert "Is there a student Peter Johnson?" and "Is there a course IS2?".

Shortcomings in FCO-IM

We believe that current views in using FCO-IM have one fundamental shortcoming, the generation of the starting document. No real attention is given on how to generate the contents of this document. This is due to the fact this step requires a great deal of creativity and in contrast to other procedures in FCO-IM cannot be defined by a precise set of rules. This step requires a great deal of human interaction which is hard to guide strictly. This step actually requires freedom to let ideas develop and creating a strict framework can actually inhibit the domain experts in generating the contents. Hence literature tends to ignore this part and just assumes "it will be there".

We disagree on this. This is a fundamental step in the process on which the rest of the process is built. Mistakes made here will be a lot harder to rectify once the Information Grammar Diagram has been created. Making sure the starting document is accurate and complete can save time and improves the quality of the resulting Information Grammar Diagram.

We also think that this is the step were the principal stakeholder validation should take place. Letting stakeholders validate the resulting Information Grammar Diagram will not work unless the stakeholders are experts in FCO-IM modelling, something we assume will generally not be the case. Validation by showing the elementary fact sentences and concretes examples is the preferred way to validate the data. However this data is derived from the starting document. So why not make sure validation has taken place there already?

By taking a semi-structured approach to generating the starting document it should be possible to include validation into this step which will serve as an extra layer, next to the regular validation already included the FCO-IM process. Validation should be easiest in this step because the document is entirely written in natural language and written as a story without any syntactic or semantic constraints yet applied. As soon as we start making elementary facts we are applying abstraction making validation possibly less accurate.

This approach to generating the starting document will make the step of generating the starting document more tedious and time consuming but in cases were completeness and accuracy is important this is well worth it.

Serious gaming

Games are traditionally played for entertainment purposes, either alone, with or against others. The word *games* is nowadays commonly associated with video games. Tabletop games (such as board games or card games) still exist.

Michael Zyda[Zyd2005] defines video games as follows:
"A mental contest, played with a computer according to certain rules for amusement, recreation, or winning a stake."

Serious gaming is a relatively new field of attention. Serious games add another dimension to games, a pedagogic factor. The purpose of a serious game is not entertainment or relaxation, but conveying knowledge or skills. Certain other goals are also possible. Zyda defines serious games as follows:

"A mental contest, played with a computer in accordance with specific rules, that use entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives."

We find this definition too limiting. We let go of the association with video games and associate it with games in general. Any game, whether it be a video game, board game or pen-and-pencil game, it is still a game played for amusement according to a certain set of rules. In fact, these games existed long before the video game surfaced. We define a serious game as a derivation of Zyda's definition:

"A mental contest, played in accordance with specific rules, that use entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives."

This definition does not exclude the involvement of a computer or automated system but also does not exclude any other type of game.

A well-known example of a serious (video) game is the first person shooter *America's Army*. The players assume the role of a recruit in the U.S. Army. Although this game is very similar to other first person shooters, the game is not intended to be primarily played for entertain, but be a recruitment tool for the armed forces. Entertainment is merely a mean to achieve this goal. Zyda mentions that at least one training camp of the U.S. Army uses this game for training actual recruits. Another example is the strategic shooter *Operation Flashpoint*. While this game was designed for entertainment purposes, the underlying technology and experience of the development team was used to create a military simulator which is in use with actual armed forces, including the Royal Netherlands Army.[DEF 2008]

Military applications are a good example, but serious games can be applied in many other areas, for instance market simulation. The author took a course *Knowledge Management* at the Nijmegen School of Management of the Radboud University Nijmegen. This course included a market simulation game which was part of the final grade of the course.

Serious gaming for information modelling

Serious games for information modelling are being developed as well. Daily life compares tasks and activities metaphorically to games, such as *the game of politics* or *not playing according to the company's rules*. In the fields of politics or business for instance we see many aspects of games, such as competition, scores, winners and losers, rules etc. This is called the *game metaphor*.

This game metaphor can be extended to information modelling. Hoppenbrouwers et al argue in favour of this:[Hop2009]

- Information modelling is a task typically done by specialists. Not many people in an organisation will have the necessary training and skills to so. Experts are generally scarce and costly to hire. But to make a good information model, the input of a lot of people in the organisation is required. To ensure all relevant aspects are modelled it is necessary for non-specialists to be able to contribute to and validate information models. These activities cannot be too time consuming or painful. Games can offer a framework and rules to guide and govern these activities so that non-specialists and inexperienced modellers can contribute or even make an information model without an expert modeller.
- By approaching information modelling as a game it might be possible to increase the motivation off all people involved. Information modelling is often seen as boring. By utilizing a game-like approach it might be seen as less boring. It is probably utopic to think that information modelling can be transformed into a fun-to-do activity, but even making it less boring offers the chance that people get more involved in the activity.
- Games can help to improve the quality of the information models to be made. By introducing a framework with a certain limiting scope and rules, people will be force to work into a general direction and not be distracted by trivial things.
- Games can help with research into model oriented interaction systems or systems for collaborative modelling. A game can be played by a large amount of groups of different compositions, allowing for a reusable method to gather empirical data on a large scale.

Most tools support only the creation of syntactic correct models, but offer no support for generating the content of these models. That means they are only useable by experts who are trained to elicit content.[Hop2010a]

Game Design Theory

Creation of serious games uses the *Game Design Theory* (GDT). Game Design Theory is a fairly new field of research and must not be confused with Game Theory, which analyses games to find strategies to win. Game Design Theory focuses on analysing and creating rules for games without involving the behaviour of the human player.

Järvinen has created a framework for game analysis and game design and has defined nine categories if important game elements [Hop2008]:

- Components
- Rule set
- Environment
- Game mechanics
- Theme
- Information
- Interface
- Players
- Context

According to Järvinen the following elements are absolutely necessary to design a game.

- Components: objects that can be manipulated by players.
- Rule set: the rules govern what a play may and may not do.
- An information structure to store all information relevant to the game.
- At least one game mechanic: the ability to manipulate one or more components, giving the players something to do.
- A goal that needs to be accomplished by using the game mechanics.

Goals and rules

Clear goals are an important aspect when designing rules for serious games for modelling. Hoppenbrouwers, Weigand en Rouwette[Hop2009] dub these *goals for modelling* and distinguish two types of goals:

- Utility goals: what can the model be used for or what is the purpose of the modelling activity?
- Modelling goals: sub-goals regarding details for the modelling process in the game.

They identified a few *key modelling goals*. The most important ones are:

- Creation goals: what kind of items are supposed to be delivered by playing the game? This is a utility goal.
- Grammar goals: which language rules must the players observe while playing the game? This is a modelling goal.
- Validation goals: what sort of agreements must be reached and between whom in the game? This is a modelling goal.

With this theoretical background about FCO-IM, serious gaming and game design theory we can start thinking about a serious game for FCO-IM. But we need more. We require a way to analyse conversations to come up with the actual content of our game.

Focused Conceptualisation

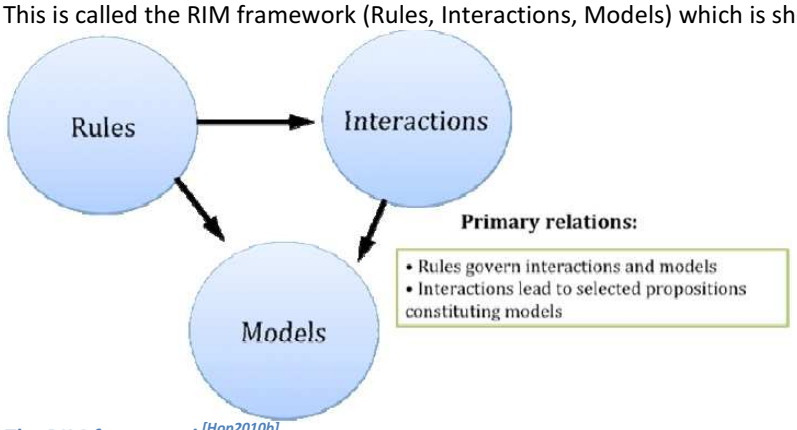
RIM-model

Hoppenbrouwers et al. are performing research to facilitate the communication in Group Based Modelling. They have introduced the concept *Focused Conceptualisations* (FoCons).[Hop2010b]

The motivation for this research is the observation that the modelling process itself is not well facilitated. Most tools only facilitate the construction of syntactically correct models and are only useable by experts.

They see modelling as a constrained and purpose-driven conversation. Each model most work towards some kind of goal. They define modelling as follows: *"the purposeful creation of structured and coherent texts or graphical artefacts and subject to strong conceptual (and other) constraints."*

In this definition, modelling methods are seen as interactive systems. Modelling consists mainly of interactions, guides by rules. These interactions lead to models. These models must adhere to specific rules. This is called the RIM framework (Rules, Interactions, Models) which is shown graphically below.



The RIM framework[Hop2010b]

Rules play an important part in the RIM framework, guiding both the interactions and constraining the models. The RIM framework identifies three types of rules.

- *Goal rules*: these rules govern the goals of the modelling process and can be divided into content, syntax, validation and argumentation rules.
- *Interaction rules*: these constrain the interactions.
- *Procedural rules*: these govern the workflow.

We can compare the key modelling goals as identified by Hoppenbrouwers to the rules of the RIM framework. Creation goals can be found in the content goals and specify what must be delivered. Grammar goals are found in the syntax rules and govern both the modelling process and the model that is being conceived. Validation goals are found in the validation goal rules of the RIM framework.

They also define a basic set of interactions:

- Propositions
- Questions
- Agreements
- Disagreements
- Arguments
- Clarifications
- Acceptations
- Rejections

A set of rules and a set of interactions are the basic components for a dialogue game.

Focus Questions and Abstract Conceptualisation

Modelling requires abstraction. In Focused Conceptualisation we call these abstract conceptualisations. We have three activity types of abstract conceptualisations:

- generation of proposals
- classification of proposals
- selection of proposals.

These three abstractions can be done one at a time or all at once. People with little experience will most probably do the abstractions separately, while experienced people will do it all at once.

Another important aspect in a conversation is the focus. We distinguish two types of focus:

Pragmatic focus: focus on information that is relevant to the modelling goal. People appear to have an innate ability to focus their descriptions towards the goal.

Semantic-syntactic focus: focus on required semantic and syntactic aspects. This focus is less natural than the pragmatic focus and does not focus on content but the form wherein this content is presented.

The pragmatic focus should be the most dominant focus when choosing a modelling language. It is possible to create a semantic and syntactic fully correct model that models the wrong things and hence is not useable. The modelling language must be able to express what is needed.

The semantic-syntactic focus is helpful in preventing a flood of different conceptualisations of the information by focusing on the chosen conceptualisation form.

The contents of FoCons

Hoppenbrouwers and Wilmont have conceived the concept of *Focused Conceptualisations (FoCon)*, mini dialogue games. The FoCon concept is designed to support the thinking about questions and answers.

They give the following definition of a FoCon: *description of a communication situation in which one or more participants engage in a focused conversation in order to arrive at a specific conversational goal, typically some sort of highly structured abstract description, specification, or (partial) model.*

FoCons can be used to analyse model oriented conversations or as a framework to guide such conversations. The latter makes it an interesting tool to use in the design of dialogue games.

To use FoCons, the authors made a template with six information categories that make up a FoCon:

Short description	**Clarification**
What may or must 'go in'	Types of information; sources thereof
What should 'come out'	Pragmatic as well as semantic/syntactic constraints on textual and other results (including social results), preferably phrased as 'modelling (sub)goals'.
The type(s) of abstraction activity involved	Generation, classification or selection (separate, or integrated in one step)
The specific focus questions asked (literally so)	This concerns both the pragmatic and the semantic-syntactic focus)
The (types of) participants involved and their relevant competencies and expertise	Possibly, flaws therein; possibly, other relevant information on the participants
Instructions given and/or procedures, conventions and guidelines	Explicit and also implicit if relevant; adhered to by the participants ('rules of the game')
Further situational aspects or constraints	E.g. media involved, resources required, organisational issues, social issues, political issues, or whatever is deemed relevant.

So far the authors mainly used the FoCon concept to analyse conversations. They offer a foundation to design rules that guide such interactions by specifying how an interaction should proceed by using these information categories. By thinking about what has to be done, rules and guidelines can appear. It can also be used to design dialogue games as a whole. This approach has been tried by students of the HAN and Radboud University.[HAN001][HAN002][VOG001]

Question Asking Framework

Focus questions are the heart of the FoCon method. It is hard to virtually impossible to come up with a strict framework and define a set of rules and questions to follow during a collaborative modelling session. Sessions are highly dynamic and rigid frameworks will not be able to deal with this. Furthermore they might hamper the participants by constraining them too much. Flexibility in asking questions is important.

But asking the right question in a right way is a challenge by itself as well. While it is hard or even impossible to setup a solid framework for questions within a dialogue, structuring this dialogue can help and guide a facilitator in asking question, just as structuring the entire process brings some sort of support.

The research done by Hoppenbrouwers and associates on dialogue games address this topic as it is an essential element. Some experimental research in the form of the previously mentioned bachelor's and master's thesis projects has begun to explore this area. This has led Hoppenbrouwers et al. to define the *heuristic Question Asking Framework (QAF)* pictured below.

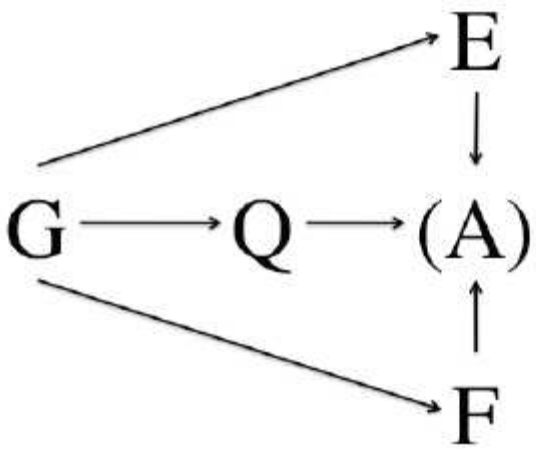


Fig. 1: concepts of the heuristic Question Asking Framework (QAF)

In the center we find the question (Q). Hopefully this question will lead to an answer (A). Each question is driven by a conceptual goal (G). This goal can be pragmatic, semantic-syntactic or both and pertains to the ultimate creation goals of the model to be made. The goals will constrain the form of the answer (F), a description of the properties the answer should have, again pragmatic and/or semantic-syntactic. This will constrain the answer itself. To help domain experts it can be helpful to provide a relevant example (E). These examples are again constrained by the goals.

We would like to slightly alter the heuristic to allow the Form to constrain the Examples. It is true that the ultimate pragmatic and semantic-syntactic constraints, both constrain Example and Form. But the ultimate choices made for the Form should also constrain the Example. We want to make sure that the examples we give are accurate so that the domain expert hopefully give an answer that indeed abides by the form. Having merely the Goals constrain both Form and Example will not necessarily do so.

Using this heuristic as a guideline can help us in designing questions or "question structures" for dialogue games.

Previous works

Two pairs of students from the Hogeschool Arnhem Nijmegen (HAN) have made a first attempt to apply a dialogue gaming approach to FCO-IM using the Focused Conceptualisation framework.[HAN001][HAN002] The first thesis focused on applying constraints as this part of FCO-IM is very well and thoroughly explained in detail with a proposed methodology. Therefore it seems suitable for a dialogue gaming approach. The second focused on building a prototype implementation in Graphity. Both thesis' focus on a practical implementation and spent little to no thought on the first conceptual stages in a FCO-IM process.

During the bachelor thesis we made a first attempt to introduce a dialogue gaming approach to Requirements Engineering, using the Focused Conceptualisation framework to try out a simple dialogue game with the purpose of eliciting simple Use Cases.[VOG001] A simple task (withdrawing cash money) was presented by a facilitator to a domain expert. Through a staged question-and-answer process several parts of a Use Case were generated, including the Basic Course of Events and a Use Case scenario fitting that Basic Course of Events. It proved difficult but possible to come up with some form of guidance for a requirements engineer/facilitator in these sessions. Implementation was kept very simple (Excel sheet) as the focus was on the technique, not the implementation.

Considering that the basis for FCO-IM is laid down in the very first stages and considering that these stages receive little to no attention in literature in regards of support we want to see if we can use this same approach in FCO-IM modelling.

Chapter 3: designing a dialogue game for FCO-IM

In the previous chapter we have explored some theories. In this chapter we used and combined these theories to design a dialogue gaming approach to FCO-IM. This chapter describes the genesis of the final design and elaborates on design decisions. We will also highlight findings that came up during testing.

First we set the goals for our game, using the goals for modelling as established by Hoppenbrouwers, Weigand and Rouwette. Next we did a FoCon analysis on what should be done and reflected on this. We started to conceptualize the game. To do this, we made some design choices and thought about asking questions and how questions can guide a conversation and keep both pragmatic and semantic-syntactic focus. We did a first test session with a crude first design with a former student Information Science. We picked someone with modelling experience so we might get extra input. We reflected on this and improved upon the design, also taking into consideration some tips from our test subject. We gave this another try with a master student Information Science. This session did not bring any new things to light. We were ready to write down our final design.

Goals

To design a gaming approach to FCO-IM, we must first think about the goals for this serious game; what do we want to accomplish? We will look at the goals for modelling as defined in the previous chapter:

- Utility goals: The final product is a FCO-IM Information Grammar Diagram. What we do with the model will, the utility goal, depends on the circumstances.
- Modelling goals: we construct this diagram according to the FCO-IM method, striving for completeness, accuracy and validation.

We can refine those into the key modelling goals.

- Creation goals: the deliverable is a complete FCO-IM Information Grammar Diagram.
- Grammar goals: the players will converse in natural language. The language will depend on the participants. For drawing the model, the FCO-IM syntax will be used.
- Validation goals: the domain expert must validate every piece of information modelled in the Information Grammar Diagram. He must agree that what the information analyst draws corresponds is correct.

In this thesis we set up a dialogue game between an information analyst, who also functioned as facilitator, and a domain expert. We assumed that the information analyst is familiar with FCO-IM and modelling. We did not expect the domain expert to have any modelling experience or experience in creating or reading FCO-IM Information Grammar Diagrams.

Applying Focused Conceptualisation

We have discussed Focused Conceptualisation the previous chapter. Focus Conceptualisation helped us to make the first step towards a dialogue game for FCO-IM. We used FoCons in a FoCon analysis to help us shape our very first design. These FoCons helped us focus on what was important, mainly the input and output. It also made us consider what kind of questions we had to ask to transfer the input into the desired output.

We captured the entire process, in this analysis, including adding constraints. The first step is to see the whole process as one large FoCon. This generated the overall scope of the project. This did not proof to be satisfactory and we decided to break down the process into sub-FoCons. These FoCons would be the foundation for our design.

Constructing a FCO-IM Information Grammar Diagram begins with a starting document. The document should describe all information and information processes relevant to the case at hand in general terms. This is done with domain experts. An information analysis is performed on this document. Focus is applied on the information itself, not the processes operating on the information (i.e. the contents of a database are important, database operations carried out on these contents not so much).

Once this document is created, concrete examples are given and by performing classification and qualification, artefacts for the repository are generated. These serve as basis to draw the Information Grammar Diagram.

FoCon analysis 1: all-in-one

We can see the whole process as one large FoCon.

FoCon 0
***Name:* Construct an Information Grammar Diagram with constraints for a given UoD.**
This FoCon encompasses the entire process, starting with generating the information by talking to a domain expert and ending with the constrained Information Grammar Diagram.

Input: the input for the FoCon is any information that the domain experts gives to the modeller. This information is generated by the modeller asking questions to the domain experts who answers them to provide the input needed.

Output: the output will be a FCO-IM Information Grammar Diagram (Information Grammar Diagram). Several constraints apply. All information that goes in and comes out incorporated into the Information Grammar Diagram must be relevant to the modelling purpose of the session. This needs to be defined beforehand by the modeller. Any information that comes up and is not deemed necessary or out of scope should not be processed into the Information Grammar Diagram. Creating the Information Grammar Diagram must be done according to the FCO-IM modelling and the resulting Information Grammar Diagram needs to be complete and adhering to FCO-IM rules.

Abstraction: all types of abstraction will be part of this FoCon. The FoCon starts with generation. Classification and selection take place in later step when the actual modelling begins.

Focus questions: the focus questions must properly enforce the constraints we set to ourselves. The pragmatic focused is focused on keeping the conversation on track and make sure all information that is modelled into the Information Grammar Diagram is actually relevant for our modelling purpose. The semantic-syntactic focus must make sure the questions and modelling is done according to FCO-IM rules. Considering the vast scope of this FoCon, the repertoire of questions needs to be rather large and diverse in nature.

Participants: there will be at least two participants. One is an information analyst (or modeller) who will also act as facilitator. We choose not to split these roles but have one person act as both to give the modeller all the freedom he requires. The modeller/facilitator needs to be proficient, preferably expert, in FCO-IM and must possess the skills to lead modelling sessions, both one-on-one and group modelling. One or more participants will act as domain experts. The amount of domain experts can vary from case to case. No knowledge in FCO-IM or modelling in general is required from the domain experts. This would be preferred but in reality it will be very hard to realize modelling sessions with domain experts who are also experts in modelling. It is required that domain experts are indeed experts in their field of expertise, especially when elicitation is required.

Rules and guidelines: the facilitator leads the session and also does the modelling. He asks questions to which the domain experts answer. The facilitator can be seen as a game master who has full control of the game and may correct the behaviours and activities of others. The domain experts follow the lead of the facilitator.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely. Face-to-face communication often yields valuable input since domain experts will feel free and less inhibited. Speaking face-to-face is natural. It also enables the information analyst to observe the domain expert and interpret body language, for instance recognising that the domain expert does not fully follow a line of reasoning or feels uncomfortable with something. Such issues are typically not quickly expressed by domain experts as people do not like to express it when they do not understand something. If participants cannot physically be together for a session, then there is no choice but to do it remotely. Doing it remotely by use of group collaboration tools has the advantage that everything can very easily be logged and that the resulting logs can be easily searched. Face-to-face session can be recorded, but in order to make things easily searchable, the whole sessions needs to be painfully transcribed. Therefore it can be argued to use group collaboration tools and use electronic communication even when being face-to-face. However this might inhibit the domain expert and reduce spontaneity. An alternative could be to do the communication electronically but allow extra face-to-face communication, in which case the session should be recorded, so that things can always be tracked.

FoCon analysis 2: Breaking down into sub-FoCons

The process is too large for a single FoCon to guide and structure. The repertoire and diversity of focus questions would be vast. We would have many questions to consider which negates the primary strength of FoCons: keeping focus.

To allow for a structured approach it will be necessary to split this FoCon into multiple FoCons. FCO-IM can be roughly divided into four phases: generating starting document, generate elementary facts, classification/qualification & drawing the diagram, apply constraints. We can divide some of these FoCons into sub-FoCons. The end goal is to model all information deemed relevant by the domain expert into an Information Grammar Diagram which the domain expert will validate. We will use the example case from the FCO-IM book to illustrate the steps. We choose to identify the following steps.

- Generate starting document: this is the very first step in the FCO-IM process. The domain expert writes down in natural language all relevant information and information processes. For instance, the coordinator of practical training for students at the university writes down the process of how he assigns projects to students, including all the relevant information he needs to do this.
- Information analysis: this step is taken by the information analyst. He takes the generated starting document and underlines the information perspective. This means he highlights the information the domain expert deems relevant. Processes operating on this information are not considered. The findings of this step encompass the information that will have to be modelled into the Information Grammar Diagram. In our example above, the information analyst has identified several lists of information, such as a list of students, a list of projects and a list of project assignments. Each list has several pieces of required information such as the students first and last name.
- Generate concrete examples: concrete examples are given for each identified piece of information. In the example case for instance the domain expert gives the names of a few students.
- The next step is verbalization of (elementary) facts. Fact expressions are generated for every example generated in the last step.
- The facts are classified and qualified.
- The FCO-IM Information Grammar Diagram is drawn using the qualified facts.
- Constraints are added last.

Take note that we did not repeat the descriptions for participants and situational aspects for each sub-FoCon, unless they differed from FoCon 1.

FoCon 1

Name: **Generate starting document**

Input: the input for the FoCon is any information the domain experts gives to the modeller. This information is generated by the modeller asking questions to the domain experts who answers them to provide the input needed.

Output: the output will be a document that describes streams of information and information processing. The document needs to be complete and exhaustive. There are no requirements or constraints concerning the form of the output. This may be written as a story in normal language. The language is agreed upon by the participants beforehand.

Abstraction: the abstraction in this phase is generation. It is important that no other forms of abstraction are utilized at this stage. The purpose of this stage is to gather all the information needed. Applying abstraction or constraints might in fact make us loose important information beforehand.

Focus questions: the focus questions must keep the conversation on track. They must make sure that relevant answers can be given and must make sure the conversation does not go out of scope. In this phase focus questions will focus on generating information. The answers must contribute to the starting document. In terms of QAF analysis this means the Goal behind the Question is that the desired answers contributes to a FCO-IM starting document. The form of the answer is not important; the only requirement will be that it is natural language and not some form of gibberish. The exact language will depend on the situation, for example English or Dutch.

Participants: there will be at least two participants. One is an information analyst who will also act as facilitator. We choose not to split these roles but have one person act as both to give the modeller all the freedom he requires. The modeller/facilitator needs to be proficient, preferably expert, in FCO-IM and must possess the skills to lead modelling sessions, both one-on-one and group modelling. One or more participants will act as domain experts. The amount of domain experts can vary from case to case. No knowledge in FCO-IM or modelling in general is required from the domain experts. This would be preferred but in reality it will be very hard to realize modelling sessions with domain experts who are also experts in modelling. It is required that domain experts are indeed experts in their field of expertise, especially when elicitation is required.

Rules and guidelines: the facilitator leads the session and also does the modelling. He asks questions to which the domain experts answer. The facilitator can be seen as a game master who has full control of the game and may correct the behaviours and activities of others. The domain experts follow the lead of the facilitator. The facilitator may interrupt in the domain expert if he thinks that focus is being lost. There are no clear cut rules to determine when this happens, it is up to the facilitator to determine this.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely. Face-to-face communication often yields valuable input since domain experts will feel free and less inhibited. Speaking face-to-face is natural. It also enables the information analyst to observe the domain expert and interpret body language, for instance recognising that the domain expert does not fully follow a line of reasoning or feels uncomfortable with something. Such issues are typically not quickly expressed by domain experts as people do not like to express it when they do not understand something. If participants cannot physically be together for a session, then there is no choice but to do it remotely. Doing it remotely by use of group collaboration tools has the advantage that everything can easily be logged and that the resulting logs can be easily searched. Face-to-face session can be recorded, but in order to make things easily searchable, the whole sessions needs to be painfully transcribed. Therefore it can be argued to use group collaboration tools and use electronic communication even when being face-to-face. However this might inhibit the domain expert and reduce spontaneity. An alternative could be to do the communication electronically but allow extra face-to-face communication, in which case the session should be recorded, so that things can always be tracked.

FCO-IM itself assumes that the domain expert writes this on his own. If we follow this assumption, then it would not be a FoCon as there is no interaction between the actors. This step could be done in a session between information analyst and domain expert. This will be very time consuming. But this document will be the very foundation of the modelling process and should be done right. A domain expert might not know what he should write down. Guidance by an information analyst could help. Especially with highly inexperienced domain experts it might be very helpful to do this together. This might require an entire session on its own. If the information analyst is confronted with a highly experienced domain expert, then it could be considered to skip this step as a FoCon and let the domain expert write the starting document on his own.

FoCon 2

Name: **Underline information perspective (Information analysis)**

Input: the input for this FoCon is the start document produced in FoCon 1. This automatically produces the requirement that FoCon 2 can only be started if FoCon 1 has been completed. In fact, in the FCO-IM process we demand that FoCon 2 immediately follows up on FoCon 1.

Output: the output of this FoCon is the starting document with the information perspective underlined, written in natural language. The language is agreed upon by the participants beforehand.

Abstraction: the abstraction activities in this FoCon are classification and selection. The information analyst analyses which elements of the starting document deal with information and which parts about processes operating on that info (classification). Descriptions about processes are left aside and he will only focus on descriptions of information (selection)

Focus questions: at this point we must realise that we might not be dealing with a real FoCon here as there is no interaction between the two actors. However, it is possible to have an actual FoCon here. The dialogue will mainly serve as validation for the input. For instance the information analyst could ask the following: "You state <this>. Am I corrected to assume <that>". A danger is the possibility that the domain expert might find this step tedious. He might think "is that not obvious?" not realising that the information analyst, as a layman in the subject matter, must be absolutely sure he is on the same page as the domain expert. If the starting document was written by more than one domain expert, then this FoCon can also serve to form consensus between those parties. To avoid this tediousness it might be a good idea to explain this consideration beforehand.

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: the facilitator leads this FoCon. There is little interaction. This is more like a facilitator activity. If at any time, new things surface, then the information analyst should interrupt this FoCon and go back to FoCon 1 and complete the following FoCons accordingly before moving on.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely. It could be considered to integrate this into FoCon 1 if the starting document is generated in a dialogue situation. In this case FoCon generates an output that only encompasses the information perspective, shaped by asking questions. If the starting document was made beforehand by the domain expert, then FoCon 2 should be done as a separate FoCon. One might argue the information analyst should do this step as a facilitator activity after receiving the starting document from the domain expert, but we would like to argue to do it in a dialogue session anyway for validation purposes

FoCon 3

Name: **Generate concrete examples**

Input: the input for this FoCon is the start document with underlined information analysis produced in FoCon 2. This automatically produces the requirement that FoCon 3 can only be started if FoCon 2 has been completed. In fact, in the FCO-IM process we demand that FoCon 3 immediately follows up on FoCon 2.

Output: the output of this FoCon is a collection of concrete examples to be stored in the Information Grammar Diagram, written in natural language. The language is agreed upon by the participants beforehand.

Abstraction: the abstraction activity in this FoCon is generation. The domain expert will generate these examples by thinking them up while the information analyst asks questions and guides him.

Focus questions: the focus questions in this FoCon are aimed at generating concrete examples of the underlined information perspective. For instance, the information analyst could select one of those aspects and ask “Can you give me an example of the information”. If the example is not concrete enough, he can ask for further clarification. FCO-IM demands a rather exhaustive set of examples for all aspects. If the domain expert has a hard time coming up with concrete examples, then the information analyst might have to help by stating some related examples as suggested by QAF. Next to this pragmatic focus, the questions also need to guide on the semantic-syntactic focus. The output does not require a specific format yet, so the semantic-syntactic focus is of less importance here.

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: the facilitator leads this FoCon. The information analyst asks questions which the domain expert answers. If at any time, new things surface, then the information analyst should interrupt this FoCon and go back to FoCon 1 and complete the following FoCons accordingly before moving on.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely.

FoCon 4

Name: **Verbalization of (elementary) facts**

Input: the input for this FoCon is the start document with underlined information analysis produced in FoCon 2 and the collection of concrete examples in FoCon 3. This automatically produces the requirement that FoCon 4 can only be started if FoCon 3 has been completed. In fact, in the FCO-IM process we demand that FoCon 4 immediately follows up on FoCon 3.

Output: the output of this FoCon is a collection of elementary facts phrased as FCO-IM fact-expressions, written in natural language. The language is agreed upon by the participants beforehand. The facts do not to be elementary facts yet in this stage but it is recommended to strive for this.

Abstraction: the abstraction activity in this FoCon is generation. The information analyst will ask the domain expert to generate these facts by asking questions about the examples from the previous FoCon.

Focus questions: focus questions will deal mainly with the semantic-syntactic focus in this stage. The pragmatic focus was the main focus in the previous FoCon. In this FoCon, these examples need to be phrased as fact expressions. The domain expert selects one of the generated and examples and asks a question like this: “Could you rephrase that into something like this: <...>”. It is important that these questions only guide the domain expert in the semantic-syntactic focus and make no assumptions about the content. The pragmatic focus has been dealt with already. An information analyst could try to combine both foci in one question. In this case FoCon 3 and 4 would be combined. But we think, especially with inexperienced domain experts, it will be more fruitful to first come up with the actual example and then, if necessary, work toward the proper form. This way the semantic-syntactic focus will not inhibit the domain expert creativity. The sessions might last longer but we think the benefits outweigh this cost.

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: the information analyst will let the domain expert rephrase the concrete examples into fact expressions. They do not need to be elementary, although one might argue against this. If unicity is not enforced at this stage, it will be in a later stage. Paying attention to unicity now has the advantage that the examples are still fresh in the memory of the domain expert. Returning to this subject later might lead to overlooking things. If at any time, new things surface, then the information analyst should interrupt this FoCon and go back to FoCon 1 and complete the following FoCons accordingly before moving on.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely.

FoCon 5
Name: **Classification**
Input: The facts verbalized in FoCon 4 form the input for this FoCon. This automatically produces the requirement that FoCon 5 can only be started if FoCon 4 has been completed. In fact, in the FCO-IM process we demand that FoCon 5 immediately follows up on FoCon 4.

Output: the output of this FoCon is a collection of (elementary) fact expressions, written in natural language and classified in groups. The language is agreed upon by the participants beforehand. The facts do not to be elementary facts yet in this stage but it is recommended to strive for this.

Abstraction: the abstraction activity in this FoCon is classification and selection. The information analyst will ask the domain expert which facts can be grouped as being similar, belonging to the same "kind" of fact.

Focus questions: the questions that should be asked in this FoCon try to group similar facts. An example would be "Can we say that this fact and this other fact are examples of the same thing?".

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: the information analyst will ask questions which the domain expert will answer. Take note that this FoCon might be redundant if examples have been generated by fact already. This will make the classification step a rather tedious one and might make the domain expert wonder why we are doing this.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely.

FoCon 6
Name: **Qualification**
Input: the input for this FoCon are the classified fact expressions from FoCon 5. This automatically produces the requirement that FoCon 6 can only be started if FoCon 5 has been completed. In fact, in the FCO-IM process we demand that FoCon 6 immediately follows up on FoCon 5.

Output: the output of this FoCon is a collection of elementary facts, written in natural language and classified in groups and meaningful names given to these groups. The language is agreed upon by the participants beforehand. The facts do not to be elementary facts yet in this stage but it is recommended to strive for this.

Abstraction: the abstraction activity in this FoCon is generation. The information analyst will ask the domain expert to give meaningful names to the classified facts of FoCon 5.

Focus questions: this FoCon will be a rather elaborate one. The groupings created in the previous FoCon will be given a name in this FoCon. The information analyst could ask for example "Could you provide a logical name to describe this first set of examples, preferably in one word?". This will yield "fact names". Another step will be generating fact expressions and labels. Questions asked then could be, with an example like "Student Peter Johnson is 25 years old": "Can you provide a logical name to describe these" or "What would you call these?" in both cases referring to the part "Student Peter Johnson". This will yield object expressions. Next we need to find out what identifies these objects. Question to be asked for this purpose could be: "How are individual students identified?" or "Is it possible that there is another student with the name Peter Johnson?". If the information analyst and domain expert conclude that the current examples do not allow for a unique identification, then one must be found. A question might be "How would you uniquely identify each student?".

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: the information analyst will ask questions which the domain expert answers. It could be considered to integrate this with the previous FoCon since the FoCon 5 might seem a bit short.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely.

FoCon 7
Name: **Construct Information Grammar Diagram**
Input: the input for this FoCon are the qualified facts in FoCon 6. This automatically produces the requirement that FoCon 7 can only be started if FoCon 6 has been completed. In fact, in the FCO-IM process we demand that FoCon 7 immediately follows up on FoCon 6.

Output: the output of this FoCon is the Information Grammar Diagram we are after. This does contain constraints yet. The Information Grammar Diagram must have a meaningful population, most be complete and adhere to FCO-IM standards.

Abstraction: the abstraction activity in this FoCon is generation. The information analyst will generate the Information Grammar Diagram from the information generated in previous FoCons and then validate this with the domain expert.

Focus questions: there are not any questions for constructions, only for validation. Questions could be "does this correctly represent what you said?". Alternatively the information analyst can explain what he is drawing and ask for validation while doing this. "Taking this <...> fact expression, we will get this <...>. Does that seem correct to you?".

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: there is not much interaction here and one might even argue whether this is a FoCon at all. The information analyst will draw the Information Grammar Diagram, either by hand or using a tool. However, for validation purposes interaction should be at least contemplated. Only the information analyst can draw or alter the Information Grammar Diagram.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely.

FoCon 8
Name: **Apply constraints**
Input: the input for this FoCon the Information Grammar Diagram constructed in FoCon 7. This automatically produces the requirement that FoCon 6 can only be started if FoCon 5 has been completed. In fact, in the FCO-IM progress we demand that FoCon 6 immediately follows up on FoCon 5.

Output: the output of this FoCon is a collection of elementary facts, written in natural language and classified in groups and meaningful names given to these groups. The language is agreed upon by the participants beforehand. The facts do not to be elementary facts yet in this stage but it is recommended to strive for this.

Abstraction: the abstraction activity in this FoCon is generation. The information analyst will ask the domain expert to give meaningful names to the classified facts of FoCon 5.

Focus questions: questions will depend on the type of constraint that will be tested. Uniqueness constraints can have questions like this: "can this <object> participate multiple times in this interaction?". Totality constraints related questions must check if each object must participate in a fact. A question could be "must every example of <this> object participate in <this> fact. Each type of constraint will have a specific set of questions.

Participants: there will be at least two participants, one information analyst, who also acts as facilitator, and at least one domain expert.

Rules and guidelines: the information analyst is asking the questions, the domain expert answers them. The information analyst will update the Information Grammar Diagram with the constraints accordingly.

Situational aspects: these will depend on the circumstances. Sessions can be done face to face or remotely.

The analysis above is a brief analysis of the FCO-IM process. We left out many details. It serves only to give us an initial idea and understanding. We were rather vague in FoCon 8. Rules for generating constraints are very specific and thoroughly explained in the FCO-IM handbook. But since the scope of our design encompasses the elicitation only, we made the decision to leave this FoCon rather simple. We would also like to point out that some students from the HAN University of Applied Sciences already worked on this. We would like to add something new, rather than build upon their work.

Reflection on the FoCon analysis

In the previous section we broke down the FCO-IM process according to the FoCon theory. The descriptions are not exhaustive. This was done on purpose. We wanted to get a feel of FCO-IM before working out all the details and all the questions. The FoCon analysis highlighted some issues that we wish to address, partially corresponding with our observed shortcomings of FCO-IM in the previous chapter.

The first one is about how the starting document should be generated. FCO-IM assumes that this document will be written by the domain expert. Strictly speaking there is no interaction at this point, so it should not be analysed as a FoCon. We envisioned a new way, where the domain expert and information analyst make this starting document together, by means of conversation. The information analyst is writing the document with input from the domain expert. The whole document will be written before continuing. But still this is not very satisfactory to us. Also, this makes step 2 a problematic one. We again have, strictly speaking, no interaction. The domain expert will feel useless while the information analyst analyses the text. Still we feel we can gain much by making the starting document in a collaborative way. FoCon 2 might be integrated into FoCon 1 so we can skip this step and speed up the process. While making the starting document, the information analyst does document everything the domain expert says, but he sets the information perspective aside, essentially doing FoCon 2 while writing the document. Feedback can immediately be given if necessary.

Splitting classification and qualification does not seem satisfactory as those things seem to go hand in hand. When grouping examples (classify) it seems rather natural to immediately name this group (qualify) and continue with the second step of the process.

A collaborative session done in this way will require a lot of iteration. First the whole document is made, then it is classified and qualified step by step, which means we have to go through everything yet again. We decided to do this in a step-by-step fashion. Instead of generating the whole starting we generate just one sentence at a time and do the procedure for this one sentence. Once this is done we have a very small piece of our Information Grammar Diagram done. Then we generate the next sentence and so on, building the Information Grammar Diagram in an incremental fashion.

This has a few benefits in our eyes. There will be less repetition. The sentence and all facts it contains will remain fresh in the memory of the domain expert until we are done. If we complete the whole starting document first, then the first sentences are not fresh in his memory anymore and thoughts need to be retraced. This might lead to a loss in information. Doing this breaks with paradigm of FCO-IM. But this does not have to be a bad thing. Just because something has been done this way for a long time, does not mean it should be done this way. There might be a more efficient way.

Using this FoCon analysis, the reflection on this analysis and our initial reservations on FCO-IM we created a first version of a workable dialogue game.

Conceptualizing the design

Before we created the actual game, we had some design considerations to make. We will describe these considerations and their argumentation in detail. We'll summarize them at the end.

A waterfall approach versus an iterative approach

The first design choice we made is to separate generating the facts & drawing the Information Grammar Diagram from applying constraints. These processes are fundamentally different in our view. The first part, generating facts to draw the Information Grammar Diagram is highly creative and the field of content generation in general has little or no support. There is also no clear-cut procedure described in FCO-IM literature on how to make a starting document. It is just assumed there will be one that is of high enough quality.

The second part of FCO-IM, applying constraints, is detailed in an exhaustive manner, complete with methodology, rules and guidelines. There has also been some research in the form of HAN Master Thesis's in this direction. We feel we can add little to this. As a scope decision, we decided to focus on this first part with this research. If one wants to add this phase to the game, we envision this a new and separate phase of the game. Switching between phases should be possible at any time.

This separation also seems natural to us for a fully fleshed out dialogue game for FCO-IM. The current methodology requires the first part to be completed before constraints are added. Of course this does not necessarily have to be case.

One might argue in favour of doing so while drawing the Information Grammar Diagram. But given the fundamental differences in approach it seems natural to split this into two phases. One might also argue to split this first phase into two phases: first generating the elementary facts and second determining the fact and objects through classification and qualification and drawing the first version of the diagram. We wanted to try it differently.
We regard drawing the actual Information Grammar Diagram as part of this first process for two reasons. First of all, once all facts are generated and the FCO-IM repository has been made, we have all we need to draw the Information Grammar Diagram. It is directly linked. The second reason is an iterative approach to building the repository and the Information Grammar Diagram itself which will be described below.

The second design choice we made is to let go of the described approach written by the authors. We think that having the domain expert make a "starting document" beforehand on his or her own is not the way to go. We will miss out on potentially valuable interaction between domain expert and information analyst. It will take more time to do this stage together, but for the sake of completeness and validity we think this is worth the time and effort.

A problem that presents itself is the step of underlining the information perspective. This is a step that needs to be done by the information analyst alone as it requires understanding of FCO-IM to know what is needed and what not. So in this step the information analyst would read over the text again while the domain expert idly twiddles with his thumbs. This is not motivating and might lead to awkward silences, which is something we want to avoid as much as possible in a dialogue game. This could lead to uncomfortable feelings and might make the domain expert "shut down".

Combining the stages of generating the starting document and the information perspective might work. However, changes will occur that might necessitate changes etc. This would be preferable to the awkward silence, but we think a better way can be found.

The approach we took is to build this starting document incrementally and model as we go. Rather than doing a waterfall approach – complete one stage, then move to the next – we will introduce an iterative approach where we build only small parts of the Information Grammar Diagram at a time. This approach yields some advantages.

Asking a domain expert to fully and exhaustively explain the activities that need to be supported and their required information can be a very daunting task if there is a lot to describe. A journey of a thousand miles begins with a single step. However, the domain expert might see a tall mountain range in his mind and will not be keen to take this first step. If we can divide this journey into smaller journeys and make the mountains seem more like hills, then he might be more inclined to begin and take the first step.

Also, the domain expert will quickly start to see things appearing in front of him. In the waterfall approach, the first version of the Information Grammar Diagram will not be drawn until the classification and qualification are done and then suddenly the whole diagram will appear. It will be a flood of information for someone who is not familiar with FCO-IM. By doing only small parts at a time, the domain expert quickly sees small pieces of the diagram that are easier to take in. He also gets a feeling for the process. Once two or three facts have been modelled he might get hang out of it, making each iteration progress more smoothly.

Furthermore, by keeping the steps small and concise, we can use Focused Conceptualisation to its fullest potential. Smaller tasks are more easily encapsulated than large steps. Keeping the focus will be less hard a task and focus questions can be kept direct. The amount of focus questions to choose from can be reduced, lessening the burden on the information analyst to decide how to proceed.

We distinguish between three types of iterations as identified by Hoppenbrouwers et al.[Hop2011b]: planned iterations, triggered iterations and ad-hoc iterations. Planned iterations are “hard decisions”, specified in the work flow. Triggered iterations are triggered by to-do lists, such as a mission list. They allow for some kind of freedom when we can choose between more than one item from a to-do list. Ad-hoc decisions occur out of the blue and the decision is made ad-hoc to react to something that has happened. Our final design will allow for all these iterations to occur and they have been marked in the design.

Task analysis versus information analysis

FCO-IM stands for Fully Communication Oriented Information Modelling. This means that FCO-IM analyses communication about a universe of discourse. FCO-IM does not model tasks or activities occurring in this Universe of Discourse. The FCO-IM method is therefore tailored toward information analysis. A question should be phrased as "what do you talk about at work?". It makes an assumption: domain experts can simply talk about what they say rather than what they do.

We would like to argue against this. We will not exclude this possibility. There will be people who can do just that. But we think that the average domain expert cannot do this and will simply wonder what you mean. We think that we cannot do information analysis without some form of task analysis or even activity analysis in these cases. This is just the way average people think. In fact, the FCO-IM book presents a case and the starting document consists of part task analysis and part information analysis.

Preliminary research done by Wilmont et al. seems to corroborate this notion. In[Wil2010] they make the assumption that novice information engineers often think object-driven and process-driven in parallel and that objects in one process trigger one in the other and vice versa. Some exploratory research appears to validate this thought.

In[Wil2012] Wilmont et al. analyse sessions of collaborative modelling in a Dutch organisation. They observe all three layers of abstraction, but concrete examples and first order abstraction seem to be dominant and the layers seem to build upon one another.

In this light we think it is useful to approach FCO-IM differently than the current methodology does. This is another design consideration. Rather than immediately talk about communication, which we see as a second-order abstraction (patterns of patterns), it is better to start at the very bottom with concrete examples. In our case these are the daily activities carried out by our domain expert. We will slowly build abstraction layers to tasks (first-order abstraction) and then onwards to the communication (second-order). Our approach will allow for flexibility. If the information analyst is highly capable and feels that his domain expert is capable as well, it is possible to skip one or two abstraction steps and immediately build the second-order abstraction layer.

In light of this we also think it is better not to work with the exhaustive examples FCO-IM now requires. This might invoke some resistance and difficulty because CASE TOOL requires this. But we think the fact that the tool cannot do it any other way, does not mean it should have to be done in this way.

A word on asking questions

Asking questions is perhaps the most vital part of any dialogue game. They drive the conversation and keep the focus. We have already discussed the Question Asking Framework (QAF).

Hoppenbrouwers has explored the topic of asking questions in a dialogue game approach to collaborative modelling and introduces several concepts using the QAF heuristic.[Hop2012d] We can use these insights for our game.

Goal questions

Goals and questions are very important to any dialogue game. Goals are important to any game as they are the main objective to be completed. The goals also keep the game on track. A dialogue game is all about conversation and questions are the driving force in this process.

Goal questions should be posed to describe pragmatic focus. What is it that we want to achieve in a particular modelling session, in other words, what will our deliverable have to be? Semantic-syntactic focus is implicitly woven into the questions.

Goal questions should ask a question and elaborate the purpose. These goal questions should be clearly communicated, possibly discussed, and participants should be reminded of them occasionally. Perhaps they can be integrated with the mission list which is always visible. A nice example is the video game Guild Wars 2. The player has a list of objectives in his screen reminding him of certain goals he has to or can achieve. He can minimize these goals and hide the descriptions to reduce the clutter in the screen, but the goals themselves always remain on-screen. We think this could work for a dialogue game as well. An abbreviated mission list with goals will always be visible at all times. If necessary, the facilitator can expand individual entries for more detailed information.

Focus questions
These are the most important part in the process. These questions guide and drive the conversation and are aimed to elicit the information the facilitator needs. These questions can be divided into two parts, a question and a topic part. The question part can be a "generic" opener, for example "What might influence...?". The topic part will depend on the context and the information required.

Forms
Forms can constrain the answers by requiring a certain form of output, enforcing semantic-syntactic goals. If certain notations are required, this could be coupled with an automatic checker to check for syntactic correctness (however no automatic checker will be able to determine if the actual content makes any pragmatic or semantic sense). We find that forms might be too limiting. The question should guide the domain expert towards the semantic-syntactic goal. We will not employ them in our game.

Examples
Examples can illustrate a question and are complementary to forms. Rather than having strict forms for the output to enforce semantic-syntactic goals, the questions could be accompanied by an example to illustrate the kind of answer the facilitator wants. The domain expert will feel freer in comparison to being confronted with a form, which might lead to unexpected new information. Care must be taken that the domain expert is guided, but not pushed. An experienced facilitator might leave out the example in the initial question, but immediately offer one when he notices it might help.

Dynamic sets and sequences of questions
Flow in a dialogue game is unpredictable. Sequences of questions should be dynamic to allow for flexibility to facilitate this and create a semi-structured environment. We share this view. There is no predefined order of questions. This allows for flexibility. This allows the participants to move around in the FoCons if necessary. The order, in which questions should be asked, will be dependent on the particular FoCon but can also be influenced by unexpected answers. Many rules and questions are therefore not hard rules, but merely guidelines. This allows for flexibility for an expert facilitator but greatly helps a novice facilitator to find a flow that works.

Testing and refining the design

With the applied FoCon analysis and above considerations in mind we made a first version of a playable game and tested this. We will not describe this first design; we will only highlight findings from our test sessions. The final design is described in detail in chapter 4. We picked a former student Information Science. While we assume domain experts do not have a modelling background we explicitly picked someone with a modelling background for extra feedback. We felt the iterative approach worked. The test session mainly highlighted some conversational aspects.

An important aspect of any dialogue game is the nature of the conversation itself. This aspect is probably not paid enough attention. Most people are concerned with formal flow and the questions. But the conversation itself is a huge factor. If the conversation starts to bore or even irritate the domain expert, this can have a negative effect on the quality of the output. For instance, we perceive that certain aspects in FCO-IM might start to annoy domain experts as we rephrase the same piece of information over and over again. In the worst case, the domain expert might even start to think that the information analyst is not taking him seriously or thinks he is giving the "wrong" answers since the same question seems to be repeated all over again in a slightly different form.

This was in fact demonstrated in our first test session when our domain expert noted off the side that he thought certain questions seemed redundant. While he realised the need for these questions, having an educational background in formal modelling, most domain experts will not realise or care for this. At some point, even the information analysts might start to feel some shame when he has to ask a question that will seem redundant. This was in fact observed as well. FCO-IM requires certain phrasings for the repository. But in light of this discovery we think that experienced information analysts should be allowed the flexibility to fill in certain parts of the repository if they are confident the information presented is accurate enough.

The information analyst must also be able to "read" the conversation. If he perceives that annoyance is surfacing, then it is a good idea to do something about it. For instance, it could be explained shortly to the domain expert that certain questions may seem redundant to him but that we, as information analysts, need to ask these question to be absolutely sure. We are not subject matter experts in the domain. This might create some shared understanding in the need for the questions and will leave the domain expert in his value. We acknowledge that we ask these questions because we are not the experts and thus have to make sure we understand our conversational partner.

On the other hand, we must take care not to overburden the domain expert with information and details he does not really need to know about. That is why reading the conversation is important. If we face a domain expert who is not bothered by it, then explanations are not necessary and might in fact have an adverse effect.

Grice's Maxims

There are no clear cut rules and procedures for this sort of thing. Dealing with people is hard. Paul Grice formulated what became known as Grice's (Conversational) Maxims as a possible "code of conduct" for conversations in general. We are able to use these principles. The Maxims are cited from[GRI001] below:

***"The maxim of quantity**, where one tries to be as informative as one possibly can, and gives as much information as is needed, and no more.*
***The maxim of quality**, where one tries to be truthful, and does not give information that is false or that is not supported by evidence.*
***The maxim of relation**, where one tries to be relevant, and says things that are pertinent to the discussion.*
***The maxim of manner**, when one tries to be as clear, as brief, and as orderly as one can in what one says, and where one avoids obscurity and ambiguity.*

As the maxims stand, there may be an overlap, as regards the length of what one says, between the maxims of quantity and manner; this overlap can be explained (partially if not entirely) by thinking of the maxim of quantity (artificial though this approach may be) in terms of units of information. In other words, if the listener needs, let us say, five units of information from the speaker, but gets less, or more than the expected number, then the speaker is breaking the maxim of quantity. However, if the speaker gives the five required units of information, but is either too curt or long-winded in conveying them to the listener, then the maxim of manner is broken. The dividing line however, may be rather thin or unclear, and there are times when we may say that both the maxims of quantity and quality are broken by the same factors."

These Maxims should be kept in mind when talking to a domain expert, in any setting. Should the information analyst realise that any point is about to or has violated the Maxims, then the course of the conversation needs to be evaluated. We will now analyse these Maxims more closely to point out some concise things that we can use.

The maxim of quantity highlights an interesting issue: overburdening with information. The information analyst of course has to be as informative as possible. However he also must not overburden the domain expert with technical details about the process or the repository or FCO-IM terminology. Doing so would violate this maxim and could lead to possible confusion, a sense of incompetence ("Oh my god, I do not understand a word of this.") or maybe even annoyance ("Why are you bothering me with this?"). It will be up to the information analyst to determine when extra information is required, for instance to avoid possible annoyance when a seemingly redundant question is absolutely necessary. He then must find the fine balance of what details he should explain and which not.

The maxim of quality applies to both participants. The domain expert should not give false information or information not based on facts or experience. On the other hand, we would like to add something to this maxim for the information analyst's point of view. He should not make assumptions that are not supported by what the domain expert is telling. If he is confident about certain things, then he can write those down without asking seemingly redundant questions. However, when he doubts, he should ask for verification. Also the information analyst must model truthfully the information he is given and not make changes because he thinks things could be done better or more efficiently. These things might be suggested, but should never be done on their own. We must model the information need of the domain expert, not our perceived information need of the domain expert.

The maxim of relation is already covered in the structure of the game. The dialogue game approach gives us a focused framework and mechanisms to keep the pragmatic focus. Whenever the information analyst acts to drive the conversation back on topic he is in fact responding to a direct violation of this maxim.

The maxim of manner reflects possible attitudes. Never, at any point, should the information analyst be rude or make the domain expert feel unappreciated or maybe even "stupid". A small sigh from the information analyst, when he is wondering why the domain expert is not coming up with something he expected, can change the mood of the entire conversation to the point that our domain expert might become hostile. Questions should be clear, unambiguous and brief. The information analyst should have elaborations at hand if the question is not immediately understood and if this happens more frequently, then the questions should be more elaborate on default. This will greatly depend on the circumstances, the topic and the domain expert.

Asking questions

With these maxims in the back of our mind, we have to take a look at the questions we ask the domain experts. We have noticed an issue with certain questions that seem to be unnecessary and redundant. In our first session, one of the things that seemed redundant was asking for more examples after the initial one was given. This raises the general question of asking too much questions and redundancy. We have to consider the following: can we reduce our numbers of questions? This has certain advantages and disadvantages. Advantages include a more pleasant perception for the domain expert and saving time. A disadvantage is the risk of loss-of-information and/or insufficient validation. The major challenge will be to judge the probability of this risk.

The game should make mention of this. Whether it will be possible to make some general recommendations for the information analyst remains to be seen. The guiding principle should be: *avoid irritation about redundant questions*. If it serves an important purpose and generates no irritation, then there is no real harm, especially when the risk of loss-of-information or improper validation lurks around the corner.

Considering each session will be different and expertise of both information analysts and domain experts will vary, we will "hard code" a choice into the game. Information analysts should be able to skip certain validation steps if they feel confident that they have everything they need. If they judge the risks to be negligent, while the dangers of irritation are high, skipping these steps should be a possible option. This reflects the flexibility the dialogue game should offer in our eyes.

We will include a short summary at the very start of the session. The information analyst will very briefly describe what they are going to do and will explain he will ask questions aimed to elicit the information the information analyst needs and that the questions are tailored to yield not only the desired content but also the desired form. By explaining this at the very start, without bothering the domain expert with too many details (for instance explaining that we want to elicit LTL-FTEs and what those are), we might be able to avoid possible annoyance beforehand.

Summarizing design considerations

While conceptualizing the design we made a number of design considerations. We summarize them and the arguments for doing so, because these considerations go against the FCO-IM procedure.

- **Splitting the process**: we split the process into two parts: elicitation of the model and applying constraints to the derived model. We decided to do this because we view these as fundamentally different stages of the process and because the elicitation part benefits the most from a serious gaming approach in our eyes. It felt natural to do so.
- **Iterative approach**: we decided to build the model brick by brick instead of first generating an exhaustive starting document, then doing the full classification and qualification and then draw the whole model at once. We think that most domain experts should feel more comfortable with this approach.
- **Starting with task/activity analysis**: we do not start with an information analysis but start with the more concrete activity and/or task analysis. We think most domain experts are more familiar with these. We started doing this unconsciously from the start and only during the conceptualisation of the first design did it occur to us we were not doing "proper FCO-IM". We decided to make this a conscious design consideration.
- **Skip questions**: doing the first test revealed an interesting part about the nature of the conversation itself. Repetition can lead to boredom or annoyance. We introduced Grice's Maxims as a result. Keeping these Maxim's in the back of our head we decided it is possible to skip certain questions under certain conditions.

Chapter 4: The final design

We did a second test session with our improved design. We paid specific attention to the conversational aspect of the game. We gave extra explanations when we thought that questions might seem redundant and also used the mission list more actively. This session did not yield any new insights. Our experiences with experimenting culminated into a final design for a FCO-IM dialogue game. This chapter describes this final design in detail.

First we recap our goals for modelling and the key modelling goals for the FCO-IM dialogue game:
Goals for modelling:

- Utility goals: The final product is a FCO-IM Information Grammar Diagram. What we do with the model will, the utility goal, depends on the circumstances. The output of our game will have no real use in the setting of this research, but we assume that this model would be used to construct a database.
- Modelling goals: we construct a diagram according to the FCO-IM method, striving for completeness, accuracy and validity.

Key modelling goals:

- Creation goals: the deliverable is a complete FCO-IM Information Grammar Diagram.
- Grammar goals: the players will converse in natural language. The language will depend on the participants. For drawing the model, the FCO-IM syntax will be used.
- Validation goals: the domain expert must validate every piece of information modelled in the Information Grammar Diagram. He must agree that what the information analyst draws corresponds is correct.

First we describe the global structure for the FCO-IM dialogue game. Next we describe the design for the game in detail. We finish with an abbreviated *rule book*. The detailed description can be viewed as a reference guide. Experienced information analysts will use the rule book while novice information analysts can use the reference guide for extra clarification. The detailed description is split into two sections. The first section describes the global structure of the game. It introduces all relevant terms. This section is kept implementation free and served as the basis for the conceptual design. The second part describes the game in detail and includes our implementation. The reference guide section starts there.

Global structure

Phases, rounds, steps and turns

Our design consists of some global elements, concepts and objects. The top level concept is the **game**. One modelling session will be done by playing the game once. The game is made up of **phases**. The phase represents one part of the process. In FCO-IM we decided to split the FCO-IM procedure into two parts. The elicitation phase encompasses the process from the content generation up to drawing the model. The constraint phase elicits and applies constraints to the model.

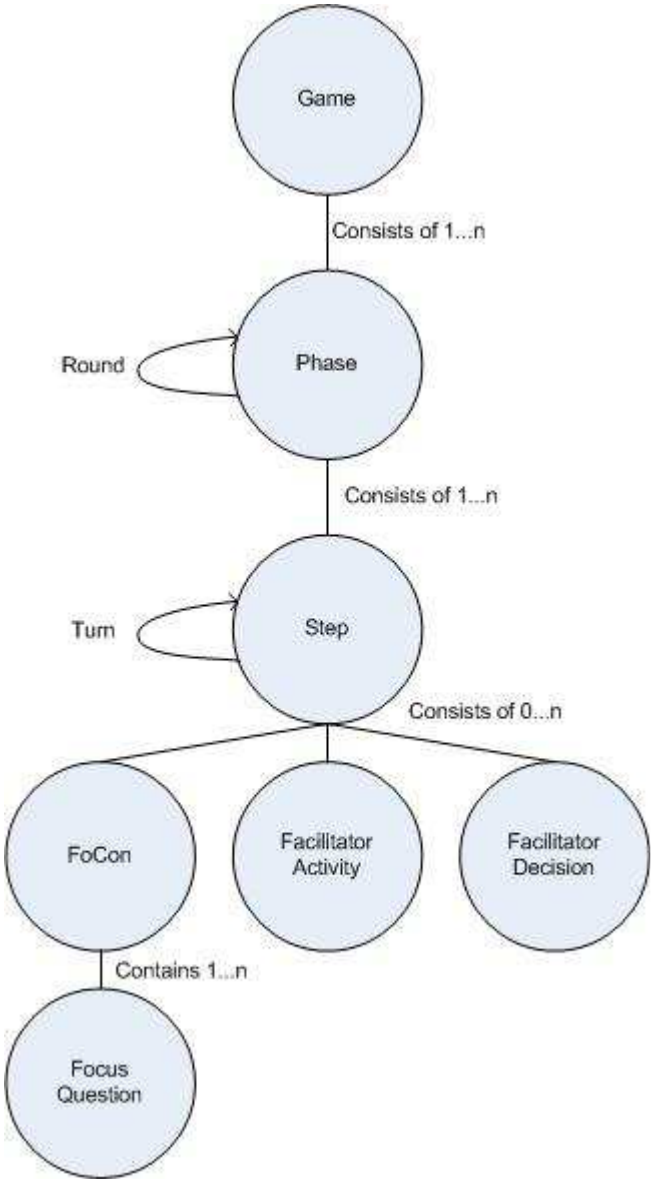
We made this division since this represents two fundamentally different parts of FCO-IM. The first part is highly creative and involves highly abstract steps. There is no clear-cut mechanism for content elicitation. The second step can be more easily broken down and concise rules exist already for eliciting constraints and applying them to the FCO-IM Information Grammar Diagram. The activities and conversations in this step will be of a different nature.

One might argue to divide this first phase into the phase of actual elicitation and the phase of classification and qualification. We have decided not to do this since we approach FCO-IM in an iterative way and not the classic waterfall approach. Phase 1 encompasses the elicitations of concepts, qualifying them and creating the FCO-IM artefacts we need; repository entries and the Information Grammar Diagram which will be gradually built.

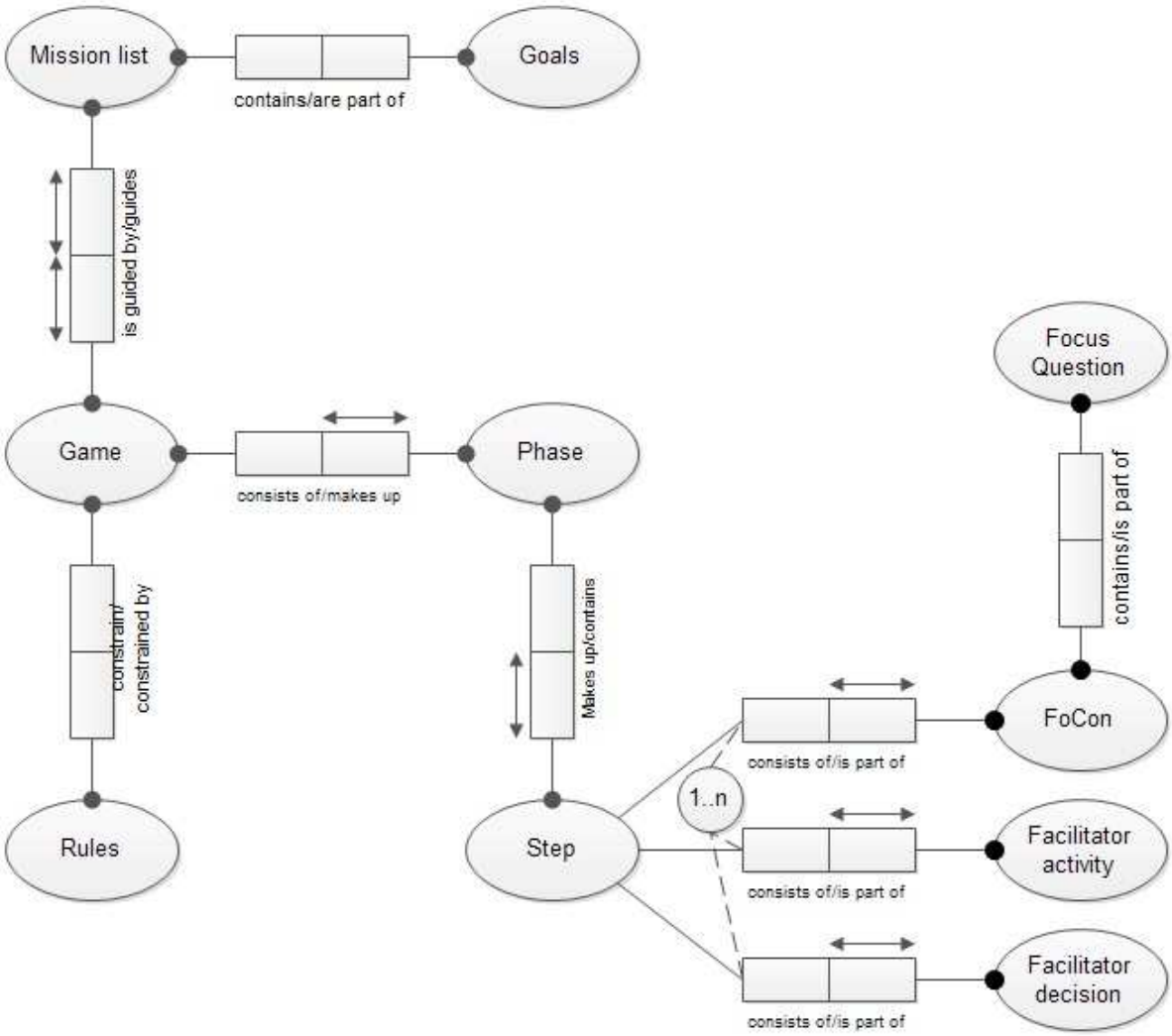
Each phase consists of a set of sub-sets. Doing an iteration from start to end is called a **round** or playing a round. A round is an instance of a phase. Rounds do not have to be played out identical to one another. The structure of the phase allows for some freedom within the rounds. The flow of the game will be directed by **decision points**. A few of decisions points are clear-cut rules. But most of the time these are moments where the information analyst will have to make a focused judgement call. In these cases, the rules offer suggestions but leave the choice to the discretion of the information analyst. At the end of each round, one such decision moment occurs. At this moment a decision will be made whether to start a new round or end the phase. The rules clearly describe how to proceed at this point to force a decision about ending the round. At any point in the game the information analyst may decide to revisit completed concepts. These ad-hoc decisions can override other decision moments. Should this lead to problems about how to proceed exactly, the described course of action should be taken after all.

Each phase is made of a number of **steps**. Steps are small separate sets of related activities. Going through one iteration of a step is called a **turn** or taking a turn. A turn is an instance of a step. If necessary, multiple turns are taken to finish a step.

The activities in a step are: **FoCons, facilitator activities** and **facilitator decisions.** FoCons represent the actual interaction within the game. We applied a FoCon analysis to FCO-IM in the previous chapter and eventually divided the process into several sub-FoCons. The sub-FoCons relevant to the elicitation phase are found here. This is the question-and-answer part of the game. Facilitator activities concern administrative work done by the information analyst. There is no interaction here. All interaction takes place in the FoCon which produces the results that information analyst needs for these steps. Facilitator decisions are decision moments concerning the flow of the game. The information analyst determines how to proceed at these points. These decisions encompass both planned and triggered iterations. The diagrams on the next two pages illustrate our design.



The game elements in a simple diagram. Rounds and turns are instances of phaes and steps and are not represented by a circle.



The game elements illustrated in an ORM-diagram. Take note that the concepts "round" and "turn" have been left out as they are no tangible elements of the design. Step requires at least one of the following: FoCon, Facilitator Activity or Facilitator Decision. Besides this requirement, step can contain any number of these. This is illustrated by our final design, where Step 0 encompasses only one FoCon and none of the other elements. All uniqueness constraints over the entire fact types are implicitly assumed. Each Mission list, phase, step, FoCon, Facilitator activity and Facilitator decision is assumed to be unique and specific for the object they are linked to. For example, Phase 1 for the FCO-IM game, cannot be part of a Requirements Engineering game. This would be a different Phase 1.

Rules and the mission list

The components described above represent the flow of the game. The rules specify all the details. For decision moments, they describe whether certain decisions are mandatory or up to the judgement of the information analyst. In the latter case, recommendations will be given for novice analysts. The rules will give a great amount of leeway since it is impossible to predict how a modelling session will progress; the flow largely depends on the outcome of its consecutive steps. Flexibility is important to deal with unexpected situations and allow for ad-hoc iterations. We will provide defaults which can be followed by novice information analysts who are unsure how to proceed or react. With this mechanism, we try to avoid a deadlock in the game. The rules will apply to the information analyst. The only rule for the domain expert is: "follow the lead of the information analyst".

The mission list is generated at the start of the game and continuously updated throughout the game. It plays a vital part in keeping focus and helps the facilitator make decisions. The mission list consists of a top level goal and sub-goals. The top level goal is the global modelling goal of the game that is about to be played. It is possible that several global modelling goals are present, one for each phase for instance.

The first sub-goals are called *concept goals*. They represent concepts that come up during conversation with the domain expert and which need to be modelled. Generally, at the end of a round, one concept goal has been modelled. Concept goals have sub-goals as well, *activity goals*. These goals must be met before the concept goal can be completed. The current concept goal will be highlighted to keep pragmatic focus. Finished goals (of any type) are crossed off. Activity goals will vary for each phase. For instance, activity goals for content elicitation will differ from activity goals for identifying constraints. Within one phase, the activity goals will be the same for each concept goal. Content elicitation will be roughly the same for every concept.

Structure of the mission list:

- TOP LEVEL GOAL
    - Concept goal 1
        - Activity 1

The information analyst has full control over the mission list. He creates the mission list by stating the primary modelling goal(s). For each concept which arises, he makes a new entry on the concept goal level and creates the appropriate activity goals for this concept. He makes sure the current concept goal is highlighted and finished goals are crossed off.

The mission list will be in view at all times for all participants. The information analyst will see the entire mission list. The domain expert will only see the top level goal and the concept goals. This prevents information overload and confusion for the domain expert. The concepts goals are shown to keep the pragmatic focus and to show progress in the game.

The facilitator is given great flexibility. The mission list will not strictly enforce activities. If an information analyst believes he can cross off a goal without explicitly asking the domain expert, he may decide to skip the activity and immediately cross of the goal. There is an inherited danger here. We risk a lack of explicit validation. This is the judgement call the information analyst has to make. Asking the question might seem redundant and possibly annoying to the domain expert in view of Grice's Maxims. The possible irritation must be weighed against the possibility of being wrong.

The general guideline is to avoid domain expert annoyance at all costs. However, when the information analyst is in doubt, he must ask. He should make sure to communicate that the question, while seemingly redundant or even obvious to the domain expert, is very important to the information analyst for understanding. The information analyst is not the expert on the subject and therefore must be sure he is modelling the right thing. By explaining this we can possibly avoid irritation over redundant questions and even boost the morale of the domain expert by acknowledging him as a subject matter expert. Novice information analysts are recommended not to skip any steps unless otherwise noted.

Participants

The game will have two types of participants or players: an information analyst and a domain expert. Typically there will be one information analyst, who will also act as facilitator, and one or more domain experts. It is not forbidden to have multiple information analysts participating. In this case it has to be decided who acts as facilitator who will decide how all actions attributed to the information analyst will be divided. It is recommended to participate with just one information analyst.

There is no separate facilitator next to the information analyst. The tasks required for the information analyst go beyond that of a regular facilitator. He can be seen as a game master who also actively participates as a player in a board game or role playing game.

The game will take into account the experience of the information analyst. It offers a framework for novice information analysts to follow, but gives leeway and flexibility to expert information analysts. We assume the domain experts have no formal modelling knowledge. But the aforementioned leeway allows for flexibility in this aspect as well. The information analyst can skip certain steps if he is dealing with a domain expert, who possesses formal modelling knowledge. Domain experts with formal modelling knowledge might enable the information to skip certain steps.

The information analyst will lead the game. He has full control of the game. He asks the questions, directs the flows, makes the decisions, updates the mission list and produces the desired output. The domain expert follows his lead; he will answer the questions the information analyst has. The domain expert may request to see additional information or go back to a previously completed part of the game. It is up to the information analyst to decide what to do in such cases.

Setting

Sessions can be done face-to-face with verbal communication, in a remote setting or face-to-face but communicating mostly electronically.

Some settings will require a remote session when the information analyst and domain expert simply cannot be in the same physical location. This will require some kind of collaborative environment that facilitates conversations and tools to convey items like the Information Grammar Diagram or the mission list from the information analyst to the domain expert. A huge advantage of this setup is that everything can be logged easily. A simple chat log would suffice. The disadvantage is that the information analyst will not be able to read the domain experts body language. It will be hard to impossible to judge if the domain expert is comfortable, feels annoyed or is confused.

Face-to-face meetings with verbal conversations incorporate this element, but this makes logging harder. Sessions could be voice recorded but this will require transcription later on.

We could combine these things, by doing face-to-face sessions that allow for verbal communication, but anything directly related to the model will be typed and thus easily logged. This will probably make sessions longer as both parties first talk, then type out their questions and answers. This might lead to annoyance in the domain experts who feel they are wasting time by doing both.

It will be up to the information analyst to determine beforehand the kind of setting. Some factors will not allow for much freedom. The absence of a group collaboration tool will make it hard to facilitate an electronic session, although a simple chat box would suffice. Likewise, distance might demand an electronic meeting. If the information analyst is free to choose he must make a judgement call between the necessity of logging, the usefulness of incorporating a group collaboration tool for constraining the conversation or the need to have an open setting and not constrain or inhibit the domain expert too much.

The domain expert should always be informed beforehand if the conversation is recorded in any way (voice or video recording). If the domain expert has very strong reservations against logging, the information analyst must make a judgement call whether the discomfort of the domain expert takes precedence over logging the conversation.

Considering the nature of elicitation, we think that face-to-face should be preferable whenever this is possible. The typical domain expert will be much more at ease talking to another human being rather than typing. Typing might inhibit his creativity. One cannot quickly add something, it must be typed out. While typing the first thoughts, the domain expert might lose more thoughts he was having and forgets about them while typing the initial thoughts. Speech is faster and eliminates the extra focus on the keyboard and screen, allowing more focus to remain on the thoughts. The information analyst will write all relevant things down. Recording (minimal voice recording) is recommended.

Questions

Questions are the heart of the game. The information analyst will try to elicit the content by asking questions to the domain expert. The questions structure the conversational part of the game and provide both pragmatic and semantic-syntactic focus. We keep the Question Asking Framework (QAF) in mind.

Each FoCon is given a repertoire of questions, for different purposes (the Goal in QAF). The information analyst is free to add his own questions or even make up new questions out of the blue if the situation requires this. It is not mandatory to use every question. In fact, some questions can be interchanged, having the same purpose. It will be up to the information analyst to pick a question that suits the current setting of the conversation the best. All questions are optional unless otherwise noted. If the situation changes in such a way that none of the questions are suitable, they should not be used.

Most questions do not constrain the answer (Form in QAF) as we want the domain expert to be as creative as possible. However, if the information analyst has trouble eliciting necessary items for the repository, he can ask a question and constrain the answer, asking the domain expert to word the answer in a certain way. He may give an example (Example in QAF) if the domain expert cannot immediately produce a correctly formed answer.

Care must be taken not to put words into the mouth of the domain expert. He should phrase the content of the answer himself. Examples may be used to help him, but the information analyst should not push him towards the answer he wants or expects. The information analyst can suggest the form of the answer, but not the content.

When asking questions, the information analyst should take great care to monitor the general atmosphere of the conversation and the body language of the domain expert. If the information analyst perceives slight confusion, he can give an example, rephrase the question or ask a different question altogether. Grice's Maxims should be kept in mind. If certain questions violate the Maxims, it is probably best not to ask them. Overburdening the domain experts with unnecessary details would be such a violation.

He must also make sure the domain expert does not turn hostile. Under no circumstance should the information analyst be rude or condescending. Irritating, angering or annoying the domain expert must be avoided. Some social cues might give away clues. A sigh can indicate that the domain expert perceives a certain question as obvious or redundant. The information analyst should immediately act and explain this question is highly important. Also it should be made clear that the information analyst is no subject matter expert and must make sure he understands the domain expert correctly. The information analyst should never blame the domain expert if the desired output is not found. If the desired output cannot be generated, then the information analyst is not asking the right questions.

To ease the atmosphere of the setting, the conversations could be kept at an informal level to put the domain expert at ease. This could be achieved by addressing one another on a first name basis and use an informal version of "you". Note: the English language makes no distinction here, but languages like Dutch or German distinguish between a formal and informal "you".

Other domain expert will insist on a formal setting. For a formal setting, the participants can address each other on a last name basis ("Mr./Mrs./Ms. Johnson") or by the usage of sir/madam (ma'am) when using the English language. The participants of the game should clear this matter up before starting the game. In some cases it will not be necessary as both parties implicitly know how the other participants want to be addressed. However, when meeting with an unknown domain expert, one should always ask what preference this domain expert has. The domain expert's preference is leading in this decision as we want him to be as comfortable as possible. An uncomfortable domain expert may be inhibited in his creativity.

The language in which the conversation will take place can also be of huge influence. Both parties should agree beforehand on which language they will use. If both are native in one language it is recommended to pick this language. If neither participant shares a native language, they should pick a language they are both fluently speaking. English, as the international business language, suggests itself as a default. But if both parties are more fluent in another language it is strongly recommended to pick that language. We must avoid errors in communication at all costs.

The game in detail

Start and preparations

The game will be played by two participants, an information analyst and a domain expert. The information analyst acts as facilitator. A language is agreed upon beforehand. In our setup this is the Dutch language since this is the native language of the information analyst and the domain experts that participated in our tests. The session will be face to face. The information analyst uses simple tools. A word document will serve as notepad and repository. In this document the information analysts writes down everything he deems important, including questions asked, answers given, highlighted information perspective, actions and elicited repository information.

A separate word document will act as mission list. These will be visible next to each other, making sure the mission list is always in full view. Considering this implementation it will not be possible to hide activity goals from the domain expert. Pen and paper are nearby for quick note taking or drawing the model.

The mission list

The mission list starts with the top level modelling goal. The information analyst has full control over the mission list. He may add, delete, alter, highlight and cross out items. The information analyst will write this goal at the start of the game. To emphasize this as our top goal it will be written in capital letters. In our case, the goal will be modelling the information need in FCO-IM of a certain process, planning a train trip.

The bottom of the mission list contains a template for concept goals and their underlying activity goals. Whenever a new concept is added, the information analyst simply copies the template to the end of the current list and assigns a name to the concept.
Concept level goal template

- Concept level goal
  - Generate 4 examples
  - Generate elementary fact
  - Elicit identifier
  - Generate LTL-FTE for repository
  - Generate OTL-FTE for repository
  - OPTIONAL: identify uniqueness constraint (UC)
  - OPTIONAL: identify totality constraint (UC)
  - Draw part of Information Grammar Diagram
  - Validate drawn Information Grammar Diagram and repository information

First we need valid examples for our concept. We think four suffices. Eventually the Information Grammar Diagram needs to be fully populated, but for elicitation purposes it suffices to have a small sample for validation. We will use one of these examples to continue. First we must formulate an elementary fact with the concept. If it turns out that the concept itself cannot be phrased in one elementary fact, it needs to be split up. A new concept will be added to the list and the information analyst decides which concept to continue on. Next we need to know the identifier, how is our concept uniquely identified? Then we generate the necessary objects for the repository. Optionally, constraint can be elicited but it is recommended not to do this. Only an experienced information analyst who feels the constraints are all but phrased should consider this. Once all the information is available, it is entered into the repository and the partial Information Grammar Diagram is drawn.

The mission list guides the game. If no concept goals exist it means we must come up with some. This means we have to do step 1, elicitation. Once concept goals exist, the information analyst will pick one for further processing. This means playing step 2, qualification. Step 2 involves working on the activity goals. The first part is done in a FoCon, generating the repository and drawing the Information Grammar Diagram is a facilitator activity. Validation is another FoCon.

Whenever a concept is chosen to be processed it will be highlighted by the information analyst. In our case we highlight it with a yellow background colour. Once a concept is finished, it will be crossed out using strikethrough. The highlighting will be removed. The activity goals will be minimized and hidden from view. If the focus of the round turns to another concept, the highlight off the current concept will be removed and the

new concept highlighted. If the information analyst decides to return to an already crossed out concept goal, he will remove the strikethrough and also maximize and uncheck the underlying activity goals. Considering the nature of our mission list, this is not possible. In this setup we decide to remove the activity goals from a finished concept. If the concept is revisited, the information analyst simply unchecks it and copies the activity goals from the template.

Activities will not be highlighted to keep this process as simple as possible. Once a certain activity has been completed it will be crossed out by strikethrough. Two activities are marked as optional. Constraints are formally not part of this phase of the game. However if the information analysts feels that certain constraints already suggest themselves or have been more or less described already, it is allowed to write these down already. Experienced information analysts may choose to skip any activity. If they feel they have all the information they need, they do not need to follow the mission list step by step. They will simply cross off the activities they want to skip and write the information down. In our setting this might confuse the domain expert. He sees activities being crossed out while there was no explicit task or question. This is a consequence of our current practical approach. We suggest not showing the activity goals to the domain expert partially for this reason.

Finishing a concept goal triggers the end of step 2 and the end of the current round (triggered iteration).

An example of a mission list during the game

- TOP LEVEL GOAL (GLOBAL MODELLING GOAL)
  - Concept level goal
    - ~~Generate 4 examples~~
    - Generate elementary fact
    - Elicit identifier
    - Generate LTL-FTE for repository
    - Generate OTL-FTE for repository
    - OPTIONAL: identify uniqueness constraint (UC)
    - OPTIONAL: identify totality constraint (UC)
    - Draw part of Information Grammar Diagram
    - Validate drawn Information Grammar Diagram and repository information

TEXT – Top level goal
Text – Unfinished concept/activity goal
Text – Current concept level goal
~~Text~~ – Completed goal

Phase 1: eliciting information and drawing the Information Grammar Diagram

Iterations

The game will consist of only one phase. We will call this Phase 1. Phase 1 elicits the information need for the given topic, creates the FCO-IM repository and draws the Information Grammar Diagram. This is done in an iterative way. We build the Information Grammar Diagram brick by brick. Going through the phase once is called playing a round. At certain points iterations will occur. The current round ends and a new round starts. How exactly this will proceed depends on the circumstances.

Iterations can be planned, triggered or occur in an ad-hoc manner. Planned iterations are unavoidable and are "hard coded" into the flow, for instance the decision how to proceed at the end of a round. When a triggered iteration is not triggered, the planned iteration will be taken. Triggered iterations are initiated by the mission list. For instance, unchecked concept goals trigger a triggered iteration, starting step 2 in a new round.

It is possible that out of the blue something happens that requires an iteration, for instance revisiting a finished concept or adding a concept during stages not meant for concept creation. Such ad-hoc iterations are allowed.

There a number of ways for ad-hoc iterations to occur and ways to deal with them. A possible ad-hoc iteration is initiated by revisiting a crossed out concept. At any point in the game, the information analyst may jump back to previously visited concepts if the domain expert signals the necessity or if the information analyst himself perceives the need.

It could be discovered by either party that a mistake has been made in a certain concept. The information analyst may decide to act on this immediately, postpone it or ignore it. The latter is not recommended. Accuracy is highly important. If the information analyst feels the current concept should be finished first because we might lose valuable information from a shift of focus, then he simply unchecks the concept in question and continues with the current concept. The previous concept can be revisited when a new round starts. In this case we will trigger a planned iteration at the end of the round.

He may, however, decide to move back immediately. He will uncheck the concept in question, shift the focus by highlighting the old concept and remove the highlight from the current concept and start a new round in step 2.

If the domain expert signals he forgot an important concept and mentions a new one, the ad-hoc iteration will first add a new entry on the concept level and then initiate a new round for this new concept. If elicitation work needs to be done first, a new round is started in step 1.

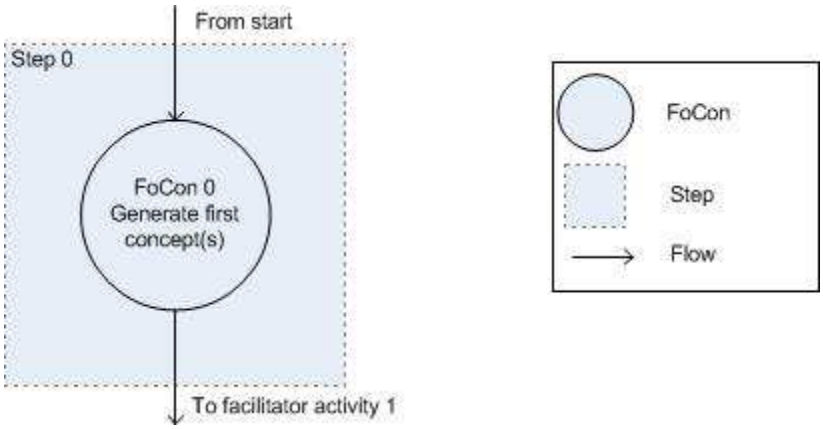
These ad-hoc iterations can occur at any stage in the game and extent through the entire game, even in another phase if multiple phases exist. It is up to the information analyst how to deal with those. It is recommended never to ignore them as we might lose important information. Whether the ad-hoc trigger is initiated or whether the decision is moved to the next planned iteration is up to the information analyst. If the domain expert signals that this will affect the current concept and maybe other already processed concepts, then the ad-hoc iteration should be initiated right away. However, if the trigger is unrelated to the current concept and the information analyst feels triggering the ad-hoc iteration now will lead to information loss of our current concept, then he should postpone going back. If the information analyst is not sure, the default course of action should be to trigger the ad-hoc iteration and move back immediately. It is important enough for the domain expert to bring up out of the blue and this fact should not be ignored.

Playing a round (Phase 1)

Once everything is in place, the game starts. The first round of phase 1 is initiated. This first round always starts with step 0. This is a planned iteration. Step 0 can only occur in the first round. In all other rounds, step 1 is the first possible step. Step 1 may not occur at the start of round 1.

Step 0 (Phase 1): Generate first concept(s)

Step 0 encompasses one FoCon, FoCon 0. The goal of step 0 is to generate the first concept goal(s) to work with. This is done by generating fact sentences.



Schematic design step 0. It shows the step, the FoCon and the flow.

FoCon 0 (Phase 1): Generate first fact sentence(s)

The purpose of this FoCon is to generate the first fact or facts to work with. The information analyst will ask the domain expert to start describing the process that needs to be facilitated.

The information analyst needs facts in regards to the information perspective and starts asking questions. He writes down the questions he asks and the responses given by the domain expert in his document. As soon as the domain expert utters a sentence in regards to the information perspective, the information analyst will mark this in his document.

At this point the information analyst should politely interrupt the domain expert and inform him he wishes to fully model a single fact from this sentence first before moving on. However, if the information analyst thinks interrupting now might cut off the flow of thought, it might be best to let the domain expert continue, but eventually the domain expert has to be stopped. Any relevant facts will be written down by the information analyst. *Guideline: the information analyst should not try to cut off while the domain expert is speaking, but he should try to wait for a natural pause and jump in.*

The information analyst moves on to **facilitator activity 1** in Step 1, finishing step 0.

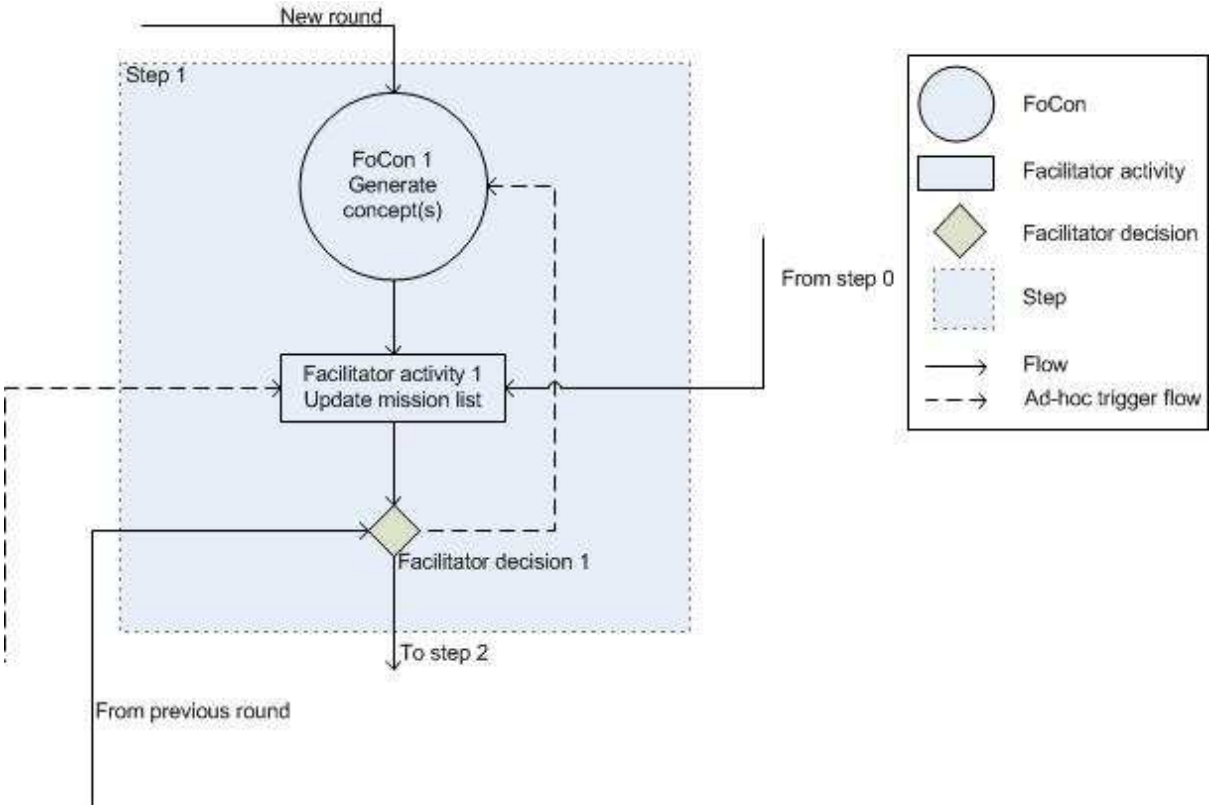
Possible focus questions:

This is the first step of our modelling session. We need to form a beginning. We should also consider the fact that our conversation partner may have no clue of what we are about to do. We guide on pragmatic focus and ask the domain expert to begin from the beginning. Questions are aimed to generate this start, elaborate if things are unclear, but also to cut off of if necessary. One important thing to keep in our mind is that we model the information perspective and not the workflow. However, we may ask about the workflow in order to get to the information perspective.

If the domain expert only explains the process without going into the underlying information involved, then we need to recognise this and ask about this. We want the answer to be plain text. When the information analyst identifies things concerning the information perspective, it is up to him to identify this. We want information in short sentences. If necessary, the information analyst might rephrase relevant info and ask the domain expert if this corresponds to what he means.

- *Can you start to describe the process in your own words?* – aims to create a starting point.
- *What is the first thing that you do?* – aims to create a starting point.
- *What is the first step?* – aims to create a starting point.
- *What is it that you do?* – aims to create a starting point.
- *At my work I do <example>. To do that I require <example>. Can you start explaining what it is that you do in such a way?* – provides an example the domain expert might relate to if he is having difficulty getting started
- *Could you elaborate on this?* – ask for more information
- *How exactly do you do this?* – switch from task to activity if the domain expert has problems visualising the information need
- *What kind of information do you need to do this?* – get the information need out of a task or activity analysis
- *Could we describe it this way: <phrase>?* – this question aims for validation while also putting a form constraint on the answer.

Step 1 (Phase 1): Generate concept(s)
Step 1 encompasses one FoCon, FoCon 1, a facilitator activity and a facilitator decision. The goal of step 1 is to generate new concept goal(s) to work with. This is done by generating fact sentences. Next one of these concepts is chosen for step 2. It is possible to skip FoCon 1 in this step when a triggered iteration skips straight to the facilitator activity or decision.



Schematic design step 1. It shows the step, the FoCon, the facilitator activity, the facilitator decision and the flow. It also shows possible flow by ad-hoc triggers.

FoCon 1 (Phase 1): Generate fact sentence(s)
Note: this step is very similar to Step 0 which only occurs in the start of the game. The major difference is that Step 0 is the very start of the session and it will probably be harder to get started and get what is required. In the second round, the domain expert will be more familiar with the procedures and things could probably go more smoothly.

The information analyst will ask the domain expert to describe the next part of the process that needs to be facilitated. The information analyst needs facts in regards to the information perspective.

The information analyst needs facts in regards to the information perspective and starts asking questions. He writes down the questions he asks and the responses given by the domain expert in his document. As soon as the domain expert utters a sentence in regards to the information perspective, the information analyst will mark this in his document.

At this point the information analyst should politely interrupt the domain expert and inform him he wishes to fully model a single fact from this sentence first before on. This is no law. If the information analyst thinks interrupting now might cut of the flow of thought, it might be best to let the domain expert continue, but eventually the domain expert has to be stopped. Any relevant facts will be written down by the information analyst. *Guideline: the information analyst should not try to cut off while the domain expert is speaking, but he should try to wait for a natural pause and jump in.*

The information analyst moves on to **facilitator activity 1**.

Possible focus questions:
Focus questions will guide on pragmatic focus. In this step we have completed at least one prior step and established that that the description of the process and thus our model is not yet finished. So we want to ask the domain expert to describe the next step of the process we are modelling. However, we must also make sure that it is indeed a next step and not a sub-step to one we believed completed. One important thing to keep in our mind is that we model the information perspective and the workflow. However, we may ask about the workflow in order to get to the information perspective.

If the domain expert only explains the process without going into the underlying information involved, then we need to recognise this and ask about this.

- *What is the next step?* – aims to elicit the next concept(s)
- *How would you proceed from the last step <recap last step>* – aims to elicit the next concept(s)
- *Once you have done <previous step>, what is the next step?* – aims to elicit the next concept(s)
- *Could you elaborate on this?* – ask for more information
- *How exactly do you do this?* – switch from task to activity if the domain expert has problems visualising the information need
- *What kind of information do you need to do this?* – get the information need out of a task or activity analysis
- *At my work I do <example>. To do that I require <example>. Can you start explaining what it is that you do in such a way?* – provides an example the domain expert might relate to if he is having difficulty getting started
- *Could we describe it this way: <phrase>* – this question aims for validation while also putting a form constraint on the answer.

Facilitator activity 1: update mission list
The purpose of this activity is to update the mission list with new concepts. The facilitator activity 1 typically follows step 0 or 1 in the regular workflow fashion. However, it is possible to arrive here in an ad-hoc iteration, when the domain expert suddenly mentions a new concept.

The information analyst has identified one or more new concepts and updates the mission list, adding all new concepts that were gathered in the previous stage. For each concept added, he will add the activity goals as sub-goals. The information analyst writes down his activities in the document for documentation purposes. The information analyst then moves on to **facilitator decision 1**.

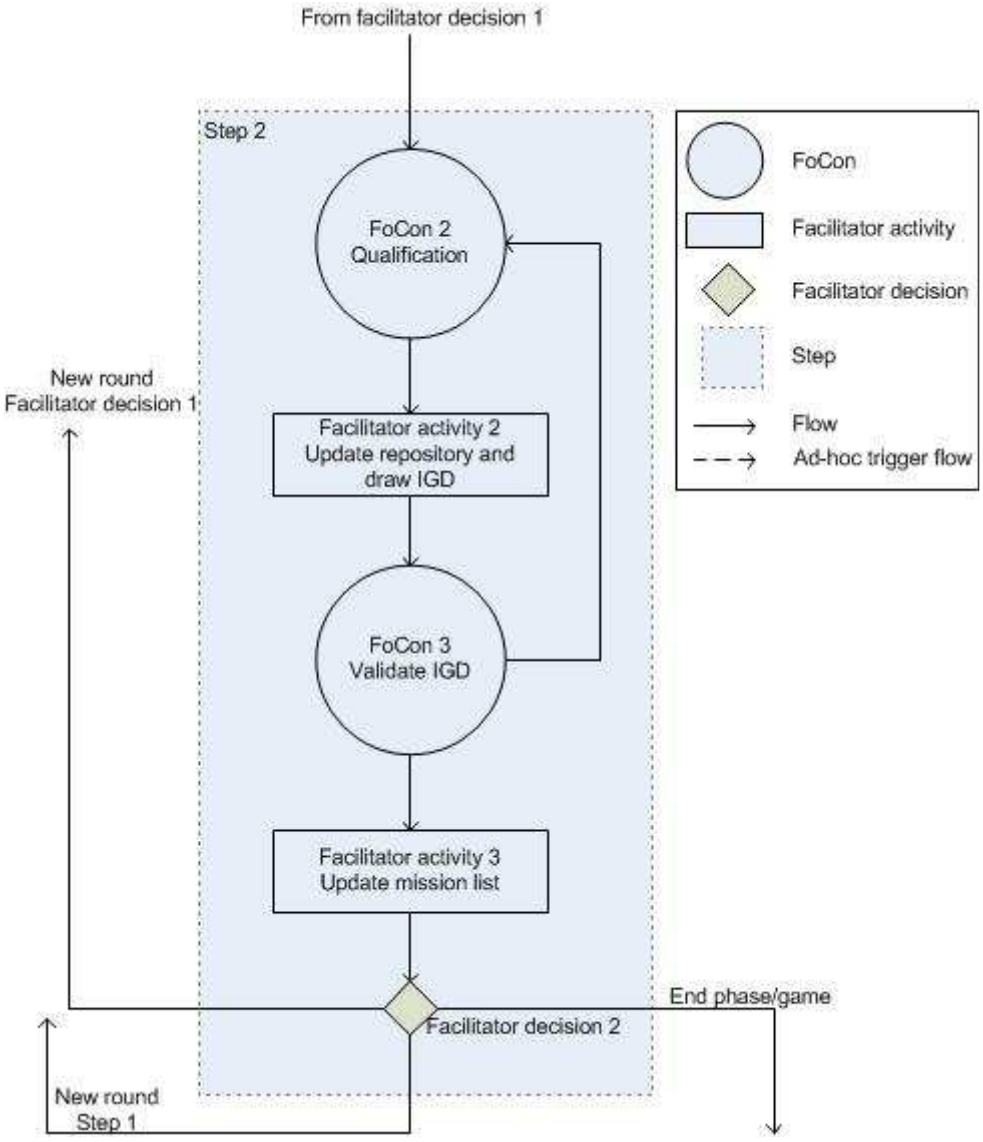
Facilitator decision 1: select entry
This activity typically follows facilitator activity 1. However, it is possible to arrive here in a triggered iteration from a previous round when unchecked concept goals remain on the mission list after completing the previous round.

The purpose of this decision moment is to determine the next course of action. To do this, the information analyst selects one unfinished entry from the mission list. If multiple unfinished entries are present it is up to the information analyst's discretion. Novice information analysts are advised to pick the first. Expert information analysts can choose to pick one out of order if they feel that that processing that entry first is beneficiary in any way. An entry that strongly resembles an entry that has just been processed might better be selected first since the domain expert probably has this in his mind set still. Once an entry is chosen, the information analyst writes down the decision in his document and moves on to **Step 2**.

It is possible that the information analyst feels more concepts should be generated. For instance, the information analyst feels we have no proper beginning or needs more concepts to form an initial understanding of the domain. He may decide to execute an ad-hoc iteration and move back to **FoCon 1**. This will take the game through another iteration of Step 1, we play one more turn before moving on. The information analyst documents the choice.

Step 2 (Phase 1): Qualification

Step 2 encompasses two FoCons, FoCon 2 and FoCon 3, two facilitator activities and a facilitator decision. The goal of step 2 is to qualify a concept from the mission list and generate the repository information. Once Step 2 is fully completed, the round will end and the facilitator decision will determine what happens next.



Schematic design step 2. It shows the step, the FoCons, the facilitator activities, the facilitator decision and the flow.

FoCon 2 (Phase 1): Qualification for one concept
In this step, one concept will be analysed by doing a qualification.

Optional: if the information analyst is experienced enough he can decide to qualify more than one concept if multiple concepts are present on the mission list, especially when they appear to be very similar. This is not recommended for novice information analysts.

The goal of this step is to generate repository items required to draw the Information Grammar Diagram. The information analyst is guided by the activity goals from the mission list.

If the information analyst feels up to it, he might identify some preliminary constraints already, but exhaustively eliciting all constraints is not part of this step. It is important to elicit identifiers in this step.

By asking questions, the information analyst aims to generate the items he needs. He writes down all his questions and the answers from the domain expert. If at any point he gets the information he requires, he writes this down in his document. The relevant mission list entry will be crossed out.

An experienced analyst can decide to skip certain parts of this step and not explicitly elicit certain element but fill them in himself if he believes he has all the information he needs already. Rather than working to a complex thing like "we have an object student and these have the labels 'first name' and 'last name'" we might just say "we have students who have a first and last name". He can make a judgement call here that students have the labels "first name" and "last name". Asking extra question might lead to irritation with the domain expert. If the information analyst skips certain parts, he will cross them off from the mission list.

Recommendation: if the information analyst is in doubt, he should ask extra questions. If he feels that the domain experts is annoyed by this, he could offer a short explanation as to why we ask these questions, which might seem redundant to the domain expert.

Once all objectives of this step have been met, the information analyst moves to **facilitator activity 2.**

Focus questions
Questions should include examples to communicate the domain expert intent and what he needs.

- *Could you give a meaningful name to this <object/label/fact type>. For instance, in a <example> scenario we might qualify it this way <example> – this question aims to facilitate the qualification step of coming up with a meaningful name for a type. If offers an example.*
- *Could we split this sentence? – verify if fact is elementary.*
- *How are these identified? – aims to elicit an identifier.*
- *How do you keep them apart? – aims to elicit an identifier.*
- *Is there another way to keep them apart? – aims for identifiers if what we came up with does not suffice.*
- *I can identify <example> by <example>. How can we do this for <concept>? – offers an example of an identifier if the domain expert has problems coming up with one.*
- *Can there be two ... with the same ... ? – aims to verify identifier. If the answer is "yes", then our identifier is not unique and we need to find another one.*
- *When we fill in <example, for instance a name> when we say <example, an object type, for instance the object "student"> – to find object/label relation.*
- *Is there a <...> – attempts to identify a existence postulating fact*

Examples of qualification
For quick reference we provide examples for our activity goals:

Elementary fact: there is a student John Doe
Preliminary fact type expression: there is a student ...
LTL-FTE: F1: “there is a student <first name> <last name>”
Object type expression: student John Doe
OTL-FTE: O1: ‘student <first name> <last name>’
OTL-FTE: F2: “<Student:O1> lives in <Place:O2>”.

Facilitator activity 2: write to repository and draw part of Information Grammar Diagram
Facilitator activity 2 follows right after FoCon 2. The information analyst writes the generated information to the repository and draws a part of the Information Grammar Diagram. This process could be automated to let a tool automatically draw part of the Information Grammar Diagram from the repository to save time. Next, the information analyst moves to **FoCon 3**. The information analyst could do as much as possible during step 2 to keep this activity to a minimum, considering the domain expert will idle. Experienced information analysts are encouraged to do so. Novice information analysts should stick with the workflow to optimally apply their focus.

If the information analyst writes down the information in his document in a systematic way, that document can serve as repository if the Information Grammar Diagram is not generated automatically but drawn by hand.

FoCon 3: validate partial Information Grammar Diagram
FoCon 3 follows facilitator activity 2. It serves as validation. The information analyst will show the partial model and quickly explain the contents without going into FCO-IM specific details. If the domain experts validates the model, the information analyst checks off the last activity goal, “validate” and moves to **facilitator activity 3**. The information analyst may only move to facilitator activity 3 if all activity goals have been checked off.

If the domain expert cannot validate the partial model, then the activity goal “validate” fails. The information analyst goes back to **FoCon 2** and unchecks the crossed out activity goals for the concept. This is a triggered iteration, resulting from a failed goal in the mission list. Expert information analysts can try to identify the point where things went wrong and pick up from there. Novice information analysts are recommended to redo the entire FoCon, even if this might annoy the domain expert. If irritation arises in the domain expert, it should be explained that the “failure” is not the domain expert’s fault. The information analyst probably was not asking the right questions.

This part is not enforced. If the information analyst feels it is better to move on, even though the partial Information Grammar Diagram was not validated, he may do so. It is only recommended for expert information analysts to take this decision. In this case, the last activity goal will be checked off after all and the game moves to **facility activity 3.** Alternatively the information analyst can decide to scrap the whole concept. In this case he removes the entire concept from the mission list and moves to **facility activity 3.**
Focus questions

- *<Explanation> Does this represent what you told me? – this question aims to validate the model*

Facilitator activity 3: update mission list
Facilitator activity 3 follows FoCon 3. One concept has been fully qualified. All activity goals of the concept have been checked off. The information analyst checks off the concept goal. The goal should be minimized, hiding all the activity goals to keep the mission list concise. This is not possible in our current design. Also both participants see the full mission list. Therefore the information analyst will delete all the activity goals to keep the mission list concise. Should this concept be revisited at a later stage, the information analyst will simply copy the activity goals template again. In a fleshed out mission list, he would maximize the contents of this concept and uncheck the goals.

The information analyst moves on to **facilitator decision 2**.

Facilitator decision 2: proceeding
The information analyst must now decide how to continue. The information analyst will check if there any unfinished concept goals in the mission list. If this is the case, a new round will start and immediately moves to **facilitator decision 1** in Step 1. This is a triggered iteration.

If this is not the case then the information analyst and domain expert will determine whether the main goal has been met. If they feel that the model is not yet complete, even though all concept goals on the mission list are finished, then a new round will be started to generate and process new fact sentences. The new round starts with **Step 1**. This is a planned iteration.

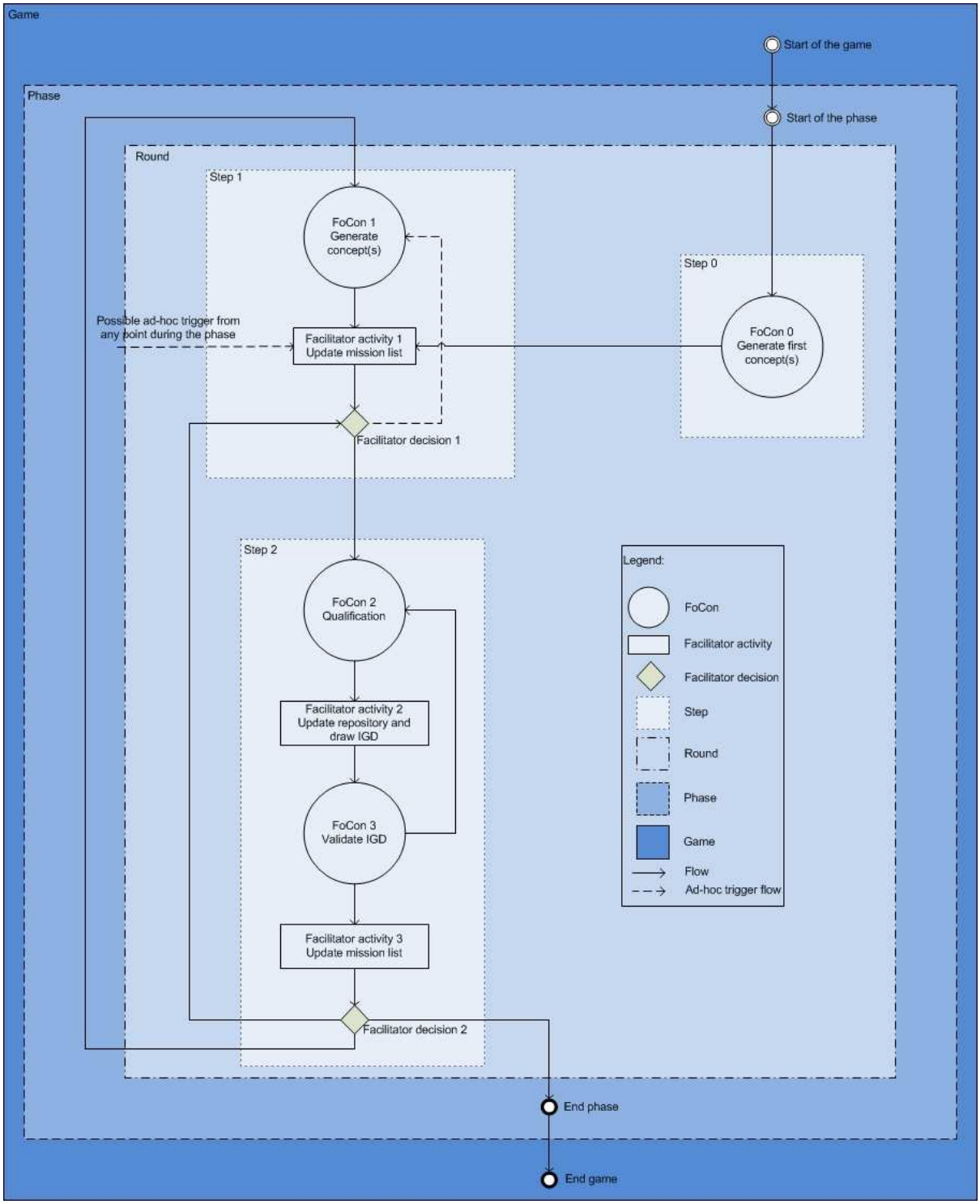
If all concept goals on the mission list are checked and the domain expert verifies that the model is complete, then the main goal of this phase has been accomplished. The game will end. In case the game consists of multiple phases (for instance determining constraints), the game will now move to the next phase. The description of that phase will explain how to proceed.

In short:
Unfinished global goal & no unfinished sub-entries -> New round, Step 1
Unfinished global goal & unfinished sub-entries -> New round, facilitator decision 1
Finished global goal -> game ends (or new phase)

Optional: it is possible to specify a hard end condition. For instance the participants can agree to do at most 10 rounds even if the main goal has not been met. This can provide a mechanism to avoid perpetually unending session but can lead to loss of information or incomplete models. It has to be decided if completeness has absolute priority or not. If so, specifying such a "victory condition" is not advisable. However, if domain experts are only scarcely available, some form of limit has to be set. By imposing extra conditions about the duration, the information analyst will be forced to adapt his game. He can take the limited duration into account and restructure his game plan to get the most out of the limited time he will have. He can also decide to generate multiple concepts in Step 0 and Step 1 and then carefully pick the concepts, choosing those he deems most relevant. This is only advised for experienced information analysts.

Alternatively there can be time limits per round or step or the prohibition of jumping back to a completed stage. We would strongly discourage this as we expect that steps can have variable lengths. First rounds might go slower because of the unfamiliarity of the approach. In contrast, later rounds might actually take longer as more and more stuff surfaces and visits to previous rounds are required. It will be up to the information analyst to make a judgement call in whether or not limitations should be imposed. At this point it is too hard to give a recommendation.

We have visualised the whole game in the diagram on the next page.



Schematic design for phase 1. This design shows the entire phase within the game, including all flows. The concept of round is visualised as well to indicate when flows start a new round.

Rulebook

Setup

The information analyst readies all components: the repository & note document, the mission list and drawing tools for the Information Grammar Diagram. For a detailed look at these components, refer to the reference guide. The information analyst gives a short explanation of the general rules of the game.

General rules

The information analyst leads the game. He asks questions, performs tasks and is responsible for the flow of the game. The domain expert follows his lead and answers the questions the information analyst has to the best of his abilities. The information analyst sees all game components and is allowed to edit them. The domain expert is not allowed to edit them in any way. The domain expert only sees the abbreviated mission list and the partial Information Grammar Diagram once a part is drawn. He can request at any point during the game to see the full mission list, the repository or the notes. It is up to the information analyst whether to show these or not.

The game consists of 1 phase. This phase consists of three steps. The information analyst and domain expert will play a number of rounds to complete this phase. Within a round they take turns, doing the steps.

The rules determine the flow. Explicit flow rules are marked with an arrow.
Example:

- ➔ Rule or decision moment regarding flow

The information analyst is given great freedom in making ad-hoc decision. Procedural flow and all questions are optional unless explicitly specified otherwise. In regards to questions, the information analyst is free to add questions not listed in the repertoire. Every listed question is optional if the information analyst thinks they do not suffice. Focus questions are marked with a question mark.
Example:

- ? *Focus question?* – goal of the focus question.

Start

The information analyst writes the global modelling goal down on the mission list as the top level goal. The first round then starts. This is a special round and is called round 0. In this, the information analyst and domain expert always do step 0. It is not allowed to start the game with any other step.

Steps

Step 0 (Phase 1) Generate first concept(s)

Step 0 consists only of FoCon 0.

FoCon 0 (Phase 1): Generate first fact sentence(s)

The information analyst asks the domain expert to begin describing his daily tasks and activities and works towards the information perspective. The information analyst writes down all things relevant to the information perspective and cuts off the domain expert at his discretion.

➔ Once the information analyst has ended this part of the conversation, he proceeds to **facilitator activity 1** in Step 1.

Possible focus questions and their purpose:

- *Can you start to describe the process in your own words?* – aims to create a starting point.
- *What is the first thing that you do?* – aims to create a starting point.
- *What is the first step?* – aims to create a starting point.
- *What is it that you do?* – aims to create a starting point.
- *At my work I do <example>. To do that I require <example>. Can you start explaining what it is that you do in such a way?* – provides an example the domain expert might relate to if he is having difficulty getting started
- *Could you elaborate on this?* – ask for more information
- *How exactly do you do this?* – switch from task to activity if the domain expert has problems visualising the information need
- *What kind of information do you need to do this?* – get the information need out of a task or activity analysis
- *Could we describe it this way: <phrase>?* – this question aims for validation while also putting a form constraint on the answer.

Step 1 (Phase 1): Generate concept(s)

Step 1 consists of FoCon 1, Facilitator activity 1 and Facilitator decision 1. This step cannot be started at the start of Round 0. The flow of the game decides which part of step 1 is initiated.

FoCon 1 (Phase 1): Generate fact sentence(s)

This FoCon cannot occur at the start of Round 0.

The information analyst asks the domain expert to continue describing his daily tasks and activities and works towards the information perspective. The information analyst writes down all things relevant to the information perspective and cuts off the domain expert at his discretion.

➔ Once the information analyst has ended this part of the conversation, he proceeds to **facilitator activity 1** in Step 1.

Possible focus questions and their purpose:

- *What is the next step?* – aims to elicit the next concept(s)
- *How would you proceed from the last step <recap last step>* – aims to elicit the next concept(s)
- *Once you have done <previous step>, what is the next step?* – aims to elicit the next concept(s)
- *Could you elaborate on this?* – ask for more information
- *How exactly do you do this?* – switch from task to activity if the domain expert has problems visualising the information need
- *What kind of information do you need to do this?* – get the information need out of a task or activity analysis
- *At my work I do <example>. To do that I require <example>. Can you start explaining what it is that you do in such a way?* – provides an example the domain expert might relate to if he is having difficulty getting started
- *Could we describe it this way: <phrase>* – this question aims for validation while also putting a form constraint on the answer.

Facilitator activity 1: update mission list
The information analyst updates the mission list by adding newly found concepts. He writes down each concept as a new sub-goal on the concept level and copies an activity goal template as new sub-goals beneath each new concept goal.

The information analyst then moves on to **facilitator decision 1**.

Facilitator decision 1: select entry
The information analyst determines the flow of the game by making a decision how to move on.

- ➔ *One unfinished concept goal: Select this goal, move to **Step 2***
- ➔ *Multiple unfinished concept goals: Select one goal, move to **Step 2***
- ➔ *Ad-hoc decision to generate more concept goals: Move back to **FoCon 1***

Step 2 (Phase 1): Qualification
Step 2 consists of FoCon 2, FoCon 3, Facilitator activity 2, Facilitator activity 3 and Facilitator decision 2. The flow of the game decides which part of step 2 is initiated.

FoCon 2 (Phase 1): Qualification for one concept
The information analyst and domain expert qualify one concept from the mission list. The information analyst will ask a series of focused questions to get the necessary information. He writes down all relevant things. He uses the mission list to determine the objects he needs to know.

- ➔ Once all objectives of this step have been met, the information analyst moves to **facilitator activity 2.**

Possible focus questions and their purpose:
- ? *Could you give a meaningful name to this <object/label/fact type>. For instance, in a <example> scenario we might qualify it this way <example> – this question aims to facilitate the qualification step of coming up with a meaningful name for a type. If offers an example.*
- ? *Could we split this sentence? – verify if fact is elementary.*
- ? *How are these identified? – aims to elicit an identifier.*
- ? *How do you keep them apart? – aims to elicit an identifier.*
- ? *Is there another way to keep them apart? – aims for identifiers if what we came up with does not suffice.*
- ? *I can identify <example> by <example>. How can we do this for <concept>? – offers an example of an identifier if the domain expert has problems coming up with one.*
- ? *Can there be two ... with the same ... ? – aims to verify identifier. If the answer is "yes", then our identifier is not unique and we need to find another one.*
- ? *When we fill in <example, for instance a name> when we say <example, an object type, for instance the object "student"> – to find object/label relation.*

Facilitator activity 2: write to repository and draw part of Information Grammar Diagram
The information analyst updates the repository and using the repository draws a part of the Information Grammar Diagram.

- ➔ The information analyst moves to **FoCon 3.**

FoCon 3: validate partial Information Grammar Diagram
The information analyst asks the domain expert to validate the partially drawn model.

- ➔ The domain expert validates the partial model: move to **facilitator activity 3**
- ➔ The domain expert does not validate the partial model: move back to **FoCon 2**
- ➔ The information analyst decides to skip the qualified concept partially drawn model: move to **facilitator activity 3**

Possible focus questions and their purpose:

- ? *<Explanation> Does this represent what you told me? – this question aims to validate the model*

Facilitator activity 3: update mission list
Facilitator updates the mission list according to the results of the previous events.

- ➔ The information analyst moves on to **facilitator decision 2**.

Facilitator decision 2: proceeding
The information analyst decides how to continue. If there are no unfinished sub-goals, the information analyst must determine if the model is complete.

- ➔ *Unfinished global goal & no unfinished sub-entries:* ***New round, Step 1***
- ➔ *Unfinished global goal & unfinished sub-entries:* ***New round, facilitator decision 1***
- ➔ *Finished global goal:* ***phase and game ends***
- ➔ *Optional: a secondary end condition is triggered:* ***phase and game ends***

Chapter 5: the generic conceptual model

This chapter aims to make a generic conceptual model for dialogue games, based on our previous findings. We will combine our findings with Järvinen's Game Design Theory, specifically the game elements he identified. These elements were: components, rule set, environment, game mechanics, theme, information, interface, players and contexts. The following elements are absolutely necessary when designing any game: components, rule set (including a goal), an information structure and least one game mechanic. These basic building blocks will be present in our conceptual model. Our model aims to be free of implementation specific design. It is possible that a software solution or tool could be used to design a game using our model, but a pen-and-paper solution might be just as viable.

Goals

The driving force is the **main goal** of the dialogue game. This will determine the structure of the game and the questions being asked. Examples could be a game for modelling (to be further specified what kind of modelling will be used), a game for requirements engineering or an interrogation game. An interrogation game requires a different approach and different questions than a game for eliciting use cases.

When playing the game, the main goal will be driving force to guide the pragmatic and semantic-syntactic focus of the game. The main goal will be the top of a **mission list** that will serve this purpose. During the game, sub-goals and maybe even sub-sub-goals will emerge that need to be met before the main goal can be completed. This illustrates another important purpose of the main goal and the mission list. It will serve as an **end** or **"victory" condition** for the game. Sub-goals will be encountered when playing the rounds. The mission list is a part of Järvinen's **information** game element

Stages of the game

There will be several stages in the game. The first stages that will be recognised are **phases**. Each phase correspond with a large FoCon. Phases are very dissimilar to each other, both in activities and theme.

In the example of our FCO-IM dialogue game, the main phases are elicitation and applying constraints. These are very dissimilar activities requiring separate methods to tackle them. Also the "theme" is quite different. The first phase is a highly creative phase of content generation while the second phase follows a more rule-based approach and performs actions on the already generated content.

The phases will also determine global elements of the game, the **context** of the game, the **players** of the game and the **environment** of the game. **Game mechanics** are introduced but not yet specified. In our FCO-IM game, these are defined in the large FoCon. The environment used a combination of paper and computer software to write down sentences, draw the model and maintain the mission list. Two types of players were defined. One information analyst acted as facilitator. There were also domain experts. In our case, there was only one. In terms of context we chose a physical session, meeting face to face.

Each phase will go through a number of iterations. We call this, playing a **round**. Rounds can be seen as instances of a phase. Different rounds during one phase will have a similar approach but the actual play per round can vary slightly. In our FCO-IM dialogue game, each round consisted of elicitation of just a fraction of the whole Information Grammar Diagram. This fraction was modelled before moving on. In the next round, the next piece of information was modelled until the model is judged to be complete (end condition for a phase).

Phases are comprised of steps. Steps can contain FoCons, facilitator activities and facilitator decisions. FoCons are the interaction-part of the game. All the talking happens here. In our FCO-IM game, the first FoCon aimed to generate fact sentences through question and answering. Facilitator activities include administrative duties which only concern the facilitator. In our game this included writing repository info, drawing part of the Information Grammar Diagram or updating the mission list. Facilitator decisions are important built-in decision moments. These concern work-flow decisions on how to proceed. Examples in our game were choosing a concept from the mission list to qualify or determining how to proceed once a round finished. Steps can include any number of FoCons, facilitator activities or facilitator decisions, but should have at least one of these component. Steps are part of the round that "belong together". Steps can be designed to be done multiple times in a single round. Playing a step is called taking a **turn**. For example, our FCO-IM contained Step 1, an elicitation step that included a FoCon, a facilitator activity and a facilitator decision. Step 1 aimed to generate fact sentences, document them and make a decision on how to proceed.

The steps and their components are the most concrete parts of the game. They flesh out the specifics and specify game elements, such as **game mechanics**, **components** and **interface**. In our case, the components were kept fairly simple. The facilitator was able to modify several documents on a PC; a document containing the sentences and his note and the mission list. He also had a sheet of paper to draw the model and another sheet of paper for taking quick notes. All these components could be manipulated (game mechanics). For instance, the mission list could be modified by adding goals, checking off goals, deleting goals etc. The model starts out as an empty piece of paper and the model would gradually appear. The interface consisted of a keyboard and mouse for the PC documents and pen and pencil to draw the model on the paper as well as keeping notes on paper.

Rules

Rules form the heart of the game. They specify what the players can do and how they can do it. They define a clear boundary.

Looking at the build-up of the game, we can distinguish three layers or tiers of rules. Also we can distinguish in rules for the domain expert and rules for the facilitator. We believe that most of the rules will pertain to the facilitator. He is the one that needs guidance in leading the process and who must in turn guide the domain expert. This can be compared to a role playing game where the game master needs to have substantially more knowledge about the game than the players. The difference between the facilitator in our game and a traditional facilitator or game master is the fact that the information analyst, who also acted as facilitator, is far more involved and needs specific knowledge (in this case FCO-IM knowledge) and experience. This is why we called this player “information analyst”. In this conceptual model we will keep talking about facilitator as the facilitator in a game of a different setting will typically be something else, for instance an interrogator.

Our design reflected that philosophy. In our FCO-IM dialogue game, most of the rules pertain to the facilitator. He has detailed rules for managing the flow of the game and rules and guidelines for asking questions. The rules for the domain expert were kept rather simple. “Listen to what the facilitator has to say and do what he asks you to do”. The rules clearly state that only the facilitator may alter the model or the mission list. However the domain expert can, at any time, ask for clarification or request to back up a step. In the latter it is up to the facilitator to decide whether this will be done or not. We will not go much deeper into this dichotomy.

Now we take a look at the tiers.

The **first tier** concerns the general rules of the game. They concern mainly the flow of the game. They incorporate rules and guidelines for opportunities and decision making during the game, for instance specifying if and when it is possible to revisit a previously concluded part of the game. They also specify facilitator decisions, for instance whether a new phase or a new round within this phase should be started and whether a new round should start with step 1 or 2. It also specifies the participants of the game, which of course will depend on the main goal as well. These rules apply mostly to the phase/round level of the game. Rules in this tier should leave only marginal room for flexibility. Expert facilitators should be able to deviate from the standard path if they think this will be beneficiary. However, there should always a clear-cut default for inexperienced facilitators.

The **second tier** concerns the more practical rules on the step/turn level. It contains the rules on the game mechanics, who may use what mechanics and when? In the FCO-IM dialogue game it is stated that the facilitator writes down fact sentences, draws a part of the diagram or updates the mission list when a new fact is discovered (adding a sub-goal) or a fact has been completely modelled (checking off a sub-goal). It also prohibits the domain expert from directly editing the model or the mission list. Once the game is being implemented, this section of rules will also specify how exactly the players can use the mechanics (interface). The rules in this tier should leave room for flexibility to the facilitator. However, there should always be a clearly preferred "default” for inexperienced facilitators.

The **third tier** concerns specific FoCons and governs the actual questions. In contrast to the first and second tiers, who are mainly general for their general level, the third tier rules can be very specific for each individual FoCon. Helping to come up with facts requires different questions than try to classify and qualify a found fact. A list of possible or suggested questions is also given. The questions should be formulated with the Question-Answer-Framework in mind. Examples should be given when necessary. The list of questions will not be all-exhaustive, nor will it be a holy grail. A facilitator can make up his own questions if he feels the need for it and can ignore certain questions if they are not needed. For novice facilitators the set of questions should be exhaustive enough and if possible default options should be given.

Mission list

The mission list is an integral part of the game. It will keep track of all goals. The information analyst may make modifications to the mission list: add elements, remove elements, check off elements, un-check elements and highlight elements. The information analyst may skip elements by checking them off without having undergone the activity associated with it.

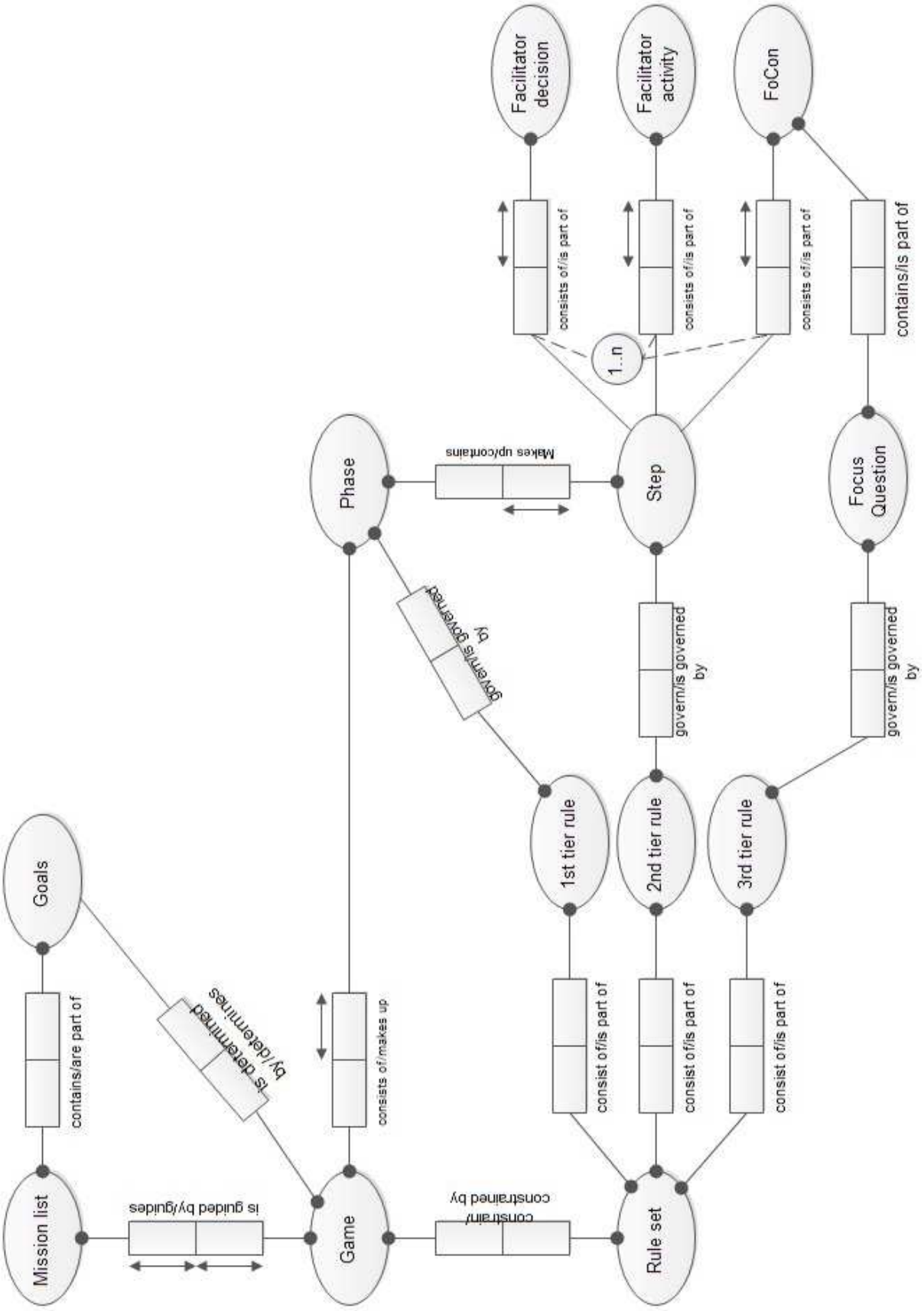
Three types of goals can be distinguished: top level goals, concept level goals and activity level goals. The top level goal represents the global goal. In our case this would be global modelling goal “Model the information need of planning a journey by train by using FCO-IM”. This goal is formulated before the session starts. The concept level goals are identified as the game progresses. In our context those were the concepts that surfaced during step 1, such as “train station”. Each concept goal will have a fixed set of activity goals associated with it which will vary from game to game. In our case the goals that needed to be completed to complete a concept level goal were related to the FCO-IM repository, for instance “generate 4 examples”. The actual amount of goal levels can vary, this is merely a suggestion. We think that each phase should have a top level goal of its own, which would mean there is probably top level goal above those for the entire game. In our FCO-IM game we only considered one phase.

The active concept level goal should be highlighted to indicate it as such. Optionally the activity level goal can be highlighted as well. A clear mechanism should be employed to distinguish between finished and unfinished goals. The example below offers a suggestion.

- TOP LEVEL GOAL
  - ~~Concept goal 1~~
    - ~~Activity 1~~
    - ~~Activity 2~~
  - Concept goal 2
    - ~~Activity 1~~
    - **Activity 2**

In the example above, concept goal 1 and the underlying activity goals have been completed. The current concept goal being processed is concept goal 2 as highlighted. Here we have already finished activity 1. Activity 2 is highlighted to indicate that this is the activity we are undertaking. In our FCO-IM game, we left out highlighting the activity goals in order to keep it simple and not confuse the domain expert too much.

The following ORM diagram on the next page shows all the objects and their relations.



This figure shows a modified ORM diagram of our final design. The rules have been split into tiers. We also made a more explicit relation between Goals and Game. The global goal will determine the type of modelling game that will be designed.

Chapter 6: Reflection

Recap

We recap our design problems from the beginning.

"Design a set of rules and guidelines that can aid and guide a modeller in a game focused on eliciting the contents of a starting document for a FCO-IM modelling session".

"Design a conceptual model for dialogue games based on the experiences gained in the dialogue game for FCO-IM".

We managed to design a dialogue game with crude implementation. This game contains a set of rules and guidelines. The game was designed in stages. We started with a FoCon analysis of FCO-IM. Using this analysis, we made several design choices. We build the Information Grammar Diagram in an iterative way, forgoing the traditional FCO-IM dogma. We focused on content elicitation required to create the repository and the Information Grammar Diagram. We left out constraints. Using our experience gained in a previous bachelor thesis, we made a first design. This design was tested using a crude implementation of text documents, pen and paper.

This session highlighted several issues which were addressed by refining the design. This was tested again. This led us to the final design presented in chapter 4. This was subjected to further testing.

We derived a conceptual model from our final design. This conceptual model follows the global design of our FCO-IM dialogue game, but it leaves any domain-specific and implementation-specific issues out. We did provide examples from our FCO-IM dialogue game for clarification. The purpose of the conceptual model is to offer a starting framework for designing dialogue games for any kind of subject, akin to a game engine for video games.

Results from the final test sessions

The final design was tested three times to see if it works. We did three sessions with one domain expert each. Our participants were a Computer Science student, an Information Science student and a Biology student. The first two students had a background in modelling but have not been exposed to dialogue games. The last student had no formal modelling background. We were already acquainted with two of the students and all three sessions were done very informally and casually. We think that this contributed to a rather relaxed and open atmosphere in general.

We decided to focus our attention on the content elicitation and skip the drawing part. One reason is our inexperience in the matter. A second and more important reason was in regards to the flow. The first tests during design already showed us that the flow is hindered by the crudeness of our implementation.

We used up a lot of time to type out questions and answers and making notes for the repository. We explained this to each participant at the beginning of the session. This is not the way it should be done, but were limited by our current implementation. All participants indicated they understood our reasoning. However, we feel that if we also drew up the Information Grammar Diagram according to specification, it would drag out the sessions to such an extent that we would test the patience of our participants.

With Grice's Maxims in mind and the fact that our goal was to test our game in general, rather than producing a full FCO-IM Information Grammar Diagram according to specification, we made the decision not to draw the Information Grammar Diagram and thus essentially skip parts of the facilitator activities and the validation of the model.

Whenever an unnatural stop occurred in the flow, because we had to catch up on our typing, we made mention of this. Thankfully none of the participants appeared to be annoyed over this fact. We realise that in real stakeholder interaction, these pauses are an absolute no-go. But considering the casual nature of the sessions and the understanding of our participants, this had no negative impact on our sessions.

To start the sessions we gave a short explanation about the game and the case. We tried our best to avoid asking questions that could lead to annoyance. We explained explicitly that some questions might seem redundant or obvious. We explained that we are not subject matter experts and need to be sure we are on the same page as the domain expert. In the third session we also explicitly stated that the domain expert cannot give wrong answers. If the process seems to get stuck or when we need to ask “obvious questions”, this is the result of answers given by the domain expert. It is a result from us asking the wrong questions or not phrasing them properly.

The first participant indicated at the end that he thought it was a good idea to make this explicitly clear at the start of the session. He had a background in modelling, so he understood the need for those questions. He stated that he has experience with talking to stakeholders. He can imagine possible annoyance. The second participant also had a background in modelling; she also understood the need for those questions.

The third participant did not have a background in modelling. She thought it would not have made a big difference if the extra clarification at the beginning had been skipped. She also did not feel any annoyance. We find this interesting. We thought people without a background in modelling might feel annoyed more quickly and sessions would benefit from extra clarification. We cannot make any substantial remarks on this topic however. We only had a very limited test. We also could not focus on analysing the domain expert since we had to keep the game going, ask questions and type at the same time.

One of the things we found hard to do was eliciting names for labels. We also experienced this as one of the points where a sense of annoyance or redundancy might occur. For example, we have the fact sentence “There is a train station Nijmegen”. We also have the examples “train station Nijmegen Heyendaal”, “train station Nijmegen Dukenburg” and “train station Nijmegen Lent”. The word or words after train station identify a train station. We want a description for this.

In the third session, we had some problems getting this description. We gave the domain expert an example, using persons and names. “There is a person Jan Vogels. ‘Jan Vogels’ is a name for a person.” We hoped this would enable the domain expert to come up with a description for the identifiers of train station. It did not prove to be that easy and we could not come up with a way to get it. Using the knowledge gained, we had to make a suggestion ourselves. We suggested “station name”. The domain expert agreed that this was a logical name for it.

We were lucky in this case as we are familiar with the domain. However, making suggestions should be the last option only in our eyes. We want to model the communication in the words of the domain experts. By making a suggestion, we are using our own words. The domain expert validated our suggestion, but we think it’s better if the domain expert comes up with a description of his own, even if it is not the one we had in mind. Also, when we talk about a domain completely foreign to us, we might not be able to make suggestions. This point deserves extra attention. The repertoire of focus questions needs improvement and expanding.

We noticed that the procedure did not feel like a game during the sessions. There is a strong game element in the conception and design but during “play” this was absent. In our experience it felt more like a semi-structured interview. One of our hopes for serious gaming in information modelling is to make modelling less boring and therefore improve stakeholder participation. Introducing serious gaming techniques did help us shape the framework and produce interesting results.

We realise that the number of sessions is very small, in the genesis and in the final stage of the design. This was a conscious decision. We were doing explorative research. Large scale tests were never the intention give the limited scope of a master’s thesis. Proper testing would have required a better implementation and a lot more work. This was also not the focus of this research. We wanted to explore if this approach could work and focus our time and efforts on the conceptualisation. We think it does. Moreover, we think that this approach made us keep an open mind. Using existing tools or building tools automatically limits the perspective.

Recommendations for future works

This research thesis provides a number of possibilities for future work and research. We will point a few.

FCO-IM: flesh out the concept for the FCO-IM game.

This thesis was written by someone who is not an expert in FCO-IM. This offers a first point of improvement. Interested researchers can attempt to refine the content, especially the focus questions and heuristics for asking them. This could be done in conjunction of refining FCO-IM itself. We pointed out several things that we perceive as short comings. This could be done as another student project as well.

The game can also be expanded with the second phase of FCO-IM, applying constraints. If this is done, we think this should be added as a new phase. This phase consists of its own steps, which in turn consist of FoCons, Facilitator activities and Facilitator decisions. We recommend against integrating this into the existing phase. We feel that these stages are fundamentally different in approach and in order to keep pragmatic focus, it is recommended to keep them apart.

Our game offers great flexibility for the information analyst in regards to revisiting past elements. This same flexibility can be carried over, allowing the information analyst to switch between phases at any point of the game. This maintains our philosophy of keeping these activities apart. However, if a highly experienced information analyst thinks it is beneficiary to combine these activities, the game will explicitly allow for it. As an ad-hoc trigger, the information analyst can decide to move the game to Phase 2. Once the concept has been fully processed, the game can move back to Phase 1 to elicit and qualify new concepts. Care should be taken to modify the mission list in such a way that it keeps track and facilitates this process well.

These two options, fleshing out our design and adding constraints, can be combined or done separately.

Building tools for support

Better support for the game is the next step. We used very simple methods: text documents on a PC, pen and paper. Integrating note taking, building the FCO-IM repository, drawing the Information Grammar Diagram automatically from the repository and automated support for the mission list would be a big step. Next would be the possibility to have two views, one for the information analyst and a separate view for the domain expert, leaving out a lot of the details.

We could not use the mission list in the way we envisioned it. Whenever a new concept was added, we had to copy a template for the activity goals. This could be automated by adding these automatically. We would also like to minimize and maximize these activity goals to avoid clutter on the screen. And finally we would like to hide the activity goals from the domain expert by default, which would require at least two views.

Easier methods for highlighting and checking off goals are also high on the list of want-to-haves. In our setup we had to select a line of text and then click a button for strikethrough or background highlight. Simply clicks, without selecting, would be preferable. When changing the highlight we had to highlight the new concept and remove the highlight from the old highlight. Automation here would be desired. Highlighting a new concept should automatically remove the highlight from the previous concept. Once a concept goal is checked off, the highlight should be removed automatically. These implementations will make the mission list much easier to use and we think that it could become a very powerful tool to keep the pragmatic focus of the game.

It can be considered to modify the mission list into an enforcing game element. As long as certain conditions are not met, it is not possible to continue to a new step. Checking off items on the mission list could also be supplied with a checking mechanism. For instance, checking off the activity goal “Generate four examples” can only be done if four examples have been marked in the document containing the notes. This might impair the flexibility our current design offers. Skipping steps when the information analyst feels they are redundant will become harder.

We suggest multiple modes. A normal mode would be suited for novice analysts and encompasses more checks and enforcement, practically forcing the analyst to “stick to the game”. More experienced analysts can chose to play the game in “hard mode”, removing restrictions and limitations and giving the analyst greater freedom but also greater responsibility for maintaining the flow.

We think that these things could be interesting topics for a more technical oriented student project. This might be combined with fleshing out the design for the FCO-IM game. A group project for GiPHouse at the Radboud University might be a viable option, having students Information Science and Computer Science work together on both the conceptual stages and building the tools necessary to play the refined game and test it. Integrating group collaboration tools and add more domain experts could be the next step.

Testing

We only did very limited testing. Further testing is required to prove the viability of serious games in modelling. We think it would be best to flesh out the FCO-IM dialogue game and build some tools for the implementation before testing it on a larger scale. Experienced information analysts should conduct these tests to validate the method. Tests should be done on a number of subjects of varying complexity. Any improvements could be added to the design. Once more research and testing have been done it could be expanded to involve multiple players and possibly use group collaboration software. Playing the game with multiple players will certainly require some form of automated support. Our crude setup proved to be challenging enough for just one domain expert. Once fleshed out and tested, a next step could be to let students play the game during a modelling course. This will show if the gaming approach can actually support an inexperienced information analyst in a meaningful way.

Another aspect that deserves testing is possible domain expert annoyance. We think that domain experts without a background in modelling might get annoyed if they feel questions are obvious or redundant. By offering a clarification at the very start of the game we hope to prevent this or at least convey the necessity for these questions. Interestingly, our participant without a modelling background did not seem to be annoyed and also said it would not have mattered much if we had skipped the clarification. But we cannot draw any conclusions considering the limited scope of our testing. We find this topic extremely interesting though. A domain expert that feels at ease during a conversation is paramount in our view, a view supported by Grice's Maxims. We recommend that the FCO-IM game is fleshed out and given some support tools in order to make the process go smoothly. However, a whole new serious game could be constructed for this purpose.

Once we have a solid game with smooth flow, we can test this on diverse audiences. We recommend splitting the audience with no modelling background into two groups. The first group should be given the clarification, while the second group is given no clarification about possible redundant or seemingly obvious questions. The information analyst should then closely observe whether or not he determines annoyance or similar reactions. The domain experts could be interviewed on their experience as well. If the majority of the domain experts, who did not get the clarification, experienced annoyance or a sense of redundancy, then the extra clarification might actually help. If both groups show annoyance, however, then we must rethink our questions altogether. Testing and analysing domain expert annoyance should be done with experts in the field of human behaviour science and human communication for the most accurate results. This opens up possibilities for interdisciplinary research.

All tests were done in an informal and casual setting. We suggest testing to compare informal and casual settings to very strict and formal settings and how this affects domain experts. We felt that our informal sessions were conducted in a pleasant way and we had no indication our domain experts felt otherwise. We cannot make any predictions in this matter given the limited amount of tests and the fact that all our tests were done in an informal way. But given the importance of domain expert participation and involvement, we think that testing in this field warrants attention. We suggest that different groups be subjected to both forms, both formal and informal as we think that preferences of people will vary with each person.

Testing in general should be setup more extensively. We used a simple case and limited ourselves to elicitation. Future testing should at least encompass the full first phase, including drawing the model, supported by a tool, and validation. Some form of recording should also be used; we suggest video recording as it can capture passive body language. This is relevant if we want to analyse annoyance with the stakeholder.

Building more games and evolution of the generic conceptual model

Another point of research is to actually use the generic conceptual model and try to construct a similar dialogue game for another subject. The simple Requirements Engineering game from the bachelor thesis could be revisited with this conceptual model in mind and completely redesigned in terms of concepts. By building different games and testing them we can test the generic conceptual model and possibly expand it. Designing games for another modelling language based on our design is a possibility as well. This could be another interesting student project or even a student group project for GiPHouse, not only designing a new game but also building automated support and proper testing.

As more games are designed and played, we expect our conceptual model to evolve. Once the model matures, it might be possible to build generic tools for the implementation of dialogue games.

Improve the game setting

We call our design a serious game. The definition holds. We have combined several elements from the game design theory and created a structured framework for asking questions. We introduced terms from the gaming world, like round or step, and tried to write the instructions to resemble a manual. Our game is a serious game. Entertainment is not the goal of the game. In fact, our game did not contain any entertainment. Serious games do not require entertainment to be a mean towards the goal of the game. But we think that whenever people hear the world “game”, whether it is serious or not, think about some value of entertainment.

Right now, there is no entertainment present. We even think it does not feel like a game. This is partially because of the implementation we used. If tools are built and technical implementations are used, it might be possible to give the game a more game-like feeling. We think that this might make the whole process less boring. It is utopian to think we can make modelling “fun”. But less boring would be a start. An interesting test would be comparing a serious game played with crude implementation, resembling semi-structured interviews, with a more sophisticated implementation that adds a more game-like feel to it. We could then try to observe whether this actually improves the motivation of the domain expert, maybe even the motivation of the information analyst. If testing seems to support our assumption, games might make modelling less boring, then this could serve as an argument to further pursue serious gaming for modelling in general.

The future

Serious gaming has been an upcoming field. By actually making a dialogue game and trying it we hope to have made a contribution to this research. It is too early to make any predictions. With improvements and better implementation, we think that dialogue games will have some value in education, guiding modelling students through their first sessions. Hopefully the business will follow. For the near future we pointed out some research options that might be suited for student projects.

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