

Analyzing a Collaborative Modeling Game

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Abstract. Analysing the modeling process within collaborative (group) modeling sessions is not a trivial task. In such environments, there are many things that influence the way the modeling process is carried along. These include the skills and expertise of the modelers, the communication between them, the decision-making process, rules and goals driving the process etc. To study and support such a collaborative modeling process, we describe, in this work, a three-tier conceptual framework that uses the game-metaphorical approach. We present preliminary findings from a case study to illustrate the concepts in our framework.

Keywords: *Collaborative Modeling, Modeling Process, Quality of Modeling, Modeling as a Game*

1 Introduction

In system development, including enterprise engineering, communication plays a vital role [9] and a number of stakeholders are usually brought aboard the system development ship with varying skills, expertise, and knowledge. This results in a heterogeneous group of stakeholders including, for example, project managers, (prospective) users who may act as domain experts etc. In such environments, participants engage in various types of conversations during the creation of *agreed models*. Such conversations involve *negotiation*, which results in *accepts, rejects, modifications* etc. see [2,6]. All this is done so that the different divergent positions and viewpoints within the group can be reconciled, and agreement and consensus reached [9].

The work of Peter Rittgen ([6,7]) is closely related to our own, based on similar principles, and therefore particularly relevant to this paper. His *Collaborative Modeling Architecture* (COMA) tool reflects a similar approach to collaborative system analysis and design. However, while he focuses on negotiation of models as such (which is indeed the core activity), he largely ignores other aspects (like language setting, planning, sub-model definition, etc.), or sets default choices for them. While we consider his approach a good start, we believe more differentiated and in-depth analysis of real modeling processes will contribute to a broader and deeper understanding of the modeling process.

2 Game Metaphorical Approach to Collaborative Modeling

As discussed in [3], instantiated collaborative modeling sessions can be analyzed as if they are games. This approach is rooted in the observation that operational collaborative modeling is an interactive process that is “played out” within the boundaries of specific constraints (rules). Though our current analysis does not involve gaming as an overt activity, our analysis is based in the idea of viewing the modeling session that is studied as a game.

Games, can be understood from many perspectives: systems, cognition, emotion (see, for example Jarvinen [4]); entertainment as well as utility (“games with a purpose” or “serious gaming”). Games are by definition rule/goal-oriented. Jarvinen developed a *Game Design Theory (GDT)* which, can be applied to method engineering [3].

Our work follows the same line of thought. Games Theory (which we *do not* directly employ) analyzes *strategies* for playing and winning games, whereas GDT describes design concepts and principles underlying good game design. In a modeling context, GDT is believed to contribute to good method design.

As for the collaborative game aspect, [10] makes a clear distinction between *competitive*, *cooperative* and *collaborative* games. *Competitive games* force players to identify strategies that are diametrically opposite. *Cooperative games*, in contrast to competitive games model situations in which players’ interests may be “neither completely opposed nor completely coincident”. They contain a set of enforceable rules that govern and direct the negotiation and bargaining of the players. Our work embraces this view and applies it to collaborative modeling by identifying a set of rules and goals governing and directing the modeling process, and studying the interactions in view of those rules.

Thus, we view modeling as a game in which a set of rules and goals direct and govern the collaboration of the players (modelers). In this paper, we explain an operational conceptual framework related to the game metaphor, and illustrate the framework at the hand of data and results from a case collaborative modeling session. These being preliminary results we only report on results concerning interactions and few rules identified.

3 Conceptual Framework

Our conceptual framework for analysis is based on previous theoretical work on the act of modeling [5], but pushes for operationalization of the theory in the form of qualitative analysis of (transcripts of) actual modeling sessions. In a collaborative modeling session, modelers come together to perform some modeling task. They interact and communicate their ideas and opinions to other members. For them to reach consensus and agreement, they need to commit themselves to work as a team and abide by their collective knowledge, conventions and decisions (rules of their game). Their interactions, the rules and goals and the

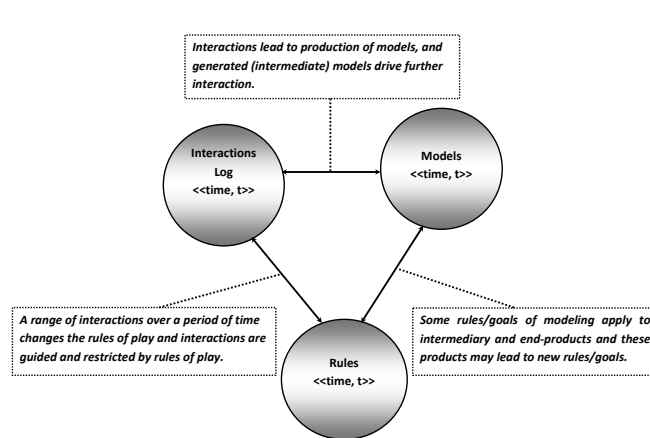


Fig. 1. A methodological approach for analyzing interactions, rules and models.

models produced drive the modeling process at any given time, t . The interplay between them is given in Fig. 1.

We view goals as a key type of rule (“goal rules”) [3]. The goals are *rules setting states to strive for*. The rules should ideally guarantee process and model quality, but they also reflect existing conventions for (inter)action in modeling and conversation. We distinguish two basic types of rules in collaborative modeling: *rules set for the game*, i.e., setting the game as such, and *rules set in the game*, i.e., by the players.

4 Collaborative Modeling Session Experiment

The modeling session was organized and passively attended by two researchers. Three modelers (identified by M, D,R) participated in the actual session. They all had some experience in process modeling in a system development context, but were not expert modelers. The session (which took 18 minutes) was video recorded with good sound quality. The modelers were also given a digital writing pad, which was recorded alongside the video. See Fig. 2 for a snapshot of the recording.

Transcription. A complete transcription was made of the recording and to effectively study the conversation patterns in the modeling session, we identified atomic interactions (i.e. disentangled them if they were wrapped up in complex sentences) and annotated and categorized them.

The following information is covered by the coding of the transcript:

- **Interactions** - with properties: *time and interaction number, actor(player), topic/content, and speech act type*. Table 1 gives an example of interaction coding, interpretation and the meta-data associated with its properties.



Fig. 2. Snap-shot of the recording

- **Rules** - with properties: *time of activation, content and number of interaction it was proposed in, time of deactivation, content and number of interaction it was proposed in, type of rule*. Interactions are identified by numbers.

Table 1. Interaction coding, interpretation and meta-data

Time/Int#	Actor	Speech Act - [Type]	Topic
6:04 105	M	<i>Should we introduce a vendor, actor?</i> [Question 9]	Set content
6:08 106	D	<i>The material handler already functions as the vendor.</i> [Argue against 105]	Set content

5 Findings and Analysis

The whole collaborative modeling session consisted of a total of 291 interactions and took 17.25 minutes or 1045 seconds. It showed three clearly distinguishable phases: *I-Setting of the main approach: choosing the language and sub-division of work, II-Exploring and deciding which actors play a role in the first partial process model and III-Modeling the sub-process* each with its own typical proportion of interaction types. A number of interaction topics and rules/goals were identified. These are shown and explained below.

We used conversational analysis and Language-Action Perspective (LAP) [1] to identify the different speech acts in the modelers' conversations.

Table 2. Number and type of speech acts within the phases

Speech Act Type	Phase I		Phase II		Phase III		Total	
	#	%	#	%	#	%	#	%
Propose/Answer	7	33	30	24	39	27	76	26
Counter_propose	0	0	3	2	6	4	9	3
Question	7	33	25	20	16	11	48	16
Argue_for	2	10	3	2	7	5	12	4
Argue_against	1	5	9	7	7	5	17	6
Agree_with/Accept	4	19	17	13	23	16	44	15
Disagree_with/Reject	0	0	16	13	7	5	23	8
Non-verbal(graphical) acts	0	0	23	18	39	27	62	21
Total	21		126		144		291	

Table 2 gives the distribution of the interactional speech acts over the three phases.

In Table 3 we show the interaction topics as identified. The numbers and their corresponding percentages in the column total indicate the frequency use of the interaction topics.

Table 3. Number and type of interaction topics

Phase	<i>Interaction Topic</i>											
	GRM		PLN		CON		CRT		COL		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
I	4	25	3	43	2	1	12	100	0	0	21	7
II	2	13	1	14	120	47	0	0	3	100	126	43
III	10	63	3	43	131	52	0	0	0	0	144	49
Total	16		7		253		12		3		291	

GRM = Grammar, PLN = Planning, CON = Content, CRT = Creation, COL = Collaboration

Categories of interactions identified are: Content Setting (which does not concern goal setting but fulfillment of goals) hence falls outside this paper's scope, but deserves further study. Collaboration Setting is an interaction category not previously proposed. It concerns *how modelers are to collaborate with each other*: what roles, hierarchy, responsibilities; how they organize themselves. Another "new" topic was found: Planning Setting, concerning options for temporal scheduling and strategies concerning the fulfillment of creation goals.

We found nine rules, all goal setting rules. Three rules were explicitly set *for* the game: one creation rule, one grammar rule and one validation rule. Seven rules were set *in* the game: six of them concerned grammar goals, one concerned a creation goal in the game.

6 Conclusions and Further Research

We have presented and illustrated a research approach aimed at analyzing the detailed process (act) of modeling. We presented a three-tier (Rules, Interactions and Models) conceptual framework. We analyzed an actual collaborative modeling session to illustrate the framework. Findings were also presented, to perform a partial validation of the Quality of Modeling (QoMo) [8] and COMA [7] approaches.

We do not claim that our approach is definitive and static. There clearly is room for elaboration and improvement. We plan to carry on in this line of work in a recently started PhD project that this paper is also a product of. Our applied aim is to lay a foundation for the design of advanced, modeler-oriented support tools for collaborative modeling using a gaming approach to modeling.

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