# Conversational Narrative Interfaces for *Sensemaking*

Doctoral Consortium

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## ABSTRACT

This PhD thesis aims at studying the generation of dialogues within the context of narratives based on the theory of inferential pragmatics. When referring to inferential pragmatics, we consider the non-semantic elements of the meaning of statements that can be inferred from its implications. Our goal is to generate dialogue statements based on a model that integrates pragmatic context knowledge. This model aims to generate misunderstandings arising within a dialogue between a human user and a virtual agent, focusing on contextual inconsistencies.

## KEYWORDS

Dialogue Models; Social Agents; Narratives; Speech Act Theory; Pragmatics

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## 1 INTRODUCTION AND RELATED WORK

Research in generating dialogues within spoken dialogue systems has immensely progressed over the last decade. Generally, pragmatics based language understanding systems focus on a specific task, such as making reservations, car rental services, or insurance [5, 9], being in fact automatic dialogue systems with the goal of searching for information.

This thesis aims to develop, implement and test a model for building a system based on speech acts and conversation theory proposed by [6], that contains a syntax, semantics, and a procedure of analysis of the dialogue sequences. We consider elements of pragmatics theory, such as the context and the language, and we aim to obtain a computational model. We use discourse structure theory to generate inconsistencies that arise during a dialogue, mimicking the process of detection. After *detecting* them, the system must proceed to repair these situations of misunderstanding according to their classified level.

We find ourselves at the intersection of four important domains: discourse structure, dialogue systems, inferential pragmatics and narrative generation mechanisms focusing on the understanding of the narrated story [8, 10] that essentially represents the rules the generated utterances will be based on. Concerning its linear representation, one advantage is that the users do not have the possibility to modify the procedure in which the story unfolds and ends [13], their only goal being to have an understanding of the facts that were told.

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## 2 THESIS OVERVIEW

The considered application framework (Fig 1) is that of a dialogue between a human user and a virtual agent focusing on the overall understanding by the user. Here, the dialogue plays an intermediary role, administering and creating a balance between the user's understanding and the computer's representation of the user's beliefs regarding the received information [3]. A representation of the user's beliefs of the story narrated by the agent is built incrementally. During dialogues, situations of misunderstandings may arise.

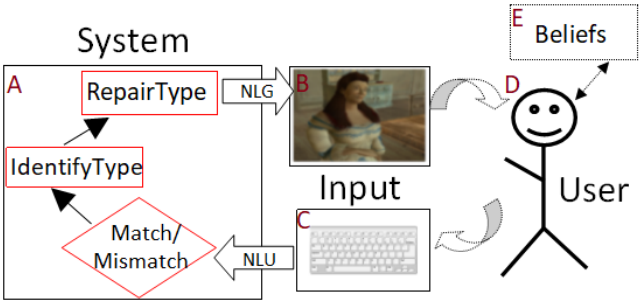


**Figure 1: Architecture overview: A. The system; B. Visualization: 3D virtual character Emma [4]; C. Input, in this presentation, the keyboard; D. The user; E. The user's beliefs.**

To begin with, the system generates utterances based on the narrative representations. Then, to respond to the user's statement, the system must interpret what the user actually said and their intentions. Each participant in a dialogue initially assumes that there is a mutual understanding, inferring the existence of an equivalent narrative representation. To identify exactly where the misunderstanding appears, we must consider the given response. In theory, this recognition can be divided into positive proofs (relevant contribution, paraphrasing, repetition or utterances) and negative evidence (negative or inconsistent statements).

We are not only looking for the exact meaning of a word but we are focusing on how we can use dialogue structures to understand the overall message being conveyed. When referring to a dialogue model, we consider a dialogue structured in an already predetermined sequence of types of utterances [12]. Dialogue theory is used to model interactions using specific entities, such as exchanges, interventions, and interlocutory acts [6].

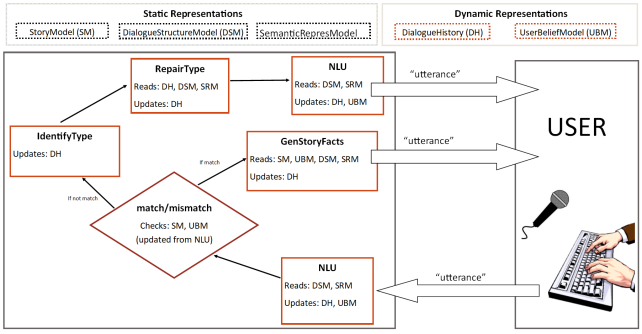


**Figure 2: System architecture. The main processes of our system are: (i) generating dialogue statements from the causal representation of the story (GenStoryFacts), (ii) understanding and inference of what the user means when inconsistencies are identified (NLU), (iii) detection of inconsistencies, (iv) identification (IdentifyType) and (v) generation of responses to the user (RepairType).**

Based on our work so far, we aim to propose a model of the system (Fig 2). We have a representation of the context of the story (StoryModel), and references between the text and the entities, the actions and the relations, i.e. a context being attached to the words (SemanticRepresModel). The system includes the user's belief model containing assumptions about the user's knowledge (UserBeliefModel). After the user's response, the system updates its representations.

The first important process that the system is responsible for is generating dialogue acts from the actual representation of the story (GenStoryFacts). Then, using its representation of the user's story and belief model, the system will generate real statements, with the intention of telling the story. [6] proposed the generation of statements based on the dialogue structure by integrating discursive connectors according to the discursive markers theory [11]. Specifically, we plan to determine what type of intervention corresponds to the act of dialogue and where this is situated in the overall context. Dealing with user responses' understanding, the main purpose of the model is to find and map the meaning of the statement most relevant to the context. As for the generation process, it attempts to connect entities, actions and relations to the context. We refer to this process as a dual, literal and contextual process. The process of decoding the sentence at the syntactic level is based on a predefined lexicon and grammar. Then, the semantic analysis is performed, mapping from the context to specifically announce to the agent what the user is saying. To respond to the user, the system must first understand what is being addressed and its reasoning. To make inferences on the user's understanding, the model considers the result of the formal representation regarding the current user's moves. This result is compared with the system belief and the history representation (the match/mismatch process in Fig 2). If no match is found, the system will highlight an inconsistency.

After the study of validated literature, we state the levels of misunderstandings that we will consider. To start with, we designate level 0 when *no misunderstandings* are generated, in which the user positively acknowledges the facts. Level 1 consists of the *knowledge of concept* [2, 7]. Within this level, the user clearly states they don't know the meaning of the concept, or the user defines that concept to get the approval or disapproval from the agent. At level 2, *knowledge of reference* [2, 7], the user understands what is being transmitted, but will not make sense of the concept that is being referred to. Level 3, referred to as *different cognitive systems* [2, 7], deals with its own stereotypes of thinking, due to personal previous experiences, identities and values. Level 4, the *re-contextualization* [1, 7], implies no intersection between what the user is talking about and the system's topic. For each type we propose to implement causes and methods to solve it, for example, we will use exemplification, definition, correction or repetition, depending on the case.

A fixed structure pattern is attached to every level of misunderstanding. For *Level 1*, this pattern consists of one main exchange that comprises of one initial move, an exchange where the utterances representing the *detection* and *solving* of the misunderstandings, and a final move with the positive acknowledgement. After defining the respective structure, we map the types of moves with the appropriate classes in which datasets representing the utterances are found. Fig. 3 illustrates one example output from the generation of a *Level 1* misunderstanding, as an extension to the standard *Level 0* exchange which does not include any misunderstanding.

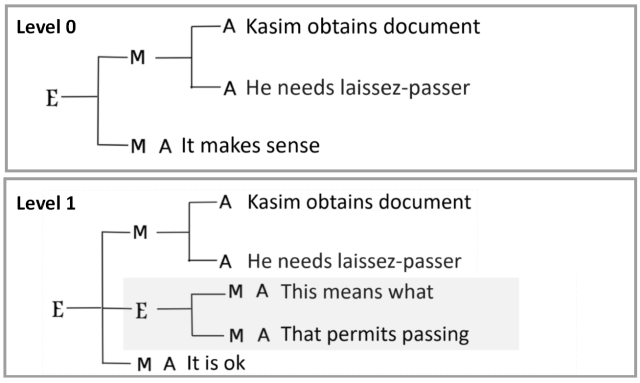


**Figure 3: First results of story-based examples generated for *Level 0* and *Level 1* of misunderstandings.**

## 3 CONCLUSIONS AND FUTURE WORK

We propose a model through which inferences at the context level are possible, to generate and evaluate real dialogue statements from the story representation. Our proposal could be integrated within interactive narrative systems. The next step of the work will include implementing the proposed model, followed by evaluations both technical and user-based. We plan to submit the full evaluations' results as a full paper to next year's conference.

## ACKNOWLEDGMENTS

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