MODELLING CHARACTERS
AND THEIR DECISIONS

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Abstract

This paper describes a theory of character modelling in the context of story understanding. The theory attempts to model the goals of the characters in a story, and the system's understanding of the evolution of these goals as the story progresses. We address the issues of how these goals are initiated, how they interact with other goals, both of the same character and of the other characters in the story, and how they can be used to explain the actions of these characters. In particular, we are interested in modelling decisions, and how a theory of decisions can facilitate the understanding of the sequence of events in a story. Compliance decisions, which form a subset of general decisions, have been studied as a prototype, and the resulting theory has been implemented.

1. Introduction To The Problem

Consider the following sequence of events from a story:

John pointed a gun at Mary.

John told Mary to get into his car.

John drove Mary to his hotel.

Reading these three lines enables us to understand the manner in which the events described relate to each other. A conventional story understander could easily infer that Mary got into John's car when he asked her to, and that enabled him to drive her to his hotel. However, this does not tell us why Mary got into the car. A theory of goals alone would attempt to explain this by giving Mary the goal of getting into John's car, which is established when John points his gun at her and tells her to get into his car. Another possible explanation is that Mary got into the car because she wanted to be in the car. In the same manner, we can infer that John got into the car, and assume he did so because he too wanted to be in the car.

We feel, however, that such an explanation is inadequate, and misses a crucial point which we, as people, grasp immediately. In particular, Mary does not really have the goal of getting into John's car. She does not want to go with John; she only does so because she believes that she would otherwise run

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the risk of some harm. There is clearly a difference between John’s and Mary’s reasons for getting into the car. A complete explanation should capture the support for Mary’s conscious decision between the alternatives presented to her.

People continually make decisions. Some decisions arise out of conflict between the goals of a single person; economic decisions arising out of scarce resources are a well-known example of this. Decisions could also arise out of interactions between the goals of two or more people; the above mini-story is an example. Our approach to story understanding incorporates a theory of decisions. We attempt to model why decisions arise, what the alternatives involved in the decisions are, and why a particular alternative eventually gets selected, which, of course, depends on the context, the character making the decisions, and his or her relationship with the other characters involved, if any.

A theory of decisions alone does not an understander make; we need also to model character interactions, plans and goals, causality, and several other issues. Several researchers have been interested in some or all of these aspects of story understanding. Wilensky’s theory of plans and goals [Wilensky78, Wilensky83] is suitable for modelling several of the goals and goal interactions we need to deal with. There has been some work on character interactions, relationships and affects [Dyer82a, Dyer82b, Lehnert81, Lehnert82], and this is important if the story is to be understood satisfactorily. However, we found these theories inadequate in modelling episodes like the one above, in that they did not really capture the decision-making processes that were central to the explanation. We needed to model this aspect of story understanding as well.

There are theories of decisions in psychology [Kahneman82, Slovic82], but these are either tangential to the task at hand, or are inadequate in capturing the subtleties that we intend to capture. We need a theory to guide the story understanding process. It has to explain where and why decisions arise (and are taken) as the story is read by the understander, not really the mental processes of the characters themselves in making those decisions. Models of decision-making of the kind presented in [Doyle80] and [Pearl79] address better the latter issue, which is important but orthogonal to our task. Also irrelevant for our purpose are the decision tables used in expert systems to model expert decisions (for example, see [Szolovits78, Trigoboff78, Weiss78]), the decision procedures of theorem proving (see [Cohen82] for some

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references), and decision trees in learning [Hunt66].

In the rest of this paper, we shall present the context in which the problem arose, and, via an example, outline the theory which we developed to solve the problem.

2. The Story Processing Domain

The story processing domain is well suited for the investigation of a variety of theories in Artificial Intelligence. Many programs have been implemented dealing with some aspect of this domain. Researchers have been interested in the parsing of English language input [Marcus74, Marcus80, Schank73], modelling of events and states in the real world [Charniak78, Charniak81], generation of coherent English language stories [Meehan76], modelling goals and plans to achieve them [Carbonell79, Meehan76, Wilensky83], and several other problems [Dyer82a, Granger83, Lehnert81, Lehnert82, Norvig83]. As indicated above, we are interested in modelling decision processes, and how a theory of decisions can be useful in understanding the sequence of events in a story.

A story is a sequence of descriptions of states and events in the real world, which are causally connected together in some coherent way. These descriptions may be in English, or in some convenient conceptual representation form. The participants in the story, called characters, are sentient entities with goals, beliefs and desires, who take part volitionally in various actions which typically help them satisfy some of their goals. The goals of a character interact with other goals, both of the same character and of the other characters in the story, giving rise to decisions points where the character must consciously consider alternatives and make a decision. These decisions depend upon the context, which includes the state of mind of the character involved, as well as his or her relationships with the other characters affected by the decision.

To understand such a story, then, is to take the input descriptions and to construct an internal model of the events in the story, the goals of the characters, and how these relate to each other. The story presented is typically incomplete in several ways. Many of the actual events and interactions are left unspecified, and must be inferred from the ones explicitly mentioned. Causal connections are seldom made explicit, and reasons for the observed behavior of the characters usually need to be filled in by the story understanding process. The creation of a causally complete model of the imperfectly specified story

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requires much background knowledge about the world.

If the story presents an interesting or useful concept as its overall theme, the relevant portions of the story should be extracted so that this new concept can, after suitable generalization away from the specifics of the story, be added to the system's repertoire of world knowledge. We are working on a system capable of this kind of learning in the natural language story processing domain [DeJong84], which incorporates a theory of learning known as Explanatory Schema Acquisition [DeJong83a, DeJong83b]. The problem of decision modelling arose during our explorations with this system. Our model of compliance decisions has been implemented in our story processor.

3. The Kidnap Story

The story we are currently working on deals with kidnapping. Since we do not wish to address the unrestricted English language parsing problem in this project, we transcribe the story into a conceptual representation form, being careful not to augment the conceptual structure from a literal English interpretation. This mapping is performed automatically by a simple "literal-minded" parser. The story is presented below in an Englishified form. The conceptual representation is shown in Figure 1.

Fred is Mary's father.
Fred is a millionaire.
John approached Mary.
John pointed a gun at Mary.
John told Mary he wanted her to get into his car.
John drove Mary to his hotel.
John called Fred.
John told Fred that John had Mary.
John told Fred to give John $250,000 at Trenos restaurant.
Fred gave John the money.
Mary arrived home in a taxi.

Much processing is needed to satisfactorily understand this story, and to understand how John's goal of getting money is achieved. The details of the understanding process are not all relevant here (see Modelling Characters and their Decisions.
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(move (actor (person (name (mary))))
 (to (location (of (house (resident (person (name (mary))))))))
 (instrument (car (owner (yellowcab))))

Figure 1: Conceptual Representation of KIDNAP story.

[DeJong84] for a more complete description), but some of them will become apparent when the modelling of the characters' goals, beliefs and decisions is described.

4. Character Models

4.1. Goals

Every character in the story has certain goals and beliefs, which evolve as the story progresses. Some of these are explicitly stated in the story. For example, we could be told that John wanted to buy a new car. Some goals are known beforehand to be typical of most people. An example of this is the goal of getting money. When the system realizes that John is trying to get Fred to give him money, it ties in the sequence of events related to this with what it already knows as part of its "generic" knowledge about people. Other examples include life-theme goals [Schank77].

Most goals, however, need to be inferred, and this process may be quite complicated. In the kidnap story, when Fred finds out that Mary is in danger, the system infers that he has the goal of saving her, since it has been told that he is her father, and it knows that parents care for their children. This is crucial in understanding why Fred gave John the money he demanded. Some goals can be inferred directly from certain actions. For example, John tells Mary that he wants her to get into his car, which tells the system that his goal is to have Mary believe that he wants her in his car. In general, goals may occur to satisfy the character's own desires or needs, or they may occur on behalf of another character, as in the example with Fred wanting to save Mary.
4.2. Character Models

These goals are represented in *character models*. Every character in the story has a character model associated with him or her. When characters are first encountered in the story, they are given default character models, consisting of life-theme goals like satisfying hunger. Another universal goal which people typically have is acquiring money. The character models evolve as more goals are stated in or inferred from the story. These goals provide the explanations for the various actions that the characters perform. When goals are satisfied, they are not used to explain further inputs. However, they remain part of the character models, serving as a trace of the evolution of the goal structures, and are an important constituent of the final model.

Character models also include decisions considered and taken by the characters. These arise, for example, due to interactions among the goals of a character, and between characters, and are considered next.

4.3. Decisions and Compliances

There are several decisions to be understood in the above story before all the events can be connected together coherently. These are not explicit in the story, but instead must be inferred from the given inputs and the system’s background knowledge about the world. For example, when John tells Mary to get into his car, Mary must decide whether or not to comply with this request. Such a decision is called a *compliance*, in which one character must decide whether or not to (volitionally) perform a certain action for another character’s sake. Another compliance in this story involves Fred, who must decide whether or not to give $250,000 to John.

As mentioned above, compliances also form a part of character models. A compliance is represented as a *compliance-box*, which is a schema with three main roles: the actor, the benefitter\(^1\), and the action. In the second compliance above, for example, Fred is the actor, who is considering the action “give $250,000 to John”, and John is the benefitter of the action.

\(^1\)To avoid the legal connotations of the word *beneficiary*, we use *benefitter* to denote the character who directly *benefits* from the action. A character benefits from an action which satisfies one or more of his or her goals. Alternatively, an action can benefit a character by satisfying enablement preconditions for another action of which the benefitted character is the volitional actor.

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In general, characters get involved in decisions between two or more alternative courses of action. Some decisions arise out of conflict between the goals of a single person, often due to scarce resources. Decisions could also arise out of interactions between the goals of two or more people. A compliance is such a decision.

Decisions tie in with the rest of the story in two main ways. The understander uses them to explain actions, so that the action where Fred gives $250,000 to John is explained as being the (positive) outcome of the compliance-box already built. To satisfactorily explain the input, the understander must also support the decision itself. This involves explaining (a) why the decision arose in the first place for the character, and how the understander realized that there was a decision involved, and (b) why it had the outcome that it did. In this example, the compliance gets built because John tells Fred that he wants Fred to give him $250,000, which causes the system to anticipate a decision on Fred’s part as to whether or not to give John the money. Why he chooses to give the money is explained by the fact that he cares for Mary (since he is her father), and he believes that Mary will be safely released if he gives John the money.

4.4. A Detailed Example

Consider again the following sequence of events from the kidnap story.

John pointed a gun at Mary.
John told Mary to get into his car.
John drove Mary to his hotel.

It is instructive to trace through the understanding process that the system goes through when presented with this input. When the characters John and Mary are first encountered, they are provided with default initial character models, which consist of life-theme goals like satisfying hunger, and other common goals like acquiring money.

Now the input “John pointed a gun at Mary” is encountered (see Figure 2). The understander recognizes this as an action, and tries to link it up with what it knows already. First the preconditions of the action are reconciled, for example, that John possess the gun he pointed. This involves inferring the preconditions (since we do know that the action occurred), and trying to link them up with what the

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system already knows. The preconditions are basically enablement conditions for the action. However, these only tell us that the action could have occurred, not why it did. We must also account for the action in terms of the goal structure in the volitional actor's character model. For this input, no such accounting can be done as yet, since there is no indication thus far as to why John would want to point a gun at Mary, even if he could. The gun pointing episode is also used to prime schemas for higher-level actions it could be part of, like shoot and threaten. This corresponds to a bottom-up expectation that John may actually be about to shoot (or threaten) Mary.

The next input is "John told Mary to get into his car". The precondition for this is that John have previously established a communication path between himself and Mary, which is assumed to be an effect of the previously encountered "John approached Mary". This line of the story also confirms the (already
primed) threaten schema, since we know now that John is indeed threatening Mary. This schema is *instantiated* and added to the story model being built. The system now believes that John is threatening Mary, and can construct causal and temporal dependencies between the sub-actions of this schema, as well as between this schema and the rest of the model. Since Mary knows that she is being threatened, instantiation of the schema also has the effect of adding some goals to Mary's character model. In particular, she now has the following goals: one, the goal of getting away from John, and two, while she is still in John's control, the goal of doing what John says so as to avoid harm to herself.

**Figure 3: Building a Compliance Box**

(Mary's decision regarding whether or not to move into John's car for John's sake)

(Representational details omitted; see Figure 2.)
This input also invokes another interesting mechanism. Since Mary knows that John wants her to get into his car (having just been told that), the understander expects Mary to make a decision as to whether or not to comply with this request. To model this, a compliance-box is added to Mary’s character model, which represents the decision of whether or not to get into John’s car for John’s benefit. We also know that if she does indeed comply with the request, she will have done so because she is being threatened, and so the understander adds the appropriate support links from the compliance-box to the threaten schema, and to the goal, recently established, that Mary has of doing what John tells her to. Some of the story model structure is shown in Figure 3.

Now the input “John drove Mary to his hotel” is encountered. One of the preconditions of this is that John be in the car. To achieve this, he must have moved into the car. Since John is the volitional actor of the drive, and we expect him to enable other actions he might wish to perform, this poses no problem. We still do not know why he would want to drive Mary to his hotel, but given that, we can explain his subsidiary actions. Another precondition, and one that is more difficult to resolve, is that Mary be in John’s car. To achieve that, she must have moved into the car. But we must explain why Mary did such a thing, for since she is satisfying a precondition for one of John’s actions, John (and not she) is clearly the direct benefitter of her action. This is the kind of action which is explained by a compliance decision. In this example, we already have a compliance set up for Mary getting into John’s car. The understander traces back from “John drove Mary to his hotel” to “Mary is in John’s car”, and from there to “Mary got into John’s car”. This is explained by the compliance-box, which is now known to have a positive outcome. The reason for this, of course, is that Mary is being threatened by John, and hence feels she is in danger.

4.5. Compliances Revisited

We have seen how compliances are used to model people’s decisions about actions that benefit other people. The outcome of a compliance decision could be either positive or negative, representing the decisions to comply with or not to comply with the other character’s goal, respectively. The outcome of the compliance in the above example was explained by the fact that Mary was threatened by John. In general, there are several ways in which the outcome of a compliance may be explained. Threat is one of

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them. Another way to have a character comply is through persuasion, or through bargaining. Alternatively, a character may do something for another character out of friendship or courtesy. In the kidnap story, Fred helps Mary achieve her goal of escaping from John since he cares for her (being her father). Fred complies with John's goal when he gives him the money for another reason; in this case, the compliance is due to the bargain which is set up between the two.

As mentioned previously, the understanding system must support the compliance satisfactorily. It must explain why the compliance arose for the character, and how it realized that there was a compliance involved. It must also explain the outcome of the compliance. This involves understanding the action, the characters and their goals, and the relationships between the characters.

5. Conclusion

We have presented a theory of character modelling including decision making in the context of natural language story understanding. This is intended to augment the theory of events, actions, goals and plans that a story understander would implement, and to provide an insight into situations where a theory of goals alone would be inadequate. Such situations arise frequently in real world stories. We outlined an example to illustrate the processes involved in an implementation of our ideas. The example has actually been implemented as part of the story processor for the Explanatory Schema Acquisition system described in [DeJong84].

We have been working with compliance decisions, but the theory itself is not limited to these alone. We plan to extend it to cover general decisions. Further work needs to be done on modelling character relationships, interactions and affects [Dyer82a, Dyer82b, Lehnert81], and goal interactions [Wilensky83], upon which any theory of decisions must depend for providing the explanation structures underlying the decisions.

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