

# Influential Words: Natural Language in Interactive Storytelling

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## Abstract

In this paper, we introduce the use of Natural Language as a paradigm for influence of plans that are used to drive the behaviour of characters in Interactive Storytelling. We briefly introduce our character-centered approach to Interactive Story system is briefly introduced, and the knowledge representation of stories. Using an example based upon a fully implement first prototype, we discuss how the user is able to interfere with a story by issuing advice to the characters, and how the recognized speech acts are mapped onto their plans.

## 1 Introduction

In this paper, we discuss issues pertaining to the use of Natural Language Processing (NLP) as a paradigm for interaction in Interactive Storytelling. Interactive Storytelling is an increasingly popular area of research, and can be thought of as the convergence of new technologies (Virtual Reality and Computer Games) with traditional storytelling [Cavazza, 2000]. Several paradigms of Interactive Storytelling have been proposed, each with differing perspectives [Mateas, 1997][Szilas, 1999] [Young, 1999].

Our character-centred approach essentially follows proposals by Young [1999], where story is generated from the interaction between different plans. The user is afforded anytime interaction at a physical level, for example taking of objects important to the story, and more interestingly, the user can also make utterances based upon their present understanding of the story. Utterances are processed in real-time and are then intended to influence the development of the story; this can of course be towards both positive and negative conclusions. The example story used throughout the paper is loosely based upon the sit-com television show “Friends”, where the premise of the baseline story is that the lead male character (“Ross”) is attempting to ask the lead female character (“Rachel”) out on a date.

With natural language, you can imagine the possibility of watching a movie and issuing advice to characters – and then observe the advice actually affecting the outcome. Whilst these are the long-term objectives, we are at present we are working with a fully implemented, single-user prototype. There are both practical and theoretical implications that have yet to be considered regarding a multi-user system, for instance how to resolve contradictory advice to the same actor. However, our prototype allows us to explore the possibilities of using natural language in interactive storytelling. Whilst we make no claim of inventing a new approach to NLP, we present results of its use as a natural modality of interaction to Interactive Storytelling.

In the next section we briefly introduce the current Interactive Storytelling system (more specifically the knowledge representation aspects), which is used as the platform for testing the natural language system.

## 2 Interactive Storytelling system

We have developed a character-centred approach to Interactive Storytelling. At its core is a planning system that is used to drive the behaviour of autonomous characters. Stories are generated from the interaction between the characters plans, and any particular story instantiation can be considered as the ‘cross-product’ of these plans, and through encounters with the user. There are other random (non-user) determinants of variability for story generation, such as the random spatial displacement of the actors (and objects), and the resultant temporal effects on action execution.

### 2.1 Knowledge representation for Interactive Storytelling

Our system uses Hierarchical Task Networks (HTNs) [Erol, 1995], which are suitable because of the knowledge intensive nature of our approach to Interactive Storytelling [Cavazza, 2002]. An HTN describes the behaviours of each character in the story. The lead character’s containing the base-line story, whilst the supporting character’s HTNs have them behave in a manner appropriate to the base-line story. Figure 1 is a typical HTN.

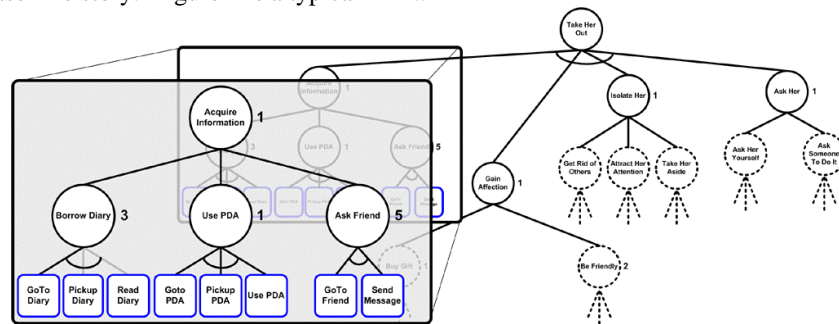


Figure 1. A typical HTN

In Figure 1 the various stages of the story are represented in the first layer of nodes immediately following the goal, these are: acquiring information, finding an appropriate gift, isolating her, and finally asking her out. There are generally several decompositions to facilitate each sub-goal, which contribute to the story variance. It is important that the system support re-planning and interleaving of planning and execution [Young, 1999] for when terminal actions and as a consequence sub-goals fail as a result of actor-actor or actor-user interactions (discussed in greater depth in the next section). As such it is undesirable to compute an entire plan, instead we require local re-planning, to find an alternative solution to the current sub-goal (if possible).

### 2.2 Implementation

We have used the Unreal engine<sup>1</sup> as a visualisation and development tool for the Interactive Storytelling system. It provides a scripting language (UnrealScript), which is used for the

<sup>1</sup> Epic Games, USA

execution of the low-level actions that are provided by the planner. The Speech Processing sub-system itself is an external application that communicates with the engine via UDP.

### 3 Interaction in Interactive Storytelling

As the story is dramatised by the characters carrying out their various low-level actions, the user can identify situations that have narrative importance – this is assisted by the use of a text-to-speech system (albeit sounding somewhat robotic). This information is likely and intended to influence the users behaviour, resulting in them interacting with the story<sup>2</sup>.

#### 3.1 Physical interaction

Physical interaction in Interactive Storytelling generally is limited to picking up and dropping resources. The impact on the story would rely upon the characters plans and their dependence on the resources existence. For instance, consider “Ross” that is walking towards a flower bouquet. The user can then infer that it has some narrative significance, and take it making it unavailable to “Ross”, whose sub-goal will fail invoking re-planning.

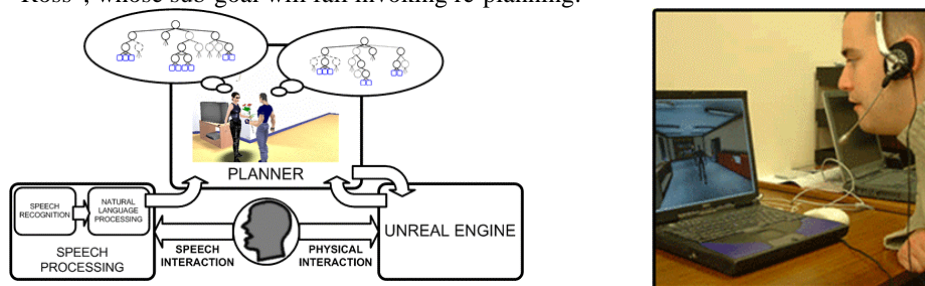


Figure 2. User participation in the development of the story

#### 3.2 Natural Language interaction

However, it is more interesting to consider how the user may interfere with the story by using natural language to affect a characters’ plan at a higher level. As previously noted, we envisage future entertainment systems where the user(s) may actively participate in the story development (Figure 2). To make these systems more believable to the user, more natural forms of interaction to enhance their “suspension of disbelief”. Natural language for Human Computer Interaction (HCI) is widely researched and developed; here we consider how it can be applied to influence and assistance (or contrast) the development of a story. The user is considered as an “active spectator”, however we do not wish to consider the use of language as an alternative to a conventional input device of character control (e.g. ordering an actor to move to a specific spot with the mouse), as this contradicts our notion of influence.

The system has two layers: A Speech Recognition layer and the Natural Language Processing layer. The Speech Recognition layer has been developed using an off-the-shelf package (EAR SDK<sup>3</sup>), which provides tools for developing the surface forms of the recognised sub-language and a C/C++ API to use it. As well as providing utterances for each potential narrative situation, we

<sup>2</sup> Of course the user could decide to do nothing!

<sup>3</sup> BabelTech, Belgium.

must provide suitable quantity of semantically equivalent utterances to allow the user to speak relatively freely, without needing to learn a strict sub-language – otherwise this could impede their belief of the system. The NLP layer attempts to map the output from the Speech Recognition layer and carries out the actual speech act recognition. In effect, it computes the influence on the characters plan. This is performed in a two-phase template processing system. The first phase attempts to identify the surface form of advice, this includes any selectional constraints on specific slots. Once a match is identified, the second phase will take the semantic information and instantiate a possible speech act. The effect of the speech act would be used to update nodes in the plan that matches its pre-conditions.

The system must also recognise the context in which the utterance is presented, and interpret it accordingly. As observed by Blaylock [2001], “Different planning contexts will result in different interpretations of the same utterance”. For example, consider the utterance “Ross, Rachel is in her room”, the interpretation is dependant on the stage at which “Ross” plan has reached. If he is acquiring information by attempting to read “Rachels” diary (which is in her bedroom), then “Ross” should find an alternative solution to acquiring this information. On the other hand, if “Ross” is about to ask her out, then this information can be used to inform him of her location.

#### 4 Advice: Doctrines, Information Provision, and Warnings

We have identified three types of advisory utterance as viable forms of influence in Interactive Storytelling. Doctrine utterances will have a global impact on plan development (of a specified actor), and can be used to avoid certain situations from ever arising, such as the meeting of two actors. Information Provision will allow the user to solve an actors’ sub-goal, for instance indicating to “Ross” that “Phoebe” can provide the details of “Rachel’s” gift preference. Warnings can be used to inform “Ross” that a situation may arise that could jeopardise his plan. Consider that “Ross” is reading “Rachel’s” diary, yet “Rachel” or another character friendly to her is approaching. The user could warn “Ross” of this situation, which would cause a short-term intermediate situated plan to trigger such as making a drink or watching the television. We generally consider these events as situated reasoning [Geib, 1993]. It is also feasible and desirable that the user can accidental or deliberately make incorrect utterances. The result of which would have variable impact on the story, and have potentially disastrous outcomes for “Ross” plan. For example, lying about “Rachel’s” gift preferences.

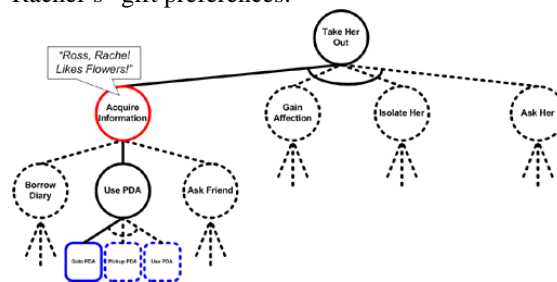


Figure 3. Solving a sub-goal by providing the information.

#### 5 Results

Following on from the previously introduced base-line story, Figure 5 is an actual story instantiation. “Ross” is going towards the “Rachels” PDA, however the user knows that she is using it, and tells “Ross”. This causes the closest sub-goal to fail, as it’s pre-condition is that the

PDA is free and that there are no other characters around. This triggers re-planning, and speaking to “Phoebe” is computed as an alternative strategy for acquiring information.

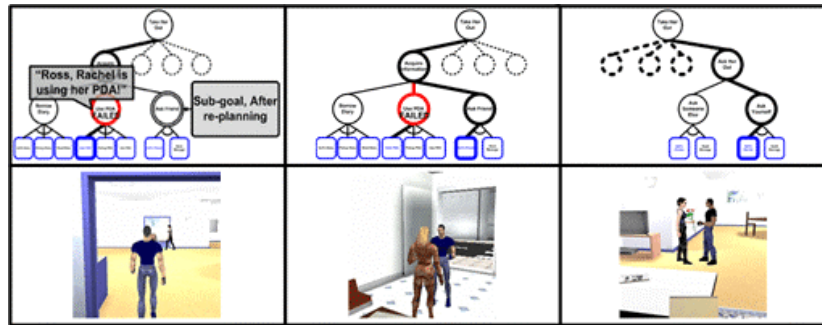


Figure 5. Providing advice to influence a character's plan

## 6 Conclusions

We have introduced a paradigm for user interaction to influence a story's development in Interactive Storytelling. As interactive entertainment (including Interactive Storytelling) develops, more natural modalities for Human Computer Interaction will be needed, to allow the users to express themselves more naturally. We have presented a first prototype to test the use of natural language that allows a single user to interact with and affect a story. However, we do not use natural language in a traditional dialogue-based context, but rather as a form of influence over the higher-level planning activities of an artificial actor – where speech acts can be used to explicitly modify their plans.

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