

IDtension: a narrative engine for Interactive Drama

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1 Introduction

1.1 Objective

For several years, digital writers have wished to create new forms of narrative, where the audience plays an active part in the course of the story events. The two main forms of such interactive narrative are hypertexts and video games. This research is focused on Interactive *Drama*, where characters' actions are directly seen by the audience, even if Interactive Narrative is concerned in general.

It appears that nobody really managed to produce such an interactive narrative experience: interactive narrative exists but either it does not apply to the story itself or it is limited to a graph of possibilities predetermined by an author [1], [2], [3]. For example, hypertext based fictions become deconstructed when the interactivity goes beyond a certain level. Adventure video games, which give a full control of a character to the player through the story world, are loosely interactive at the story level: interactivity can be observed mainly *between* narrative events (in fights, explorations, puzzles).

These failures have led to two attitudes:

- Claims that interactive narrative or drama is impossible [4], [5]
- Scientific research for solutions to interactive drama [6], [7], [8], [9], [10], [11], [12], [13].

Our work is situated within the latter attitude.

Among the “claims of impossibility”, some are at a technical level. The goal of this paper is to exhibit a computer system, called IDtension, that demonstrates the possibility of combining narrativity and interactivity.

Other claims are conceptual: Interactive narrative would be fundamentally impossible. There is an open debate on this topic. Although this is not the focus of this paper, we shall give here a quick overview of our position on this debate, which will be developed in an upcoming publication.

A linear narrative, although unidirectional, is a kind of dialog [14]. The author, in his writing process, constructs an “ideal reader”, with whom he imagines the interaction. As stated by Umberto Eco, “a text needs someone to help him working” (our translation) [15]. Interactive narrative is an extension of the linear narrative, where the dialogical nature of the narrative takes a concrete form: the audience can indeed dialog with the narrative, through the choice of some actions of characters.

It is important to note as explained in [16] that this action does not require any artistic skill: any user is able to act and dialog. So, in the system we are designing, interactive narrative is not about transferring artistic or narrative skill from the author to the user. Note that in other systems for Interactive Drama, the user is a co-author [17], [18].

In the following, we will first expose the methodology and the approach that guide this research. Then, the theoretical and computer models are described, in relation with existing narrative theories.

Finally, some experimental results of highly interactive drama are provided.

1.2 About Narrative Theories

Any attempt to build a system for interactive story telling is guided by a set of theories about what a narrative is. These theories can yield a computer model of narrative.

It is tempting in our current description to start from the theories, and show how these theories are used in the computer model, in order to justify specific algorithmic choices. However, this would be an illusion of justification. There are plenty of different theories of narrative, and researchers in digital story telling are in fact choosing the more convenient theories for their application. Furthermore, most theories of narrative are not scientifically established, so the truth of one theory against another one is controversial itself.

Thus, our methodology is different. It consists in considering that the choice of a narrative theory rather than another is rather arbitrary, and highly motivated by practical constraints. Thus, we explicitly design our own theory of narrative and drama, both influenced by existing theories and the specific needs of a computer simulation. This theoretical model serves as an intermediate level between existing theory and practical implementation. Whether this theory is interesting as itself is an interesting question, but out of scope of this paper, because this study is focused on the design of new technologies and media.

1.3 The General Approach: Simulating the Narrative Laws

Several approaches have been used to design interactive drama.

The first approach is “character based”. It consists in building rich characters and let them evolve in the virtual world. We have argued in a previous paper [19] that a pure character based approach can not produce a narrative. Several narrative theories illustrate this point. For example, Genette shows that the occurrence of a certain action in a story is not necessarily what would be most probable, from a realistic point of view [20]. A variant of this approach consists in considering not characters but actors [12], [21]. The system of Chris Crawford [10], despite of its different approach, is rather close to the actor based approach. As actors, the characters are endowed with a role and narrative oriented behaviors. However, this is not enough to capture narrativity, because some effects like suspense or conflict need a more global view on narrative (imagining some future actions, anticipating reactions, inventing actions from out stage characters finding the ending of the story, etc.). It could be argued that real improvisational actors do manage to catch these features, and some research on interactive drama make explicit reference to such improvisational actors. However, the human ability to improvise requires quite a few years of learning, and the computer models of actors do not reproduce the improvisational strategies that make improvisational theatre possible.

A second approach consists in structuring the drama in macro-elements, usually scenes. These scenes can be described at an abstract level, for example “the hero meets the villain”, in order to be instantiated during the performance, according to the user’s actions. The order of scenes is either prewritten by the author [13], or established through a graph [11] or dynamically calculated according to rules [8]. The Propp’s model [22] is one of the model used for determining the ordering of scenes [11], [17]. The advantage of this approach lies on authorship: the author can keep a global view of the narrative, while allowing the user to interact. However, the interactivity of the user is limited. The interaction within a scene does not necessary have a great influence on the whole narrative. This scene based approach is also used in “presentational” Interactive Drama [18], [17].

A third approach, on which IDtension is based, consists in focusing on narrative properties rather than on a course of events or actions. For example Nikita Sgouros calculates the successive actions in order to create the conflict in the story [23]. Michael Young focuses on the suspense, in order to shape the actions inside an interactive drama [9]. In [6], [7], a story is described as a set of interrelated objects, each object being a narrative component: Actants (from Greimas model [24]), events, types of relation between an actant and an event (obligation, desire, capability), etc.

We consider that this third approach, in order to be successful, must tend to really simulate the laws of narrative. We know how to simulate the laws of physics in order to create a movement or a deformation; we know how to simulate the laws of optic in order to create the lighting of a 3D virtual scene (ray tracing, radiosity, etc.). Similarly, in the long term, we have to be able to simulate the narrative laws in order to create good interactive narratives. This claim must not be misunderstood: it does not mean that we simulate the artistic creation. Simulating laws of physics does not mean designing a car; similarly, simulating the laws of narrative does not mean designing a story [25]

2 The Theoretical Model of Narrative

The model we introduce here is a model of narrative which combines several findings in narratology. Indeed, we realized that any particular study on narrative was always limited, focusing on one aspect of narrative, neglecting the other. The following theoretical model is the guideline for the computer model, developed in the next session.

We consider that any narrative, and in particular any drama, is composed of three layers. Each layer is necessary to build a narrative.

The first layer is the *discourse* layer. It means that any narrative is a discourse: it aims at conveying a message to its reader/viewer/listener. This pragmatic view of narrative, neglected by structuralism, puts the narrative at the same level as any rhetorical form, even if narrative conveys its message in a very particular manner. As stated in [14], the characters actions serve as a pretext to convey this message.

In particular, the discourse layer conveys a kind of morality. A narrative is not neutral: it conveys the idea that some actions are good, some are not. The good and bad evaluation is relative. It depends on a *system of values*, implicitly used by the author [26]. Note that this system of values can conform to the global cultural values of the audience, or in the contrary can be inverted: the narrative can then be considered as “subversive”, since it conveys an ideology that is contrary to the “culturally correct” morality [26].

As an example, in a fable written by La Fontaine, the morality is usually included in the text itself: “rien ne sert de courir , il faut partir à point” (“Rushing is useless; one has to leave on time”). But in most texts, although not visible, the morality is implicitly present.

If the discourse layer is omitted, the audience is asking: “so what?” [14 p108], and the narrative is a failure.

The second layer is the *story* layer. A narrative is a specific type of discourse, which involves a story. The story is described as a succession of events and character actions, following certain rules. Structuralism has proposed several grammars for the narrative [27], [24], [28]. At the heart of these models is the narrative sequence, initiated by an initial imbalance, and terminated by a final evaluation or sanction [14]. The story itself is a complex combination of several sequences. Note that although Propp’s model [22] seems to be a unique sequence, Bremond demonstrated that even Russian folktales consist in several sequences superimposed [27]. The story level is also described in theories of screenwriting (for example [29], [30]).

Structuralist models are descriptive: they stem from the analysis of particular texts or a set of texts, sometimes following a real experimental approach (see the work of Propp [22] and Souriau). Psychoanalysis however tends to provide some explanation of the structures of the story models [31 p 139]. For example, in [32], the Greimas actant’s model is reinterpreted in psychoanalytic terms (the subject is the Ego, the object the Id and the sender is the Super-ego). However, psychoanalysis does not provide any new rich model of narrative. An exception might be the analysis of narrative in terms of paradox, proposed in [33].

The third layer is the *perception* layer. Indeed, we found that the elaborate models of narrative proposed by structuralism are uncompleted [34]:

- how a single sequence is temporally organised, with regards to the duration of time, beyond the ordering of its elements?
- How the sequences work together?
- Why one sequence follows a certain route versus another?

It seems that the study of how the narrative is perceived during reading/viewing/listening is the answer to these questions. Among perception, a key factor is emotion.

Barthes wrote in [35]: “le récit ne tient que par la distorsion et l’irradiation de ses unités” (“the narrative holds thanks to the distortion and the irradiation of its units”), and then discussed the notion of suspense in terms of an emotion. We have here one example of emotion, but there is not one single emotion in narrative. In particular the books on dramaturgy and screenwriting insist on the fact that the notion of *conflict* is the core of the drama [36], [37], [30], [38]. Conflict typically produces an emotion in the audience.

Generally speaking, the detailed role of emotion is often neglected in narratology. It might be due to a classical view of semiotics which opposes the cognitive and the emotive view of communication, while current research elaborates cognitive models of emotions. According to Noel Carroll: “What is not studied in any fine-grained way is how works engage emotion of the audience” [39, p 215]. Emotions are not a “nice to have” component of narrative, but it is a “condition of comprehension and following the work”. More precisely, according to Noel Carroll, emotions play a central role for focusing the attention of the audience.

Non-emotional perceptive factors also play a role inside the narrative. For example, it is classical in drama to consider that some actions allow to characterize some characters. The choice of such an action is not guided by the story itself but by the fact that the audience must know the characters in order to understand the story.

If the perception layer is omitted, it would give a “syntactically correct” narrative, but audience would neither understand it nor get engaged in it.

3 The Computer Model

From the theoretical model above to a practical implementation, there are dozens of possibilities. In the following model, also partially described in [19], [40], [34], we tried to stick as much as possible to the narrative nature of the interactive experience we want to provide to users.

3.1 Overview

The general architecture (see Fig. 1), can be divided into five modules:

The world of the story: it contains basic entities in the story (characters, goals, tasks, sub-tasks or segments, obstacles), the states of the characters (defined with predicates) and facts concerning the material situation of the world of the story (the fact that a door is closed for example).

The narrative logic: it calculates from the data stored in the world of the story the set of all the possible actions of the characters.

The narrative sequencer: it filters the actions calculated by the narrative logic in order to rank them from the most valuable to the least valuable. For this purpose, the sequencer tries to provide some narrative effects (or fulfill some needs).

The user model: it contains the state of the user at a given moment in the narrative. It provides to the narrative sequencer an estimation of impact of each possible action on the user.

The theatre is responsible for displaying the action(s), and manages the interaction between the computer and the user.

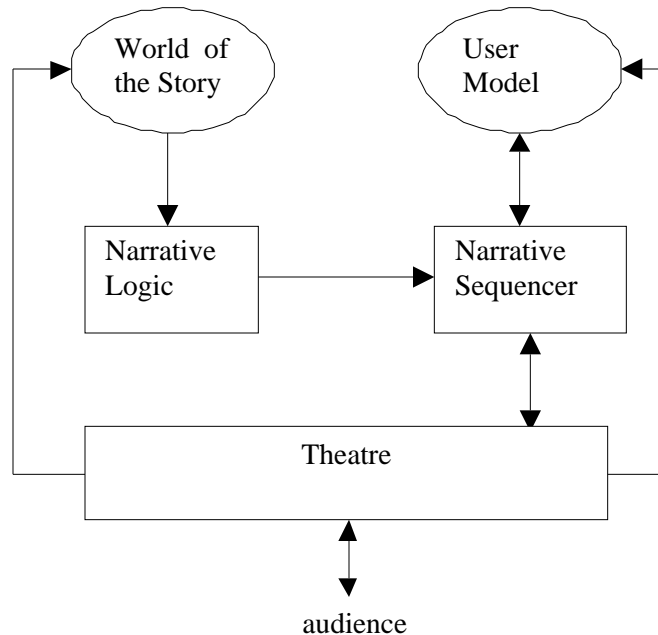


Fig. 1. The general architecture of the system.

Depending on the narrative mode chosen for the narrative sequencer, there are several ways to activate these five modules. Currently, we have two modes:

- automatic generation: the narrative sequencer chooses one action among the best actions, which is sent to the theatre;
- first person: the user is responsible for all of the actions of one character. The user and the computer alternate their action, like in a chess play.

3.2 The Action Calculus

By *action*, we mean a dialog act or a performing act on the virtual world, which has a narrative signification.

The choice of the set of generic actions comes from narratology. These actions constitute the basic units of the narrative sequence.

Current actions are: *decide, inform, incite, dissuade, accept, refuse, perform, condemn and congratulate*. (*decide* concerns the goals, while *accept* concerns the tasks).

These actions contain parameters, which are elements of the world of the story:

- characters, goals, obstacles, tasks, attributes,
- state of characters: WISH CAN, KNOW, WANT, etc. (WISH concerns a goal, while WANT concerns a task)

A set of 35 rules produces the possible actions. For example the following rule describes the possibility of triggering an incentive:

- KNOW(x , HINDER(o , CAN(x , t , p))) means that x knows that the obstacle o hinders him to perform task t (with parameters p).
- KNOW(x , CAUSE(E , o)) means that x knows that condition E causes the higher level of risk of occurrence concerning obstacle o
- KNOW(x , E) means that x knows condition E, which appears to cause an obstacle.

Depending on the existence of this knowledge, several dramatic situations are produced, around one obstacle. The transition from one situation to the other is also quite interesting.

This must be combined with the risk of the obstacle, and the perceived risk, respectively stored in *HINDER* in the example above.

Each obstacle has two levels of risks, high and low, which correspond to the risk if the condition is verified or not. These risks are numerical values defined by the author. They are used both to speak about the obstacle and to calculate the success or failure of the task (other parameters are involved in this calculation, see below)

Some incentives or dissuasions can modify the perceived risk.

This model is rather rich to express a multitude of obstacles. Its limitations are:

- the causes of obstacles are binary: they are verified or not. Some multi-valued or continuous function might be necessary
- one cannot handle some “generic obstacles”, not related to a task that a character could perform. For example, a sentence like “this road is dangerous”, without any current task involving this road would not be possible.
- the obstacles have no consequence, beyond hindering the performance of the task. This is the most serious drawback, that we are going to solve in the near future.

In the computer model, obstacles are linked to a segment, a segment being the linear decomposition of a task. Fig. 2 represent the obstacles as black diamonds. The consequence of a goal is noted {E} if it adds a fact E, and {-E} if it withdraws it. Thus, in the case depicted in Fig. 2, a new goal can be decided by the character because the withdrawn condition of the second goal is the fact that causes an obstacle.

3.4 The System of Values

The above mechanism of goals, tasks, segments and obstacles remains a pure performative representation of the drama.

In order to implement the discourse layer described in our theoretical model, the computer model handles the notion of value. A value is an author-defined axis according to which the tasks are evaluated. The model focuses on tasks that are negatively evaluated, because this creates immediate conflict: a task allows to reach a goal but violates some values which are important for the character.

Each character is more or less linked to all values in the narrative. Obviously, these links will be different for each character, in order to provide some contrast between characters and exhibit the system of values.

In the future, the narrator will also be positioned into the system of values, and we will be able to implement strategies (especially about success/failure and sanctions) that are guided by this position of the narrator.

3.5 The Narrative Effects

The narrative logic produces some raw “story material”, but not the way to arrange this material. For this arrangement, an author would imagine an audience and how this audience perceives the narrative; he would make a “model of the reader” [15].

The IDtension system follows the same principle, by using a user model. This user model contains the criteria according to which a succession of actions is satisfying or not, from a narrative perspective. We have listed many such criteria on paper, and we have now implemented six of them:

- ethical consistency: The action is consistent with previous actions of the same character, with respect to the system of values.
- motivational consistency: The action is consistent with the goals of the character.
- relevance: The action is relevant according to the actions that have just been performed. This criterion corresponds to one of the Grice’s maxims.
- cognitive load: The action opens or closes narrative processes, depending on the current number of opened processes and the desired number of opened processes (high at the beginning, null at the end). A process is a micro narrative sequence, as defined in [27].
- characterization: The action helps the user to understand characters’ features.
- conflict: The action either exhibits directly some conflict (like for example an incentive that is in conflict with the inciting character’s values), or the action pushes the user towards a conflicting task (for example by blocking a non-conflicting task, if a conflicting task exists)

The satisfaction measure of an action is a combination of the satisfaction of all these criteria. The combination is not linear. For example the ethical consistency must be satisfied in most cases, except when the motivational consistency reaches a certain level, raising a conflict.

The narrative effects implement the perceptive layers of the theoretical model described above. Only one emotion is modeled now (conflict). Other emotions will be added in the future.

4 Experimental Results

4.1 The Scenario

The first scenario developed for the system has been designed without artistic view, in order to test the system. It is a very basic scenario, with only three goals, four tasks, three obstacles.

“One night, the boss of an important firm has been murdered. Mr D., the guard of the factory, asserts that he saw a girl running away in the dark that same night, and that he believes it was Anna B. Anna B. is thrown in jail. Joe, the protagonist, is Anna’s wife. He wants to save Anna, and for that, he wants the guard to withdraw his testimony. Bill, and Sylvie are two of Joe’s friends. Mrs D. is Mr D.’s husband.”

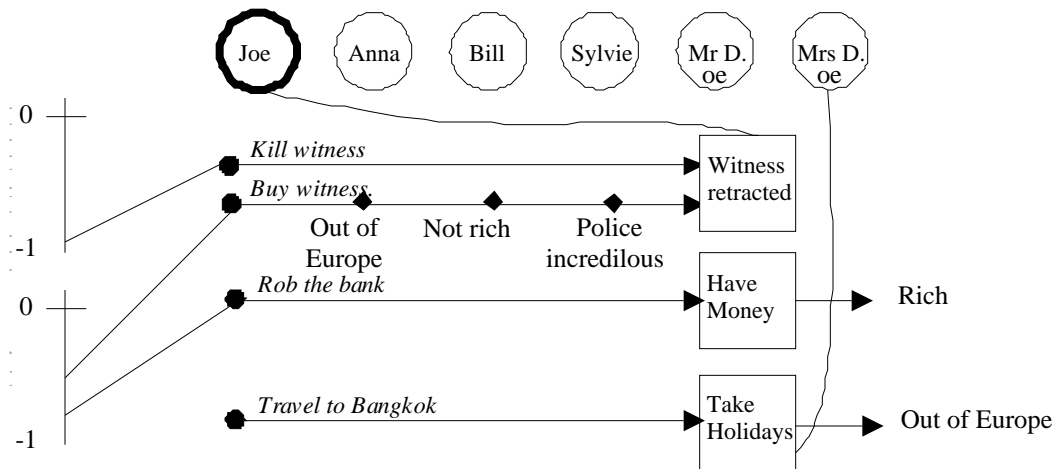


Fig. 3. Graphical representation of a specific elementary scenario. The character controlled by the user is Joe. Attachments of characters to values are not represented, for lisibility (see Table 1).

The story is composed by the elements described in Fig. 3. The two values are “non-violence” and “law”. The four characters involved in the main goal “save Anna” are attached to those values differently (see table 1).

Table 1. Attachements of characters to values. Note that Mr and Mrs D. are not attached to the values, because it was not necessary in the present scenario.

	Joe	Anna	Bill	Sylvie	Mr D.	Mrs D.
Non violence	0.8	0.6	0	0.5	0	0
Law	0	0.2	0	0.9	0	0

4.2 Automatic Generation

One of the tests consists of letting the system “play with itself”. At each time step the system ranks all actions according to their degree of satisfaction of the narrative effects. In order to ensure a variability, the played action is chosen randomly among the top actions (the acceptance threshold within the top actions is a tunable parameter).

Table 2 shows two pieces of story automatically generated by the system, from the scenario described above. We started the piece of story from the moment when Joe wants to have the testimony withdrawn to the moment

when the witness signs a refutation of his testimony. In order to make the piece of story not too long, we have discarded two rules from the narrative logic, concerning information actions.

The two pieces of story shown below are randomly picked: We did not try to improve results by selecting them manually among a larger set of simulations.

The output of the system is a succession of predicates, which we have manually translated in English (the language generation is not the focus of this research).

Table 2. Automatic generation of a piece of story. The two columns correspond to two random intializations.

Piece of story 1	Piece of story 2
Anna tells Joe he could try to buy Mr D., the witness	Anna tells Joe he could try to buy Mr D., the witness
Joe accepts	Joe accepts
Bill tells Joe to kill Mr D.	Bill tells Joe to kill Mr D.
Joe refuses to do that.	Joe refuses to do that.
Joe tells Anna he could kill Mr D.	Joe tells Sylvie he could kill Mr D.
Anna dissuades him to do so!	Sylvie dissuades him to do so!
Joe tells Anna he wants to buy Mr D.	Anna incites Joe to buy Mr D.
Anna incites him to do so	Bill incites Joe to kill Mr D.
Bill incites Joe to kill Mr D.	Joe meets Mr D.
Joe meets Mr D.	He proposes him some money for changing his testimony, but Mr D.
He proposes him some money for changing his testimony, but Mr D.	wants a lot of money, and Joe is not rich enough
wants a lot of money, and Joe is not rich enough	Joe tells Anna he could kill Mr D.
He then decides to get money	Anna dissuades him to do so!
He tells Anna about it	Joe proposes again to Mr D. some money for changing his testimony,
Joe tells Sylvie he could kill Mr D.	but Joe is not rich enough
Sylvie dissuades him to do so!	He then decides to get money
Joe tells her he is trying to get money	He tells Sylvie about it
He tells Bill too about it	He tells Anna about it
Bill inform him that he could rob the bank	He tells Bill about it
Joe accepts.	Bill inform him that he could rob the bank
He tells Anna he wants to rob the bank	Joe accepts.
Anna incites him to do it	He tells Sylvie about his intention
He tells Bill about his intention two	Sylvie dissuades him to do so
Bill incites to do it	Bill incites Joe to rob the bank
He tells Sylvie about his intention	He tells Anna he wants to rob the bank
Sylvie dissuades him to do so	Anna incites him to do it
Joe robs the bank, and he is successful	Joe robs the bank, and he is successful
He pays Mr D.	He pays Mr D.
He obtains the withdrawal of testimony from MR D.	He obtains the withdrawal of testimony from MR D.

For these stories (and for all the others we could observe, based on the same scenario and parameters), the main goal is reached. Thus we managed to recompose the story from the flat non linear description of the story (Fig. 2).

Given the limited number of tasks, the succession and order of performed tasks is about the same between stories. But the variability here lies in the transmission of information and the influences (dissuade, incite).

The knowledge of the possibility to perform a task is stored in some character, which is decided in the design of the scenario. Here, Anna knows that Joe could buy Mr D. and Bill knows that Joe could rob the bank. The same mechanism is used for obstacles. Thus, information circulates differently among characters, allowing a variability in the dramatic situations.

Dissuasions and incentives are performed accordingly to the attachment of characters to values (see Table 1). But interestingly, there are exceptions. For example, when Anna incites Joe to rob the bank while she is normally attached to law. This creates a conflicting situation, which later will be expressed in the way she incites Joe.

4.3 Interactive Story

In this mode, closer to Interactive Drama, the player and the program play in turn. The program, as above, picks an action among the most satisfying actions and (dis)plays it on the screen. Then a list of all possible actions from the characters controlled by the user are proposed to him or her. (S)he then chooses the action to be played. This menu-like interface is not at all the type of interface we envision for Interactive Drama. Its unique role is to test the generative capabilities of the system.

When the program starts, the action “Anna tells Joe he could try to buy Mr D., the witness” is displayed. The user can choose between 6 proposed actions (see Table 3). If (s)he chooses to accept the proposition, he then has 11 different choices (see Table 3). Even with a very small number of tasks, the user has several options. Each of these options are taken into account by the system, and determines future actions or events in the story. For example, if Joe says to Sylvie that he wants to buy Mr D., then she dissuades him to do so (short term

consequence), but if she learns that Joe effectively did it, she could punish him by hinder him in a further task (longer term consequence). It is clear that with five choices at each step, reproducing this interactivity with a pre-scripted scenario would be quickly intractable.

Table 3. Choices offered to the user, in the first two runs of the story. Note that some aberrant choices are proposed, like telling Mr D. or her wife that he wants to change the testimony. The idea is that no option should be blocked to the user, in order to give him or her a freedom based interactive experience.

User's choice for the first turn	User's choice for the second turn
Joe tells Bill he could buy Mr D.	Joe tells Anna he wants to buy Mr D.
Joe tells Sylvie he could buy Mr D.	Joe tells Bill he wants to buy Mr D.
Joe tells Mr D. he wishes to change Mr D.'s testimony	Joe tells Sylvie he wants to buy Mr D.
Joe tells Mrs D. he wishes to change Mr D.'s testimony	Joe tells Mr D. he wants to buy Mr D.
Joe accepts to buy Mr D	Joe tells Mrs D. he wants to buy Mr D.
Joe refuses to buy Mr D.	Joe tells Anna he could kill Mr D.
	Joe tells Sylvie he could kill Mr D.
	Joe tells Mr D. he wishes to change Mr D.'s testimony
	Joe tells Mrs D. he wishes to change Mr D.'s testimony
	Joe accepts to kill Mr D.
	Joe refuses to kill Mr D.

If the user makes choices similar to those performed in the automatic cases (see Table 2), then he manages to reach his goal. But if the user goes straight to his goal, without any consideration for the possibility of eliminating Mr D., then an obstacle occurs, during the third phase (segment) of the task “buy Mr D.”: the police does not believe the change of testimony. Why? Because in that case the user did not go through the conflict that is contained in the task “kill Mr D.”. For each goal a “potential of conflict” is calculated, and this potential must be expressed during the interaction. It does not mean that the user must perform the conflicting task: incentives, dissuasions, refusal are also conflict expression. This is an example of plot control, which is not guided by realism but by narrative constraints. Such a control of success or failure of tasks is also used in [9], with advanced planing mechanisms.

In a slightly different scenario, we get the action “Bill tells Joe that he could lack money for buying Mr D.”. This is a preventive information: Bill wants to help Joe by warning him of a danger, so that Joe could anticipate it. In another situation, Sylvie can also inform about an obstacle (the fact that the police would not believe the change in the testimony), but her motivation is different: she wants to dissuades Joe to perform the task. Indeed, the two obstacles are different: in the first case, one can do something to overcome the obstacle, while in the second, there is nothing to do. Thus the model of obstacle leads to various dramatic situations, which can lead to new developments in the story.

5 Conclusion

The success of an effective combination of interactivity and narrative, at the very level of the story, depends highly on the vision of narrative that is taken. The originality of this research is that we based our system on a procedural view of narrative, in the sense explained in [16]. Narrative is not considered as a succession, more or less deconstructed, of events, but as general non-temporal principles: a discursive approach (through the system of values), a narrative grammar, emotions and perceptive criteria.

Thanks to this approach, we are able to present an interactive experience where the following constraints are respected:

- The user intervenes in the story very often (frequency of interactivity, see [41 p 20])
- The user has many choices (range of interactivity)
- His or her actions have dramatic consequence on the story (significance of interactivity)
- The overall experience is narrative

The first experimental results exposed above give a sketch of such a combination. The simplicity of the scenario and the current limitation of the program reduce the potentiality of our approach to a experience that could almost be simulated with an advanced graph. With the collaboration of scenarist, we are currently implementing a more complex scenario, which would exhibit the full generative power of the IDtension system.

As stated in [41], frequency, range and significance are not sufficient to guarantee an interesting interactive experience: the way the user participates in the story is fundamental too. This is another major axis of development of this research, which is linked both to the scenario specification and the user interface design.

Beside the improvement of the story generation algorithms, which is continuous, a major future development of this research lies in the development of the “theatre” (see Fig. 1). If a real-time three dimensional environment is a natural complement of the current program, other alternatives are possible: pure text, fixed 2D images (interactive comics), or even real actor performance, in a context of participating theatre and/or mixed reality.

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