Structural Models for Interactive Drama

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ABSTRACT

We are designing computer programs for Interactive Drama, where the audience can act to modify the story while the computer responds to these acts and maintains the narrative nature of the experience.

Such computer based Interactive Drama requires narrative models able to both simulate the narrative on a deep level, and allow the user to interact with it.

We discuss in this paper the extent to which structuralist models are useful for this purpose. Then, we describe our own computer model and its structuralist sources. Finally we discuss the limits of Structuralism for our model.

General Terms

Algorithms, Design, Human Factors.

Keywords

Interactive Drama, Interactive Fiction, Interactive Narratives, Structuralism, Narrativity, User Model.

1. INTRODUCTION TO INTERACTIVE DRAMA

The interactive nature of computers opens the way to a new narrative genre where the audience can interact with the narrative. While several forms of such interactive experiences do exist (interactive fiction, video games, etc.), it is admitted that none of the above let the user interact deeply with the story itself.

We will call *Interactive Drama*, a drama on computers where the user is acting as one of the characters (the protagonist), and where his/her actions modify the story itself, while maintaining the narrative aspect of the drama.

Whether Interactive Drama is possible or not is controversial. We will not discuss this issue here. More practically, we are involved in the design and implementation of a software system for Interactive Drama [18][19]. Our system, called IDtension, has been inspired from several structuralist theories. The goal of this paper is to discuss the following:

- How and why Structuralism should be used for Interactive Drama in general?
- What are the choices for the particular IDtension system?
- Why Structuralism is not sufficient for the IDtension system?

Before discussing Structuralism we need to present our vision of Interactive Drama. Each Interactive Drama needs a model of narrative. The challenge of Interactive Drama is to find a model suited to the interactive nature of computers. According to J. Murray[14], computers are procedural, which means that a good computer model of narrative should be an *engine* able to *produce* a narrative. However many models of narrative are descriptive rather than procedural (see for example the three act structure): they describe narrative as a given temporal succession of events. Even if it is possible to follow such temporal models to make Interactive Drama (see for example the project described in [12]), we believe that in the long run Interactive Drama should be based on a real simulation of drama. Thus our goal is to find a procedural model of narrative, and to allow the user to interact with it.

2. CONTRIBUTIONS FROM STRUCTURALISM

We find in Structuralism the response to our quest for a procedural model.

Indeed, structuralists have described anthropological entities like myths or narratives in terms of structure instead of a sequence of events.

For example, Greimas represents the meaning as a reduced network of oppositions and contradictions, which is an abstract description that goes beyond the linearity of narrative [8]. One the other hand, his description of narrative in terms of "actants" remains at a level where structure prevails over time.

The analysis of myths by C. Levi-Strauss [10] follows the same principle of reducing time to structure as stated by D. Andrew: "for Levi-Strauss the world of stories is solely a mechanism of forces and relations" [1].

Such structural and non temporal description of narrative opens the way to a procedural model of narrative simulated on computers.

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According to Levi-Strauss: "L'ordre de succession chronologique se résorbe dans une structure matricielle atemporelle" (The order of chronological sequencing is reduced in a matrix and non temporal structure) (Levi-Strauss 1960, cited in [5]). The role of the computer is to:

- model such an a non temporal structure;
- simulate this structure to unfold the chronological sequence of events.

If we examine closely the structuralist models, two features are of particular interest for Interactive Drama:

First, the structuralists have introduced the very idea of a function: an action defined from the intrigue point of view [15]. Thus Structuralism focuses directly on the meaning of actions, from the story's perspective. Applied to Interactive applications, this provides a clear distinction between realistic virtual environments, which imitate the real world (see Artificial Intelligence based characters in realistic virtual worlds), and Interactive Drama, which aims at conveying meaning through a narrative: "La passion qui peut nous enflammer à la lecture d'un roman n'est pas celle d'une vision […] mais celle du sens." (The passion that evolves at the reading of a novel is not that of a vision, but that of meaning) [3]. Current trends in Interactive Drama confirm this evolution towards a global view of Interactive Drama [13].

Second, structuralist theorists do formalise their approach, modelling transformations in narrative with predicate based logic (see in particular [8][20]). This kind of formalism is suited to a computer simulation even if the transcription from theory to computer programming is not straightforward. This will be discussed in the next sections.

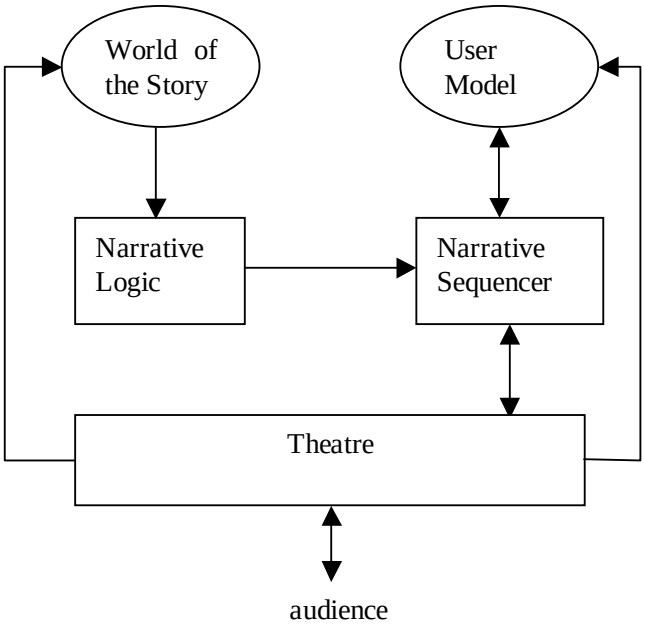


Figure 1. Insert caption to place caption below figure.

3. GENERAL DESCRIPTION OF THE IDtension SYSTEM

The general architecture of The IDtension system is shown on Figure 1.

The "World of the story" contains all information about the current state of the story :

- basic elements contained in the story : characters, goals, tasks, obstacles
- states related to characters: characters's wishes, knowledge, opportunities for action, etc.
- facts concerning the material situation of the world of the story (for example: a door is closed).

The role of the Narrative Logic is to calculate from the data stored in the "Word of the story" the set of all possible actions of the characters at a given time in the narrative.

The Narrative Logic manipulates a set of rules. For example, the following rule applies to a situation where a character is informed that he could perform a certain task:

IF
CAN(X,a)
~KNOW(X,(CAN(X,a))
KNOW(Y,CAN(X,a))
THEN
Inform(Y,X,CAN(X,a))

All these possible actions are then processed by the Narrative Sequencer. This module filters the actions in order to rank them from the most valuable to the least valuable. For this purpose, a series of *needs* has been identified. By "need", we mean a narrative-related emotional or cognitive variable that must be maintained at a certain level in order to make up a good drama.

The narrative sequencer uses a general strategy to satisfy these needs, and uses the User Model.

The role of the User Model is twofold:

- estimate the user's "need" when those needs vary in time
- simulate the impact on the user of each possible action.

The narrative sequencer chooses the action whose the simulated impact best matches the user's "needs", at a given time in the narrative. For example, if a surprising event is calculated to be valuable, then such an action is looked for within the set of all possible actions provided by the Narrative Logic.

We have identified the following needs :

Table 1. Narrative needs in the model

Need	Description
Consistency	The action is consistent with previous actions of the same character
Conflict	The action expresses an internal conflict
Demonstrativeness	The action shows the values of a character
Variability	The action is different from previous one(s)
Surprise	The action is unexpected
Forward going / progression	The action keeps the story moving forward
Suspense	The action promotes suspense.
Spectacle	The action provides a pleasant spectacle to the audience

Such kind of narrative variables are also used in [2]: a complex user model is proposed as a new approach to story generation.

Several of these needs refer to a central concept in our system: the narrative values. Values are thematic axes according to which each task is evaluated: honesty, friendship, family, fraternity, etc. They are stored in the user model. As an example, the conflict arises when performing a task which does not match the character's values is necessary to reach a goal.

The User Model will also be adaptive, in the sense that the character's attachment to values will depend on the user's actions [19].

The theatre is then responsible for displaying the action(s). It also manages the interaction between the computer and the user. At this point, the interface is purely textual, but it will be of graphical nature in the future (typically in Real Time 3D).

Currently, the user interaction is organised as follow:

1. the set of all actions the protagonist can perform are suggested to the user
2. the user chooses the action he or she wants to perform
3. the action is performed on the computer
4. the computer calculates the best next action to be performed by a different character
5. the computer performs the action

This cycle is repeated until the end of the story.

But several variant can be tested within the system. For example, several actions can be played by the machine. Or only a subset of actions could be proposed to the user. We have also implemented a non interactive mode, where the whole story is generated automatically.

4. STRUCTURAL COMPONENTS OF THE IDtension PROJECT

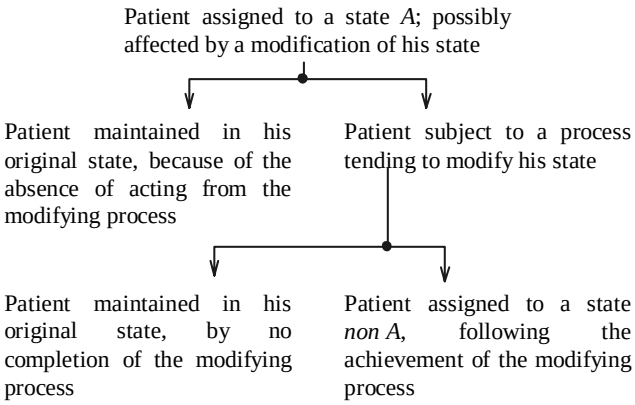
We will detail here one component of the system, the Narrative Logic, because it is where Structuralist theories have been used. A more detailed description can also be found in [18].

We have shown how Structuralism fits Interactive Drama needs. Since there is no unified structural theory of narrative, many options were available in order to apply it to IDtension. We have made some choices but we do not pretend to claim that it is the best or only choice. An interesting alternative, based on Greimas' ideas, is shown in [17].

We were inspired by Claude Bremond's theory of narrative. There are several reasons for this choice:

- In the introduction of his book [5], C. Bremond writes: "est-il possible de décrire le réseau complet des options logiquement offertes à un narrateur, en un point quelconque de son récit, pour continuer l'histoire commencée?" (is it possible to describe the complete network of choices that are logically given to a narrator, at any point of his narrative, to continue the story?). This is exactly this question that arises in Interactive Drama.
- as stated in [4], these "choice points" correspond to the expectations that the audience creates during the narrative. Thus, the "choice points" seem to be the good level of interaction.
- Bremond's logic starts from Propp's model [15] but goes further, allowing rich narrative with several intertwined narrative sequences. In [11], the Propp's model is adapted successfully to the computer, but in the context of "story creation", which is slightly different. Furthermore, their work [11] addresses tales for children, which are exactly the kind of story that inspired Propp's model. For our more general approach, Bremond's model is the natural extension of Propp's model.
- Unlike Greimas semiotics, Bremond's logic provide a detailed description of the multitude of actions which occurs in narrative. It thus seems more directly applicable to computers.

Bremond splits a narrative into a succession of processes that modify some narrative roles. For example:



There are more than 50 of such processes and we took into consideration only a few of them. Bremond's logic constitutes a huge repository of narrative processes which will enable us to enrich the model in the future.

Our logic is also inspired from the "narrative transformations" proposed by T. Todorov. This is a more formal approach where actions are represented as predicates which transform some propositions [20].

As a result, we build a narrative logic that handles the following entities, belonging to the World of the Story :

- Goals: States in the world of the story that characters want to reach
- Tasks: Concrete activities which lead to the goal
- Obstacles: practical elements in the world of the story which hinder some tasks
- Characters: entities which have goals and perform actions

The model makes a clear distinction between goals and tasks, which respectively correspond to the ends and the means in Bremond's logic.

The Narrative Logic produces actions: what characters do, including information transmission, influences, tasks accomplishment (acts) and sanctions.

Actions correspond to Bremond's processes. We currently implemented the following types of actions:

Table 2. Actions in IDtension

Action	**formal form**	**Description**
Informations	Inform(X,Y, PREDICAT)	*X* informs *Y* that … ANY PREDICAT
Influences	Incite(Y,X,a)	*Y* incites *X* to perform *a*
	Dissuade(Y,X,a)	*Y* dissuades *X* to perform *a*
Decisions	Accept(X,a)	*X* accepts to perform *a*
	Be_tempted(X,a)	*X* begins to accept to perform a (then he hesitates to perform *a*)
	Refuse(X,a)	*X* refuses to perform *a*
	Renounce(X,a)	*X* renounces to perform a (then he hesitates to perform *a*)
Acts	Perform(X,a)	*X* performs *a*
Sanctions	Congratulate(Y,X, a)	Y congratulates X for having performed *a*
	Condemn(Y,X,a)	Y condamns X for having performed *a* (because of a value of Y violated by *a*)

Some other actions will be implemented soon. For example, sanctions are currently only verbal (congratulations and condemnations), but there will also be concrete rewards and punishments.

In the current version of IDtension, the Narrative Logic is composed of 24 rules.

This set of rules is a very simplified view of Bremond's transition diagrams. We know that this is not the final set of rules. In the near future, we will explicitly group these actions into a process. Such groups can be compared with the notion of beats used in [13], an action-reaction couple, although beats are used at a lower level.

5. ABOUT NON STRUCTURALIST COMPONENTS OF THE IDtension PROJECT

Beyond the fact that the user model approach is a good answer to the need of an audience oriented approach to narrative [9] and interactive narrative [16], the question we would like to raise is the following: To which extent the user model is a consequence of a limit of Structuralism applied to Interactive Drama?

Obviously, there are limits in particular structuralist models for the purpose of Interactive Drama: they are not unified; they are not perfectly formalised, they are not designed for computers neither for interactivity. But the question is whether there is a fundamental limit of the application of Structuralism to Interactive Drama, whether the user model can or cannot be reduced to a structural description of narrative.

It appears that structuralists themselves acknowledge some limits in their analyses. For example, Bremond explains, in the conclusion of his book, that there is no narrative text that could be reduced to its intrigue [5]. Commenting on the structural analysis of narrative, Barthes writes that a very large number of narrative functions cannot be mastered by narrative analyses, which focus on the large sequences of the narrative [3].

Three interrelated questions remain unanswered:

- how a single sequence is temporally organised, with regards to the duration of time, beyond the ordering of its elements? Barthes describes that the sequence is expanded and distorded, but does not explain how [3].
- How the sequences work together? Some types of combinations are described for example by Bremond ("one next to the other", "enclave") but the global organisation is only described metaphorically in musical terms by Barthes ("le récit est fugé" – "the narrative is like a fugue"), in chemical terms by Bremond ("entre les séquences, un jeu d'affinités et de répulsions s'institue, comparable à celui qui règle en chimie la combinaison des corps simples" – "between the sequences, an interplay of affinities and repulsions takes place, similar to the chemical combination of elements").
- Why one sequence follows a certain route versus another? Bremond describes stories in terms of "choice points", but he does not answer the question of how to choose between one branch or another.

Could such detailed sequencing be described in a structural way? There exist rules in music which describe some inter-sequence relations, called the rules of harmony. However equivalent narrative rules would be different. Contrary to music, one cannot assert a priori that two elements of two narrative sequence fit together. It all depends on the temporal context, thus on the whole narrative.

What dictates this inter-sequence temporal organisation is something that is not part of structural analysis and could not be: the emotional dimension.

The emotional dimension must be simulated dynamically because of its temporal nature, and the equations for this simulation, as for many simulations, cannot be "solved" in order to produce a set of structural rules.

Thus, everything that relates to the pacing of a narrative – and we know that filmmakers do work on that dimension- is not in the scope of structural analysis. Neither is it possible to describe how several plots should intersect in structural terms.

For example, structuralist theories do not take into consideration the fact that at a certain point in the narrative, the introduction of a surprising event is valuable. A structural model of surprise is not feasible.

The thesis of Noël Carroll on fiction perception confirms the central role of emotion in the narrative. According to Carroll, the role of Emotion is to focus the audience's attention on important features of the fiction: "Emotions are a central device that authors have for managing the attention of readers, listeners and viewers. […] our emotions keep us locked on the text on a moment-to-moment basis" ([6] p. 235).

Thus, the structural analysis gives us tools for writing stories in terms of structural, non temporal elements and provides basic units that must be assembled to constitute a narrative. But the precise way these units should unfold in time is treated as a separate issue.

That is why our Interactive Drama architecture is composed of both a structural part (World of the Story and Narrative Logic) and a user centred part (Narrative Sequencer and User Model).

6. CURRENT AND FUTURE DEVELOPMENTS

We have ran simulations of a first version of the IDtension system. This version allowed us to test the global architecture of the system but results are still insufficient to demonstrate the system, because the stories produced need improvements. That is why we are developing a new version, which will successively include :

- better management of obstacles
- better management of goals and tasks
- better modelling of conflict
- modelling of suspense
- spatial dimension of drama
- integration into a graphical system.

In addition, we are working on the scenario writing process. Indeed, an object oriented language does not prevent a programmer to develop traditional procedural programs. Similarly, providing IDtension to writers is not sufficient to guarantee strongly interactive drama. We are thus working on elementary structures made with goals, tasks, obstacles and values which are capable of exhibiting strong interactive experience.

7. CONCLUSION

We are developing a system for achieving the ultimate goal of Interactive Drama: deeply combining interactivity and narrative.

To achieve this goal, we borrowed a lot from the structuralists' analysis of narrative in order to build a procedural model of narrative able to convey the very meaning of the narrative. But the IDtension architecture contains non structuralist elements, enabling it take into account the emotional dimension.

As a result, IDtension is a complex and hybrid system. We believe that true interactive drama cannot be achieved with an single easy mechanism. The work of C. Crawford, involved in

Interactive Drama for several years, supports the above statement: "Any story telling software must be equipped with algorithms with great complexity before it can yield any interesting results" [7].

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