

Effects of Narrative Levels on Comprehension : Theoretical Framework and Methodology

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Abstract. Studying educative interactive narrative, we define the deep level as characterized by a conjunction between the storyworld and comprehension macrostructure ; we define the surface level as characterized by a disjunction between the storyworld and comprehension macrostructure. Both are often used in interactive designed for children. The goal of this contribution is to present work in progress that intend to evaluate educative effects of both levels. First, we will present the whole research and its theoretical bases ; second we will present what it is set up for empirical evaluation.

1 INTRODUCTION

Narration is often used in edutainment products. Sometimes, it seems that it's only for 'packing' (presumed) boring educative content. Narrative is supposed to be attractive despite difficulties linked to the educational content. In other cases, narration results from a scenarisation process of the hypermedia (for example an hypermedia structured around a quest). And there are another cases, when narration and educative content seem be set up together (i.e. due to structural convergences, like for historical contents). All these examples show that there are different uses of narration in educative interactive documents. And it shows also that if narration constitutes a structure for all these documents, narration can imply very different documents and, thus, different comprehension processes for a given reader/user.

For these reasons, distinguishing between all these situations is important. Distinctions must furthermore be used for setting up some reception models focusing on possibilities of different ways of using narration. These models should be useful for researchers in education, but also for designers. If we can prove there are some significant comprehension differences between different ways of using narration in educative narrative, you will not write the same story if you want to focus reader's attention on one aspects more than another one. Results should be valuable as well for 'classic' (linear) narratives as for interactive narratives or narrativised educational games.

We will present in this paper some elements of an undertaken research about educative use of narrative, especially in interactive narrative. Because this research is still a work in progress, this contribution intends focus on theoretical and methodological issues with broader interest. But this aspects will be enlightened by some empirical elements. We will focus on a single assumption but this research counts other dimensions we will not discuss here. This

focused assumption concerns what we called the 'level' of narration use in educative narratives, which is illustrated by previous examples. First there will be a short presentation of research theoretical framework. Then experimental design will be presented and discussed.

2 THEORETICAL BACKGROUND

2.1 General context

The general purpose of our research is to investigate educative effects of narrative use for science popularization. Can we learn something when explained with narratives ? 'Effects of narratives' are defined in terms of cognitive effects : how can subjects use narratives in order to understand parts of the world narratives are talking about ? Indeed, we make some distinction between understanding a story and learning somewhat from a story. Only this last case is called 'comprehension'.

First, we will describe how people understand narrative. Then, in next section, we will see how we can consider narration as an cognitive resource for readers. By this way, we will have at disposal some model describing how storytelling can be used in education.

2.2 Narrative comprehension

Following van Dijk and Kintsch [17], we define discourse comprehension as the constitution (by the receiver) of a mental representation integrating and articulating inputs. Following this theory, readers 'comprehend' a discourse (we generically call 'text') through a double process of construction of a coherent representation of discourse and construction of a model of the situation this discourse is speaking about. This process results from an automated (mental) strategie. Schema theory can be use for describing the integration/organization of picked-from-the-text elements in a coherent mental representation [2], [15], [16].

What about comprehension of narrative ? Narrative comprehension is basically a discourse comprehension operation even if narratives are particular discourses. In narratology —with the *story schema* theory [13], [14]— 'schema' definition remains ambiguous because it can either refers to mental structure or parts of the story (semiotic structure) [3, p.381]. So, we prefer describe these mental structures with the mental models theory [9], [10] (which is not incompatible with the schema theory). According to this model, various cognitive operations result from (non propositional calculation) operations carried out on the basis of running a 'mental model'. This model of the world is far away from the syntactic structure of narrative sentences, even it's based

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on a narrative and is a model of the world narrative is speaking about. Signification cannot be reduced to a purely intra-linguistic operation [10].

If we follow Herman's cognitive narratology [8], [6], narratives suppose a double mechanism of story comprehension and construction of a situation model similar to this postulated by van Dijk and Kintsch, and which can be completed in terms of mental models. Herman considers that comprehension of a narrative passes by the constitution of a 'storyworld' [7], i.e. a mental model of situation defining some elements useful to locate, contextualize and interpret the narration. The storyworld is built from the narrative text when the reader articulates bottom-up and top-down operations in two stages. Level of the microdesign (bottom-up) for the reader consists in establishment of an inventory at the local level while concentrating on 'What's going on?'. The macrodesign (top-down) level refers to integration of these various parameters in a higher level whose result will consist in a mental model of situation.

2.3 Can narratives be used for comprehension ?

Lots of works have shown such comprehension mechanisms. But what it is interesting is that we can use the constitution of a given mental model by the narrative reader, to present the assumption that this mental model—the storyworld—can be used for later cognitive operations based on this model. Herman, following Vygotsky's 'cognitive artifact', considers narrative as a general cognitive tool : "I argue that stories provide crucial representational tools facilitating humans' effort to organize multiple knowledge domains, each with its attendant sets of beliefs and procedures. [...] My hypothesis is that stories provide, to a degree that needs to be determined by future research, *domain-general* tools for thinking" [8, pp.157-159]. This postulate enables studying the knowledge and the comprehension of the world conveyed through narration, or more exactly through the mediation of a storyworld built on the narration.

This not only happens in *educative* narrative, but potentially in all kinds of narrative. But because we want precisely see how narrative can be used as tools for learning, specific inquiry must be set up.

There are no reasons of thinking that this is not true for interactive narrative or even some narrative games (due to narrative structure of most of them based, for example on a quest schema), even if it's possible to formulate opposite assumptions about the effective effects of interactivity and non-linearity².

3 THE 'LEVELS' OF NARRATION

So, readers constitute a mental model of what they have read [7], and this mental model can be used by people for later mental operations (for example : inference). The question now is : when narrative contains specific educative stuff (explanation of a scientific phenomenon, historical precisions, etc.), how is it implemented to the storyworld ? Or : has the specific educative content a different place in reader's storyworld in different narratives ? More concretely, designers will ask how to implement educative content in a narrative so that the narrative will encounter the (correct) planned educative effect.

The concept of storyworld allows to define different ways using narrative in educative interactive documents. We call these ways

'levels' even if there is no normative judgement about it. We define two opposite levels of using narration : a 'surface level' and a 'deep level'. In both cases, new knowledge must be extracted from narrative, but we assume that the way it is done differs from one case to another. Last, these two cases can be viewed as extreme poles of a continuum on which we can place most of educative narrative productions.

The surface level appears when one gives a 'narrative packing' to some educative content in order to transmit educative information to the reader. In this case, the storyworld does not relate to the field of knowledge which one wants to speak about in the narrative, but it refers to the situation of the narrative (characters, actions, etc.). In this case we assume that understanding a narrative is not sufficient to reach comprehension. Readers must integrate specific integrative information in another mental model : the storyworld doesn't help for integration.

The deep level consists in using the narration structure itself to transmit the matter. There is a stronger integration between the field of knowledge and narration ; the storyworld can be used as basis for real appropriation and integration of this knowledge. Readers can base their comprehension of educative content on the storyworld, even if abstraction/extraction work has probably to be done for total integration of new knowledge.

The main consequence of this assumption is that formal aspect of a narrative should directly influence comprehension of educational data integrated to the narrative. Effect depends on reader's focus which depends on used level. Reader's capacity of extracting and integrating new data should be greater with deep level. In surface level case, disjunction between the story itself and educative stuff should cause integration (to a coherent mental model of the explained situation) problem. But that does not mean that first case is *better* than the second one : it depends on the planned/desired effect. We test here comprehension, not memorization, for example.

4 CURRENT EXPERIMENTATIONS

4.1 Research assumption

This framework leads us to the following research assumption : deep level narrative should lead subjects to build to a relatively unified representation. On the contrary a surface level narrative should oblige subjects to work with two levels of representation : one for the story itself, and the other for the educative contents.

This assumption is currently being quasi-experimentally tested with specific educative interactive narrative explaining to children a scientific phenomenon. We speak about 'quasi'-experimentation [4] because it will be performed in schools rather than in real lab conditions.

The dependent variable is thus the coherence of the mental model/representation of the scientific phenomenon. The explicative variable is the level of narrative use (deep/surface). Other variables will be controlled as much as possible. In particular, we will neutralize the 'interactive' or non-linear variable³ : all experimental document will be strictly linear for this quasi-experimentation. Finally, our population sample can be considered as 'equivalent' in terms of scholar skills because we will carry this out in classrooms in the same degree.

² These assumptions about interactivity effects are for example partially developed in [3].

³ This quasi-experimentation is a part of a broader research for which we also test effect of linearity/non-linearity with similar interactive documents. For this specific test, we don't use any non-linear document.

4.2 Methodology

We will compare representations of a scientific phenomenon acquired by two groups of children from a deep level narrative and from a surface level narrative. We will control these results with those of two other experimental conditions : a group who read a non-narrative explanation, and a control group without any explanation about the phenomenon. (This last is set up only to control children skills about the matter.)

The comparison will focus on children ability to synthetically explain the scientific phenomenon explained in interactive document. We indeed postulate that discourses held by subjects contain 'traces' of mental model used by subjects to understand the situation they are speaking about. We need this postulate in order to consider any empirical experimentation about such phenomena. It is consistent with works about language postulating and/or highlighting linguistic traces of the subjacent cognitive activity⁴.

So, our data will consist in written discourse held by subjects as they were answering a research questionnaire after reading the interactive document. This questionnaire contains four questions. One is a recall question (they have to explain what they remember about what's explained in the document). One another is a problem-solving question (subjects have to solve a problem which need a good comprehension of the scientific phenomena). Third is a 'drawing' question (subject have to make a schema of the phenomenon). The last one consist in words explanation ('what's a bacterium?', etc.). These questions should enable us to sketch central dimensions of the subject's mental model (storyworld).

Our indicators are :

- Elements and relations between elements (spatial relations, inclusion, exclusion, superposition, motion...) in pictures ;
- Specific vocabulary used by subjects when describing the scientific phenomenon, especially action verbs, personification, names, etc. ;
- Conjunction or disjunction between answers ;
- Subjects ability to abstract and re-use gathered info (in problem-solving question).

All groups will have the same questionnaire, behalf the control group (condition without any document) where the recall question (that makes no sense) is suppressed.

4.3 Experimental material

We will work with around 100 children of Belgian 5th year elementary school (± 11 years old). They will each read one version of the experimental interactive documents built for the experience. These documents are HTML pages. These documents explain a simple 'scientific' phenomenon : how do tooth decay develop in the mouth? Three versions of the experimental document have been built⁵. They are partially derived from a former study on narration and memorization [5] because it showed they were suitable for 11 years old children.

Two versions of the explanation are defined as 'narrative', following Adam's six criteria. It's indeed difficult to characterize exactly a text as 'narrative' even if everybody know spontaneously

what a narrative is. So we use Adam's criteria [1]. It's not the only way to define a narrative and each criterion could be discussed, but we assume that if each criterion is individually respected, the text can surely be considered as a narrative. For Adam, a narrative is characterized by : (1) a temporal succession of actions, (2) a thematic unity, (3) predicates transformation, (4) a process, (5) narrative causality-consecution in dramatization and (6) a final evaluation [1, pp. 92-110].

Both experimental narratives are written following all six items, but in two different ways. The first one is defined as a 'deep level narrative' : scientific content is narrowly integrated to the story (it's the story of a bacterium who tries to perforate a tooth in the mouth). We consider there is a narrow integration because characters (bacterium), processes (transformation of sugars into acids) and other agents are the same for understanding narrative *and* understanding how does a decay develop. The other one is defined as a 'surface level narrative' where we maximized disjunction between the story (it's the story of a boy who must go to dentist before a match play) and scientific content (how does tooth decay develop). These two versions correspond to modalities of 'level use of narration' variable.

The third (and last) version is defined as a 'non-narrative' condition : that's an explanatory text where we paid attention not to follow Adam's criteria when it make sense. For example there are no characters, no predicates transformation, no dramatization.

All scientific (i.e dentistry related) information has been controlled so that it is strictly equivalent between conditions. Each condition will count around 25 pupils.

4.4 Forthcoming results

Data acquisition is currently under way. Some data were already collected in two schools. The full tests should be performed for april-may 2007.

5 CONCLUSION

The main goal of this research is to enlighten the presumed role of what we called the level of narration use in comprehension of a phenomenon. Even if we conclude with significant results, that will not mean there is a *normative* difference between levels of narration use. We hope this experimentation will provide sufficient data in order to perform additional qualitative and comprehensive interviews with other subjects. The purpose of this forthcoming phase will be enlightening elements required for a better integration of so-acquired knowledge.

If our assumptions about surface and deep level are verified, further works should focus on precise effects of these levels in terms of comprehension in relation with hypermedia elements that enable (or prevent) conscious use of one level or another. In particular, it will be useful to focus on the mechanisms of extraction of scientific information in the two configurations.

Another axis of investigation is the interaction between levels of narrative use and reader's implication, especially in interactive stories and games. We can for example presume that improving reader's 'first person' central experience increase effects of deep level because it's own experience is mobilized in defining a mental model of the matter.

⁴ See for example the cognitive grammar of Langacker [12] or the works about metaphor of Lakoff and Johnson [11]. These authors show (each one on their specific object) how the language contains traces of mental operations and structures on which would be based our knowledge of the world.

⁵ These can be read for a while at following URLs (all documents are in French) : <http://www.comu.ucl.ac.be/reco/grems/batweb/expe/site2/> for deep level narrative ; [.../site4/](http://www.comu.ucl.ac.be/reco/grems/batweb/expe/site4/) for surface level narrative ; and [.../site3/](http://www.comu.ucl.ac.be/reco/grems/batweb/expe/site3/) for non-narrative condition.

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