StoryTelling based learning and knowledge sharing

Jean Caussanel*, Eddie Soulier**

*Faculty of Applied Economy at Aix-Marseille III University

**University of Technology of Troyes (UTT)

jean.caussanel@univ-cezanne.fr, eddie.soulier@utt.fr

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Abstract

The experience presented in this article is based on cognitive psychology studies dealing with the role of expectation failures in story- based learning. Computer Based Human-Learning Environments which can be designed on such an approach of learning appear to be well adapted to behavioural skills learning. Underlying assumption lies on the possibility to use such artefacts in order to partially - but effectively - recreate situations of communication and learning with regard to the transmission of knowledge and skills. In this paper we present an example of such a system dedicated to the improvement of social behaviour of specialized consultants.

1 Introduction

The use of experts narratives managed by a computing environment in a didactic aim is a paradigm of training which has been developed rather recently (Schank, 2002). The aim of this article is to clarify learning mechanisms around the notions of narration and story modelling for Computer Based Human-Learning Environments (CBHLE) design. In these works, such a system is dedicated to enhancement of behaviour skills of consultants. This environment was designed in the frame of a cooperation project with the company Cap Gemini Ernst & Young (CGEY).

2 The notion of story in cognitive psychology

Unlike the technical competences, which can be validated by a competent outside observer or from an external repository, behavioral skills are more complex to model and "simulate" in a purpose of education. However behavioral skills are recognized to be imperative for performance as well as technical know-how. "Realistic models" of competences try to establish nomenclatures of the most common competence in companies. Such sets can gather 30 to 70 elementary skills, according to various professional repositories. "Elitist models" of skills recommend on the contrary the evaluation of a limited number of competences which distinguish superior performers from the others (Boyatzis, 1982), those which make the difference (often less than 10). We situate our works in this second perspective.

Another aspect deals with the ambiguous status of knowledge associated to behavioral competences. Unlike the technical competence, it is difficult to estimate quality of knowledge involved in a contextualized competence (self knowledge, customer orientation, listening, capacities of decision, self management …). We only notice that existing knowledge of agents are used and, more or less, appear to be well adapted to the processing of the current situation. Such a characteristic sends back to paradigms of errors processing (Bachelard, 1938) or misconceptions (Confrey, 1986). Nevertheless, we will rid ourselves of it by considering that the question of efficiency of practical knowledge characterized by a behavioral nature can't be expressed in terms of true or false knowledge, but in terms of surprise or non surprise. Such a notion, we state at the origin of the mechanism of cognitive-maladjustment awareness, and its restoration (Piaget, 1975), is one of the fundamental engines of learning. It was investigated, for example, in terms of dissonance (Festinger, 1957), notion which expresses a state of psychological discomfort. The surprise is one of the sources of discrepancy and a cause of its activation. In the constructivist theories, the conflict is a different concept but which is considered as another possible source of imbalance. In such theories, notion of surprise doesn't intend still either error, or conflict, or any existing referential knowledge, true and

consensual. The state of knowledge of a human agent at a given moment is closer to a consequence of an optimal co-adaptation between subject and an environment in interaction under criteria of equivalence and from effectiveness (Balacheff, 2000). Learning can be viewed as the process which allows such a system to find a balance point after a disturbance. Surprise is a serious disturbance, although it is very common in everyday life. Surprise is also a sort of parser of the cognitive processes. It expresses questioning of current knowledge of an agent and an increasing rebalancing, and consequently the learning which can follow.

Surprise means that expectations and predictions of agent, based on his older knowledge, were thwarted. The knowledge is the opposite of the surprise. "The incapacity" to predict a situation on the basis of our older knowledge often leads us to revise our "knowledge base". We look for an explanation in ourselves or from others in our quest for more precise predictions, because individual tries to control events which can affect him (Bandura, on 1997). Nevertheless, to learn, the subject has to detect and be able to consider its surprise as the testimony of a failure, as an unsatisfied expectation. It is during this second stage that notion of ambiguity (equivocality). The knowledge badly adapted by the consultant confronts him with a situation which he will consider ambiguous rather than erroneous. The notion of equivocality relates to the opportunity of multiple interpretations for a same situation. Failure of its expectation leads the subject to elaborate story, a "case" in a sense given by Artificial Intelligence researchers in Case Based Reasoning (Kolodner, 1993; Pale and Shu, 2004). Speech in interaction (conversation, discussion, dialogue) and the narrative documents (Zarri, 2006) are the main instances of stories location.

Narration is the discursive equivalent of the surprise which set up on a more behavioral than cognitive plan. According to Dessalles (2000), our narrative way of communicating is "shannonian". An event brings information especially as it is unlikely and disruptive. Labov (1997) considers that a story is organized around the event most "tellable" it contains, that is to say, the most surprising with regard to the experience of the narrator or the attendee. Bruner (2002) confirms that to be a story, an unforeseen event has to occur. Otherwise, there is no "story". Story are sensitive to all that can thwart our sense normality. Orr (1996) showed that experts exchange stories of past experiences around a previous failure and its resolution in order to build a diagnosis shared on the current problem.

The use of such human knowledge characteristic - widely based on surprise processing and its track (the narrative communication of failures) - is a promising stream for CBHLE design. When an agent faces a failure with regard to his expectation, it would be useful if he could remind or recall in memory all good stories, at the right time, which would allow him to process with his failure. Sometimes, it is exactly what happens. When it happens in a working situation, this reminder becomes expertise: agents say to themselves: "I had this problem previously, here

is the solution!". But sometimes agents have not enough experiences to be able to recall Stories from which they could learn. To acquire such experiences and convert them into recallable stories, agents have to fail in their work or in a simulated situation. Failure gets agents more responsive to stories.

First task of the designer of a CBHLE consists in collecting the best stories that an organization is capable to produce and promoting failures in a simulation driving learners are avid to hear stories. Our CBHLE, as other systems of case based learning based on failures (Burke and Kass, 1996), prepares learners to manage with situations where events don't occurred according to their initial plan. Later, when learner will face to a problem, we assume that he would be able to remind simulated experience and be aware of "what he does not have to do". Second task of designer is to elaborate a computer simulation of the failures based on the target behavioral competence which are to be acquiring. Principle is the following: a competence to be acquired is related to a scenario simulating a failure in an exemplary story. Every competence was beforehand broken down into elementary skills characterized by a more reduced scope, which match to the deliberate actions described in stories. Then, the work of the designer consists in defining realistic scenarios, associated skills - gathered in a behavioral competence to be acquired, corresponding failures classes and finally experts' narratives which can illustrate the whole mechanism.

3 Storiet acquiring and indexing

Stories are acquired using interviews according to a particular mode of discussion namely "narrative discussion" (Vermersch, 1994) about which we can't provide more details here.

Work of the scenario writer is to split the complex narrative in order to find out simple narratives (that we call Storiet). To identify such storiet, he has to look for events and anomalies which mark out the narrative. Such a method is based on deep analysis depending to the analyst skills and is not related on any linguistic principles.

The experiment deals with a project of Knowledge Management involving a team of 5 consulting people in a big French company of telecom, affected to a two years duration assignment. We carried out interviews of these consulting people, acquired 8 hours of interviews gathering about 480 simple narratives. From analysis of the first 200 narratives, we extracted about 30 Storiets. Such a proportion shows us that any narrative is not a story in the sense of Storiet as we defined it above, that is to say, including an anomaly.

Our model of story, which comes from UIF (Universal Indexation Format), provided by (Schank et al., 1990) specifically for story indexing, will conduct to categorise the storiet according to several indexes (Caussanel and Soulier, 2005).

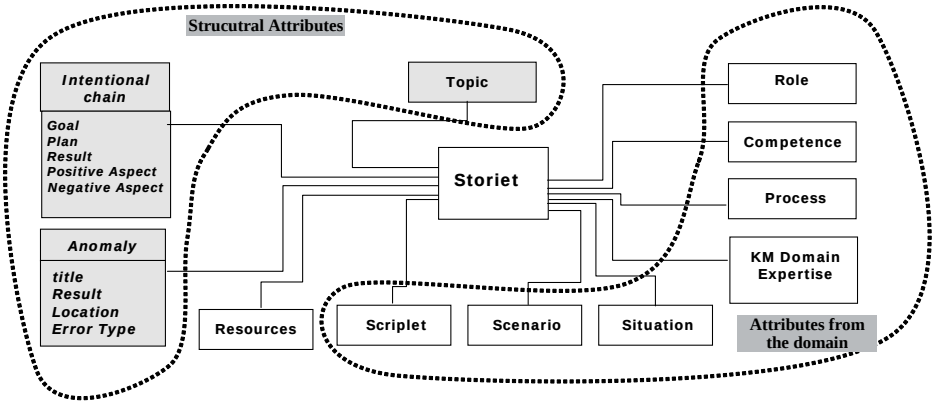

Figure 1. Components and indexes of the Storiet

We currently differentiate two family of indexes: those which are related on agent action and the story and those which are related to the knowledge domain (consulting and advising in this case).

From our perspective we will focus on the first one, that is to say, on the intentional chain, anomaly and topic.

3.1 Intentional Chain and Anomaly

Intentional chain defines objectives of story main protagonist. It includes a goal, a plan designed to reach the goal, a factual result and, eventually, some secondary or collateral negative or positive aspects stemming from this result. Even if event is in the heart of the story it must, for having an effective story, be the cause of an other phenomena symbolised by the notion of «anomaly» (expectative failure). Anomaly represents difference between agent expectations, on a large sense, compared with events which really happened. We propose such a notion of anomaly derived from the notion of "expectation failure" emphasized by (Schank, 1999). It deals with a contradiction on agent anticipation and expectation system about the current situation, his own behavior or again, the behavior of others agents. From a structural point of view (Burke & Kass, 1996) define anomaly as follows: "a character X expected the Y event but finally Z happened".

In any cases, narrator explicitly points out anomaly. Sometimes it's even the object of the narrative but such case is relatively rare. Generally, narrator states events which make emerge a gap between protagonist expectation and facts, but he doesn't explicitly points out the anomaly. When anomaly can be easily detected, the corresponding narrative should be added and indexed in a story base.

Table 1
Abstract of an expectation failure taxonomy

Anomaly Location	Anomaly origin mechanisms	Error Cases
Action	Action processing, heuristic, action regulation, ecc.	Action failure, attention failure, execution monitoring;
Reasoning	Interpretation (understanding), actions planning, problem solving, ecc..	Incomplete rules, wrong reasoning, application of wrong rules, analogical transfer of an inappropriate procedure, ecc.
Goal	Intent generating, sub-goals scheduling, goal oriented control, ecc.	Erroneous goal, sub specification of goals or sub goals, ecc.
Knowledge	New situation, general knowledge, ecc.	Relevant knowledge of the space of problem are incomplete, ecc.
Input	Perception, attention, representation, ecc.	Inattention, error on information acquiring, ecc.

Based on works about errors proposed by Reason (1990) and Rizzo *et al*. (1994) we offer an expectation failure taxonomy (type of error) according to agent mental activities. Such taxonomy should be used to facilitate, more again, the location of anomaly and also for identify its type (table 2).

In our representation of a story, anomaly is characterized by a title, a result, a location of the error (cf. table above) and a type of error depending on its location. Attributes associated with Storiet dealing with intentional chain and anomaly will be exploited later to reuse Storiet as an example in a category of learning scenario presented below. Anomaly is used to drive such a classification. This is the reason why its characterisation is critical. In a first time, three classes of error are used to gather expectation failure enumerated above. Classes are the following:

- Error on knowledge: errors placed on knowledge or reasoning;
- Error on goals: errors placed on goals;
- Error on results: point out certain errors related to results of the action.

Storiet whose anomalies don't belong to one of these categories will not be exploited. These three meta-classes are used as pivot categories in order to integrate stories inside our learning scenarios that we describe below.

4 Error based learning

Our hypothesis relating to story based learning relies on the fact to be faced to a new experience strongly analogous to a previous experience leads someone

to construct intents or "expectations". When such intents fail to be achieved, we recall any other experiences including similar failures and we create starting from these experiences a new set of expectations. Expectations - and more specifically failures in the achievement of expectations - are the foundation of human learning. They are the origin of high level skills, specifically for behavioural skills.

In order to recreate such a context of learning in a CBHLE system, we associated to each of error classes, some instructions leading learning people immersed in a given situation to experiment a failure relating to the achievement of his expectation. By doing so, he will make a mistake which can be identify in the typology previously listed.

Table 2

7 (number 1,2,4,5,7,11,12) among the 13 storytelling scenarios based on error

Scenario	Instructions	Activity of learner	Procedure on WebCTTM
1. Erroneous hypothesis	Formulate an hypothesis on his behavior	The learner formulate a similar hypothesis dealing with him	1. The system proposes a task to be achieved; 2. The learner proposes a resolution; 3. The system asks for clarify the underlying hypothesis; 4. The system proposes a story showing the erroneous character of the hypothesis.
2. Ineffective plan	Select between numerous plans	The learner complete a similar plan	1. The system proposes a task; 2. The learner proposes a plan between several plans; 3. System presents a story where such a plan is ineffective.
4. Alternative Plan	Elaborate a plan (which will be negatively evaluated)	The learner carry out a plan without any success	1. A plan is to be elaborated; 2. Elaborating the plan; 3. Plan Testing; 4. Fail of plan to reach the goal; 5. A story showing an alternative plan.
5. Negative Result	Select an action to achieve	The learner achieve a successful action	1. Presenting a problem; 2. Ask to select an action to solve it; 3. Selecting an action; 4. Success of the action; 5. Story showing a negative result from an identical action.

7. Unexpected success	Estimate the possible effect of his action	The learner predict the result of his action	1. Presenting a problem; 2. Ask to select an action to solve it; 3. Selecting an action; 4. Ask to predict a result of this action; 5. Presenting an unexpected success; 6. Story showing an unexpected success.
11. Non occurred fears	Select a fear concerning an other agent	The learner formulates a fear dealing with an other agent	1. Presenting an action of one agent; 2. Questions on fears prompted by agent; 3. Answer; 4. Story showing fears of one concerning an other agent which had never occurred.
12. Non occurred hypothesis	Formulate an hypothesis concerning an other agent (who will be negatively evaluated	The learner formulates a hypothesis concerning an other agent.	1. Presenting action of one agent; 2. Questions on assumptions about this agent; 3. Answer; 4. Story showing an agent elaborating hypothesis non based on an other agent.

Unlike scholar contexts, where a grounded knowledge could be postulate (Astolfi, 1997), lets us remind that our goal is more on the questioning of expectations than on “errors” properly speaking.

We have currently defined 13 learning scenarios based on 13 types of failures leading to very classical errors in the field of advisement or identify as such in the gathered narratives. Table above presents an abstract of these 13 scenarios. Instructions, in the “instructions” column will be indicated to learner by the environment. Tasks assigned to learner, as mentioned in the third column, will be assigned accordingly to related instructions. Last column gives details about the procedure which leads the learner to make a mistake and we also mentioned types of the story presented in this last column.

Scenarios are implemented in a Learning Management System (LMS) WebCT ©.

Our aim is to simulate this process in a CBHLE system. The main difference between such an approach and some real experiences lies on the fact that the learner doesn’t have at disposal his own experience and, hence, his own history of such expectation failure. The system has to drive the learner to express his expectation, and then, to fail in the achievement of his expectation for proposing him a story, real version of the scenario simulated in the CBHLE.

5 Example of carrying out

Between the thirteen identified potential strategies of storytelling, only ten were really implemented for experimentation purpose. Once identified in the system WebCTTM, the learner access to the three expectation meta-classes listed in our theoretical part. For each of scenarios designed for each type of expectations, a self-assessment is proposed to the learner by the way of multiple choice questions. Of course, some other forms of tests exist and are possible. For reason of readability we only show the most essential part of Web screens content presented to the learner. The example presented here is that implemented for the scenario "Erroneous scenario" dealing with the following expectation: personal effectiveness expectation.

Proposed procedure for the scenario «Erroneous hypothesis» (2nd stage)

Multiple Choices Questions:

1. Which was your assumption to start the mission

- You first listen the needs of your customer before working on this issue
- It is necessary to work its question before meeting customers

The story recommended for the scenario: «Erroneous hypothesis»

If I take stock of the mission, I do not see myself having started two or three things, and then said: "and now… stop!" or "We have to completely change". No! If I had to do it again, I would surely do it similarly. Just, well, at a moment one reproached me not to see people [client]. For me... it seemed to me that… to start, well I always act like that… I am very " state of the art", therefore at the beginning, I tend to want - before going to see the client, immediately - to immerse myself in the mission, and to know… in-house [in the consulting company] what we already made in the field.

And what I know is, at a moment, someone said to me: "But you have to see the client immediately" and I answer "No! I do not see the things like that!". I didn't see myself going to talk to a Webmaster asking him: "so, what are you bringing to me?" whereas I'm consultant, paid for such a mission, to bring him something indeed !".

The learner can also listen to the story, which improves attention of learner and the scope of the lesson. Let us notice that part of the stories was revised and recorded by an actor different from the consultant who tells the story during narrative interview.

Finally, the learner can eventually access to an explanation, elaborated by

the team of consultants, system and approach that we cannot detail here. At the end of a simulated experience of expectation failure, learner is better capable to hear the lesson embedded in the story suggested. He is also able to and to adapt the explanation which will enable him to integrate new information in its memory and, therefore, to progress.

6 Conclusion

Based on results in cognitive psychology relating to the role of expectation failures in learning processes, and contextualized knowledge embedded in experts narratives we conceived and implemented a CBHLE dedicated to learning and training of behavioural skills of beginner consultants faced to contexts where the implementation of adapted social conduits is decisive. Story based learning systems are very promising systems. Nevertheless, story acquiring, analysing and indexing, behavioural skills definition and design of learning scenarios are still relatively heavy tasks in terms of resources needed to complete them. In addition, the mastering of the learning process induced by transfer mechanism from the real story to the learner using the artefact, in the simulated scenario, still remains imperfect and strongly dependent on assumptions that next experiments should allow to finely adjust. Such a result is an immediate perspective of our current works.

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