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Molecular Model for Multimedia Screenwriting

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1. Introduction

From its inception, multimedia's documents have experienced many developments. These changes are often the result of technological advances, but economic pressures have also helped to change the form of documents produced and to change the methods of work to product the documents. In the euphoria of the 1990s many multimedia start-ups were created. The lack of good work practices and of risk assessment has led many of them to bankrupt (Viéville, 2003). This experience resulted in a restrictive streamlining of production. Today, most of multimedia documents are only a hierarchical and indexed form of an information website: the risks of financial excesses are limited by reproducing the same documents structures and by applying specific ergonomic rules. So there is a standardization of documents structures and of methods used to produce them (Cartier, 2003). Despite a specification of methods and tools for multimedia design documents – AUTHOR methodology (Huart, 2000) (see figure 1), web design in terms of effective

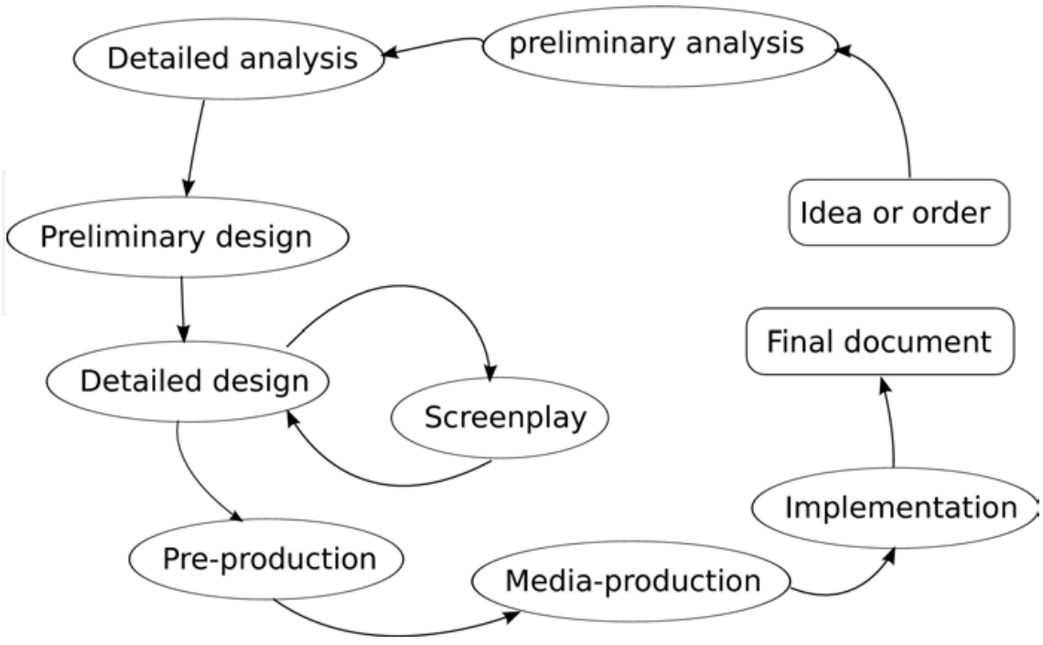

Fig. 1. AUTHOR methodology

communication (Rojas, 2007; Pignier & Drouillat, 2004) or specific tool (Bailey & al., 2001) – the writing process is often overlooked. Most often, creativity is only expressed only through the graphics and user interfaces.

The aim of the present work is to provide a writing formalism for multimedia usable by most authors (literary writer, artists). To quote Yves Jeanneret and Emmanuel Souchier the aim of this model is to define an "Architext" (Jeanneret & Souchier, 2005) writing tool.

Firstly, the functions of a multimedia screenplay will be presented. Secondly, molecular screenwriting, which has been adapted to the representation of multimedia documents, will be described in order to meet the criteria set out in the first part. The terminal goal is to provide a simple tool for textual representation of multimedia documents with autonomous entity able to interact with each other and the user – as an intelligent agent (Genesereth & Nilsson, 1987).

2. Screenwriting

Before describing the screenwriting problems in multimedia design, we will describe some characteristics of multimedia production.

2.1 Multimedia production

The multimedia development requires the production of various documents. These will be incorporated into the final document with functions for interaction between the document and the user.

For large documents, many specialists are involved in their implementation. Thus, the production of a multimedia document requires some flawless organization and planning. Indeed, the slightest malfunction involves problematic costs. So, it is necessary, before starting the production, to have the equivalent of high-performance "plan" for architects. From these we have to imagine what will be the document before completion. Television and motion picture production, for this point of view, are close to the multimedia (except the aspect of interactivity's development). The script is a centerpiece of the "plan". However, if the organization design and implementation models of the Audiovisual are partly adaptable to multimedia, the interactive specificities of multimedia and of associated supports are beyond the motion-pictures models capacities: shooting scripts and storyboards are too linear.

2.2 Screenwriting for which document

Today, there are several kinds of multimedia designers. The "lonely" designers and those who work in teams. The former tend to avoid the script writing and the latter must write a screenplay as revealed by Nicolas Viéville (Viéville, 2003).The script is based primarily on the graphic environment and on the model of interactivity, as the features to reach the different parts of the document – usually the definition of menus and buttons (Fournier, 2003).

However, the script models are ossified by the hyperlinks and documents are static (except in the virtual world of the games). Jean-Pierre Balpe already wrote on this fact in the 1990s about CD-ROMs (Balpe 1997). Today, despite the development of broadband networks and

computer performance, link structure can be found in most websites. The capacity for self development of the document is thin.

So, the multimedia script, as a product of multimedia design (whether web design, game design or other types of documents) is similar to the description of a puppet wire show. Each wire (which is a link, a built-in function) enables a specific action controlled by the puppeteer (representing the user). Then, the author acts as a master of the world: nothing can be done, nothing can be predicted, unless it was clearly conceived by the designer. We are in a logic of "nothing-but": nothing is possible except what is expressly specified. To represent some living document (with the dimension of generativity, and scalability), you must sweep the hierarchical representation and adopt a different approach (as the droid approach which enable the logic of "all-except" described in part 2.2.2).

2.2.1 Diegesis as a multimedia script

In fact, more than screenplay, it would be wise to talk about potential screenplay : that's the diegesis – to borrow a film term. This concept, was introduced in France by Etienne Souriau (Souriau, 1953). The diegesis is the (fictional) world in which the situations and events narrated occur, and telling, recounting, as opposed to showing, enacting (Prince, 2003). It is a virtual world, with entities, and which is governed by laws. Entities are objects, things (real or imaginary), involved in the development and the description of the environment.

Contrary to a film scriptwriter – who represents a linear story – it is impossible for the multimedia author to know the structure, the order, of the information units which will be broadcast through the document. This fact hampers the design of live documents when the authors are artists.

The current software abilities may enable agent reasoning in the design documents. So the author defines each entity – spaces (concrete places,...), abstract objects (active, inactive...), people (real, imaginary...) and so on – of the document.

Each entity "knows" the actions or the changes it can cause. At the opposite of "wires puppets" thinking (the author observes the document as a world master), the droid reasoning enables the observation of the environment throughout each entity. It is then possible to imagine live entities. The authors could even use an "all-except" thinking: everything is possible except that which was prohibited by the author.

To adopt this reasoning, a radical change of mindset is needed. The representation of live entities has led to abandon the linear representations (the tree structure of the scripts) in favour of a structure that the computer scientists could name intelligent agents (Russell & Norvig, 2010).

2.2.2 Form of representation as an object of multimedia screenplay

This change in attitude causes serious ideological problems. Jean-Pierre Balpe would say that "The book is the problem..."(Balpe, 2001). Indeed, today, the author (or the designer) does not accept that the "scenation" (i.e. order of informations units broadcast) (Colin, 1992) is not strictly equivalent to what he expected. This fact limits inevitably the range of possibilities. Many authors consider that if they can't define all "scenation" of the document, part by part, they are deprived of their creation. This is a major problem for researchers who

are working on generative and interactive storytelling: what is the author's status in an automatic generation of documents (texts, dialogues, computers graphics...) (Szilas & Axelrad, 2009)? Yet the author holds a prominent position in the autonomous documents. He instils his creative vision in the document – through the entity descriptions and their potential evolutions... If the designer has defined how the entities of the document work with sufficient creativity, the document will then be imbued with his creative power. The author will not be dispossessed of his creation, quite the contrary.

2.3 Features of the multimedia screenplay

The screenplay is the abstract representation of the document. It uses a specific formalism, appropriate to imagine the document. The multimedia script is a model of the document which will be made. It includes interactive features. With the screenplay, all stakeholders of the production and its preparation may imagine the future document.

First, the script used to evaluate the production costs – and thereby its financial feasibility. For a financed document, this could result in an increase or decrease in the scale of the multimedia document.

As in the audiovisual sector, the multimedia screenplay can help the author to find funds for the document production. Then, script – as any plan in architecture – is written and drawn, or at least separate of any process of production (unlike the "author software" which implements media or – at the best – simulates the "scenation" process).

2.3.1 Production process separated from screenplay

The screenplay is a document required for the pre-production staff – to prepare the media production and their implementation. It enables one to define technical solutions to produce the document. If the script clearly expresses the communicative choices of the product and its appearance, the staff can then best produce the document and approach more likely the original objectives. This is only possible if the screenplay is separated from any production process. Even if the specifications define some technical constraints, they should not impose an ossified mode of creation.

The author imagines a multimedia document. He designs an interactive creation. He is guided by his personal knowledge (or ignorance) about the possibilities of technical support. However, the script is not concerned with the media production and their implementation: he frees himself from describing the technical solutions.

A production process separated from screenplay means that the script is not a simulation of the document (unlike the script for software engineering) but a formalized representation of the creation (Colin, 1992). The screenplay is so far from any automation of the media implementation. It will be the preferred means of communication of the production and implementation team. Anybody can correctly imagine the document with a shared reference: the screenplay. It outlines the communication goals of the document and also the component objects.

This representation of the document is the reference for its production and its implementation process. It requires a formalism, a code, which enables it to be understood by the greatest number of stakeholders during the project process. This code becomes

identified with formal model of design. It will become a tool for the author to express his ideas. So, the written screenplay highlights the coherence of the creation, before its production.

Consequently, with the formal model of design the designer can express:

- the functions of the document parts,
- the solutions (directly or indirectly perceived by the reader, the document user), to achieve the communication goals during the script writing.

This enables an audit by comparing the solutions (proposed by the designer through the screenplay) and the objectives (defined in the specifications). In addition, each stakeholder of the project can thus operate with defined goals. Everyone in the staff offers the optimum technical solutions within the framework of the document production, while enabling any creative (or aesthetic) "finds". This enables a calmer work during the production and this improves the creator's job. Bertrand Tavernier (a French film director) said about this idea: "When I make a movie, I spend a long time to polish the script. With Jean Cosmos, we wrote 17 versions of Conan... After I'm free, I know where I go, I can use the improvisation" (Raspiengas, 1997). So when the shooting starts, everything is perfectly defined: the film director can entirely focus on his artistic work.

To achieve these objectives, the formal model design should be suitable for the human processes of the creation and needs of the script reader.

2.3.2 Relevance to human processes: Creative process

Creation is a development, a series of continuous exchanges between ideas and their expression. The expression of an idea leads to its conceptualization. It then has to developed, broken down: a vague screenplay element become clearer. The product of this formalization generates new ideas that must respect the project coherence. Creativity changes constantly from a general specification to a detailed expression and vice versa. During all stages from script writing to production, the possibility of an overview as so as the precision of details is important.

Screenplay generic model could facilitate the breakdown of meaningful entities in several others smaller, the braking down of elements specifies the original entities. At the opposite, an author also writes the screenplay with detailed ideas. He then joins it to the general design model before it is completely structured. To some extent, this is a synthesis of elements of scriptwriting. This abstract is based on a composition of elements to introduce more general ones.

Furthermore, with some detailed elements the creator is able to write other script elements - particular or general - while maintaining the overall coherence of the future document. Often a particular point is the catalyst for a part of the creative process. Moreover, the details can be dramatic nodes (i.e. milestones which structure and justify the development of the way).

This is consistent with the thinking of John Locke. For him, all our ideas come from experience: "Our understandings derive all the materials of thinking from observations that we make of external objects that can be perceived through the senses, and of the internal

operations of our minds, which we perceive by looking in at ourselves. These two are the fountains of knowledge, from which arise all the ideas we have or can naturally have." (Locke, 1690)

2.3.3 Relevance to human processes: Microscopic and macroscopic view

The different accuracy level of the document's representation is particularly important for the coherence study or for the understanding of the document objectives.

Also, some stakeholders only need to have a large point of view and to read the general properties of the document. Conversely others use only specific elements of the screenplay. However, they still want to soak up an overall feel to apprehend the subject, and have development issues that affect them specifically.

In short, a model of multimedia screenplay should enable

- to develop general facts of the script by making elemental components conversely
- to build general constituent by assembling simple elements.
  These possibilities are related both to the script itself and to its formal model. Indeed, the making up and the braking of microscopic and macroscopic components are as important for writing the script as for reading it afterwards.

2.3.4 Autonomous entities and reader model

In video games, some rules of operations, of games, define the live entities. It is commonly accepted that the games are not scripting (Alvarez & al., 2007). This is only a consequence of the lack of representation for live entities. So, the multimedia screenplay should define some entities with their operating rules. Thus, each entity can interact with any other entity (virtual entity in the document or the most important: the reader). The document is designed for readers. So, the human part of the receptor guides all the design process. It is therefore better if the script includes some imprint of relationships – cognitive and psychological – as intended by the author. This can go through a reader model.

The reader model is not the user model defined in artificial intelligence. In fact, it should provide the representation of the reader imagined by the author. It is an avatar. This is not to reify the reader but to specify some possible evolutions of entities based on a hypothetical user. Thus, changes in the document may be determined by the state of the imagined reader through his model.

It will also arbitrarily define a mental model of the reader toward the messages broadcast in order to facilitate:

- The assessment task,
- The objectives understanding by all stakeholders.

In addition, a reader's model takes into account the modes of action of the user. These action modes will enable the definition of a reader type (in conjunction with the hypothetical operating rules of the mental model) according to his responsiveness and the document itself. The document will then develop a strategy for development adapted to different types

of readers. Few documents were based on a hypothetical nature of the reader (following his behaviour and his attitude during the broadcast).

The reader is part of a system in which the document takes place with its technical environment. The model of the reader enables one to imagine the reader with the data provide by the human-computer interface. The image of the reader within the document is not an exact representation. It can even be completely wrong, perhaps because the reader acts to deceive the live document, or simply because the model is not suitable to the reader's type.

In an artistic design, the model of the reader is often designed without specific reference. Then, the reader's representation – constructed by the document – is not likely to correspond to the reality. It reflects an artistic approach. This approach will provide the coherence between the document and the author's project.

2.4 Rule of the screenplay and its generic model

In short, the specifications for a generic multimedia script are classified under two headings.

The first defines the script and its model at a conceptual level and thus separates the script from its implementation in order to:

- provide a real creative process,
- help the designer to express and expand his ideas,
- enable the production of a script for improving the communication between stakeholders.

The second advises the integration of communication characteristics with humans through:

- a model of formalization of functions,
- a hypothetical model of the reader,
- a formalism that enables a representation of the document from a macroscopic to a microscopic point of view and vice versa.

These criteria, which may seem based on a common sense, are only partially used in multimedia design. The lack of writing tool, and before, the lack of formalization for an abstract representation of multimedia documents (from websites to virtual worlds through the video games) are one of the reasons for the paralyse of multimedia documents mentioned above. The rest of this chapter proposes a writing structure for multimedia authors based on the principles outlined above.

3. Molecular scriptwriting

The general way of molecular representation uses the document's diegesis. The representation with entities makes it possible to formalize evolutionary or generative elements. Thus, with a model of the reader, the author can imagine ways for reader-document interaction. This model can be defined by hypothesis.

3.1 Introduction to molecular screenwriting

The goal of the molecular model is to be able to write and to represent some live documents while forbidding an automatic implementation of the document with the script. This

formalism designed for writers, artists (possibly hermetic to technical tools of production) to provide a way to write the screenplay of a multimedia document. This script will enable stakeholders to understand and to realize the multimedia document as the author imagined it.

This model, as its name implies, was designed by analogy with the concepts of chemistry. It is therefore based on atoms and molecules. The molecular model doesn't consider the script as a sequence of things, facts and actions any longer. It aims at representing entities, with their operating rules and their potential actions (based on the environment). Atoms and molecules describe the entities and their potential actions induced by special circumstances. They are necessary for the formal representation of the multimedia document. Atoms are simple elements. A single text entity describes a script atom. In contrast, the molecules are complex elements whose description requires several distinct components. Thus, a molecule can be composed of several atoms or molecules.

3.2 Atoms and molecules of a screenplay

There are three major families of atoms and molecules to build the model:

- The diegetics atoms and molecules describe the entities of the document;
- The circonstantials atoms and the cyclical molecules describe the different circumstances involved in the document;
- The atoms and the molecules of actions describe the actions by changing situations, the entities, the state of the document.

3.2.1 Diegetic atoms and diegetic molecules

Atoms and molecules diegetic represent the entities of the document.

Each one is a fragment of a screenplay and represents the element as an entity of the document.

A diegetic atom with an elementary representation (partial or total) is sufficient to define conceptually – at a particular stage of the design – the part of the entity.

Here, the diegetic atoms are represented here by oval elements.

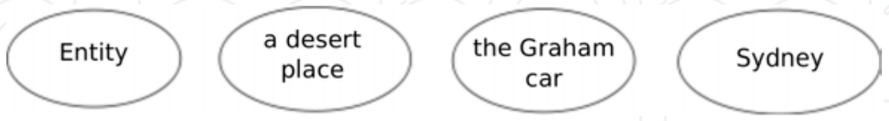

Fig. 2. Examples of diegetic atoms

A diegetic molecule is the complex conceptual representation of an autonomous entity of the document. The temporal dimension of those molecules is underlying (the entities have the ability to obey to rules of operation or behaviour, and thus are related to time).

A diegetic molecule is composed, in addition to the name that defines of:

- interlocking factors: they define the conditions of occurrence of the represented entity,
- perceptible descriptions: they describe the factors affecting the physiological perception of the entity by the reader,

- semantic descriptions: they describe all orders which aren't perceptible.

The name given to the entity can be identified. This identifier is usually an expression representative of the entity. The name can also be called an alias.

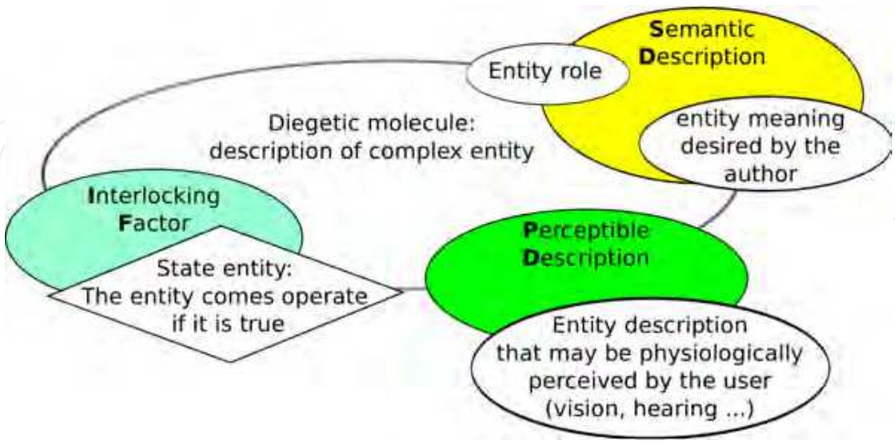

Fig. 3. Graphical representation of a diegetic molecule

Elements of Perceptible Descriptions describe the characteristics of the entity actually visible. This description may contain a set of atoms or molecules of sensible nature, that is to say related to events that will physiological affect our senses of perception (if the corresponding entities are shown). These can be compared to the description of expressions of a message in semiotics (Deely, 2005).

Thus, the apparent descriptions define what can be seen and heard of the entity during the reading of the document. These descriptions can be purely factual (definition of an established fact) or set of potential actions of the entity (travels, environmental changes...)

If – for example – a diegetic molecule represents a house, the size and the appearance of the building descriptions are visible.

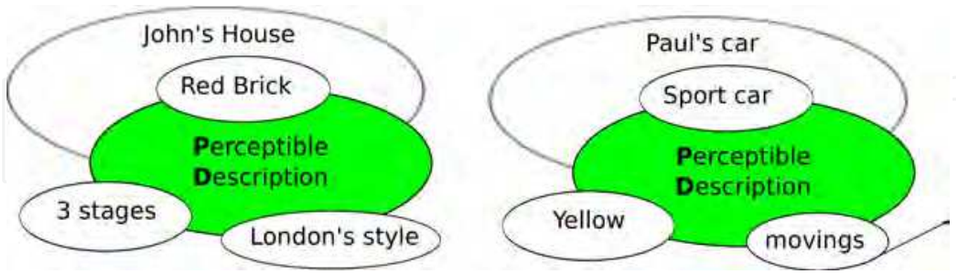

Fig. 4. Example of descriptions of two visible molecules

The elements of Semantic Descriptions specify the entity significance (intended by the author) and anything that can not be directly seen physiologically.

The communication's functions of the entity are also described in the semantic descriptions.

For example, if the author wishes to define a molecule representing a character who is afraid, the indication of the fear of the character is the semantic description. At this level of

design, this fear is not directly observable. This is however not necessary. This description will be converted by visible facts (beads of sweat, eyes bulging, stillness, nervous tremors, screams, etc... falling within the perceptible description) much later, when one approaches the "scenic" and the manufacture of the document – the "scenic" is the process to translate the text into a concrete reality: it is the result of aesthetic choices, practical constraints or financial... (Leleu-Merviel, 2005) .

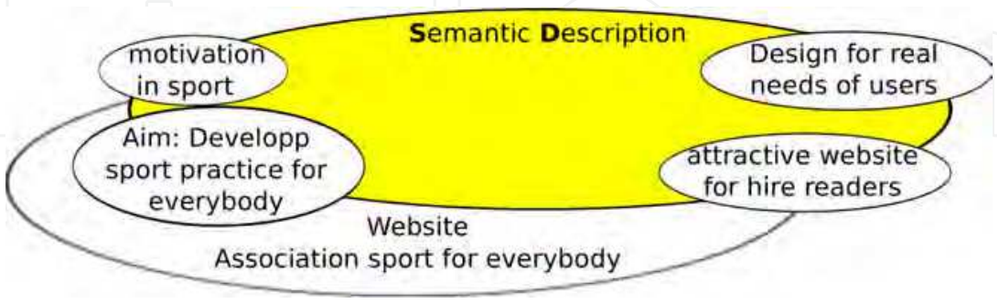

Fig. 5. Example of semantic descriptions related to the functions of the document

The semantic descriptions can also define some useful information for the staging of the document. Thus, the psychological description of a character occurs within this description.

In the early stages of writing the script, in the macro-molecules (molecules most general), the semantic descriptions are very important. They can indicate the function (particularly in terms of meaning) of the documents being written.

The direction indicated by these descriptors is potential. The semantic descriptions are a statement of intents. They contain the objective meaning of the information transmitted to the reader.

The interlocking factors are running the entity. They depend on the entity being described. If any of the circumstances (or conjunctures) specified (within the factors) is true the entity is showing it, putting it on the stage, making it active...

These interlocking factors are major players in the autonomy of the represented entities So the entities themselves contain the conditions of the necessary information (but not necessarily sufficient) for putting them into function (display, arrival in the area of a perception of the reader...).

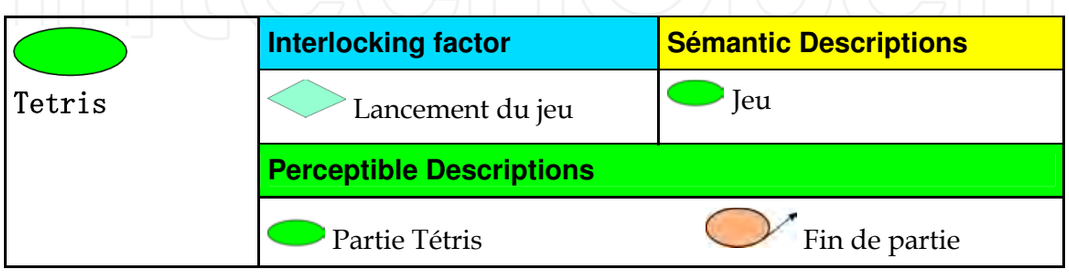

Fig. 6. Example of switching factor of a molecule in a tabulo-graphic representation

It may be noted that an active entity is not necessarily perceived directly by the reader. For example, if a light bulb in a closed tightly box, it is not perceived as operating from outside.

3.2.2 Circumstantial atoms, cyclical molecules

A circumstantial atom, formalized in figure 7 with a diamond, is the representation of a screenplay circumstance.

Circumstance specifies an instance of state. The state of circumstances is evaluated by a logical variable. Thus, in binary logic, a circumstance is true or not true – It is also possible to adopt a fuzzy logic (Zadeh, 1965) to improve the evolution capacity of the document.

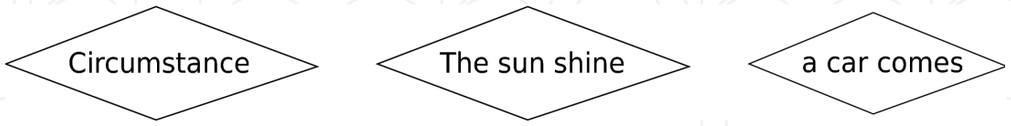

Fig. 7. Circumstantial atom and Examples

If a circumstance is insufficient to describe a state, it will be described by a combination of facts that is to say a conjuncture.

A cyclical molecule is the representation of a conjuncture within the script. (see figure 8).

A conjuncture is a set of circumstances (or of conjunctures). It is constituting a logical proposition. As a circumstance, a conjuncture is assessed in accordance with the logic used (binary, fuzzy...), even though the binary logic was chosen here in order to simplify the development.

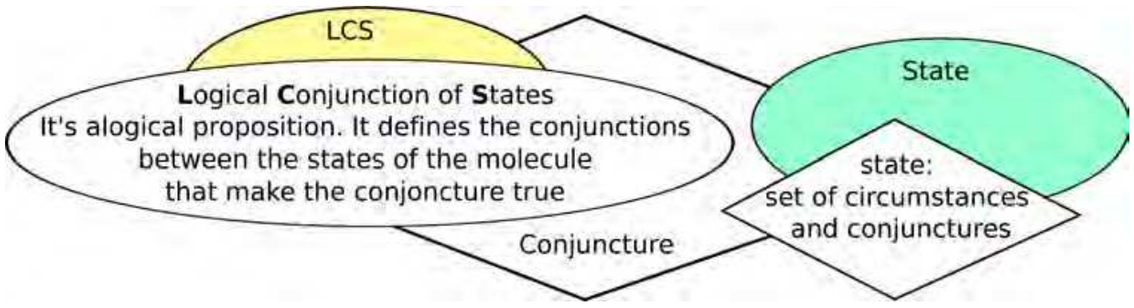

Fig. 8. Graphical representation of a cyclical molecule

A cyclical molecule is composed of:

- states (that correspond to conditions or circumstances which will be checked to make the situation true),
- logical conjunction of states (that define the logical links between all states of the molecule).

The states of a cyclical molecule are circumstances or conjunctures that the cyclical molecule contains. They represent conditions that contribute to real molecule.Cyclical molecule can be defined by a single state. In one screenplay, it can re-express a state. This enables one to define more precisely a fact without increasing the molecule which contains this state. The figure 9 is an example.

When a cyclical molecule contains several cyclical conditions or circumstances, rules are needed to prioritize their operation. It is the role of logical conjunction of the states.

Conjunctions of Logical States (LCS) define the logical links between all the states that define the molecule and contribute to its cyclical expression.

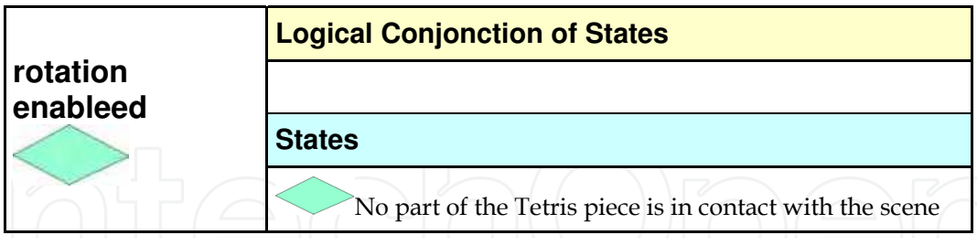

Fig. 9. Example of conditions defined by a single state

Indeed, a situation may be true if only one of the circumstances is true. Conversely, there may be an obligatory combination of a set of circumstances to asses it. So these conditions define relationships of the type “and”, “or", “no” and other logical operators, among the elements in the circumstance.

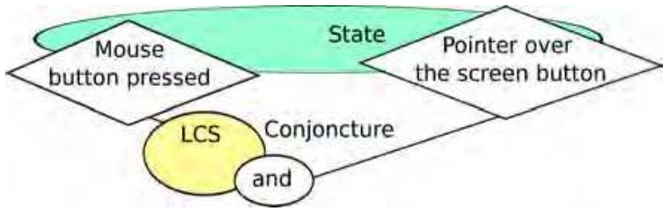

Fig. 10. Example of description of circumstances

At a given time, a circumstance or a situation is true or false. Depending on their value, entities can be put into operation (depending on the interlocking factors of diegetic molecules), or events can be triggered.

It is interesting to note that despite the binary logic used, it is possible for the author to introduce a form of fuzzy logic. For example, if a molecule is considered true if “the character is close to the trap” and if the author did not define absolute criteria of proximity, the programmer can adapt this concept in fuzzy logic.

3.3 Atoms and molecules of action

The last type of atom, the atom of action – that is, below in figure 11, the shape of an oval with an arrow – defines an event or a procedure of the screenplay.

An atom of action is an elementary event. An event is an action – or set of actions - aimed at changing the system.

Fig. 11. Atom of action and examples

Induced actions may be limited to a change in the “scenation”, that is to say display actions. However, if the molecules of action are elements of a script for a document with generative data, some of them define operations on entity contents. The events can then induce the

modification or creation of entities. An event produces an action on the environment. The general situation of the system is modified.

A molecule of action (figure 12) is composed of:

- interlocking factors,
- actions, which are the different events making up the molecule,
- shares of logical conjunction that establish a logical link between the various actions.

The interlocking factors are all circumstances and / or conjunctures which (when they are checked) cause the event.

Interlocking factors have exactly the same role within the molecules of action and within the diegetic molecules. If the interlocking-factor is true, then the action runs.

Actions are events induced by the validation of the molecule.

The molecules of action can define the transformation or the creation of entities.

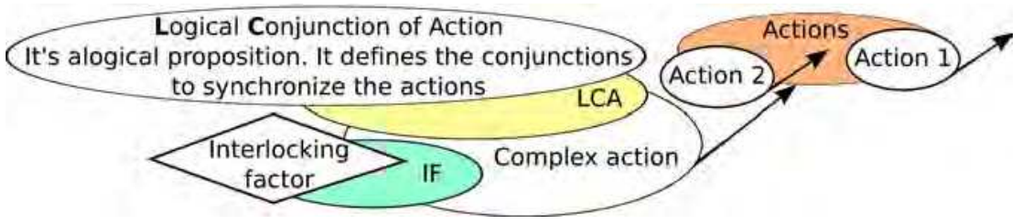

Fig. 12. Molecule of action

The Logical Conjunction of Action (LCA) defines the logical operators governing the actions contained in the event. Indeed, an event is characterized by any combination of several other events. This may be a chain, a simultaneous or even a choice of several actions. Logical Conjunctions of Actions are key rules for managing events contained. These include logical operators such as the algebra of Allen (Allen, 1986) (Allen & Ferguson, 1994).

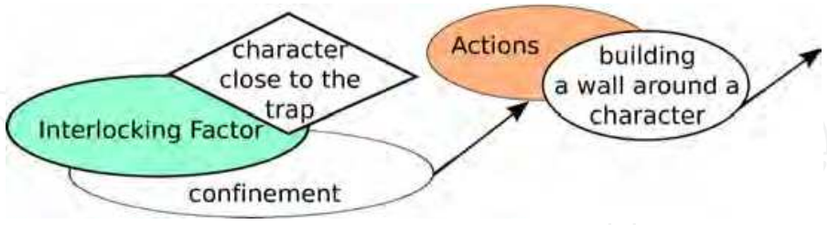

Fig. 13. Example of a molecule of Action

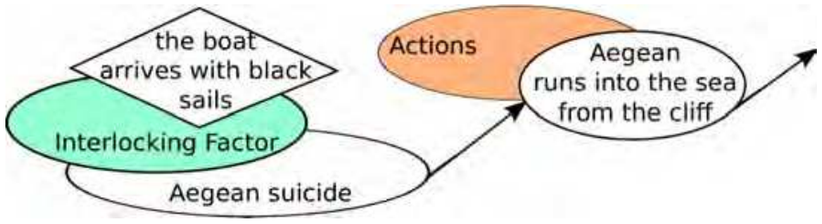

Fig. 14. Another example of molecule of action

The Algebra of temporality ALLEN defined between two entities A and B rigid reltionships:

- A equals B (perfect timing)
- A starts B (A and B start simultaneously)
- A finishes B (A and B ends simultaneously)
- A meets B (B starts when A has finished, what can be called sequential events if A and B are events)

and flexible relationships:

- A during (t) B (A starts t after B has started, with A ending before B)
- A before (t) B (B starts t after A is finished)
- A overlaps (t) B (B starts t after A has started, with B ending after A)

3.4 Representation of atoms and molecules

After defining the general structure of the molecular model (with its three types of components) this section discusses the diffrents shapes of molecules in the screenplay.

3.4.1 Forms of representations

Nowadays, multiple representation of atoms and molecules are possible.

- A graphical representation (mostly used in this document)
- A textual representation, (as in figure 9 or 17)
- A tabular representation,
- A graphico-tabular representation
- ...

Any of these representations can be used. It is even possible to use its own representation if the molecular structure is correct. In this text two representations are used: the graphical and graphico-tabular representation. The first because it is easy to differentiate the different types of atoms and molecules. However an author may find it difficult to use it in the absence of “script processor” (by analogy to word processor). The second is a compromise between usability and readability of scriptwriting: a simple template for word processing is used to write the screenplay.

3.4.2 Differentiation atom / molecule

In one screenplay, it is necessary to distinguish a molecule of an atom inside another molecule. In the graphic molecular representation is adopted, the molecules are “shaded", which distinguishes them from an atom. In the case of graphico-tabular representation it was decided to use the underline with a different colour (if colour display is possible) as a hyperlink symbol.

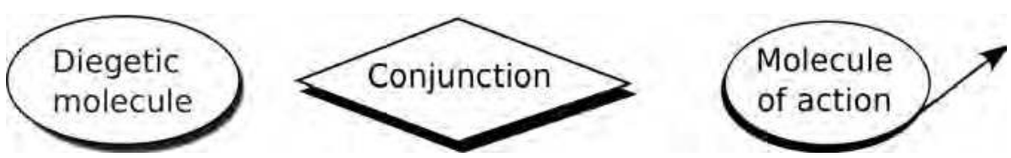

Fig. 15. Closed molecules

These modes of differentiation atoms / molecules are mainly features of links to some software used for general text editing or graphics. Indeed, when reading the version of the document, the selection of a molecule located in another molecule provides access to the detailed representation of the molecule in question.

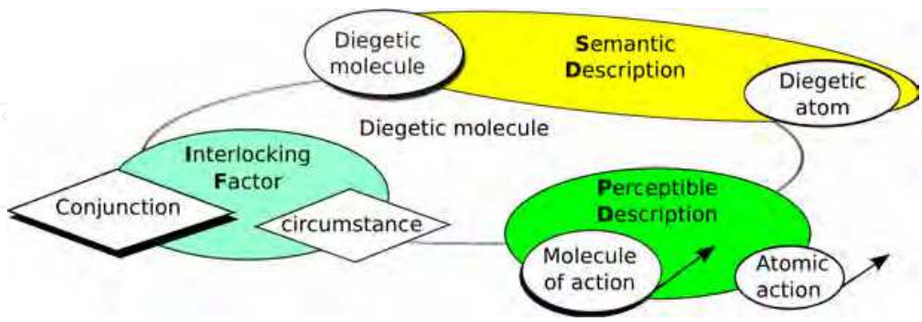

Fig. 16. Differentiation atoms / molecules in a graphical

	Name of diegetic molecule	Switch-factor
		Circumstance Conjunction
Descriptions Sémantiques		Descriptions Perceptibles
Diegetic atom Diegetic molecule		Atom of action Molecule of action

Fig. 17. Differentiation molecules/atoms in a graphico-tabular representation

4. Writing a script

The molecular model is based above all on a formalization of ideas (on the development of a text of the literal sense). This text (the script or the screenplay) represents the document throughout the eyes of the author.

Between the idea of document and the final script, many stages punctuate the work of the author.

In general, before setting out to write, the ideas of the author (or partner in an industrial context), are functions of the document.

4.1 Start writing

The functions of the document are usually expressed through the semantic descriptions and perceptible diegetic molecules. The document at this stage is in its "intent". The document itself is an entity. It will therefore be described by a molecule that can be described as parent compound or molecule aggregate.

In the initial state, the parent compound contains the different intentions of the author. Its semantic descriptions can then define the functions of the document. Thus, the author begins by setting out ideas, sometimes very descriptive - possibly by his own limited

imagination. These ideas are not necessarily structured. It is only later that the author develops the script to provide solutions in terms of communication for the ideas presented which are functions of the document.

The parent molecule – or global molecule – is the whole document. If at the beginning of writing, the parent compound just contains the functions of the document, by the time the script is finished, the overall molecule contains all the molecules and atoms representing the paper (figure 6 show an example for the global molecule of Tetris).

Gradually, from the functions, the author defines entities that structure the screenplay. He has the ability to break down and identify (give solutions in terms of communication) functions. It also has the ability to assemble, integrate, molecules representing entities already written down. These functions of the molecular model are the structural operations of it

4.2 Writing and structural operations

Gradually, from the functions, the author defines the entities that shape the screenplay. To work out the script, develop ideas, organize them, the author uses structural operations. For example, an atom, previously defined, may prove too imprecise in writing. This screenplay atom can then be refined. Its decomposition will produce several elements (atoms or molecules). Conversely it is possible to form a "synthetic molecule". So, atoms or molecules can be combined to synthesize a new element of ideas...

The terms of these operations use particular properties of atomic fission and combinations.

The combination is to group multiple molecules or atoms to form a new molecule.

Thus, the combination creates a new molecule by "assembling" atoms and existing molecules. This method of design is useful when one has to build up entities to ensure the dramatic consistency of a document.

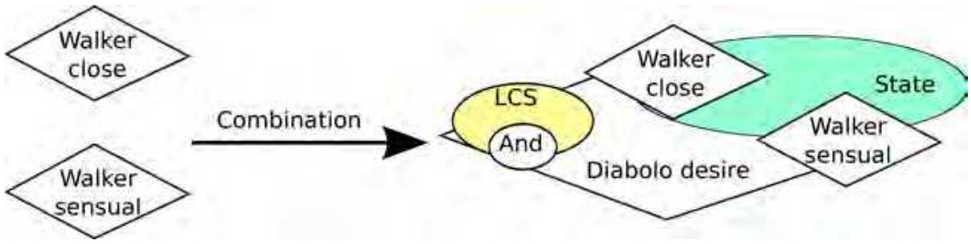

Fig. 18. Molecular combination

An atomic fission splits an atom into several others, as shown on of figure 19. A screenwriter uses rarely a fission alone but it is commonly used during a decomposition.

The author, with this function, must then clarify his ideas, his entities. This is the traditional process of creation. From the definition of a general idea, step by step, the creator define this idea precisely.

An atomic decomposition is the product of a fission followed by a combination. In figure 19, the fission of the atom "car" products two new atoms "body" and "wheel". The combination products the molecule "car" composed by next atoms. The splitting of the atom car leads to two atoms. The combination of these results in the synthesis of the molecule car.

At the end stage of writing (within "preproduction" phase) some decomposition can improve the understanding to reduce the gap between the entity representation (of the author) and its understood (by the achievement team). Indeed, if the creator has represented a "bird" entity by an atom, he may want, after some working time, to decompose the representation of this bird by characterizing its family, its colour of its feathers or its beak so that it perfectly represents the image that he has in mind.

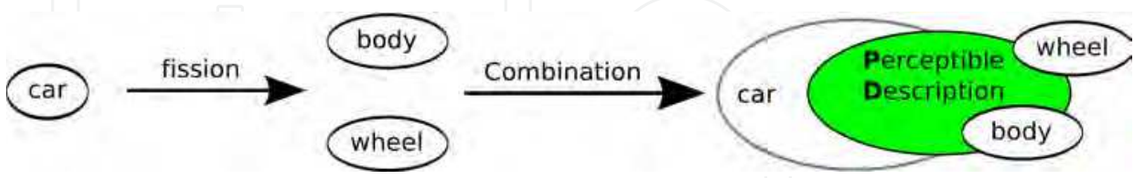

Fig. 19. Fission followed by a combination

Another example for the design of a document on the state of the world, leads to define a molecule "The earth" from several entities that are the continents (figure 20). Each of them can be cut into large geographic areas or independent states. One then has to perform a series of fission and combinations to achieve at the desired level of detailed screenplay.

It should be noted that during an operation of decomposition, the item is "shaded" or "outlined" (as has already been specified) to differentiate between atoms and molecules (figure 21).

The substitution operation is about replacing an atom or molecule with a new feature. They may be substituted by another atom of similar function, but it is possible to substitute an item whose function is different. Indeed, it is not uncommon, during the creation process, for some issues to be seriously altered. For example: "Light motor vehicle with four wheels for transporting several people with some luggage" substituted "car". "isolated castel" substituted "isolated mansion"

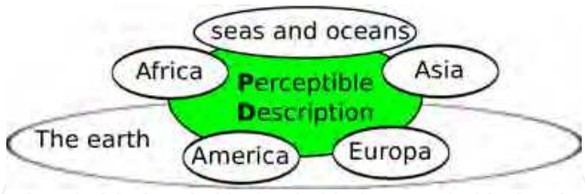

Fig. 20. Molecule composed only of atoms

Fig. 21. Result of decomposition of the atom "America"

More simply, an author often re-expresses or reworks an idea. Rewriting a sentence of a script can be regarded as a substitution.

4.3 How to orient the "scenation"

The "scenation" of an interactive document is unpredictable. However, the designer can introduce guidelines or criteria "scenation" through the interlocking factors, logical conjunctions or perceptible descriptions.

So, the screenplay can specify the spatial position of some entities. This pieces of information are included in the descriptions or can be defined through specific events.

Interlocking factors are circumstances or conjuncture that define the conditions for which the corresponding entities and events will come into operation. If one of the factors identified in a molecule proves to be true, the entity is operated or the event is occured. If the validation – or the commissioning – of an entity is determined by the conjunction of ordered factors, the author will create an appropriate cyclical molecule.

If an entity is operating, it validates itself, and recursively, the entities that constitute it (provided that their interlocking factors are checked too): if the representation of the latter entities or events has no engagement, they are then validated by default. Thus, for the entity "documentary" to be enabled (see figure 22) the interlocking factor "session beginning" must be checked. The diegetic molecule "documentary" consists of two molecules covering "Life of tarantulas in South America" and "Bears in Europa". The first theme is treated with a documentary film "film 1". No constraint is specified for engagement "Life of tarantulas in South America". Therefore, this entity "film 1" is put into service as soon as the entity "documentary" is operated. This process could be described as "auto-switch". On the other hand regarding the entity "Bears Poldavia" it will be validated only when the documentary "film 1" is completed.

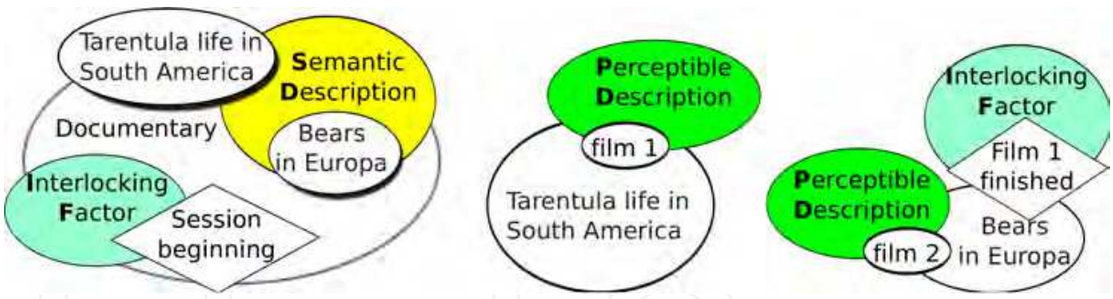

Fig. 22. Example of representation of validations "nested"

A lack of interlocking factors generates systematic validation of the entities or events, as soon as one part of the container is running.

Logical conjunctions of states and respectively cyclical molecules and molecules integrated actions are made up of shares of logical operators. These define the conjunctions between components. Some of these operators are presented in this text, but the list is not exhaustive. An author can define a new logical operator if the developed screenplay item requires it.

Thus, rules of engagement priorities can be defined on the basis of logical conjunctions of statements or actions. For example, if the designer decides that a part of the document will consist of a slide show with musical accompaniment (see figure 23), he may want to synchronize precisely audio and visual entities. In this case, the molecule of action "to play a slide show" is a script example of this documentary extract. This molecule indicates that the

events “Play Music” and “show pictures” will be synchronous with the logical conjonction “equals” (which requires special attention when performing). On the other hand, the molecule “broadcast slide show 2”, due to the use of the logical conjunction “starts” indicates that “view photos” and “play music” are operated simultaneously, but their perfect synchronisation is not required. The logical conjunction of actions “meets” of the molecule of action “photographs show” indicates that the three photos are displayed one after the other.

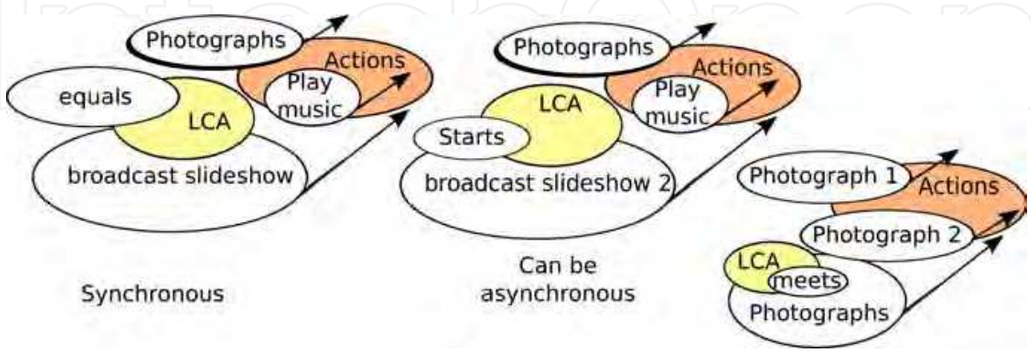

Fig. 23. Examples of parallel and sequential actions synchronous or not

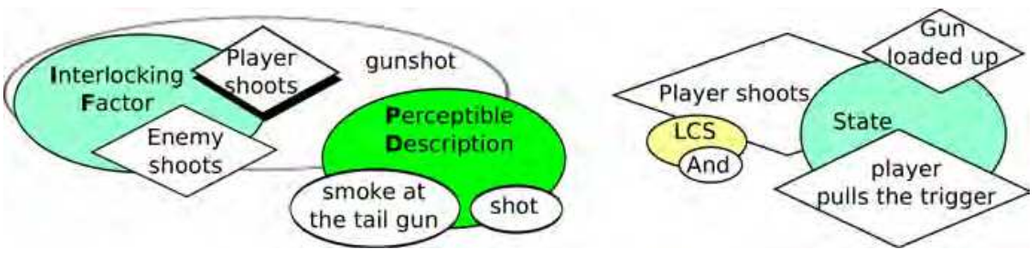

Fig. 24. Such entities simultaneously validated

The author can define the temporal position of the entities using interlocking factors of diegetic molecules. Thus, when two molecules have identical interlocking factors, the entities they represent are enabled simultaneously. Also – in the example in figure 24 – “shot” and “Smoke at the tail gun” entities are switched at the same time, or when “the enemy shoots”, or when “the player shoots” (the latter screenplay occurs if the “player pulls the trigger” and the “Gun loaded up”).

The definition of the circumstances – interlocking factors – and events induce a variable temporal “scenation". This enables the description of autonomous entities too. The live document involves the modification of the “scenation”. The evolution of the document is modified by the actions of the user, but also by the combined actions of the user and the others entities in the document. Moreover events in the context of generative data documents can change the data. These documents are then dynamic documents.

5. Autonomy document

Entities in a document which generates data are “alive” (they can evolve with the progress of the document). They are dynamic. Moreover, a model of the reader extents the possibilities of the interaction and of the document's evolution.

An entity is dynamic if its characteristics are subject to change or modify something while the document is reading. This is particularly true in virtual reality where viewing the scene is drawn in real time, from a small database, or also when some states (such as the diagnosis of the presence of a visually impaired reader) can change the display of visual and auditory entities.

5.1 Documents and dynamic entities

The diegetic molecules are the representation of autonomous entities. By analogy with artificial intelligence, they set out the bases of declarative and procedural facts(diegetic atoms and molecules whithin the semantic and perceptible descriptions noticeable as declarative facts, molecules and atoms of actions within the molecules diegetic as procedural facts). Therefore, the molecules can describe dynamic entities. The entities can be operated with some the status of the document. It is the role of interlocking factors.

In summary, the entities contain their own operating procedures (interlocking factors and actions).

The evolution of an entity from the document results from the representation of its potential actions, the environment states or evolution or external events., For example, the visual space of Tetris is constantly changing until the gameover. Indeed, the forms that arrive alter the playing area. This one could be consider as a live entity.

It is possible that the user can not perceive an entity acting (if he is not seeing or earing it). (for example, if an entity represent the path of the reader through a document and if it is not displaying). The entity "path" is changing as soon as the reader travels through the document.

Moreover, the representation of dynamic entities, combined with the definition of a hypothetical sense produced by their display, enables an evolution by closing semantic.

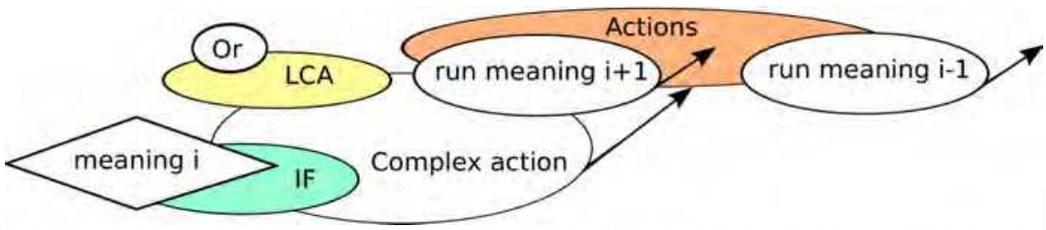

Fig. 25. Evolution by closing semantic

A meaning is defined by the creator from assumptions which are products of choices, possibly artistic ones and which often prove arbitrary. In the example in figure 25, if an entity means "meanings i" was displaying, the document will display an entity will mean "meanings i+1" or "meanings i-1". The document will be able to follow a coherent evolution towards the objectives of the creative elements. The document successively validates semantically close or at the opposite far away elements: some situations may indeed lead to strong semantic ruptures.

Such a conception leads to the realization of interactive documents without always a direct action of the reader.

5.2 Model of the reader

Most documents today have a relatively low level of interactivity. This appears through orders for direct action and reaction between the document and reader (the impact on the display of the player's action is instantaneous). Thus a mouse-click, a "drag and drop", a " rollover" causes an immediate reaction of the documentary system.

However, it is preferable to consider the behaviour of the reader to change the "scenation" of the multimedia document. Of course, the user, his relationship to document, his perception of the document are included in most multimedia designs, including through the design of interfaces (Pignier & Drouillat, 2008). The interfaces are increasingly based on metaphors designed primarily to facilitate the usability of navigation. The point of view is no longer restricted to specialists of "human-machine communication", but it integrates functions of esteem necessary for the reader to support the document.

However, an author, especially if he is an artist, will go beyond the functional aspect of the relationship between the reader and the document. He will want to innovate and have the means of expression needed to complete the document. The artist will dream a "game's situation" between the reader and the document.

The autonomy of the entities enables the representation of a model of the reader. It is not to reify the reader but to propose an "avatar" (an avatar is a representation – necessarily schematic – and approximate of the user within the system). These define a psychological state of the player according to their actions. This will often be in a totally arbitrary way, regardless of any psychological model scientifically established, as is the case in the examples in figures 26 and 27. The model serves only to establish a strategy of evolution. A novelist, a screenwriter or film-maker will write on the basis of the potential reactions of an imaginary reader. In the same vein, a model of the reader will enable the author to establish a strategy of interaction between the entities of the document and the reader.

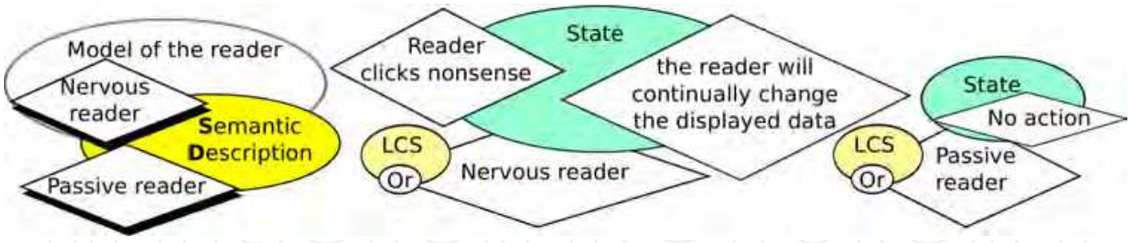

Fig. 26. Example of models of reader

Today, it is possible to determine few cognitive states and emotional states of an user (Labour & Kolski, 2010), but it is impossible to determine it directly, in real time and without complex interfaces.. This means, if you want to adapt the system to the reader, that one must go through models of representation of it. In fact, a model of the player is an entity that seeks to characterize the reader from facts which are objective and measurable by the document and its technical environment. The character deduced can also influence the evolution of the document. The author may delegate to specialists in artificial intelligence the design of a specific system of diagnosis of a cognitive, psychological state of the reader during the implementation of the document.

However, especially in a context of artistic creation, a designer may want to change the document according to the reader's behaviour with the document (regardless of any scientific model). He may be helped for this representation of a reader's model by some diegetic molecules he has built. The model of the reader that follows is primarily in this context. In addition, an imagined state of the reader can generate simple solutions for the diagnosis of one state of the reader. Thus, an author may decide that the document will consider a reader as nervous if he clicks continually. Conversely if the reader has no action, the document may consider him as a person in deep trouble or absent. This model of reader can be used to devise a strategy or mode of evolution of a document.

This type of model, from simple rule, has enabled student groups to script documents establishing strategies of evolution fwith the player behaviour (or his avatar). They were, for example, documents determining the presence (or absence) of visual impairment in the reader and in order to offer navigation features adapted to their handicap without special interface.

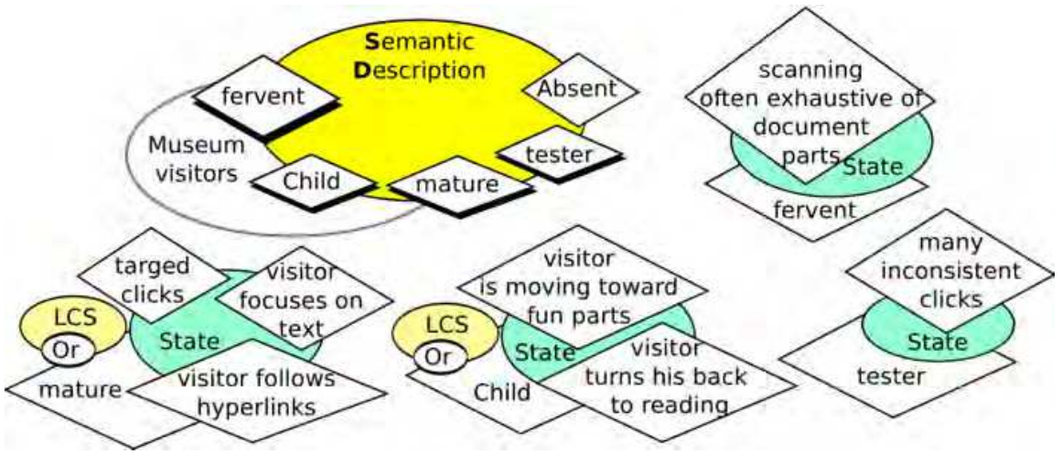

Fig. 27. Another example of models of reader: type of visitors

To sum up, the molecular model of the reader is not there to “manufacture” a reader, but to contain - in an arbitrary, possibly with the vision of an “artist” - a hypothetical mental state according to his reactions. This model is based on observable facts in the document and its technical environment.

6. Conclusion

The model in molecular scriptwriting which has just been introduced enables one to represent an imaginary world with its own laws, in the form of a screenplay. The latter defines the document with the representations of dynamic entities.

The creator no longer defines the connections between data. He characterizes entities (subject, location, character, real or imaginary, who participates in the development or description of the environment). The entities are defined by the criteria of state and characteristics of evolution. They are autonomous and may interact with each other. The reader participates in the evolution of the multimedia document through his avatar, “the model of the reader”. This defines a hypothetical reader, imagined by the author, to enable artificial entities of the document to act on the alleged conduct of the imaginary reader. In this sense, the reader is an

entity of the environment. Finally, the inclusion of a semantic description of the entities can be used to treat entities in terms of data but of possible meanings.

The basic principles outlined in this document may seem simplistic at first. However a study of several authors shows that the media idea of adaptive documents or autonomous entities do not come to the minds of designers. These principles are conceivable for any games, but definitely not for disclosure documents. Moreover, the method of collecting linear documents often prohibits the writing of autonomous entities. This was also revealed with students of audiovisual and multimedia sector positioned as authors (regardless of any subsequent effective implementation).

In summary, the imagination of entities that can be autonomous and the design of information units depending on different users cause problem. Today there is a lack of "witness's documents" with its screenplay to illustrate the model. Examples of scripts exist and the reader may consult published http://lambouxdurandrech.free.fr/ to illustrate better these concepts.

Another problem identified by the authors as "professionals" and by students (and any type of multimedia document produced), is the lack of suitable writing tool. This tool - which can be described as "multimedia screnplay processor" - must be developed.

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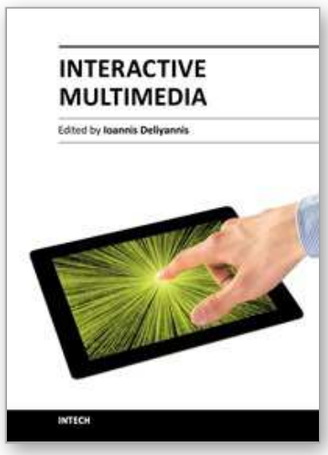

Interactive Multimedia

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Interactive multimedia is clearly a field of fundamental research, social, educational and economical importance, as it combines multiple disciplines for the development of multimedia systems that are capable to sense the environment and dynamically process, edit, adjust or generate new content. For this purpose, ideas, theories, methodologies and inventions are combined in order to form novel applications and systems. This book presents novel scientific research, proven methodologies and interdisciplinary case studies that exhibit advances under Interfaces and Interaction, Interactive Multimedia Learning, Teaching and Competence Diagnosis Systems, Interactive TV, Film and Multimedia Production and Video Processing. The chapters selected for this volume offer new perspectives in terms of strategies, tested practices and solutions that, beyond describing the state-of-the-art, may be utilised as a solid basis for the development of new interactive systems and applications.

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