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Report on Emerging and Alternative Narrative Formalisms

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Executive Summary

A number of research prototypes have been developed (IRIS, 2011), that are based either on existing AI techniques (planning, agents' architectures, etc.) or on the partial modelling of classical narrative theories (structuralist models, screenwriting models). Current research is dominated with the improvement of existing prototypes and approaches, which constitute incremental research over already established principles. In this report, we attempt to foster new and more radical approaches to IS, that could open different avenues for future research.

We have come up to ten innovative approaches, grouped them into four categories:

Incorporating new Elements form Filmic Language: We investigate here some narrative phenomena that are present in the "old" media but that are rarely in use in IS. **Parallelism** for example, is in use in any visual narrative but is rarely managed at the narrative level in IS, that seems too much influenced by the classical narratological view. **Ellipsis**, is omnipresent in movies but more difficult to manage in IS, although it could provide a novel way to visualize stories in an interactive way.

Multiple storyworlds: The theoretical idea that one story contain or implies several (possible) worlds leads to a series of other ways to consume an interactive narrative. **Embedded Stories** are frequently at play in narratives. Interacting with them, that is navigating not only *within* a world but also *between* several worlds opens the way to new and playful modes of interactive narrative consumption. With M**ultiple Actualisation**, it is possible to reason at the level of the multiple routes a single story can take, providing a reflective point of view on a narrative, far beyond the well known multiple stories in linear media (Smoking/non smoking, etc.). Finally, **Other Inter-Worlds Relations** are systematically explored, to propose other innovative forms of IS.

The Frontiers of Fiction: The clear border between what is the fiction and what is the real world in which the fiction is told, can easily be crossed in IS. Firstly, we investigated the concept of **Metalepsis** (crossing and transgression of a fictional border), and how it could be used practically in IS. For example, by acknowledging their fictional status, characters create a distance between the end-user and the fiction, which might be an essential difference with film, that is typically based on the concept of immersion.

Author Centred Narrative Formalisms: Formalisms in IS are not only meant to produce an end-user experience but also to be handled by authors. We investigate here in which extent the authoring point of view could be adopted right at the beginning in the design of an IS system. Three different approaches are explored. First, we propose an **Author Centred Performative Structures** , a new formalism to represent the organization of goals and tasks. This model has been directly guided by the close collaboration with a creative author. Second, the **Stateless Formalism** is a more radical approach that consists in describing the rules for generating story events only in terms of relations between actions. Finally, the **Configuration of Affective Characters** is explored, in terms of how the multiple characters parameters could be authored differently.

1. Introduction

The field of Interactive Storytelling (IS) emerged during the early nineties. It was created when the new communicative features of computers (interactivity, Multimedia, 3D visualisation) crossed with Artificial Intelligence(AI)-based algorithms for the dynamic generation of story events. Twenty years after, a number of research prototypes have been developed (IRIS, 2011), that are based either on existing AI techniques (planning, agents' architectures, etc.) or on the partial modelling of classical narrative theories (strucuralist models, screenwriting models). Current research is dominated with the improvement of existing prototypes and approaches. Related research questions are: How to improve planning to incorporate some narrative qualities? How to better parametrize agents to make them behave interestingly? How to better model the end-user so that to improve his/her user experience? How to improve the staging of virtual agents? Etc. While all these questions are relevant, they constitute incremental research over already established principles. In this report, we attempt to foster new and more radical approaches to IS, that could open different avenues for future research.

We have come up to ten innovative approaches, which are the result of both our own research and the observation of some trends in the field. The choice of these ten approaches remains arbitrary, for two reasons. First, by definition, such list is unbound: We cannot pretend to have exhausted the set of yet-to-be-invented IS approaches. Second, we made the choice of not mentioning some innovative approaches, for example the research on dramatic improvisation, because we estimated that these approaches were “on the air” for a while, and we preferred to focus on less known directions. We have grouped them into four categories:

- Incorporating new Elements form Filmic Language: We investigate here some narrative pheonomena that are present in the “old” filmic media but that are rarely in use in IS.
- Multiple storyworlds: The theoretical idea that one story contain or implies several (possible) worlds leads to a series of other ways to consume an interactive narrative.
- The Frontiers of Fiction: The clear border between what is the fiction and what is the real world in which the fiction is told, can easily be crossed in IS, leading to interesting novel forms for IS
- Author Centred Narrative Formalisms: Formalisms in IS are not only meant to produce an end-user experience but also to be handled by authors. We investigate here in which extent the authoring point of view could be put as an initial constraint, in the design of an IS system.

The content of this report is related to published and submitted papers by IRIS partners (Szilas, et al., 2011; Szilas and Axelrad, 2009; Szilas et al., 2012; Petta, et al., 2012)

2. Incorporating New Elements from Filmic Language

2.1 Simulataneity and Parallelism

Narrative theory has covered extensively the notion of *narrative sequence*, paying less attention to the phenomenon of simultaneity: the fact that several narrative actions occur at the same time, either in the story time or in the discourse time. Some definitions of story or plot would even exclude the notion of simultaneity. For example, “Story is the full *sequence of events* in a work of fiction as we imagine them to have taken place, in the order in which they would have occurred in life” (our italics).

However, it is obvious that within a story, events do occur at the same time. Even in a (written or oral) text, which is linear at the discourse level, an expression such as “meanwhile” means that the events that will be recounted

occurred at the same time as the events recounted just before. In visual narratives, and in particular theatre and film, two events can and often do occur in parallel, at both discourse and story levels. Typically, an action occurs in the foreground while another action occurs in the background.

Does this happen in IS ? It depends on the type of drama management in use. Systems strongly based on autonomous characters do have parallelism, since character are autonomous to do what they decide to do and their actions can occur simultaneously. However, such simultaneity is not controlled, neither by the program nor the author. It occurs, or emerges, from the existence of autonomous entities. In systems based on a more centralized narrative management, such as Façade (Mateas and Stern, 2000) or IDtension (text version (Szilas, 2007)), events at the narrative level are triggered sequentially. For example, Façade handles the notion of beat sequence. In other systems, such as Mimesis (Young et al., 2004) or IDtension (3D version (Szilas, et al., 2007)), actions are triggered in parallel, but the impact of simultaneity on the end-user is not computed.

But parallelism occurs at the behavioural level. The notion of joint behaviours (Mateas and Stern, 2004) is a typical case of parallelism.

What is missing in current IS systems is a narrative management of parallelism, that is the ability for a narrative engine to decide how many narrative actions can occur in parallel, and in which conditions. More precisely, a narrative engine should be able to decide:

1. How many actions can occur simultaneously at the story level?
2. Which narrative actions can/should occur simultaneously at the story level?
3. How many narrative actions can occur simultaneously at the discourse level?

We take here the general case where story and discourse are not superimposed.

The “how many actions” questions above (numbers 1 and 3) can be rather easily formalized by introducing two measures:

- Story density: Number of narrative actions occuring in parallel in the story.
- Discourse-density: Number of narrative actions displayed in parallel.

Then simple rules can be used to manage these densities in realtime. For example, a rule could be to maintain the story density to a certain maximum value (say “2”). This maximum value is decided by the author, for each specific scenario. Such a simple algorithm has been implemented in the latest version of IDtension.

The question 2 above is much more difficult to formalize. What makes two actions suitable to occur un parallel? A first possibility consists in letting the author decide. For example, the author would specify that the action of A stealing an object from B could be preferably played simultaneously to the action of C searching for A. However, this process remains tedious, since all pairs of actions should be examined by the author as candidates for simultaneity. The author could also reason at a more generic level, by specifying, for example, that the action of A criticising the attitude of B regarding an action from C that violated a given value v could be preferably played simultaneously to the action of C doing an action that also violated the value v. But still more general rules would become necessary, even if they are less expressive than the two previous examples. For example, assuming that each action is ranked according to a general desirability/importance scale, such a rule could be: “only one narrative action with an

importance above a given threshold can be play at the same time". These few examples show that this field of investigation is wide and largely unexplored.

While the proposition we are making is mostly motivated by aesthetic considerations, it should not be omitted that parallelism raises some technical challenges as well:

Execution conditions maintenance: If actions *a1* and *a2* occur in parallel, and the execution of *a1* invalidates the preconditions of *a2*, then *a2* should be cancelled.

Synchronization: Some action must not only occur in parallel but need to follow some temporal constraints such as *a1* must finish before *a2* (Porteous, et al., 2011).

Finally, we have not discussed yet the modality for representing parallel actions at the discourse level. This can be managed by the camera itself, either via shooting angles showing several actions or by an alternating editing. Another option is the split screen, which consists in dividing the screen into several subparts. The digital medium offers much flexibility regarding how several shots can be combined into one screen. Video games provide many interesting examples.

2.2 Ellipsis

An ellipsis is a frequently used narrative device in literature (Eco, 1979) and film (Durand, 1993) to condense time or to create space for free imagination. By omitting a portion of a sequence, it becomes up to the audience to fill in the narrative gaps. This can simply be used to shorten the telling of an action like standing up, walking through the room, opening the door and going out. The reader of a story or the viewer of the film understands the action by simply showing the standing up and the coming out of the door. A second function of an ellipsis is to create a metaphorical parallel between two different instants in a story. A great example is given by Stanley Kubrick in his film *2001* where he uses an ellipsis to create a metaphorical relationship between the first tool used in the history of humans (a bone) and the latest in the near future (a space station).

Ellipses are rarely used in IS, simply because they do not fit with the idea of real-time interaction. While real-time interaction is absolutely necessary for action-based games, it is less true for interactive narratives. In this section, we want to explore how ellipses could be used in IS. Within IRIS, INRIA has investigated the management of ellipsis at the level of character control (either by accelerating the 3D simulation or by cutting the current scene and replacing the characters according to their role in the next scene). What we want to discuss here is how the decision to make an ellipsis is made, either by the computer or by the user. Note that we won't discuss scripted ellipses imposed by the computer (for example between levels or scenes in a video game).

Let us define the following notions, for an ellipsis between two scenes.

- The start time: the time in the story when the first scene stops.
- The stop time: the time in the story when the second scene begins just after the ellipsis
- The ellipsed period: the portion of the story between the ellipse-start time and the ellipse-stop time (by definition not seen by the user).
- The duration: the time length of the ellipsed period.

Three cases are worth being distinguished:

1. **The ellipsed period contains no narrative action:** the ellipsis is just a way to speed up the narrative and eliminate "empty" bits, like for example movement in a room. (Of course, these bits are only empty from the narrative progression point of view.)

2. **The ellipsed period contains NPC actions only:** the system calculates some actions that are played by the NPCs. The user will (or will not) discover these actions after the ellipsis. Such an ellipsis is similar to the kind of ellipses found in movies.

3. **The ellipsed period contains player character's actions:** this implies that the user let's his character act autonomously during the ellipsed period. This is a loss of control from the user towards his character, who becomes semi-autonomous (Portugal, 1999). How will the user's character behave? Either automatically or according to the user's instruction. Metaphorically, the character goes into an "auto-pilot" mode.

A key issue in the ellipsis management is the balance of control between the user and the computer: Either the ellipsis (start time and duration) is decided by the computer or it is decided by the end-user. Computer-decided ellipses need to be implemented with subtlety. The ellipsis should not be felt as a loss of control ("Okay, whatever I do, I get the same end scene anyway!"), but instead as a device creating narrative tension ("Well, how will all this finally end?").

Several computational challenges are raised by the computer-controlled ellipsis:

- First, rules regarding the pacing of the narrative must be introduced, so that ellipsis are triggered neither too rarely or too frequently.

- Second, rules regarding which narrative actions can be skipped must be established. These rules can vary considerably in their nature. For example, some narrative actions can be skipped because they are considered as not so important in the narrative. But omitting an important action is a powerful narrative device.

- Third, because ellipsis is about letting the audience guess the omitted parts, making an ellipsis supposes being able to anticipate that the audience will make such a guess. This implies a sort of modelling of the user.

- Fourth, in some cases, the omitted events need to be told afterwards, which raises the issue of the when (when the past action is inserted in the present flow of actions) and the how (how the action is recounted: textually, visually, explicitly, metaphorically, etc.).

To conclude, although ellipsis play an limited role in IS compared to cinema or litterature, it should be noted that the rules for managing them is yet to be invented and should not strictly copy the “old” media.

3. Multiple Storyworlds

3.1 Introduction to possible worlds

Possible worlds is a set of narratological theories that describe narrative in terms of several worlds, including:

- The actual world (noted W0), in which the reader reads a book, the movie audience sees a movie and the audience and actors gather inside a theatre.

- The fictional or dramatic world (noted WD), that is described by the narrative, inhabited by characters, places, objects, and where narrative actions take places.

- Spectators' subworlds, which are worlds that the reader constructs mentally as possible/anticipated worlds. They correspond to “inferential wandering”, according to U. Eco (1979).
- Characters' subworlds, generated by “world creating” propositions such as wish, hope, or imagine.
- Alternate fictional worlds, which are parallel to WD, when the story explicitly tells several variations on a story so that to create several alternate fictional worlds (It's a wonderful Life (F. Capra), Smoking / No Smoking (A. Resnais), etc.).

Possible worlds have been formalized in logico-mathematical terms, with the particular goal to formalize the *relations* between these goals. For example, what is the relation between W_0 and W_D? What is the accessibility between one possible world to the other? Etc.

For Interactive Storytelling, formalizing these possible worlds is a natural option. Artificial Intelligence research provides useful tools for that purpose. For example, the Expert System JESS offers the possibility to apply reasoning rules specific to a “world”, called a *module*. The very principle of planning is an exploration of possible worlds, in order to generate a solution (in W_D) that satisfies some given constraints (such as enabling to reach a certain story goal). This relationship is well established in the book from Marie-Laure Ryan entitled “Possible worlds, artificial intelligence, and narrative theory".

If on the theoretical level, possible worlds and IS are well connected, from a practical point of view, the very fact that a single story can embeds a multitude of possible worlds of different natures, each these subworlds being candidate to some degree of interactivity, has been largely overlooked. The three following sections attempt to suggest some new possibilities of IS, based on the narrative theory of possible worlds.

3.2 Embedded stories

One of the most visible “world creating” proposition is the fact that a character in a narrative tells a story. Such an embedded story is a fiction in a fiction. Within a first fictional world, the embedding world, a boundary is crossed and the reader/audience is transported into another world, the embedded world (Ryan, 1991). An exemplary form of embedded stories is the *1001 Arabian Nights*, in which Sheherazade is constantly embedding new stories within the current story, as a narrative strategy to extend the narration. Embedded stories are a common device, both in literature and drama. According to Todorov, the embedded narrative is a "narrative within a narrative". The embedding narrative provides the contextual theme for the embedded narrative (Todorov, 1978). In movies, there are several examples of "film/play in a film" which also constitute embedded stories: for example *La Nuit Américaine* (F. Truffaut) or *Deathtrap* (S. Lumet).

Applied to IS, embedded stories would consist in letting the user act in both the embedding and the embedded worlds. A Non Playing Character (NPC) would "tell" an embedded story in a participative way, since the user would play one character in the embedded story. Depending on what crosses the boundary between the two worlds, several cases can be distinguished.

- **Separate worlds:** The embedding and embedded worlds are totally separate. The user goes into the embedded worlds and what happens in that world does not have any influence on the embedding world that he comes back to later. The two stories can only be thematically linked.

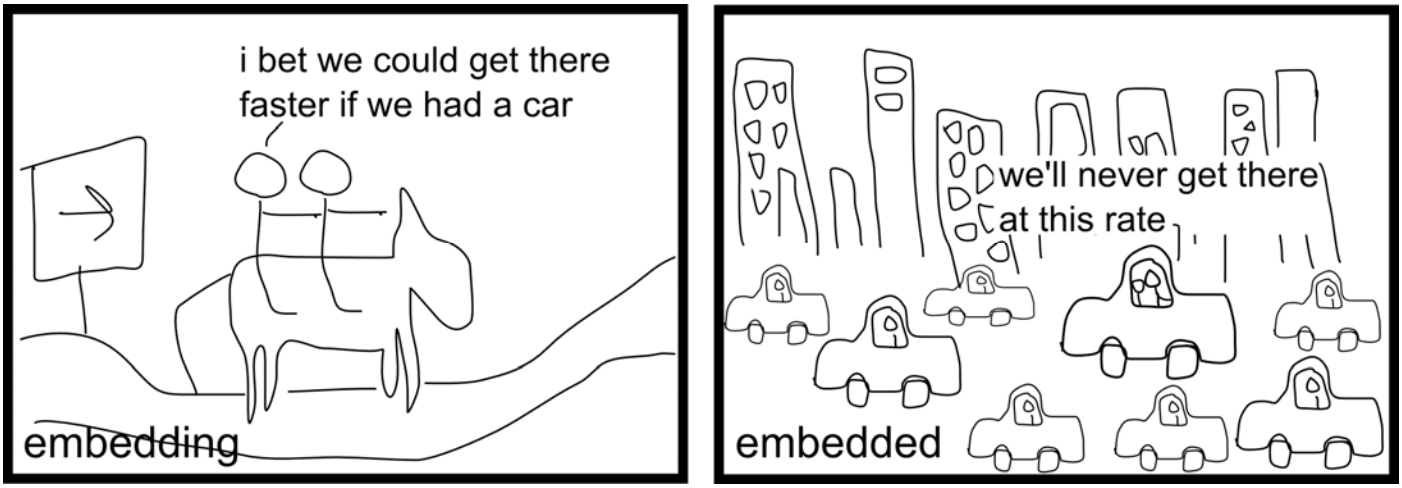

Figure 1: Separate Worlds: Embedding and embedded worlds that are only thematically linked.

- **Knowledge connected worlds:** Some knowledge crosses the boundary between the two worlds. Typically, the embedded stories would serves as a metaphor to inform about something that is relevant in the embedding world. For example, a NPC, instead of convincing the user via a dialogue based argumentation, would let the user play a relevant embedded story, announced in a sentence such as "Imagine yourself in this situation" and the boundary would be crossed.

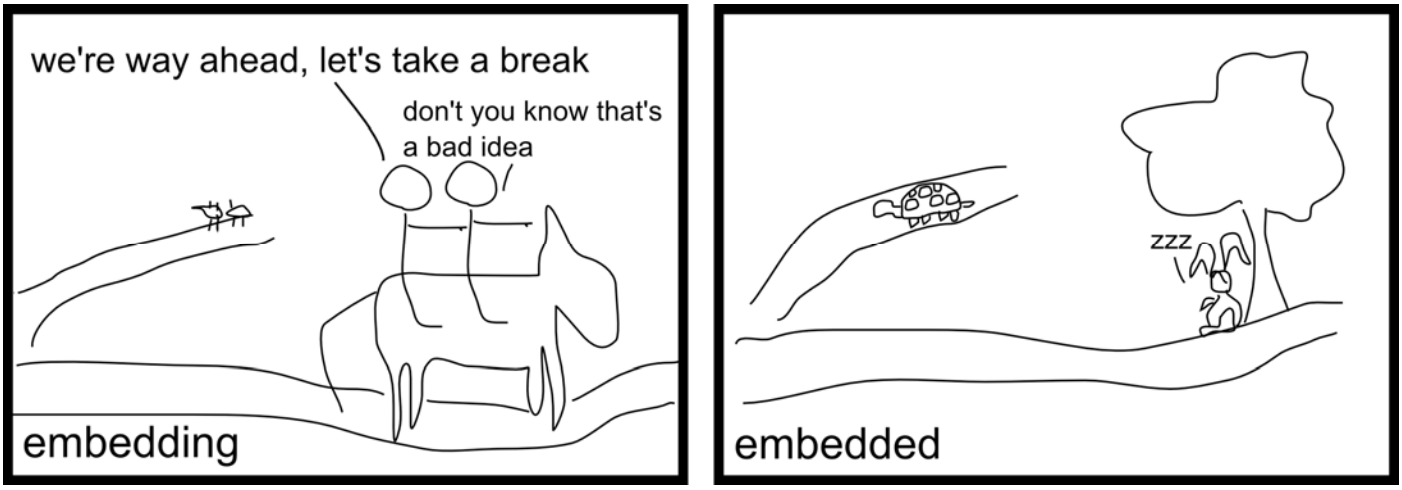

Figure 2: Knowledge Connected Worlds: The embedded world (The Tortoise and the Hare) serves as a metaphor to inform about something relevant in the embedding world.

- **Materially connected worlds:** The embedding and embedded worlds recognise a change; the absence of the user or introduction of a new object. For example, as is nicely illustrated in the movie *The Purple Rose of Cairo* (W. Allen), when the character leaves the film to enter the audience's world (the movie theatre), the rest of the cast in the movie becomes stuck because they cannot finish the movie. With materially connected worlds, the character physically travels from one world to the other, not just the user's point of control. We can further distinguish between three kinds of material connections:

1. ***Absence:*** *A minima, the character is missing in one world, which might have some consequences, as illustrated in the above example of The Purple Rose of Cairo.*

2. ***Object transfer:*** *The user's character can cross the boundary with objects. If the two stories are happening in different periods in history, this can create humoristic anachronisms, as is often seen in time travel movies.*

3. ***NPC transfer:*** *In this case, a NPC can cross the boundary, either on its own initiative or being invited by the user to do so.*

Technically, the Separate Worlds only requires managing two separate narrative states in parallel. However, the other cases are more complex to manage. When the two worlds are knowledge connected, part of the experience in the embedded world needs to be translated into knowledge added in the embedding world. The Materially Connected Worlds is harder to model since one needs to model not only the reaction of the "travelling" character to the other world but also the reactions of NPCs to the "stranger" character.

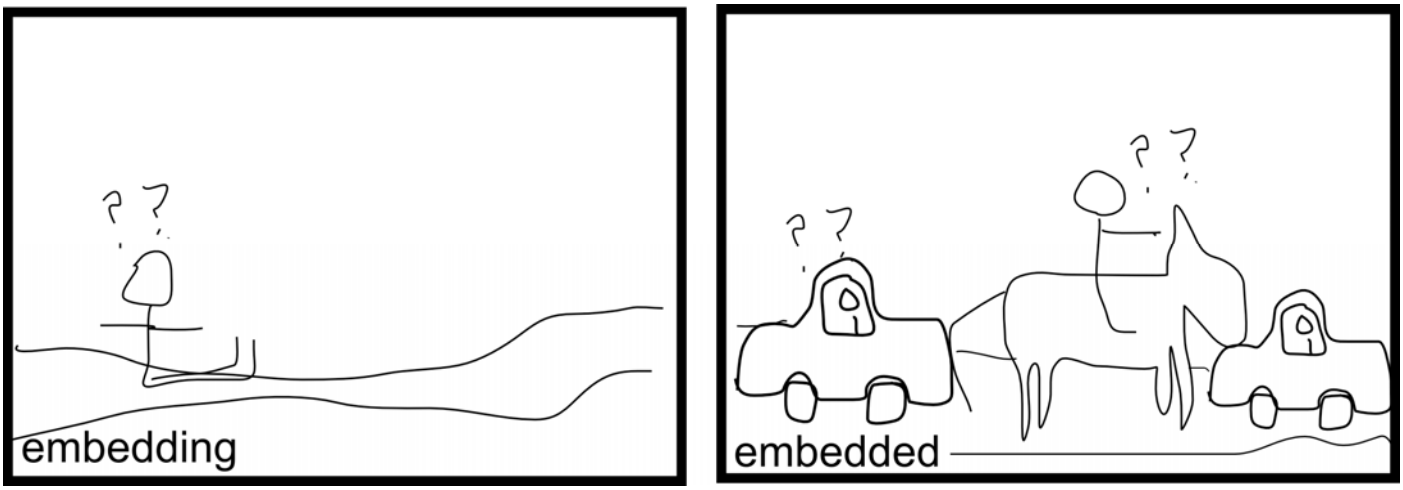

Figure 3: Materially Connected Worlds: There is a recognised change in both the embedding and embedded world.

Furthermore, the navigation to/from an embedded world can:

- occur at the user's initiative
- be proposed by the computer, typically a NPC
- be imposed by the computer

Note that the case of materially connected embedded worlds is also related to the notion metalepsis (Section 4.1).

3.3 Multiple actualisations

With current IS systems, although the user imagines a multitude of possible worlds (spectators' subworlds, see above) and is given choices at several points within the story (choice points), only one route is finally explored. If the user replays, he can explore another route, but each reading is distinct, and previous readings are not accessible during the current reading.

How can the possibility of multiple actualisations be better exploited in IS? If we stay in the usual interacting scheme in which the user interacts via a character, the only way to create alternative worlds is through a character's choice points. Thus, this opens the possibility that when interacting with a story via a choice point, the user can, not only actualize one of his choices, but also explore other alternative routes.

Before going further in this investigation, it is convenient to represent these routes as a tree: the root node is the start of the story, each node represents a choice point, a bifurcation corresponds to the creation of an alternative route and world from an existing one, the leaves represent the world in the state the user left it, and finally a storyline or route is a full trajectory from the root node to a leaf (see Figure 1).

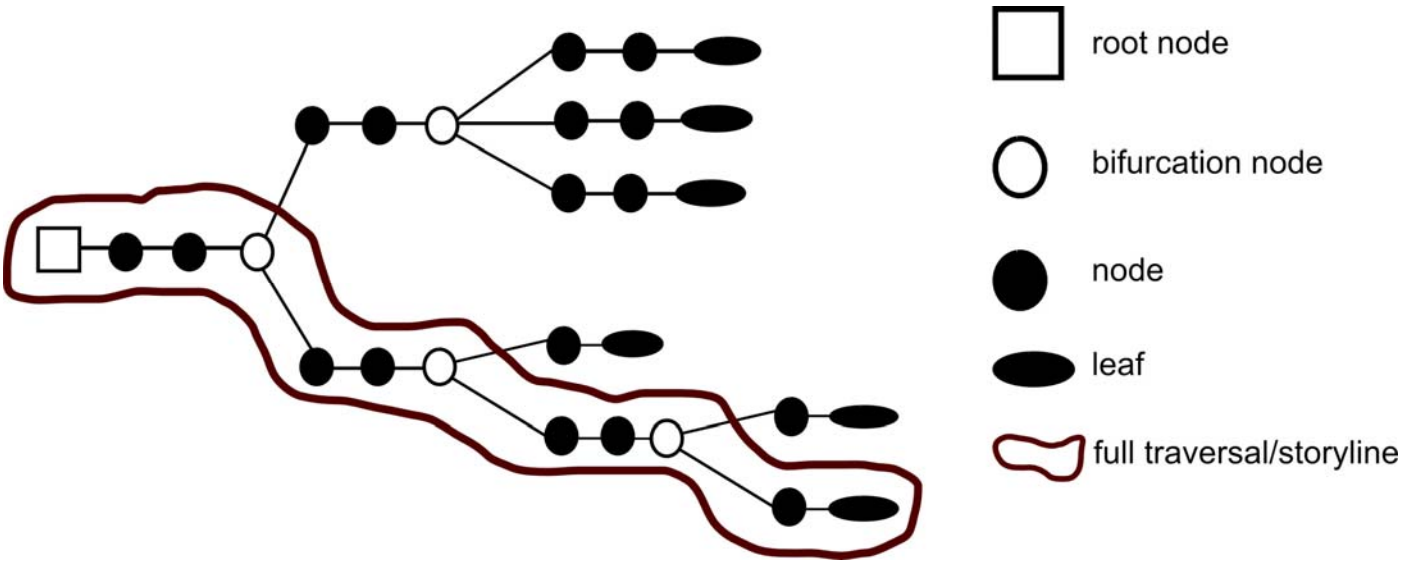

Figure 4: Multiple Actualisations

This tree representation shows that the system enables the user to build his own hypertextual narrative based on his exploration. However, this hypertext is radically different from classical hypertext because it is build by the user instead of the author. In fact, a main property of generative IS is that a hypertext representation of all possible paths is not feasible. In L. Manovich's words (Manovich, 2001), generative IS is based on algorithms while classical hypertext is based on data. The tree representation above is the result of an algorithm-based calculus – or is procedural, in J. Murray terms (Murray, 1997).

We can then further refine this potential form, according to three criteria.

1. The bifurcation point chooser: **Who** decides where the bifurcation points are, the user or the computer? Four cases can be distinguished:

- **Free choice:** Any user interaction point can be a bifurcation point, leaving the user the possibility to create as many alternative worlds desired.
- **Computer-constrained:** The computer filters the user interaction points to keep only a part of them, among which the user is free to choose.
- **Computer-proposed:** According to the current state of the story, the computer proposes several bifurcations points that the user is free to accept or not. Typically, the computer is able to calculate causal dependencies between events and it proposes to "replay the past to modify the present".
- **Computer-imposed:** The computer decides which bifurcation points must be explored by the user.

2. The moment of bifurcation point choice: **When** the user or the computer decides that a bifurcation point is worth exploring.

- **When played:** after encountering a certain choice point, the user or computer decides that this moment in the story should create two possible worlds to be played. Then, in most cases (but see part 6) the user will explore one of them, leaving the alternative world for later (in playing time).

- **Retrospectively:** when at a leaf of the story, one or more bifurcation points are decided, and the user either explores one of them (the most natural case) or continues with the current storyline route.

3. The navigation between alternative worlds: how does the user stop exploring the current world and go back to a previous (in playing time) alternative world?

- **Totally free:** the user can go towards any bifurcation point, either continuing an already started storyline at its leaf or directly starting another branch from an existing bifurcation point to create a new alternative world.

- **To any leaf:** The user can continue any already started storyline at its leaf.

- **At a subset of leaves:** The computer restricts which leaves can be continued.

- **At the previous leaf:** To simplify the user's representation of storyline imbrications, the user can only go back to the storyline he came from.

When combined, these different criteria can produce many different subforms of multiple actualisations. All these forms enable navigation at the discourse level on top of navigation at the story level, managed by the narrative engine.

Let us provide a few examples of combinations of the above criteria:

- Free choice of the bifurcation point, retrospective bifurcation, going back to another alternative world at the previous leaf: The user plays his story and can decide at any moment to stop the current storyline to explore another branch from any previously played storyline. At any moment, he can also stop the current storyline to go back to the previous storyline's leaf he quit to join the current storyline.

- Computer-proposed bifurcation point, retrospectively chosen, going back to another alternative world at a subset of leaves: During his interaction in a storyline, the user is prompted by the computer: "apparently, your choice to [...] three months ago had serious consequences. Do you want to replay this previous scene?". If the user clicks "no", he simply continues the current story, but if he clicks "yes", he replays the past decision point and chooses another option. He then explores the consequences of this choice. When the equivalent situation to the previous leaf is played, the computer prompts the user: "which story would you like to explore further?". The user can then either continue the first storyline, or the second one.

- Free choice of the bifurcation point, chosen when played, going back to another alternative world at any leaf: While playing the story, the user has the possibility to mark some of his decision points. Later, he can choose which among the marked decision points will constitute a bifurcation point, from which another storyline will be explored. He can quit the current storyline to continue any other previously started storyline.

Technically, realizing multiple actualisation requires storing the global narrative state at each potential choice point. From this global narrative state, any existing IS algorithms can be employed to deliver the interactive narrative

within a given actualized world. Thus, appart from the storage requirement, there is no added need for advanced AI to manage multiple actualisations.

These forms rely on a Graphical User Interface (GUI) that enable the choice of bifurcation point (if not computer-imposed) and the navigation to and from these bifurcation points. The tree representation already mentioned above is certainly to be reused in this GUI. The user would visualize the whole set of his multiple storyline current exploration and navigate through it. This particular GUI separates the story from the interface. Even with a more integrated GUI, the concept of navigation through alternative worlds is a break in the search of immersion. By quitting a world to re-enter another one, the user is in a more distant position regarding the fictional world. This contrasts with the "Hamlet on the Holodeck" (Murray, 1997) point of view on IS but promotes a more reflexive and critical approach regarding the story. Such view is also expanded in Section 4.

Finally, it should be stressed that such multiple actualisation forms are not so far from the saving mechanism in video games. By saving a game, the player stores a specific game's state (choice of the bifurcation point when played) that he will be able to explore later. There exists a multitude of variants of the saving mechanisms in video games: automatic save points (the game is automatically saved when a given stage is reached), in-game (diegetic) save points (the possibility of saving is represented in the fictional world by a specific artefact), manually vs. automatically labelled saved games, constrained or unconstrained number of saved games, etc. But the saving mechanism in games is primarily a tool allowing both to enable to play a game in several sessions and to manage the reaching of the game's success in the most efficient manner (that is without having to replay a large part of the game) (Amato, 2001). The saving mechanisms in video games are rarely used as a narrative device. An interesting exception is the game *The Last Express* (J. Mechner), in which the user can go back in time in the current storyline via a rewinding clock metaphor, to explore another branch (but the previous leaf becomes no longer accessible). Four such clocks are available in the game, constituting four saved games.

3.4 Other inter-worlds relations

In this section, we investigate the other types of world creating propositions. They correspond to *modes* in classical narratology, as described by V. Todorov (1978):

- Motivation-based modes
  - **Obligative:** What must be true in a society: "You have to respect the law: tell them the truth"
  - **Optative:** What characters desire: "I want that... "
- Hypothetical modes
  - **Conditional:** if something becomes true the character will do something: "If you give me a rose, I will kiss you"
  - **Predictive:** What could happen if something were true: "If it rained, people in this country would be happy"

We can extends these four modes with the work of M.L. Ryan [32], who adds the following worlds:

- **K-worlds, worlds of knowledge:** The knowledge a character has of the fictional world is in itself a possible world. Of course, if this knowledge is true, this K-world is not particularly interesting because the possible world and the fictional world are the same. But if it is wrong, then the beliefs of a character

can constitute a separate and relevant possible world to explore. Example: "We know that the world is flat: if you walk in that direction, then there is nothing".

- **Pretend worlds:** In this case, the possible world presented by a character is deliberately wrong. This is very common in narrative, two excellent examples are the movies *The Usual Suspects* (B. Singer), where a large part of the movie happens to be a pretend world or *Big Fish* (T. Burton) where most of what is recounted is embellished to the point where the audience is brought to believe it is pretend.

- **F-Universes, mind's created worlds:** The possible world is simply imagined by the character. This case includes dreams, hallucinations, fantasies and fictional stories. Example: "I dreamed that...". This case resembles the case of embedded stories, with the difference that the worlds "creator" might not be aware of the fact that this is a different world.

Applied to IS, the idea consists in letting the user act in a possible world created during a given dialogue. We denote the *Initiating Dialogue Act* the precise dialogue line which triggers the possible world. It can be considered a generalization of the embedded worlds case discussed above, where the relation between the embedding world and the embedded world can vary in nature. Let us shortly review what kind of narrative forms this could take, depending on the above narratological discussion:

- **Obligative interactive world:** The user would enter in the NPC's "obligative logic" to live what it means, in this context, to respect what must be respected. This case has something special in that the user's possibility of acting would be constrained: each time he would select a non correct action, he would be reminded that it is not the way to proceed and the action would be blocked. This interactivity management might seem odd and contrary to the principle of IS, however, it can provide a powerful expressive means. For example, the game *Real Lives* (Education Simulations Corporation, 2011) uses a similar mechanism: it puts the user in the life of a person in the developing world and explicitly shows impossible choices to express the idea that some actions cannot be taken. It is contrary to the basic ergonomic principle of control but still provides a narrative effect.

- **Optative interactive world:** In this case, the user would enter an alternative world, bifurcating from the current situation. However, this alternative world that would not follow the natural property of the fictional world but it would be biased by what the uttering character wishes. If the wish is a NPC's one, then a branch would be explored by the user, as described in Section 3.3 regarding multiple actualisation, with the difference of status: this new branch must be tagged as a character's wish, rather than as a mere fictional possibility. It might be the case that one storyline evolves according to that wish, but it could also be the case that all storylines that the user would explore according to the multiple actualisation system described above will never conform to the wished storyline.

- **Conditional and predictive interactive worlds:** We group these two modes, since the latter is in fact a generalization of the former [33]. This case is already covered above: case where the bifurcation is proposed by a NPC in a dialogue and the navigation back to the original storyline necessarily gets to the initial dialog.

- **Knowledge world and pretend world:** It is a variation of the embedded story case (Section 3), but the embedded world is 1) introduced by a NPC in a dialogue 2) similar to the embedding world, with specific knowledge differences (a mistake or a lie).

- **Mind's created worlds:** See embedded worlds.

Finally, we found that a hypothetical mode, missing in the narratological work we referred to, should be added: the *past conditional mode*, to follow a grammatical metaphor, or the retrospective extension of K-Worlds, to follow M.-L. Ryan's classification. It consists in assertions such as "If I had done this...". In IS, two sub cases are worth considering:

- **Backlooking or "Nostalgic" past conditional interactive worlds:** The embedded world is played before the embedding world, and the initiating dialog act is performed by the user: The user plays a first storyline, then, according to the mechanism discussed in Section 2, he goes back to another alternative storyline. At some point in this second storyline, during a dialogue, the user can refer to the previous storyline, and utter: "If I had done this, then ...". Such a sentence would be generated from the GUI used for the navigation through the different alternative worlds.

- **Backtracking past conditional interactive worlds:** The embedded world is played after the embedding world, and the initiating dialog act is performed by a NPC: The user is prompted by a NPC, with a dialogue line such as: "let's suppose you had..." (or "he had" or "it had"). Then the user would play an alternative branch and go back later in the initial dialogue.

This exploration of novel interactive forms based on possible world interaction in dialogues gives us a multitude of possibilities for IS that we have certainly only partially covered in this section.

4. The Frontiers of Fiction

4.1 Metalepsis

This section is reporting some research done in collaboration with Sébastien Allain, working on another project as part of his PhD Thesis (UNIGE, Université de Savoie - France). Many ideas that follow are his, but IRIS members have also been involved in the study of metalepsis, in particular during a one-day workshop organized in Geneva in April 2011, with the participation of Marie-Laure Ryan.

Metalepsis is a narratological term introduced by G. Genette as "any intrusion by the extradiegetic narrator or narratee into the diegetic universe (or by diegetic characters into a metadiegetic universe, etc.), or the inverse" (Genette, 1972).

A metalepsis is a violation of the narrative notion of *world*, as a separate entities, since elements from one world moves to another world it does not belong to. Several examples of metalepsis exist when the fictional world gets "intruded" by elements of embedded worlds. The *Purple Rose of Cairo* is one of them. Another one is the movie *Stranger than Fiction* (M. Forster), where the main character happens to be the character of a book being written by another character in the same world. But the type of metalepsis that is worth considering for IS is the interpenetration of W_0 and W_D., called *level 0 metalepsis*.

Why this type of metalepsis is worth studying for IS? This investigation has been initiated at UNIGE by Sébastien Allain, working in the field of narrative Serious Games. In this context, what happens in the fictional world in meant to connect to the real world: the end-user needs to learn from the fictional world for the real world. Therefore, the clear separation of these worlds that the notion of fiction presupposes might not be the most efficient way of learning. Another motivation to study metalepsis comes from the observation that immersive approach, as advocated by J. Murray (1997) and that is explicitly or implicitly underlying most work in IS, might not be the only

paradigm for IS (Szilas, 2004; Tanenbaum and Tanenbaum, 2008). From a theoretical perspective, some authors even argue that Interactive Storytelling is intrinsically metaleptic (Di Crosta, 2009; Jones 2010): the fact that the end-user intervenes in the storyline is a metalepsis. All these theoretical studies tend to claim that immersion is incompatible with interactivity, and that metalepsis would be the best way to understand and manage interaction.

Practically, this corresponds to IS situations where instead of seeking to put the end-user in the shoes of an avatar evolving in a close and immersive virtual worlds, one would put him and/or the virtual character he is controlling at a certain distance from the fictional world.

More precisely, it consists in:

- Letting the user navigate from an immersive perspective to a distanced perspective. In this context, the User Interface is not seen as an obstacle to the immersion but as a locus of metaleptic intrusion. (See also next section.)
- Letting the fictional elements, and in particular characters, acknowledge that the real world exists beyond the fictional world. This is typically achieved in movies when a character looks at the camera and speaks to the audience. These disrupting effects are rarely in use in movies, and even less in IS. Our proposition is that these effects might move from the status of an anecdotical effect to a founding principle of interaction.

Here follows a series of possible User Interface ideas, that follow the concept of metalepsis:

- The main character is able to make judgements bout the user's choice (agreeing, disagreeing, being surprised, making fun, etc.). This character is thus interacting at two levels: the level of the fiction and the real world (Allain and Szilas, 2011)
- A NPC declares that he or she is not really “John Smith” but a NPC in a virtual environment (Allain, 2010)
- A NPC declares that he is just the product of an author, and explains why, how, when ,etc. he or she was designed (Allain, 2010)
- A NPC refers to the narrative/computational mechanisms that makes him behave the way he or she behave.
- During iddle animations, the NPC look at the player, as if they were waiting for his/her activity
- User Interface elements are inserted within the world itself and not as a superimposed layer. This exists in video games for “save points” for example.
- Etc.

Several of the above interaction mechanisms are met in some video games, but often in a scarse and anedoctical manner. IDS research would benefit in a more principled application of metalepsis.

5. Author-Centred Narrative Formalisms

5.1 Introduction to the Author-Centred Approach

So far, formalisms for IS have been mainly driven by the necessity to overcome the limitations of the "natural" way to describe a story, as a series of events linearly organized or, as an extension, organized as a graph. This has led to number of IS prototypes (IRIS, 2011), which all face the issue of authoring: First, author who are able to use the prototype are hard to find; Second, when involved in the creative process, they experience several difficulties (Spierling and Szilas, 2009), which, at the end, strongly limit the expressive power of the IS prototypes. There are several approaches to cope with this issue, that are investigated in the IRIS dedicated workpackage "Authoring" (WP3). One of these approaches is a radical one: going back to root of the problem, and rethinking computational models for IS in a way that would better suits the authoring needs. In the way, an important constraint is not to go backwards, that is not to propose models that are not generative, or only in a limited way.

This approach appears challenging, because IS is inherently based on generative hence abstract hence difficult to grasp concepts. However, at the same time, we believe that the space of possible algorithms for IS has been largely unexplored. Thus, rethinking the IS algorithms in authoring terms might lead to some alternative formalisms for IS that have been neglected, because they do not fit with the usual formalisms used in Artificial Intelligence (AI), as the examples below will illustrate.

5.2 Authored-Centred Performative Structure

While it remains difficult to provide a unified view on the different IS approaches a common feature is for narrative progression to be represented in a state-oriented view in terms of *goals* and *tasks,* a goal being a specific state in the fictional word that one wishes to reach, and a task (also termed action or operator) being a transformation of the fictional world from one state to another. Goals and tasks not only constitute common concepts in Artificial Intelligence but often are also taken to correspond to fundamental narrative entities. For example, the notion of *goal* can be taken to correspond to one of the six main *actants* in structuralist narratology (Greimas, 1966) and is likewise seen as basic ingredient of narrative in dramaturgy and screenwriting (Vale, 1973; Field, 1984). Goals and tasks are organized in different ways across different approaches to interactive narrative. We term this organization a *performative structure*.

This organization serves the purpose of computations performed by, for example, planning (Young, 1999), rule-based action selection (Sgouros, 1999), or subgoaling (Szilas, 2007). In this section, we investigate a novel Performative Structure, called *PS-101*, that incorporates two additional constraints: 1) being based on what we know from narrative theories and 2) ability to *use* the performative structure as accessible and expressive material. It is our expectation that this should lead to more artistic and novel work that exploits and expresses more of the potential of Interactive Narrative.

Formal characterization of a performative structure is based on the computational structures constituting the *building blocks* for Interactive Narrative models. Following the above constraints, these *first-class elements* should be narrative-related, author-friendly, and relevant in terms of story generation and interaction. The four first-class elements in PS-101 are: goals, tasks, obstacles, and side-effects:

- In PS-101, *goals* represent what characters want to achieve as a state of affair in the fictional world. Goals are expressed simply by stative verbs such as *be*, *have*, *love*, or *believe*. To increase generativity, goals may include parameters: named terms left undefined at authoring time and instantiated at execution time with concrete *entities*: characters, objects, or places.

- In PS-101, *tasks* are concrete actions characters can perform to reach a goal. Tasks are expressed by dynamic verbs such as *eat*, *steal*, *offer*, or *read*. A task is always associated to a single goal, which is reached when the task is performed successfully. The same goal may be reached by multiple tasks.

- *Obstacles* represent *failure* events that can happen when a task is attempted. An obstacle prevents the character who attempted the task to achieve the goal the task is associated to.

- *Side effects* also occur during the execution of a task. However, while obstacles cause a task to fail, side effects do not influence the reaching of the goal the task is associated to. Side effects have other positive or negative consequences *outside* of this goal.

In addition to a set of narrative first-class elements, a performative structure also includes *relations* between these elements. These relations describe in an abstract way the potential dynamics of the performative structure. Relations are *oriented* from a *source* element to a *target* element and are visualized graphically by arrows from source to target. PS-101 currently comprises (so far) nine relation types:

- Subgoaling (sub). A *subgoaling* relation links an obstacle, termed the *triggering obstacle*, to a goal, termed the *subgoal*. When an obstacle is triggered, it triggers the subgoal associated to it. The subgoal then needs to be reached first in order to achieve the character's overall goal. Conversely, if the subgoal is not reached, then the obstacle remains *on* (and will trigger with the probability specified by the author-defined *risk*). For example, an obstacle "the door is locked" may trigger a subgoal "have the key". If the narrative engine supports it, a subgoal may already be triggered when the obstacle relating to it is merely *anticipated*.

- Counter-goaling (cts and ctg). A *counter-goaling* relation links a goal (termed the *counter-goal*) to an obstacle (termed the *blocked obstacle*). Whenever the counter-goal is reached, the associated blocked obstacle becomes *on*. If the overall goal (hindered by the blocked obstacle) and the counter-goal belong to two different characters, it creates a conflict of interest or a voluntary obstructing of one character by the other. PS-101 distinguishes two types of counter-goaling relations. In the first type, named *simple counter-goaling (cts)*, the obstacle exists (is instantiated) independently from the instantiation (i.e., active pursuit) of the counter-goal. In the second type, named *generative counter-goaling (ctg)*, the obstacle is instantiated only when the counter-goal is instantiated.

- Obstruction (obs and obg). An *obstruction* relation is a relation between a side effect and an obstacle. As soon as the side effect is met (triggered), the obstacle is set to *on*. Obstructions can be used to model direct causality between events. Similarly to counter-goaling, two types of obstruction relations are distinguished in PS-101. In *simple obstruction* (*obs*), the obstacle exists (is instantiated) independently from the existence of the side effect. In *generative obstruction* (*obg*), the obstacle is instantiated only when the side effect is instantiated.

- Clearing (cle). A *clearing* relation also holds between a side effect and an obstacle. It allows to model that a side effect clears the obstacle. In this sense, it is the opposite of the obstruction relation and corresponds to a positive consequence of a side effect. As soon as the side effect is triggered, the obstacle is cleared (set to *off*) and no longer hinders the execution of the task it is associated to.

- Needing (nee). A *needing* relation is a relation between a side effect and a goal. It means that as soon as the side effect is triggered, a new goal is created. It serves a similar function as the *obstruction* relation,

but in an indirect manner, via a goal. Furthermore, it enables the creation of a new goal *after* the triggering of a side effect. The distinction of obstruction and needing in PS-101 is also the result of empirical observations.

- Solving (slv). A *solving* relation is another relation between a side effect and a goal. It means that as soon as the side effect is triggered, the target goal, if activated, is reached. It models a positive side effect of achieving a first goal with a second goal "in the pipeline". This relation is opposite to the *needing* relation.

- Chaining (chn). *Chaining* is a relation between two goals. When a first goal is reached, the second goal is activated. It is a simple relation that (re-)introduces some linearity, but at the higher level of goals rather than of tasks. Note that for a character under user control it may be preferable to propose activation of the second goal as an option to the user, rather than activating it automatically.

These four states and nine relations, when combined together, form a graph, that is visually represented and authored as follows:

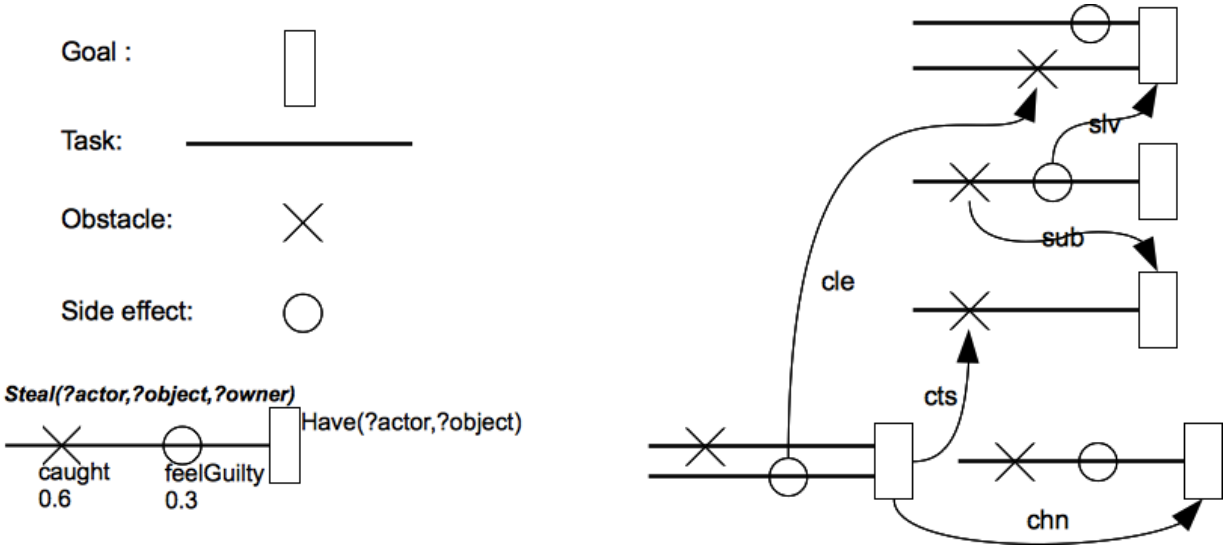

Figure 5: At the left are represented all four elements of PS-101, with an example of their use. At the right is represented a performative structure making use of various elements and relations.

Rules for executing these performative structures have been specified (Szilas, et al. 2011). They decide which elements get activated/suppressed, which obstacles or side-effects are triggered during an execution. Note that PS-101 is focused on the performative structure because it constitutes a key component for a large class of systems based on computational narrative. These systems also make use of additional mechanisms such as planning or inter-agent communication. Therefore, the performative structure PS-101 does not constitute a full IS engine but is only a part of it.

Finally, below is represented an example of a story described in PS-101. This story features Frank, a teenager who has to deal with his father, Paul, who is suffering from a Traumatic Brain Injury. Paul often shows inappropriate behaviours that are difficult to deal with. In the particular situation of the example, the family is at home and Julia, Frank's classmate, comes to visit him to ask him some question regarding the last math course.

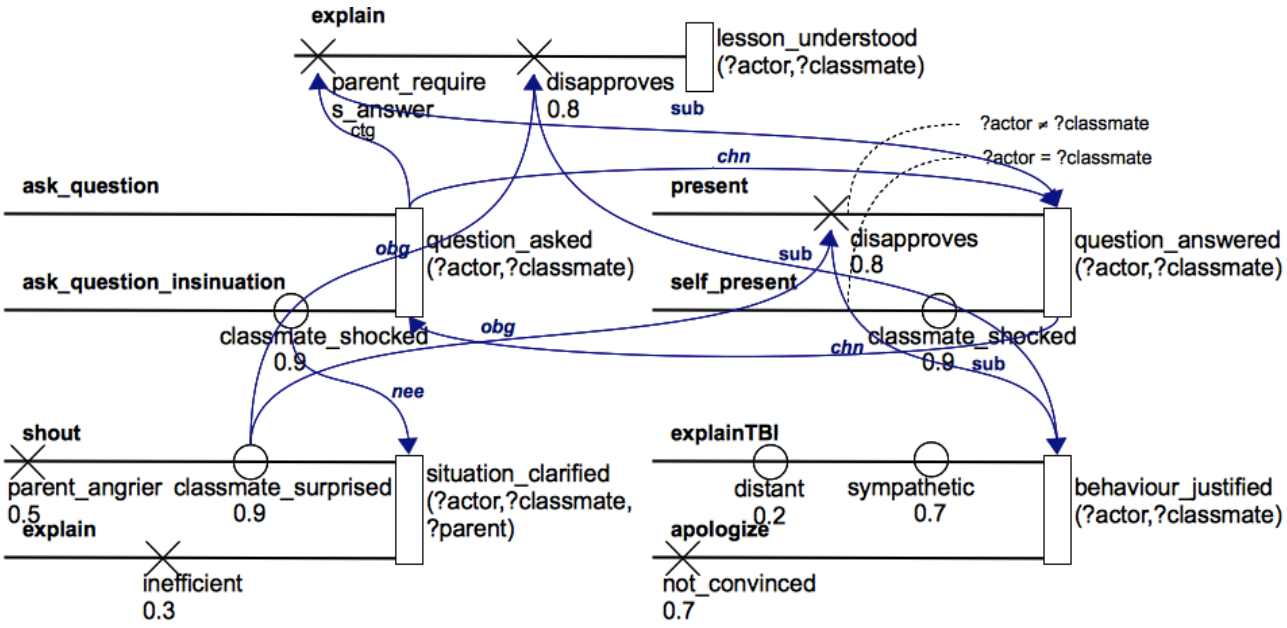

Figure 6: An example of a full performative structure.

5.3 Stateless Formalism

By analyzing the basic elements of narrative, narrative theorists established some classification of the main micro-constituents of a narrative. In [9], several such theories are overviewed. A basic distinction emerges from this overview, the distinction between static parts (*states* or stative events) and active parts (non stative events or *events*). This corresponds to the classical distinction between description and action.

States, even if they are not explicitly represented in the story, are usually used to describe the story logic. At a general level, a story is often defined as the transformation from one state to another. In a detailed analysis, Bremond describes processes, which are a series of local states between which actions can occur (Bremond, 1973). More audience-oriented theories also use states, such as emotional states of the audience (Tan, 1996).

Despite the existence of these narrative theories based on states, we claim that states in narrative, and especially in drama, are *indirect variables*. They are often not directly seen because actions are seen. In fact, states are inferred by the reader, through interpretation (Friedman-Hill, 1995). For example, in a movie, we would not objectively see the fact that a character is sad, be we would see him crying. We are not saying that states cannot be expressed in a drama (at a minimal level, it can always be expressed by a narrator), but that a state is more interestingly expressed through an action. This corresponds to the classical writing advice: “show do not tell” (e.g. (McKee, 1997)).

Following this claim, we can derive a narrative engine where the author would only describe actions, and relations between those actions. Let us take the movie “It' s a wonderful life” as an example. The overarching story can be summarized as follows:

S1: George’s company is ruined
S2: George wants to commit suicide
A0: Clarence shows him the world as it would be if he hadn't been born
S3: George is horrified and wants to live again

While this first description is correct and conform with the idea of a story as a transformation, an alternative way to describe the same story is:

A1: Uncle Billy tells George he lost George's company's money
A2: George starts to commit suicide
A3: Clarence shows him the world as it would be if he hadn't been born
A4: George asks Clarence to live again

While the first description contained four states and one action, this second description is purely based on actions. A stateless narrative engine would only contain rules that link different actions together, rather than a rule from a state to an action. An English description of such a rule could be: "If someone learns he has lost all his money, then he can kill himself", rather than "if someone is ruined, he can kill himself".

Attempting to describe the storyworld, the rules between actions, in a compelling way, we have come up with a visual representation of both rules and narrative simulations (stories-so-far), in terms of *links between actions*. On central type of link is the enabling link, between two generic actions. For example:
perform(X,t) –e informPerformance(X,Y,t)
This means that if the left part of the rule has already been executed (i.e. is part of the history), then the right part can be executed. X,Y and t are variables, that can be instanciated during a particular execution (X and Y are characters, t is a task).

With enabling links only, incoherence would occur as soon as the system is nonmonotonic, that is when something that is true at time t might not be true at time t+1. Let us take the example of a storyworld with the following enabling link: *perform(X,sell(o,Y)) –e perform(Y,sell(o,Z))*. It means "if Y has been sold an object o, it can resell it to another character". When executed, this storyworld would execute the link ad libitum, meaning that the owner of an object could resell it infinitely. To prevent this to happen, we introduce another link, the *inhibitory links.* In our example, an inhibitory link connects a selling action to a selling action, to express the fact that "one cannot sell something that one has already sold", which is formalized: perform(X,sell(o,Y)) –i perform(X,sell(o,Y)).

Two other types of links are then introduced:

- The relevance link: inspired from the Gricean maxim of relevance ("Act according to what has been acted before"), a relevance link relates two actions that should occur one after the other, or at least within a short time distance. Relevance links work differently from enabling links. They do not make an action possible or impossible, but rather favor one action instead of another. They are used in the algorithm to weight and rank actions already selected according to enabling and inhibitory links.

- The explanation link: The links between two actions is sometimes weaker than an enabling link. Let us take the example of revenge. If somebody's loved one is the victim of a degradation action, then revenge, for this character, consists in repeating the action, but against the aggressor. The action of revenge must already be possible (via an enabling link), but becomes narratively interesting because of the initial action. This kind of link is called an explanatory link, because the resulting action is explained by the initiating action. Thus, as with relevance links, explanatory links will not enable or disable some actions but reinforce an action over another.

Detailed algorithms to manage the triggering of these various links is detailed elsewhere (Szilas and Axelrad, 2009). We have performed preliminary test that demonstrate that link structures can be used to generate simple stories. This stateless approach has several advantages:

- Reasoning in terms of relations between actions is more natural for authors, as it corresponds better of the narrative nature of the simulation.

- When authoring and "debugging" an interactive drama, it is always difficult to identify what caused one action to trigger instead of another. It usually requires inspecting the internal state of the engine, and multiple variables. In the proposed approach, what needs to be inspected are the various links from past actions to the action in question. We expect such a narrative engine to be more transparent to a non-technical user.

- The approach has some potentials in terms of expressiveness. Every time an action is selected, we directly have access to all previous actions that caused (in the large sense) this action. It opens the way to richer output expression. For example, to express the giving action, one can say “I sell you the ball I have” (state representation) but one can also say “I sell you the ball that Chloe sold me yesterday” which is not only more complete, but more relevant as well, especially from a narrative point of view.

- Finally, links between past actions and future actions could be used for the user interface. In a menu-style interface, it would consist in selecting a past action and choosing which possible action this past action enables or explains or immediately arouses (according to enabling, explaining and relevance links respectively).

The “stateless” formalism (more formally, we should say that computer's internal states represent past actions rather than the fictional world's states), also meets limitations when the storyworld grows, especially when the state-based equivalent situation is: A single state is the consequence of *m* actions and it can trigger *n* actions. In that case, we need to author *m x n* rules (links) instead of *m + n* rules. Nevertheless, this is a promising formalism that is worth exploring.

5.4 Configuration of Affective Characters

The approach of affective characters is to some degree orthogonal to the notion of multiple storyworlds: characters with different degrees of autonomy interact in a story-world and thus create the space of different possibilities for stories to unfold. From an author's perspective, the question remains what controls or directs the autonomy of these characters. In practice, the answer is: an instance of an agent control architecture that is carefully crafted to reflect a backstory that motivates the character's behaviour, that is relevant to the story's topic, and that is fleshed out by the author(s) during the creation of the story. One of the purposes of author-centred narrative formalisms is to bridge the gap between such a modus operandi, mainly influenced by practical necessities, and the theory and practice of authoring.

Affect is an important element for agent control architectures needed to drive these synthetic characters: on the one hand, for the convincing portrayal of emotional reactions, but moreover due to the importance of affective processes in detecting relevance, motivating behaviour, and understanding social relationships (Marsella, et al. 2010). Affective agent control architectures attempt to translate these beneficial competencies, as described in psychological theories, to application areas such as IS, thereby providing the basis for autonomy (inside a story-world). But how can and author use an affective agent to create a synthetic character with a suitable personality and level of autonomy, i.e. an autonomous personality agent? Or more concretely: How does the notion of a story character with a backstory relate to the configuration and parameterization of an affective agent?

There is a long tradition in the field of place approaches to interactive storytelling on a spectrum between `strong autonomy' and `strong story' (Mateas and Stern, 2000; Swartjes, 2010). Overall it is clear that, the further a system

goes towards strong-autonomy, the more important the configuration of individual characters and their affective and situated competencies become (Petta, 2003; Marsella, et al. 2010). However, even in a strongly story-based system, autonomously competent agents are valuable for enacting scenes on a smaller scale if they can be configured to act `in character' during such episodes that are not directly controlled by the story-based framework. Further, the techniques for configuration can also influence strongly story-based systems that explicitly represent emotional links between characters as part of the authoring process, e.g. Perez y Perez (2003).

Independent of the actual agent architecture that is employed, we can distinguish three different non-distinct levels of presenting configuration:

1. Direct changes to or selection of sets of initial inner states of agents. This can range from relatively intuitive concepts such as the specification of goals, beliefs, and available competences or plans to elements that are closely tied to the internal structure of an agent architecture. Practically ubiquitous in available affective agent architectures are the notions of goal utility, as well as numeric thresholds and decay rates for emotional reactions.

2. Parameter settings that influence the inner working of an agent in correspondence to a theoretically persistent characteristic of the agent as a whole: traits. This can range from implementations based on personality theories such as the five factor model over quality criteria for planning processes to more abstract parameters such as the motivators and modulators stemming from PSI theory (Bach, 2003).

3. Complete stock characters with a particular personality that can be selected and used as a basis to start from for customization. This corresponds to a notion of prototypes but does not imply that the resulting characters need to be `stereotypical' in the pejorative sense.

4. Configuration of background beliefs and emotional parameters such as coping style based on the selection of backstory experiences.

Figure 7 illustrates the different levels mentioned here. Regarding the different options for configuration mentioned, we can distinguish between options in so far as they pertain to levels 1 and 2, i.e. they modify the working of particular inner states or of the agent as a whole. Practical and intentional examples for the third level are rare to non-existent. However, most architectures have naturally been designed for a specific purpose and therefore the specific characters that have been used are available, at least in principle. Further, efforts based on narrative traditions centred on character types, such as the “comedia dell'arte” or improv-theatre, are a start towards a more formalised approach. To the best of our knowledge, no exhaustive set of character configurations to be used as a starting point for authoring affective characters exists to date. The fourth level suggested above is based on practical authoring experience as well as the potential of case-based reasoning for story construction. It provides a further promising avenue for bridging the gap between system construction and authoring practice.

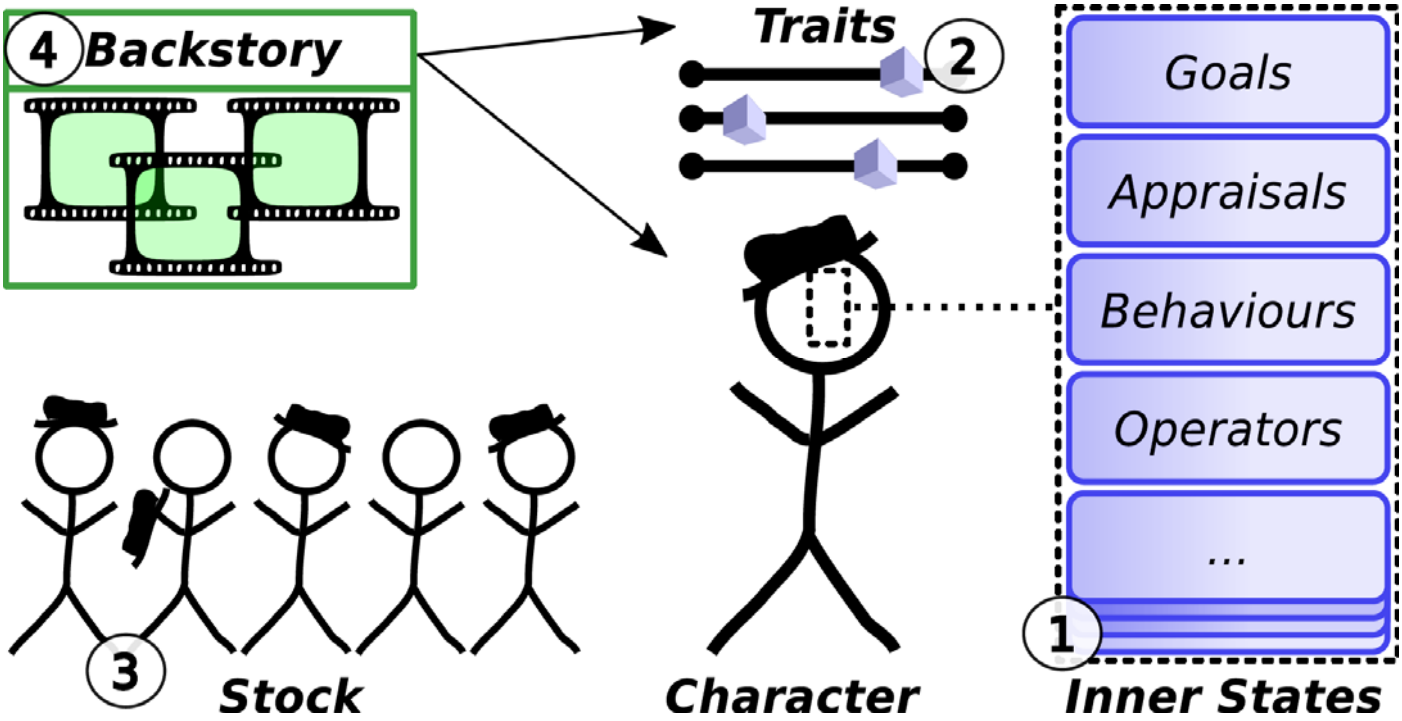

Figure 7: Levels of character configuration in IS

6. Conclusion

While most existing IS systems are either based on existing computational approaches or on classical narrative approaches (classic narratology or screenwriting), we have explored in this report several alternative formalisms, grouped in four large categories. We have not tried to place them in a unified framework, because they correspond to individual and heterogenous lines of exploration, that do not necessary follow the same goals. For example, on the one hand multiple story worlds approaches mostly attempt to extend both the type of stories represented in IS and the user interface. On the other hand, Author-Centred approaches aim at improving the quality of produced stories, without extending the range of stories that the system is theoretically able to represent.

What emerges from this exploration is that the space of exploration for IS is particularly large, in terms of story complexity, end-user's positioning, interaction paradigm or authoring viewpoint. Further investigation in any of these tracks can be either “research-based” or “design-based.” In a research-based approach, the goal is to demonstrate that one approach leads to a better performance that the “traditional” approach, with a scientific evaluation along some quantified criteria. For example, showing that end-users offered with an embedded story ability have a more fun experience than users playing with a single story world. In a design-based approach, the purpose is to design a compelling interactive storytelling prototype, whose narrative quality and large adoption “proves” the validity of the underlying approaches, and foster further adoption of them. The design-oriented approach is demanding in terms of both programming, visual design and storytelling, and tends to be neglected by researchers, because this is not their primary job to develop a practical story: video game companies or other private businesses are best suited for this task. However, the short history of our field has shown that designing a compelling system has the largest impact, both to the public and the researchers – We are of course referring here to Façade (Mateas and Stern, 2000). Therefore, as a conclusion, we would like to promote a “design-based” approach for Interactive Storytelling. Given the effort that such an approach requires, typically far beyond a single PhD work, we believe that a key issue is to able to reuse already developed technology (a Narrative engine, a visualisation

system, an agent technology, etc.). Therefore, this investigation of alternative formalisms goes hand in hand with another IRIS effort, related to the interfacing and sharing of IS technological components.

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