Affective Storytelling based on Characters' Feelings

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Abstract

Most Interactive Storytelling systems developed to date have followed a task-based approach to story representation, using planning techniques to drive the story by generating a sequence of actions, which essentially "solve" the task to which the story is equated. One major limitation of this approach has been that it fails to incorporate characters' psychology, and as a consequence important aesthetic aspects of the narrative cannot be easily captured by Interactive Storytelling. In this paper, we introduce a new approach to Interactive Storytelling which aims at reconciling narrative actions with the characters' attributed psychology as stated in the narrative. Our long-term goal is to be able to explore Interactive Storytelling for those narrative genres which are based on the characters' psychology rather than solely on their actions. We used as a starting point the formalisation by Flaubert himself of his novel *Madame Bovary*, which includes a detailed account of character's desires and feelings. We describe a prototype in which characters' behaviour is driven by a real-time search-based planning system applying operators whose content is based on a specific inventory of feelings. Furthermore, the actual pattern of evolution of the character's plan, as measured through the variation of the search heuristic, is used to confer a sense of awareness to the characters, which can be used to generate feelings about its overall situation, from feelings of boredom to hope, despair and helplessness.

Introduction

One of the main challenges of Interactive Storytelling (IS) is to determine the real-time behaviour of virtual characters in a way that is consistent with narrative phenomena. The duality between character and plot emphasises the difficulty of reconciling a character's perspective with the control exerted by the storyline. In addition, the psychology and feelings of characters is an essential part of most dramas. It is therefore some kind of a paradox to see these under-represented in interactive narrative research, to the exception of simulation and educational storytelling [Aylett *et al.*, 2005; Marsella and Gratch, 2003]. One possible explanation is that the emphasis on narrative representations has essentially been on narrative actions rather than characters' psychology, feelings and motivations. Characters' psychology has been diluted into mythical narrative functions, such as *treason*, which were supposed to subsume the psychological determinants of characters' actions. Throughout the narrative genres that have served to illustrate research in interactive narrative, there has been a prevalence of those genres based on actions and situations rather than the psychological relations between agents. One notable exception has been Mateas and Stern's *Façade* system [Mateas and Stern, 2002]. One of the central aspects of Façade, which consists in departing from the "task completion" approach to interactive storytelling to investigate the aesthetic satisfaction of the narrative, is certainly the best description of the problems facing those investigating IS from the perspective of new media and digital entertainment.

Previous and Related Work

The inclusion of emotions in IS systems has been extensively described by Gratch [2000] and Marsella and Gratch [2003]. It follows the development of emotional planning by Gratch [1999], as most IS engines are based on planning systems. Further, they introduced the two central notions of *appraisal* (evaluating the emotional significance of events) and *coping* (maintaining the relationship between the agent and its social environment). However, in their approach emotions derive from an anticipation of plan evolution, for instance the anticipation of plan failure due to possible threats. In that sense, emotions do not belong to the planning domain itself. *FearNot!* [Aylett *et al.*, 2005] is another example of a behavioural simulation generating emergent narrative in which realistic feelings mediate between the simulation and the narrative aspects. Rank and Petta [2005] have recently introduced a framework for affective acting in IS based on *appraisal*.

In our own previous work [Cavazza *et al.*, 2002; Charles and Cavazza, 2004], we have developed an approach known as character-based storytelling, to the extent that characters' roles, rather than a centralised plot model, serve as the main driver for narrative generation. This approach is suited to the generation of situations arising from the interaction between characters. However, we have come to realise the paradox that for a character-based approach, it is not more strongly based on the actual characters' feelings and intentions, which form an integral part of narrative descriptions.

System Overview and Architecture

To support this research, we implemented a prototype system which integrates a purpose-built AI system with a 3D visualisation engine, the Unreal Tournament™ engine, using UDP sockets to exchange control messages (Figure 1). The interactive storytelling engine is based on a multi-threaded HSP Planner [Bonnet and Geffner, 2001] controlling each character independently. 3D animations are generated from the grounded actions produced by the planner. During story visualisation, the system accepts Natural Language input, which is analysed to update characters' beliefs and emotional state, thus altering the evolution of the narrative.

During a typical cycle, the planner determines the best operator to be applied for a given character, as a function of its current feelings, its beliefs, and the world's state of affairs. This in turn generates a corresponding action in the virtual world, which is staged to visualise the narrative. It also performs corresponding world changes both in the reference 3D world and in the IS engine's knowledge representation (facts, as well as agents' beliefs, being updated as a consequence of action execution). The system stores heuristic values for the plans of each agent so as to be able to recognise specific patterns of variation in the heuristic that can have a narrative interpretation (see below). Instantiation of specific patterns of actions can also update characters' beliefs (e.g. feelings such as `helplessness` after consecutive action failures and/or negative interpretations).

Our planning component is a standard HSP-type planner controlling STRIPS-like operators [Fikes and Nilsson, 1971]. The planner has to operate in a dynamic environment because of the interactions between characters (they all interact with each other and within the same physical space) and the potential for user intervention. In order to adapt it to real-time planning we have used RTA* [Korf, 1990] as its underlying search algorithm, thus allowing backtracks in order to avoid dead-locks, and returning the best next action after a certain threshold time (Figure 2).

Finally, we use the standard HSP definition of the Heuristic computation [Bonnet and Geffner, 2001] calculated from the content of operators and the goal definition using the Value Iteration (VI) method as described by Liu *et al.* [2002]. In that sense, heuristics are guiding story generation without introducing any additional bias on top of feelings and operators definition. Computation of the heuristic accounts for a significant fraction of the total CPU time for the planner, as it is classically described in the HSP literature. On average, each HSP planner produces a response in approx. 150 ms on a 2 GHz Intel processor, which is compatible with the narrative genre considered. There is potential for optimisation, in particular in the calculation method for the HSP heuristic (for instance by using the PINCH method [Liu *et al.*, 2002]).

The system can operate in various modes, from an autonomous narrative generator whose initial conditions can be parameterised by the user, to various forms of interactive narrative, in which the user either controls one of the characters (all but the main character Emma Bovary) or influences them from a spectator's position [Cavazza *et al.,* 2002].

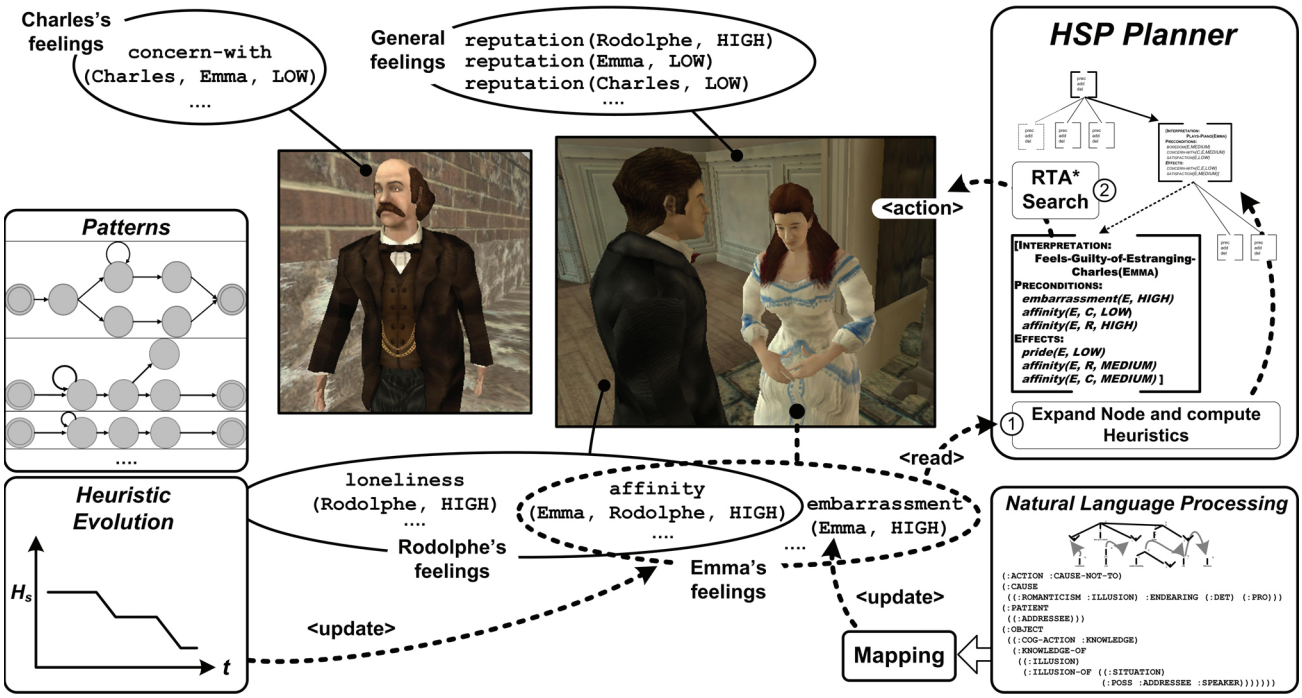

Figure 1: System Overview and Architecture (see text).

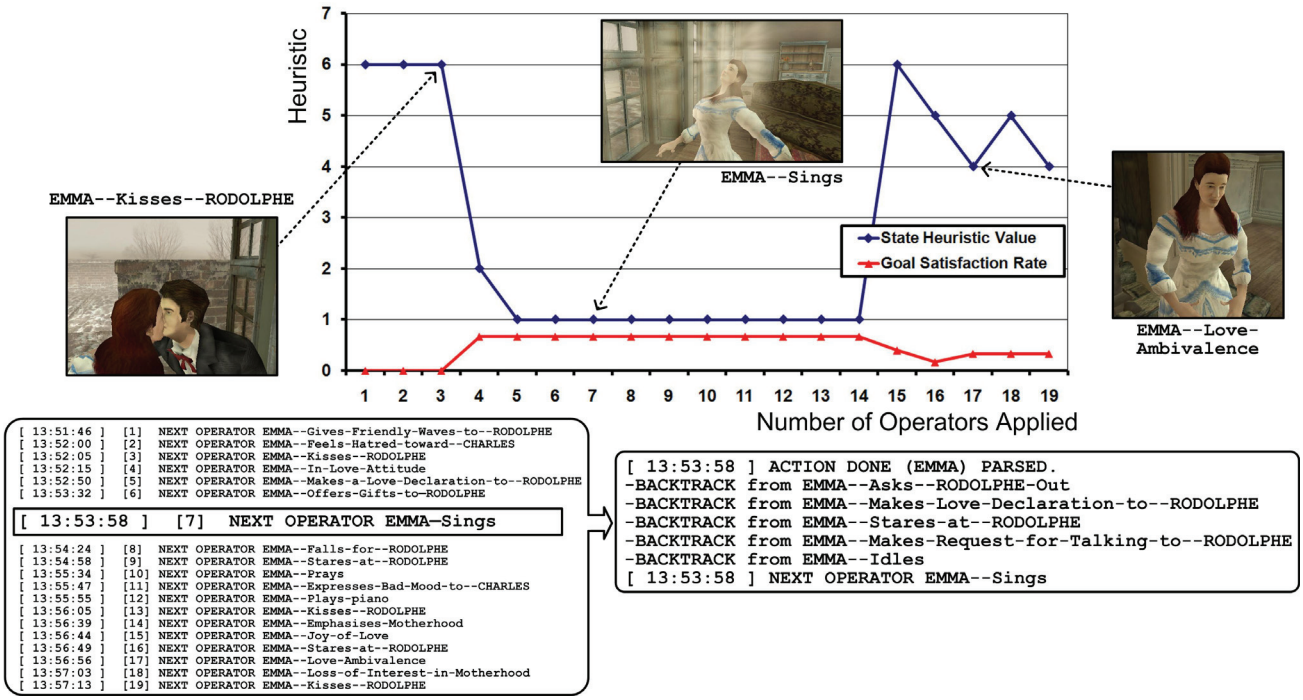

Figure 2: Example of Operators Generation at Runtime with Associated Heuristic Values.

Choice of Application and Narrative Context

The majority of IS research prototypes have made use of Planning for their baseline narrative engine, generating action sequences as the story backbone [Cavazza *et al.*, 2002; Magerko *et al.*, 2004; Riedl and Young, 2004]. Planning is neutral to the character-plot duality in IS and, as a formalism, can be used to describe both plot models [Riedl and Young, 2004] and characters' roles [Cavazza *et al.*, 2002] as the main narrative representation. A given planning formalism, such as HTN, can even be used for both approaches [Ayradinis *et al.*, 2003; Thawonmas *et al.*, 2003].

We wanted to explore another approach, which consists in adopting a weaker representational model, in which planning is only used as a technology driving action selection towards certain long-term objectives, but not necessarily equating the story to the specific instantiation of a plan. In other words, a character can be driven by long-term motivations such as *wealth*, *happiness* or *fame* rather than by a fine-grained goal description in terms of state of affairs. These motivations can be formalised as conjunction of feelings constituting the "goal state" for the planning system.

It would appear that the narrative genres which have so far supported IS research have influenced the overall approach to narrative representation and formalisation. Other factors influencing the current situation come from narratology itself [Cavazza and Pizzi, 2006] and the presentation of the overall story as some kind of problem solving which is typical in certain genres such as the crime novel (e.g. plans to commit crimes such as robbery [Riedl and Young, 2006]). Likewise epics and folktales, which are based on a set of recurring situations and on task completion [Propp, 1968], albeit in the form of the hero's challenge and leave little room to the subtleties of character psychology.

On the other hand, psychology and internal feelings permeate other forms of narratives genres such as XIXth century novels. We were thus looking for a storyline with a strong psychological component and an extensive description of its characters' feelings, which would have been developed independently of any IS system. Ideally, such a description would have been produced by the author himself as part of early sketches of a novel.

Further to placing significant emphasis on the characters' psychology, Flaubert's preliminary studies for his novel *Madame Bovary* contain a description of the plot in the form of elementary plans [Leclerc, 1995], together with extensive commentary on the characters' psychology and their feelings at any given stage of the plot. Rastier [1995] has for instance identified over 128 recurrent feelings in a corpus of French novels. He has further demonstrated that these need not be all lexicalised, illustrating this with the semantic distribution for the concept of /*boredom*/ in *Madame Bovary*.

Flaubert, in his preparatory works to the eponymous novel, has given precise indications on the feelings at play and their explicit occurrence should be considered as important a part of the narrative as the actual sequence of actions. In other words, there will be a direct connection between narrative feelings and narrative actions rather than a generation of actions from first principles based on high-level descriptions of elementary feelings. This approach falls under the generic distinction between the *cognitive*

and the *narrative* (see also [Christian and Young, 2004] on different aspects). Examples of such feelings described by Flaubert for Emma Bovary include *feeling-of-emptiness*, *boredom* [Leclerc, 1995, p. 17]; *pride-of-having-a-lover*, *poetic-feelings* [id., p. 48] *emboldened-by-love* (developing an attitude), *jealousy-curiosity* [id., p. 48]; *feels-hatred-for-Charles* [id., p. 49]; *irritated-by-vice* [id., p. 50]; *bitter-love-feelings* [id., p. 50]. Over 30 such feelings have been described by Flaubert in his preliminary plans and scenarios.

This is a rather unique case of content formalisation provided by an author himself: it constitutes a formidable starting point for the design of an emotional planner whose objective is to operate on the characters' feelings and mental states. These feelings range from the traditional (*boredom*) to the fairly specific. In deriving a planning domain from their inventory, we have first defined a set of ground mental states (such as `affinity` between characters, `pride`, `womanhood`), which were derived from the most generic feelings. More specific feelings such as *guilt* have been associated with operators (`Feels-Guilty-of-Estranging-Charles`), which actually express the consequences of that feeling, and decompose it into more elementary feelings within the expression of the operator (both pre-conditions and effects).

The ontology of those *Literary Feelings* extracted from the semantics of feelings described by Flaubert underlies the definition of operators. Planning goals are in turn extracted from the baseline story, which by extension also allows the production of significant story variations.

Narrative Formalisation

We have formalised a large section of the second part of *Madame Bovary*, more specifically chapters 9-12 of Part II [Flaubert, 1856], corresponding to her affair with Rodolphe Boulanger, which spans across several chapters of the book. This section features three main characters which are Charles Bovary, Emma Bovary and Rodolphe Boulanger. In our HSP implementation, each of these characters is under the control of an independent planner operating in a shared domain of facts. Each fact is defined as a conjunction of character's feelings and states of mind (e.g. `accepts-adultery-risk(Emma, Charles, HIGH)`) and state of affairs in the physical world (e.g. `inside(Emma, HOUSE)`).

These states admit various intensity values {LOW, MEDIUM, HIGH}, which are modified by planning operators, themselves corresponding to feelings, which govern the evolution of mental states. These operators have been classified in three categories. *Interpretation operators* update a character's feelings to react to a change in the state of the world (this being prompted by another character's actions or by the provision of new information, e.g. through user interaction). Figure 3 shows such an operator (`Emboldened-by-Love`), which corresponds to a feeling of increased self-confidence for Emma Bovary. *Character interaction operators* intentionally modify another character's mental states and correspond to narrative actions such as invitations, arguments, and declarations. Finally, *physical operators* correspond to necessary physical actions such as changing location to interact with another character (the low-level details of motion planning and animation are automatically generated in the 3D environment from the corresponding action primitive). The distinction between those three types can be made using the nature of the fluents that compose the operator. For instance, a fluent such as `affinity` between characters, which corresponds to an affective response to interaction, is modified using *Character interaction operators* whereas a fluent like `accepts-adultery-risk`, which reflects a character inner state of mind, is instead modified by *Interpretations.*

This distinction is based on the semantics of characters' feelings but also relates to a classification of characters' responses to different types of narrative events, namely interaction between characters and introspective analysis of their situation.

From the above description, it appears that the planning environment, in which each character influences other characters' feelings, is naturally dynamic, even more so considering the potential for user intervention at anytime.

As we wish to depart from the task-oriented model of a narrative, the representation of the goal state for the HSP planner should not correspond to a specific final state of affairs described in terms of situational predicates. The goal state will thus be mainly composed of feelings and, most importantly, will essentially behave as a driver rather than a specific goal to be reached. A simple example in the

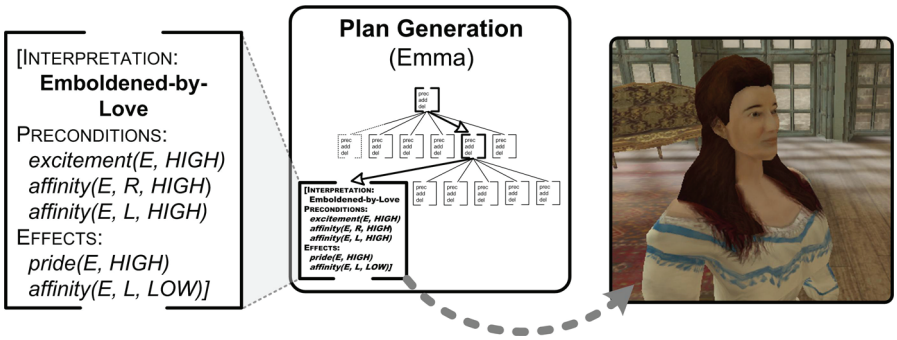

Figure 3: An Example Emotional Operator: its contents are mental states and feelings relating the various characters (E = Emma, L = Léon, R = Rodolphe).

present context would be that Emma Bovary's goal is to escape her bourgeois condition (considered as the main driver of her behaviour) and the boredom and mediocrity that constitute it. However, the novel ends with Emma Bovary committing suicide, not out of despondency or boredom, but to escape the infamy caused by her level of debts. This obviously cannot be construed as a narrative goal: if we want our interactive version to be able to re-produce the original ending as well as happier ones, endings cannot be explicitly equated to goals. Rather, the characters should be driven by higher-level goals which would correspond to desired states of mind (Emma can seek *happiness* here represented by the fact `satisfaction(Emma, HIGH)`) as well as material status (`accepts-adultery-risk(Emma, Charles, HIGH)`). Another important aspect is that these driving goals should contain a dynamic element, i.e. they are updated as the situation evolves, some desires being added and others deleted. For instance, for the examples described in this paper and considering the stage of the novel at which they take place, the initial desires of Emma relate to generic concepts of happiness but she also wants to forget her previous lover, Leon, which is represented in the goal state as an extra and more specific fact `affinity(Emma, Leon, LOW)`.

Awareness and Feelings

Early models that have included emotions in planning have been based on *appraisal* theory, i.e. emotions were related to an evaluation by the agent of its own situation, either with respect to its desires, or considering its social relations to other agents (including status and responsibility). Very often, anticipations of negative outcomes or threats to its plan have been the main drive for emotion generation. Anticipation is one particular case of the awareness on the character's side of the evolution of its situation. The other aspect often illustrating emotional planning is *coping* [Marsella and Gratch, 2002; Ayllet *et al.*, 2005]. In line with our commitment to the exploration of aesthetic phenomena in the narrative, we are looking for a representation that would not deduce character's psychology from first (*cognitive*) principles. Mechanisms of *appraisal* and *coping* could also be described for Emma Bovary, but a more appropriate level of description would make the best use of those specific semantic domains in relation to the story topics, using the more specific feelings described by Flaubert [Leclerc, 1995]. In other words we want to explore a *narrative* rather than a *cognitive* approach. If we want to relate the character's psychology to aesthetic elements of the narrative, we need to find a model in which this global awareness can also be related to narrative descriptions.

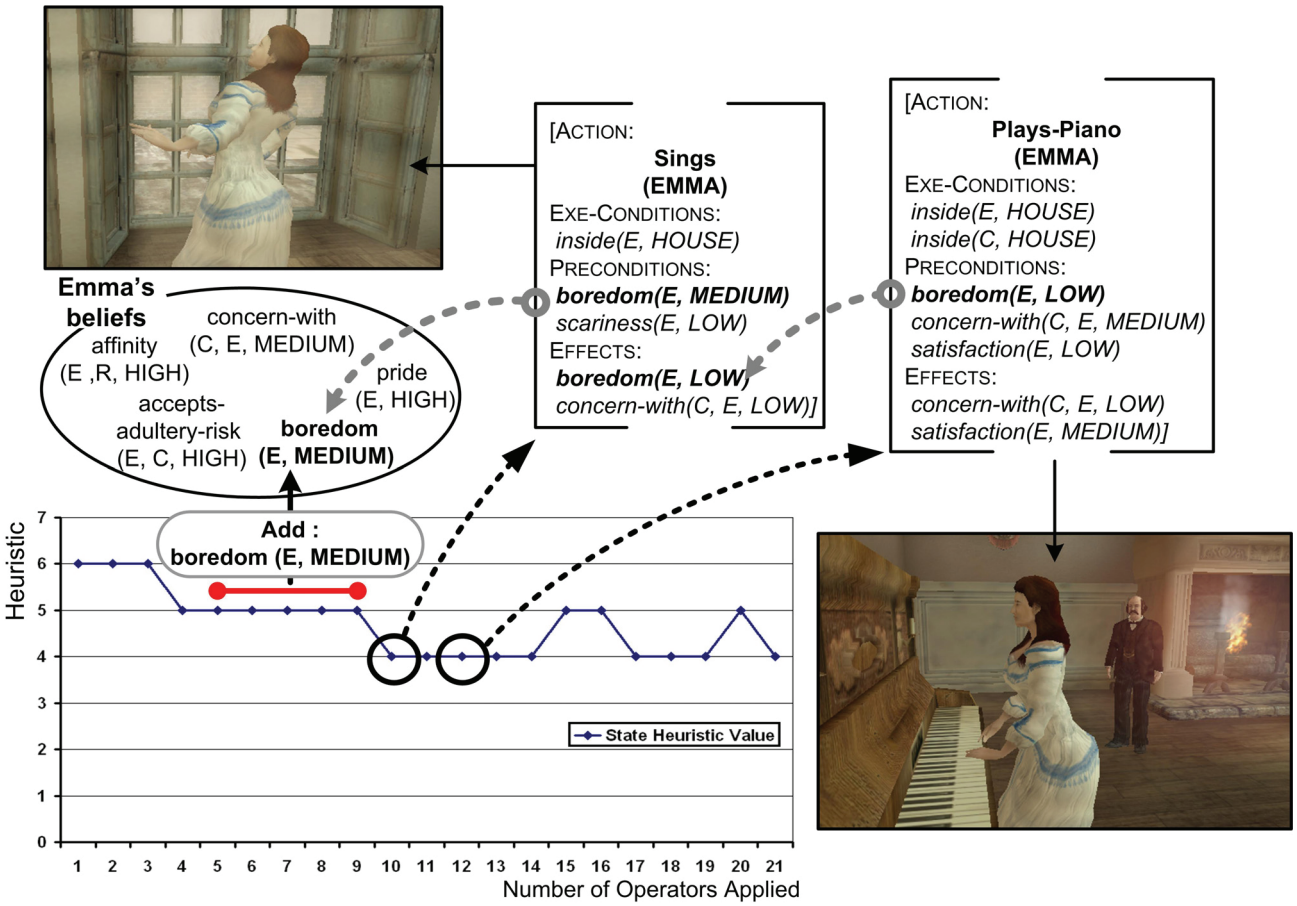

Figure 4: Emotional Feedback from the Awareness of Events' Progression

In modern narratology, Bremond [1973] has proposed to describe story progression through the evolution of characters' situation in terms of improvement and deterioration, including multiple causal descriptions of the other characters' influence on the process. The next step consists in devising knowledge representations supporting the character's awareness of how its own situation evolves as a consequence of its own actions or is affected by other characters. Reasoning on causal dependencies in plans seems better suited to task models [Riedl and Stern, 2006] or plan-space search, in which such dependencies can be explicitly formalised (see e.g. the examples discussed in [Gratch, 1999]). For state-space search, as implemented when using HSP, the contribution of specific actions to an agent's desires is best measured through the heuristic function. In this implementation of interactive storytelling, we took advantage of the generative aspects of HSP to define some cognitive elements related to the characters' awareness of their own situation as emergent properties rather than explicit representations of a priori feelings. If certain situations constitute drivers for the characters, e.g. in the pursuit of happiness, then measures of how their situations evolve with respect to these drivers can be mapped to cognitive concepts. One example which is of particular significance to the novel is *boredom*. This is perhaps the central feeling of the whole story, yet it is hardly mentioned explicitly [Rastier, 1995]. Measuring the pace of story progression towards a character's goal can indeed constitute an emergent representation of boredom as it reflects both the lack of notable events and the helplessness of a character to alter its situation. Formally, because HSP heuristics measure contribution towards the current goal, patterns of heuristic evolution (e.g. lack of decrease in the heuristic value over a period of time, indicating lack of progression) can be mapped onto the character's awareness, thus representing boredom.

Figure 4 shows such an example, where the lack of progression generates a feeling of `boredom`, in turn affecting the choice of Emma's actions. Finally, a steep increase in the heuristic value, which persists for several steps, would signal a deterioration of the agent's situation. Should such a steep increase follow an initial decrease, this pattern would correspond for instance to the narrative notion of "shattered hopes". The above patterns are encoded for recognition by the planner and dynamically generate corresponding facts, which in turn can take part in the pre-conditions of *interpretation operators*. By this mechanism, characters' feelings can be altered by its perception of how the situation evolves. It should be noted that most of these patterns of "initial improvement followed by deterioration" have actually been described in Bremond's narrative theory [Bremond, 1973]. In that sense, this mechanism we just described is consistent with the narrative descriptions of narratology. Figure 2 represents such use of the heuristic variation to generate awareness of the situation. Following the beginning of her affair with Rodolphe (initial decrease in the heuristic value, as her situation evolves towards her desires, steps 5-14), Rodolphe gets annoyed by her behaviour and is more distant (not shown on the figure): Emma decides to spend more time with her family. The steep increase in the heuristic reflects the situation and generates a pattern of *disillusion*.

We have not incorporated any aesthetic evaluation in the heuristics themselves, which are automatically derived from the semantics of operators. We have still found that formal aspects of search-based planning, such as heuristic variations and perplexity, could be easily mapped into our representational framework, even if it had been designed from the perspective of narrative content.

Results and Discussion

Figure 5 illustrates the impact of an utterance on the story unfolding from the perspective of the central character, Emma Bovary. The initial situation corresponds to Emma and Rodolphe meeting just after she has decided to reach happiness (which is translated in the planning domain by adding a new local goal represented by the feeling `satisfaction(Emma, HIGH)`). In the absence of any external (user) influence, Emma will fulfil her goal by letting Rodolphe seduce her. She engages first in a romantic conversation (`Says-Sthg-in-Confidence-Rodolphe`) before falling for her new lover (`Falls-for-Rodolphe`) and showing him signs of affection (`Kissed-by-Rodolphe`). She is now living in a new relationship

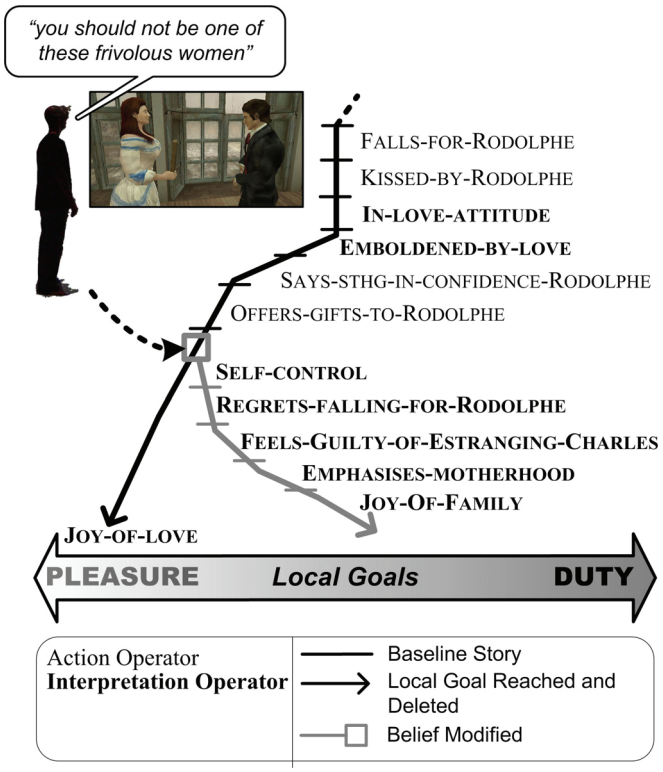

Figure 5: Impact of the utterance from the user on the story generation.

and starts to enjoy it (`In-Love-Attitude` and `Emboldened-by-Love`), which will make her forget about Leon (her ex-lover). In the end, she will not hesitate to risk her financial situation for him (`Offers-Gifts-to-Rodolphe`) before at last finding happiness with this new lover (`Joy-of-Love`). This, to a large extent, corresponds to the generation of the original storyline by the system, which would be a first indication that the planning domain is consistent.

Conversely, the right-hand side of the figure shows an alternative story evolution from exactly the same initial conditions, under the influence of a natural language utterance. The interactive component of the system is constituted by a Natural Language Processing (NLP) module, which enables the user to input utterances targeted to one character, Emma Bovary in the examples described here. These are not meant to be part of a continuous dialogue like in *Façade* [Mateas and Stern, 2002], although they can be entered as a reply to a statement made by Emma. The overall principle consists in recognising the emotional content of the user utterance so as to map it to the ontology of feelings used by the system. To that effect, the NLP module uses a small Tree-Adjoining Grammar (TAG) parser developed in previous work [Cavazza, 1998] and a semantic lexicon which associates emotional categories. The NLP module aggregates emotional features through syntactic links during parsing and the resulting features structures are searched for patterns that can map onto the feelings described in the planning operators.

For instance, the processing of a sentence such as *"you should not be one of these frivolous women"*, which is analysed as a derogative statement, producing a partial feature structure such as

```
(:PROPERTY
  ((:GROUP :FEMALE) (:DEROGATIVE :PLEASURE)
  (:INSTANCE)))
```

The /*derogative*/ and /*pleasure*/ features can be then mapped to the feeling of `embarrassment(Emma, HIGH)` in the planning domain (such mapping being performed by ad-hoc rules).

This utterance is introduced after Emma decided to offers gifts to Rodolphe. It will upset Emma about the power that Rodolphe has actually gained over her (`Regrets-Falling-for-Rodolphe`). She will experience feelings of *guilt* (`Feels-Guilty-of-Estranging-Charles`) and in absence of new seduction acts from Rodolphe, she will finally return to her family (`Emphasises-Motherhood` and `Joy-of-Family`).

Conclusions

Exploring new narrative genres, in which characters' feelings and psychology play a major role, is a challenge for IS. We have introduced a narrative approach in which the emphasis is on the use of *narrative* description of characters' psychology rather than *cognitive* models.

In this approach planning has been used with a weaker representational stance, without equating the narrative itself to a specific plan instantiation. We have grounded the aesthetic aspects of the narrative on the original description of feelings by Flaubert, thereby relying of the richness of the original description to produce situations of narrative interest. Narrative descriptions of character psychology, such as those provided by the author, are also compatible with narrative models of the plot itself [Bremond, 1973].

These *literary feelings* constitute a fine grained semantics related to the aesthetic properties of the narrative and have no claim to psychological validity in a traditional cognitive sense. Neither can literary feelings be equated to folk psychology, from which they differ in terms of granularity and lack of 'mechanistic' motivational structure.

At this stage of experimentation, it is probably too early to evaluate all aspects of the prototype which has been developed to support this research. However, we can already testify to the stability of the environment when it comes to story generation, considering that we have been able to generate episodes exceeding 6 minutes in length and up to 11 minutes (normalised for action duration) on a regular basis, which is significantly longer than anything we have presented before [Charles and Cavazza, 2004].

The automatic evaluation of story quality (in the aesthetic sense) is still a long-term endeavour, for which the recent work from Cheong and Young [2006] on suspense gives promising directions for research.

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