

# From Synthetic Characters to Virtual Actors

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## Abstract

We discuss the extension of an emotionally-driven agent architecture already applied to the creation of emergent narratives. Synthetic characters are enhanced to perform as actors by carrying out a second cognitive appraisal, based on the OCC model, of the emotional impact of their projected actions before execution.

## Introduction – Narrative and Emotion

Narrative has become a topic of great interest in video and computer games development as a way of drawing the player into the gameplay [12], and is seen as a focus for the development of mobile and Augmented Reality-based gaming [16]. Much active research addresses the generic use of interactive graphical environments and intelligent synthetic characters to extend the power of narrative in new ways [12]. Specifically it has played a central role in a number of interactive graphics-based e-learning systems both for adults [19] and children [6, 14].

The key characteristic of all these environments is interactivity: users expect to move freely and interact at will with objects and synthetic characters. Yet this interactional freedom clashes badly with the conventional narrative requirement for a definite structure, creating a narrative paradox [9]. A plot-based narrative structure supposes the right actions at the right places and times but these may not be those the user chooses to carry out [15]. More generally, an authorial plot-based view of narrative where particular actions must execute in a particular order conflicts with a character-based view where strongly autonomous [11]. Characters select their actions in response to their sensing of the state of the virtual world.

Strong autonomy for characters offers a potential solution to the narrative paradox since if synthetic characters are allowed to autonomously select actions, then a participating user can also be allowed to do so on the same terms. Given that in general, structure can emerge from interaction between simpler elements, we conjecture that interaction between strongly autonomous characters can under

specific circumstances produce narrative structure, or an emergent narrative (EN) [1].

The main objection to character-based narrative based on strong autonomy is that there is no guarantee that interesting narrative structure will result precisely because characters are responding to their internal state and individual goals in choosing actions and not to the overall story structure. This approach however prioritises the actions and experience of the participating user/player rather than the overall drama as perceived from a spectator/observer point of view. It focuses on the dramatic experience of the user [9, 18].

The specific hypothesis explored is that an autonomous agent that explicitly assesses the emotional impact of its actions on other agents around it, much as an actor would, will produce a more engaging emergent narrative than one that only uses its own ‘in-role’ emotional state to select its next action. Other virtual actors [17] have not tried to assess the differential emotional impact of a set of possible ‘in-role’ actions, making this a novel approach. Because it uses emotional impact, it is also different from assessing the goals or plans of other agents [7].

If narrative is to emerge from interaction between characters, then the character architecture is fundamentally important. It is the contextual relevance and richness of the actions selected by each character that will or will not produce sequences with the post-hoc structure of a story: that is a coherent compound of external interest and surprise (causal chains of actions) with internal perceived intentionality and emotional impact (motivation and expressive behaviour). Displaying role-specific emotional reactions to the actions of other characters and the emotion behind their own actions is an important component of successful human acting.

For this reason a number of researchers in synthetic characters, starting with Elliot’s Affective Reasoner [4] have integrated affect into their agent architectures [5, 2], usually drawing on cognitive appraisal theory. Appraisal is the human perceptual process through which objects, other characters and events are related to the needs and goals of an individual, generating a resulting emotional response and thus linking emotion to cognition. The most widely implemented system is the taxonomy of Ortony, Clore and Collins (OCC) [13], used by the FatiMA agent architecture

which formed the basis for the work described here. The OCC model is an approach based on a valenced (good or bad) reaction to an event and the structure of emotions it defines can be seen as a hierarchical taxonomy organising 22 emotion types.

### Affective agent architecture

The FatiMA (Fearnot Affective Mind Architecture) [3] agent architecture is shown in [Figure 1] (with the additions of the work reported here added in red) and is that used in FearNot!, an application that generates episodes of emergent virtual drama relating to bullying for educational purposes [2]. In this architecture, an agent’s emotional status affects its drives, motivations, priorities and relationships, with an OCC-based appraisal system and resulting coping behaviour [8] - those internal emotional adjustments made or external actions taken in order to deal with negative emotions. Characters may also have different thresholds and decay rates for each of the 22 OCC emotions, implicitly defining a large set of different personalities.

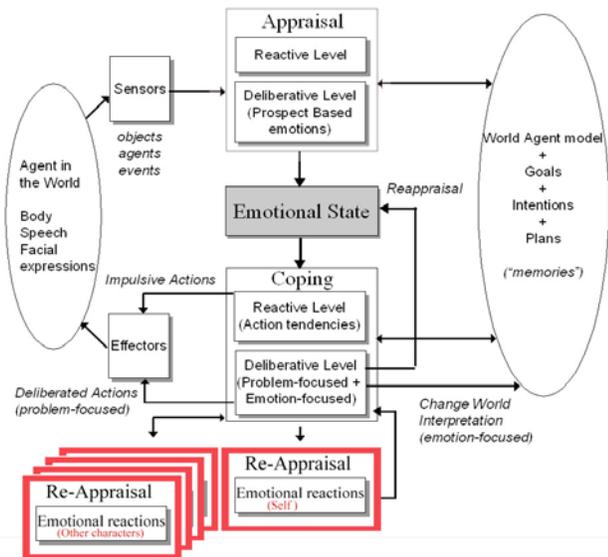


Figure 1. DAM architecture

As shown in Figure 1, the appraisal mechanism consists of both a reactive and deliberative layer [2,3]. The former is handled by a set of emotional reaction rules consisting of an event that triggers the rule and values for the OCC appraisal variables affected by the event (desirability, desirability-for-other, praiseworthiness etc).

The deliberative layer is responsible for appraising events according to the character’s goals, thus generating prospect-based emotions like hope and fear. These emotions relate to future events: those congruent with the IVA’s goals (hope) or those threatening them (fear). They thus connect the affective system to the planning component of coping behaviour [5].

**Double Appraisal approach.** The design of an agent action-selection mechanism that selects dramatically interesting actions is a technical and conceptual challenge. In particular, the subjective nature of drama and its perception makes the development of a reliable and quantifiable assessment measure very difficult. The idea explored here is to take emotional impact (EI) as a surrogate for dramatic interest, hypothesising that the EI of a specific action relates to its dramatic impact and could thus substitute for dramatic value. A character would therefore take an action not solely on the basis of its emotions, goals and motivations but also on the EI of these actions for both itself and other characters. This approach would allow the characters to conjointly assume in a distributive manner the dramatic weight of an unfolding story without relying on a pre-determined plot.

We argue that the implementation of such a concept requires a novel agent action-selection mechanism whose function is not only to make action decisions but also to project the possible impact of these decisions. The mechanism described in this section features a double appraisal cycle as opposed to the single approach discussed above. This allows the agent to appraise events as in any conventional appraisal-based system but then carry out conflict resolution over a set of possible actions by running another appraisal cycle (in parallel), assessing each member of the feasible in-role action set according to its potential emotional impact. Thus the selection of an action is made not just on the inherent value of a particular action but on its ability to generate EI. The mechanism has been implemented within the already existing FAtiMA architecture, at the coping level, and features two related approaches for evaluation purposes.

**DA: Double Appraisal.** In DA, the agent reconsiders its choice of action/intention with reference to the emotional impact if the action or emotion was directed to itself. An extra loop is added into the appraisal process by recasting each possible action into an event and feeding it back into the agent’s own appraisal system. This corresponds to a “Theory of Mind” approach [25] in which the agent assumes that everyone else would react as they would: “how would I feel if someone did this action to me?” Thus for an action such as hitting another agent, it would assess the emotional impact based on how it would react emotionally to being hit by another agent. An intention is re-appraised based on the plan to achieve it. Here the action re-appraised as an event is the one that satisfies the relevant goal via its post-condition definition. As with any appraisal-based approach, events processed by the system are matched to the agent’s emotional state and emotions are generated in response.

The FatiMA coping mechanism has been modified so that instead of selecting the action with the highest intensity, it creates a set composed of a number (3 or 9 depending on the version) of eligible actions, selected according to their ranked intensity. It then instantiates a new copy of the current agent emotional state and recasts the selected actions into an event representation where the target of the

event is the agent itself. Re-appraisal is then conducted on this event within the agent's duplicated emotional state so as not to affect the current emotional state of the agent. As a result of this re-appraisal, still within the copied emotional state, emotions are generated and the value of the strongest emotion generated determines the value of the emotional impact for the re-appraised event. This value is accessed by the coping system through the copied emotional state when the action appraisal has been completed.

At the end of the cycle, the copied emotional state and event pool are reset for the re-appraisal of the next selected action. The cycle is run until all actions selected in the valued action array list have been re-appraised. The system then selects the action whose emotional impact is the strongest. The system acts similarly for both reactive (actions) and deliberative (intentions) coping.

**DAM: Double Appraisal with Modelling.** DAM is based on the same principle as DA but rather than assessing an action or intention with respect to the agent's own set of emotional reactions and goals, it carries this out for all the agents that are part of the current scenario. Thus now an action is not assessed for its emotional impact on the agent but on its emotional impact for each different agent involved. The action with the highest emotional impact on any agent present is then selected.

Whilst an important change from DA theoretically and for evaluation purposes, the extra technical requirement is minimal. The processes described in the previous section can be reused and the overall flow of data is the same; the only major change is that of integrating as many re-appraisal cycles as there are agents in the coping system and using copies of their emotional systems instead of that of the appraising agent.

## Conclusion

In this paper, we have demonstrated that synthetic characters can be enhanced to perform as actors by carrying out a second appraisal of their projected actions.

We have conducted evaluations [10] showing that double appraisal has a positive impact on the perceived dramatic values of the generated stories. The stories generated from double appraisal scored higher than those from the original single appraisal-based architecture.

This work could also be extended to look at emotional trajectories rather than one-shot double-appraisal by considering sequences of planned actions rather than the goal-achieving action as at present. This would allow actors to explicitly consider the issue of dramatic climaxes.

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