

Towards More Believable Characters Using Personality and Emotion

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Abstract

Interactive virtual worlds provide an immersive and effective environment for training, education, and entertainment purposes. So far, there have been considerable advances in 3D and AI design to enhance virtual environments. Virtual characters are one of the crucial aspects of interactive narratives. The interaction of rich virtual characters can produce interesting narrative and as a result, enhance the experience of virtual environments. As one of those characters, the user would feel immersed and engaged when interacting with compelling characters. There are many characteristics that improve believable behavior generation, including beliefs, goals, desires, affect, and personality. My goal is to propose an affective model of personality for multi-agent narrative planning systems that is domain independent and thus minimizes authorial burden. I aim to combine existing models into a unified framework. Although the framework may oversimplify those models, it would not overlook their key ingredients.

Introduction

According to the BDI model, characters (agents in the context of a story) that have individual beliefs, goals, and desires appear more believable (Rao, Georgeff, and others 1995). The BDI model is frequently used by narrative planners. Riedl and Young (2010) applied intentionality to planning to restrict characters to only take actions in service of their goals (Riedl and Young 2010). We extended intentional planners to include another BDI element, allowing characters to have their own set of (possibly wrong) beliefs (Shirvani, Ware, and Farrell 2017). Despite their significant improvement in character believability, these models are only the stepping stones towards simulating compelling behavior.

Emotions and affect are other characteristics extensively researched to simulate virtual humans. More specifically, characters must exhibit different emotional expressions and reactions in different situations. The most notable approaches to affective agents represent emotions based on the appraisal theory, particularly OCC (Ortony, Clore, and Collins 1990), and mood using the Pleasure-Arousal-Dominance (PAD) model (Mehrabian 1996b).

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“Appraisal theories characterize emotion-eliciting events in terms of a set of specific appraisal variables” (Marsella and Gratch 2009). As one of the most well-known examples, OCC distinguishes 22 emotion types based on the psychologically significant situations they represent (Ortony, Clore, and Collins 1990).

In comparison, mood is an affective state that lasts longer than emotions. Mehrabian (1996b) represent mood as a point in a 3D space with three axes, pleasure, arousal, and dominance (Mehrabian 1996b). Roughly, pleasure refers to positive versus negative emotions, e.g. happy or sad, arousal conveys physical/mental alertness, e.g. angry or calm, and dominance is the feeling of being in control of others and the situation, e.g. proud or grateful. Gebhard and Kipp (2006) present a mapping between different emotions and moods (Gebhard and Kipp 2006).

The proposed emotional models often focus on human-computer user interfaces and thus cannot be applied to multi-character narratives. Moreover, the majority of work on virtual humans focus on fine-grained physiological manifestations, such as facial expressions, gestures, and dialog, rather than reasoning processes or higher-granularity actions.

Finally, believable characters act coherently, consistently, and demonstrate noticeable individual behaviors. Therefore, procedurally generated narratives can benefit from a model of personality.

The Big Five is one of the most well-known and extensively studied personality models (DeYoung, Quilty, and Peterson 2007). The five main categories of personality traits (known as the Big Five factors) are openness, conscientiousness, extroversion, agreeableness, and neuroticism. Lisetti (2002) define an affective hierarchy with personality at the top, followed by mood, and emotions at the bottom (Lisetti 2002). Mehrabian (1996a) determines the initial mood of an agent as a linear function of the Big Five (Mehrabian 1996a). In fact, many models only utilize personality in service of affect (Gebhard and Kipp 2006).

Models which do consider the effect of personality on agent behavior often focus only on a subset of the five factors. Bahamón and Young (2017) extend Glaive (Ware and Young 2014) to include a model of personality and starts by implementing agreeableness (Bahamón and Young 2017;

Bahamón, Barot, and Young 2015). André et al. (1999) reduce the Big Five dimensions to extraversion and agreeableness for social interactions and neuroticism for emotional influences (André et al. 1999).

Furthermore, many proposed models of personality map personality traits to specific actions or patterns by hand; e.g. labeling actions as aggressive or helpful. This makes their models highly domain dependent and increases author burden (Poznanski and Thagard 2005; Berov 2017).

My Previous Work

We started with extending the existing intentional planners with a model of belief (Shirvani, Ware, and Farrell 2017; Shirvani, Farrell, and Ware 2018). Our belief model supports infinite layers of nested beliefs, where each layer represents what character x believes about what character y believes. We used a very simplified version of the model in a 3D interactive virtual environment (Samuel et al. 2018; Ware et al. 2019). However, my focus is not character beliefs, but rather modeling individual and distinct behavior. Therefore, I think it is safe to assume a simplified version of our proposed belief model as a baseline to expand upon.

Next, in forthcoming work, I proposed a model of personality based on the Big Five (Shirvani and Ware 2019). I had two main goals for my personality model. First, the model must be domain independent to minimize authorial burden. Therefore, I only utilized existing narrative planning features, e.g. number of actions in a plan, consenting characters of an action (Riedl and Young 2010), or the number of expected actions by other characters (Shirvani, Ware, and Farrell 2017).

Second, I prioritized oversimplification to overlooking and thus tried to propose a simplified model of all Big Five factors. In fact, I referred to the Big Five Aspect Scales (BFAS) and their defined 10 Big Five aspects, two aspects for each factor (DeYoung, Quilty, and Peterson 2007).

My model simulated personality based on a character's preference over a set of plans that achieve their goals. The model first finds several plans that achieve a character's goals, calculates the utility values of each plan, and then chooses the plan with the highest utility.

In order to define the utility value of a plan, I produced a list of narrative planning features that had the potential to represent the Big Five. In total, 12 features were selected to represent the 10 aspects of the Big Five. Here, I only present a few examples of how narrative planning features are mapped to the Big Five.

- One aspect of conscientiousness conveys efficiency and getting things done quickly. Therefore, characters with high conscientiousness prefer shorter plans (with the least number of actions).
- One aspect of agreeableness conveys being kind and helpful to others. Therefore, characters with high agreeableness prefer plans that either directly satisfy the goals of other characters or help them along the way (by maximizing the number of actions that include other characters as the consenting character).

- Extroverts enjoy social interactions and thus, high extraversion scores include more characters in their plans, whether they are consenting to those actions or not.

The domain author provides 5 values for each character representing each of their Big Five factor scores. The utility of each plan is then computed based on their personality scores and the 12 selected features. For instance, a high/low conscientiousness score minimizes/maximizes the number of actions in a plan.

I conducted a study to evaluate my personality model and the results showed that the participants were able to correctly perceive the personality of the main character in a story and recognize other stories in which the main character showed the same personality traits.

Future Plans

Due to the inherent relationship between personality and emotions, my goal is employ both to improve the believability of virtual characters. I believe my proposed personality model can be further improved and I plan to expand it using an affective model based on the OCC and PAD.

As it was mentioned, OCC defines relationships between emotions, expectations, and the desirability of an event. The desirability of events can be determined based on the event's impact on goals and the importance of those goals (El-Nasr, Yen, and Ioerger 2000). I particularly focus on the relationship between expectations and emotions, since our model of belief allows agents to anticipate the actions of other characters.

Considering expectations, events can either be unconfirmed (expected but not yet happened), confirmed (expected and happened), or disconfirmed (expected but did not happen). Each pair of desirability and expectation of an event can then be assigned an emotion (Ortony, Clore, and Collins 1990). For instance, the agent feels fear for an unconfirmed undesirable event and relief when it becomes disconfirmed.

After determining the emotion resulting from an event, the emotion is mapped to a point in the PAD space and the agent's mood is updated (Gebhard and Kipp 2006). This allows the agent to select a coping mechanism based on their personality if their mood is strongly negatively affected.

I can use these relationships between actions and emotions in the reasoning process by making the agent prefer plans that increase their happiness or improve their mood¹.

In conclusion, I aim to study and implement the impacts of personality and emotions on agent behavior, specifically in the context of multi-agent narrative planning. I expect to learn new concepts to add and reconsider aspects that are not as effective as anticipated. My hope is that the resulting simulated behavior will make characters appear more believable.

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