A Personality Model based on Reiss Motivational Profile for Autonomous Digital Actors

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Abstract

The creation of a believable agent depends on several factors, one of the most important is personality. This paper presents a proposal for the development of a computational metaphor for autonomous digital actors that includes a personality component, in order to make their behavior individualized and coherent. Through the study of personality theories and their assessment instruments, we propose a model that considers personality, both in terms of its description and its dynamics. Using this model, it is expected that digital actors react in a coherent and individualized way to a given dramatic situation.

Keywords:: Computational Models, Motivational, Personality, Traits, Virtual Actors

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1 Introduction

Traditionally, the process of creating animation films requires highly trained professionals. Movie characters as Yoda from *Star Wars* (from 1999 by *Lucasfilm*); Woody and Buzz Lightyear from *Toy Story* (from 1995 by *Pixar*) and others are manually created by skilled people in every aspect of their appearance and behavior. This is a very demanding task that makes it very expensive and restricts the developing of animated films to large animations studios.

The advances in graphical modeling techniques, make possible the creation of highly realistic digital characters, that are being used in many areas such as digital entertainment and publicity. However, this realism can not be extended to the cognitive process simulation of these virtual characters which have little individuality, being mechanical and inexpressive [Egges et al. 2003].

Observing these new requirements, researchers have started to consider the role of emotions in the development of cognitive process simulations, resulting in a new area of Computer Science called affective computing. Affective computing is the area concerned with computational systems that make use of, related to or expressing and recognizing emotions [Picard 1995].

One of the possibilities of applying the principles of this new discipline is virtual humans, that correspond to computational models of people that can behave in an autonomous and intelligent way, presenting individuality and personality, with the main objective of simulating a real human [Magnenat-Thalmann and Thalmann 2004].

The credibility of the behavior of a virtual human depends on several factors, being personality one of most important to consider. Personality is understood as a set of characteristics of a virtual human that distinguishes one from others, keeping consistent through time and life experiences [Kshirsagar and Magnenat-Thallman 2002; Poznanski and Thagard 2005].

In this context, concerning to the study of mind and behavior we refer to Psychology literature for the establishment of a definition of personality, with the objective of suggesting a computational metaphor that allows autonomous digital actors to behave similarly to humans.

This approach relying on Psychology studies is not novel. The work of [Poznanski and Thagard 2005] presents a simulated personality model that varies over time (SPOT), in order to be used in games; [MacNamee and Cunningham 2003] describes a personality model to display various behaviors in Non-player characters that interact in virtual environments; finally, [Kshirsagar and Magnenat-Thallman 2002] propose a multi-layer model for the personality that is centered on moods, with the purpose of applying it to chatterbot agents, like ALICE[1].

This paper aims at studying autonomous digital actors, that are a kind of virtual humans endowed with acting skills. This research is part of Project D.R.A.M.A. that studies computational metaphors to create such autonomous digital actors. One key aspect of this metaphor is to create individualized and coherent behaviors for those agents through personality.

The paper is organized as follows: first it is describing the Project D.R.A.M.A., a research project focused on creating autonomous digital actors. Then in section 4, are described the definitions of personality Psychology that are used as requirements for the proposed model. The detailed explanation of the proposed computational metaphor is discussed in section 5. Finally, we conclude with recommended steps of research.

2 Project D.R.A.M.A.

Project D.R.A.M.A.[2] is a research project that aims at studying the requirements for the development of an Autonomous Digital Actor (ADA). The behavior of this ADA is inspired on real actors' practice, by means of a computational metaphor.

Although the process of creation of an ADA remains unknown, some requirements have already been discovered [da Silva et al. 2010]:

1. **Autonomous Script Interpretation:** is the ability of extracting informations regarding to what is expected to an ADA to perform via interpreting the script. This can be divided into two moments: first, the actor reads the script to learn his dialog lines and actions from scene descriptions; secondly, relying on script interpretations techniques, he constructs his character by combining these interpretations with previously trained acting knowledge.

2. **Acting Knowledge:** to expressively perform any role, actors need knowledge. They have to understand what it means to act like as some specific character, or what it means to experience some particular situation. For instance acting techniques like emotion and sense memories could be used to represent acting knowledge.

3. **Dramatic Performances:** Analogously to human actors, ADA needs to be able to act expressively. Character animation techniques are used to emulate these skills like facial expressions, body postures and voice intonation.

The Project D.R.A.M.A. architecture assumes that a script is submitted to a group of autonomous digital actors, for them to deliberate by suggesting acting performances. These suggestions are translated into a non-linear timeline for a given animation engine, where the user can visualize and modify the behavior of the agent.

We are proposing the addition of another module that represents the personality of an ADA, based on the character description presented in the script.

[1] ALICE stands for Artificial Linguistic Internet Computer Entity
[2] Developing Rational Agents to Mimic Actors

3 Autonomous Digital Actors

Iurgel & Marcos [Iurgel and Marcos 2007] have suggested the term 'virtual actor' as "*an analogy to a real actor, which autonomously, and by its independent interpretation of the situation, can perform its role according to a given script, as part of a story*".

Later, Perlin & Seidman [Perlin and Seidman 2008] have foreseen that "*3D animation and gaming industry will soon be shifting to a new way to create and animate 3D characters, and that rather than being required to animate a character separately for each motion sequence, animators will be able to interact with software authoring tools that will let them train an Autonomous Digital Actor how to employ various styles of movement, body language, techniques for conveying specific emotions, best acting choices, and other general performance skills*'

A believable agent is an autonomous agent, with personality, that inherits properties from artistic characters and do not need to be a realistic mimic of the human behavior [Loyall 1997].

Loyall [Loyall 1997] observed a series of requirements in order to consider an agent to be believable:

- From the character-based arts:
    1. Personality: a set of particular details that define an individual;
    2. Emotion: show an emotional state coherent with its personality;
    3. Self Motivation: realize its internal desires, opposing to a stimulus-response behavior;
    4. Change: an agent should change its current state, respecting its personality;
    5. Social Relationships: interact with other characters;
    6. Consistency of Expression: all expression channels must act together to correctly represent an unified message.
- From the autonomous agents:
    1. Appearance of goals: explicit representation of goals and objectives of a character;
    2. Parallel actions: be able to perform multiple tasks simultaneously;
    3. Reactive and responsive: coherent reaction to an action;
    4. Situated: respect the current state of the environment and change its behavior accordingly;
    5. Physical and Mental Limitations: respect the laws of physics for the scenario and the agent should not be omniscient;
    6. Social Context: the agent must respect the social conventions of the environment;
    7. Integrated: a continuous representation of the actions performed by an agent, showing smooth transitions between states.

As mentioned before, personality is a central part of the development of believable agents. It's computational definition is not enough to construct an appropriated model for representing personalities, being necessary to use the premises of traditional Psychology.

4 Personality Psychology

Observing how the individual is seen by society, the duration of the characteristics presented by the individual through time and by cultural, ethnic and gender issues, it is possible to identify the personality as a system in which a set of innate patterns of individuals interact with the social environment in affective, cognitive and behavioral dimensions, in order to produce actions and experiences for an individual life [Bressane Neto 2010; Schultz and Schultz 2009].

To study the personality structure, many theories were developed by psychology researchers. Since Freud and the psychoanalytic theory, that investigates the unconsciousness process; the behavioral approach, that focuses only on the observable behavior and others that work with biological and/or learning aspects.

Regardless of their differences related to the objects and purposes of study, most of the theories try to answer three fundamental questions [Cloninger 2004]:

Personality Description: establishment of measures to compare the differences among individuals.

Personality Dynamics: analysis and understanding of the mechanisms by which personality is expressed, focusing on the motivations that drive behavior.

Personality Development: how does the personality develop and if changes occur during the lifetime.

In this research, we will be considering only the description and dynamics dimensions. This means that our proposed computational metaphor for the personality of the autonomous digital actors will not consider personality development or its changes over time.

Regarding description, personality can be classified in three ways: by factors, types or traits. Factors are understood as a group of similar characteristics; types corresponds to a limited group of categories in which individuals can be classified.

A personality trait is a theoretical construction of a basic dimension of personality, emphasizing the differences among individuals characteristics, where measurements of these characteristics are performed through self-report questionnaires [Cloninger 2004], Traits are used by the proposed model because of their deep descriptive level that allows to compare, evaluate and classify personality by tests and observations.

Personality dynamics focuses on the motivations of the individual, its basic desires or needs that correspond to an internal state or condition that activates a behavior and gives a direction to it. Although some theories accept the existence of these desires, each of them suggest their own definitions about which are the universal motivations.

At the same time that researchers developed models to explain human behavior, they elaborated ways of measuring their assumptions through personality assessment instruments.

Two of the most popular instruments are: the Five Factor Model and the Myers-Briggs Type Indicator. The first explains personality as five dimensions or factors (Openness to Experience, Conscientiousness, Extroversion, Agreeableness, Neuroticism), whereas the second states that people fit into sixteen types. Both instruments only explain the description dimension of personality, without explaining the motivations that rely under each characteristic of human behavior.

An alternative instrument called Reiss Motivational Profile of Fundamental Goals and Motivational Sensitives [Reiss 2008] correlates these two dimensions (personality description and dynamics) in the form of sixteen universal motivations. These motivations can be used to represent the motivational state of an individual and can be directly used in EBDI model, that is responsible for agents reasoning in Project D.R.A.M.A, which is adequate to the project's goals. This project aims at combining the EBDI model with our suggested metaphor, as described below.

4.1 Reiss Motivational Profile

The Reiss Motivational Profile of Fundamental Goals and Motivational Sensitives or simply Reiss Motivational Profile (RMP) consists on a questionnaire that evaluates what motivates individuals, defining the priority and intensity of their psychological needs and presenting connections between motives and personality traits

[Reiss 2008]. These motivations are categorized in sixteen basic desires that can fit into three intensity levels:

Strong-intensity desires: defines stronger than average desires when compared with general population. To satisfy the motives here classified, the individual develops habits and traits that repeatedly fill these needs.

Weak-intensity desires: defines weak than average desires when compared with general population. There is low interest on satisfying these needs in are repeatedly manner.

Average-intensity desires: defines central desires that can be satisfied with normal activities during a day and do not show specific traits, presenting sometimes, characteristics of strong or weak desires.

According to [Reiss 2008], humans display all sixteen basic desires, but in different intensity levels. The desires are organized in these levels according to traits summarized in table 1. The sixteen basic desires are:

Acceptance: universal desire for avoiding criticism and rejection. Motivates the individual to stay away from people who dislike him.

Curiosity: universal desire for intellectual activity, determining the potential to enjoy intellectual aspects of life, such as reading a book or acquiring a new knowledge.

Eating: universal desire for consuming food.

Family: desire to raise children, direct related to parental instincts. Defines the importance given to familiar aspects in detriment of their own.

Honor: desire associated to behave morally. When satisfied, it favor the expression of loyalty and responsability, while the opposite produces shame and guilt.

Idealism: universal desire for improving society, motivating the individual to get involved in humanitarian efforts.

Independence: desire characterized for self-reliance and motives an individual to take its own decisions.

Order: Establishes the desire for ordered and structured environments, providing a sense of comfort and favoring attitudes for organizing and planning activities.

Physical Activity: desire for the need of muscle exercise. It motivates people towards physically vigorous activities, such as sports.

Power: desire for self-assertion or influence of will, that drives people to express determination and leadership.

Romance: universal desire for sex. This desire declines in intensity throughout adulthood. Motivates people to look beautiful and direct forces in pursue potential sexual partners.

Saving: impulse for collecting things, outlining the relationship between an individual and his objects or attitudes to finacial expenses.

Social Contact: universal desire for companionship of other individuals. Creates the psychological necessity for friends.

Status: desire for social standing based on wealth, title or social class. Motivates people to feel superior to others.

Tranquility: universal desire to avoid experiencing anxiety or pain, influencing the attitudes towards safety or against financial risk.

Vengeance: universal desire to get even with people who frustrated or offended others.

5 Proposed Computational Metaphor

The proposed model uses as input the personality description of a character in terms of traits, that are then mapped into corresponding psychological needs or basic desires. These desires are distributed to three levels, according with their intensity and result in a list of prioritized objectives. This list influences actions that will be performed by the digital actor.

The list of objectives and actions is related to three other factors: the *relationships*, that deal with the relations with other actors; *emotions*, represented as a series of inner states that reflect characters mental attitudes and the *environment*, which is a description of the surrounding scenario.

These three factors are not directly related to personality, but when combined they can help to determinate the possible behaviors for an agent.

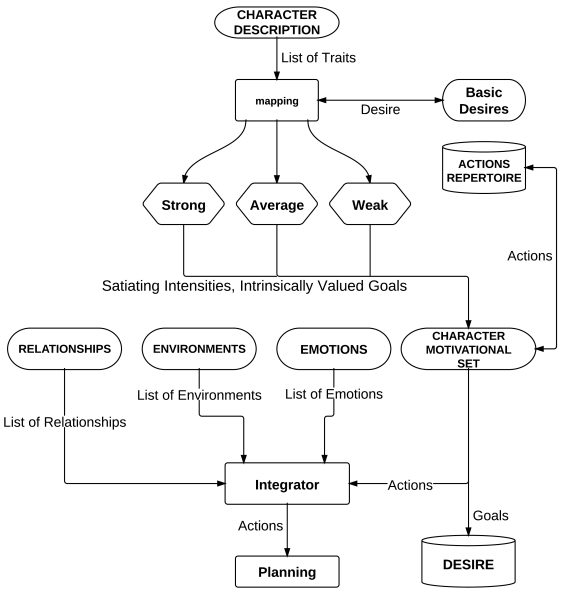

Figure 1: *Proposed Model Architecture*

As presented in figure 1, the proposed metaphor is divided into four phases. The first phase of architecture consists in receiving a list of traits or characteristics of a character (e.g.,athletic, gluttonous, neurotic, etc), that is provided by the script. This flow is subjected to a mapping function which will perform the correlation between traits and theirs respective basic desire (refer to table 1).

After mapping the characteristics using the universal desires, the intensity level of each desire is determined into one of three categories: strong, average and weak desires.

Personality Trait	Probable Motive	Personality Theme
Athletic	↑ Physical Activity	Athleticism
Gluttonous	↑ Eating	Appetite
Indecisive	↑ Acceptance	Self-doubting
Neurotic	↑ Tranquility	Anxiety
Obedient	↓ Power	Submissive

Table 1: *Partial traits and universal motives correlation*

The classification of the desire in one of these intensity levels directly interferes in two characteristics of a psychological need: satiating intensity and intrinsically valued goal.

The satiating intensity refers to how much (intensity and frequency) an individual tries to satisfy a desire. In the proposed model, the satiating corresponds to an integer value from 0 to 100, that will mean the intensities defined in the previous mapping function.

The satiating intensity intervals used for map with the intensity of a given basic desire are: weak-intensity desires (from 0 to 20), average-intensity desires (from 21 to 80) and strong-intensity desires (from 81 to 100).

These values were defined arbitrarily, since the literature provides

no means of support to confirm them and may be subject to change after the validation phase.

The satiating intensity also defines the number of possible actions that is available to an autonomous actor to satisfy his needs.

Intrinsically valued goals relate with the main goal of the universal desire filtering the ADAs repertoire for possible actions. For instance, the basic desire of acceptance directs the autonomous actor to use more actions that avoids criticism; curiosity stimulates the search for actions that promote acquisition of knowledge.

The amount of actions that will effectively be used by an agent, is defined in a character motivational set, that contains a list of motives, intrinsically valued goals and satiating intensities for each basic desire, mapped from personality traits.

Other three components are used to determine the behavior of the computational agent: emotions, relationships and environments.

The model used to represent emotions is inspired by [Lang 1995], where it is stated that emotions are dispositions to actions, reflecting in the activation and preparation towards an action. In this context, emotions can be expressed in a two dimensional space: the arousal dimension represents the intensity of a stimulus in the interval [0,100] and the affective valence dimension is classified into positive (1.0) or negative (-1.0).

Regarding the relationships, the works of [Wish et al. 1976], are used to define a four dimension space with values ranging from 1 to -1, labeled as Friendly or Hostile; Equal or Unequal; Emotional or Task-oriented and Attractedness.

Finally, there is a list of potential environments, in which the character could be acting. These environments would help characters to avoid undesirable behavior in certain situations.

Possible actions to be performed by an agent, emotions, relationships and the environments, are combined in the integrator function, responsible for selecting a coherent action for the agent.

After this process, the resulting possible actions will be passed to a planning function and the ADA's desires database will be updated.

Is important to notice that these actions proposed by our the model are not performative actions (animation commands). They are instead, simply labels to those actions, that will later be translated into animation commands by subsequent models.

The planning function and the desires database correspond to external modules of Project D.R.A.M.A. general architecture and are not being considered in this research.

6 Conclusion

Autonomous Digital Actors are autonomous agents, inspired by real actors practices, that are specialized in performing arts and represent a new way of thinking about the authoring characters for animation films.

Although some progress has been achieved in terms of graphical modeling, they have not capacity for autonomously suggesting acting performance yet.

For an autonomous digital actor, the representation of personality not need to be totally faithful to a real human, requiring only that the behavior presents the illusion of life, being consistent with the context in which it is inserted. We understand that considering personality according to traditional Psychology models is crucial for building a model that approximates virtual agents and real individuals behaviors.

We have studied several personality theories, that make it possible to identify fundamental issues about personality. These issues guided the research for two appropriate approaches for the development of a computational model of personality: the traits theory, as a way to describe it and the motivational aspects of an individual, as a universal set of needs.

The choice of traits theory is a reflection of its deeper descriptive power and how it can be measured by tests and observations, while the motivational searches a universal set of needs.

In this context, we chose Reiss Motivational Profile which performs an integration between the traits and motives of individuals.

Based on this instrument and literature review, we suggest a computational metaphor that relates personality traits and the sixteen basic desires, which combined can determine a list of possible actions of a digital actor.

These suggested actions are influenced by three other components: the relationships among individuals, the emotions the actor is experiencing and the environment where the agent is located.

The next steps of this research includes implementation of this system and validation through a metric that will consider questionnaires for accessing audience impressions of how much resulting behavior corresponds to a initially modeled personality.

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