Towards a gesture selection model influenced by personality and emotional state for virtual characters

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Abstract. The virtual characters are being used increasingly in user interfaces to improve human-machine communication. For this reason, it is necessary to improve the interaction of these characters in a similar way like the communication between human beings. This paper presents a general model to characterize and select gestures influenced by personality and emotional state for virtual characters so they can communicate intentions, feelings and ideas.

Keywords: Non-verbal behavior, Virtual Characters, Gestures, Personality and Emotional States.

1 Introduction

The current approach in creating virtual characters and virtual environments is to endow them of credibility, associating to them a feeling, personality, an emotional state establishing a bond which avoids differentiate between reality and fiction.

Our aim is to create a gesture selection model for virtual characters that can express emotions and feelings associated with the context. The difficulty is inherent in the complexity of emulating the process of human communication and the variety of emotions that can be represented by a wide range of gestural expression, which in turn can be influenced by personality and the environment.

This paper aims to propose a model of the relationship between verbal and nonverbal expressions, since the second one function as a complement to verbal expressions in order to communicate feelings, intentions or goals, and thus create virtual characters to develop applications as presenters or tutors.

The paper is structured as follows: in section 2, the framework describes the main concepts related to believable virtual characters and their non verbal communication. In section 3, we show our background and propose our gesture selection model. The

paper concludes in Section 4 with a brief summary of our main points and our current gesture approach.

2 Non verbal expression in virtual characters

2.1   Believable virtual characters

The nonverbal communication skills are specific of human beings, and for over a decade researchers have tried to transfer that richness to a virtual character, and thus facilitate human-machine communication. The creation of virtual characters involves several multidisciplinary concepts in order to represent them in virtual worlds; these characters try to improve human-machine interaction through verbal and nonverbal expressions.

A virtual character is a digital representation in a virtual environment [1]. The credibility of a virtual character is not linked to well-crafted animations and executed with precision. The reactions, verbal and nonverbal expressions and the decision-making inherent to context developed with naturally and consistency will facilitate the induction of immersion through a virtual character.

"The illusion of life" is an important objective of virtual agents research. The personality and emotions are key concepts for a credible agent and can be used to determine the expression and generation of verbal gestures [2].

2.2   Nonverbal Communication and influence of context

Nonverbal expressions have been an important part of the dynamics of communication as a means of support and in particular cases as a substitute for verbal expression. Integrating gestures, postures and facial expressions to verbal communication improve the communication of intentions, goals, feelings and ideas.
During the communication process there is an auxiliary element that can determine the true meaning of a message, this element is the context. The context can be defined as a set of elements that create a representation of the situation. It is said that the context takes a pragmatic dimension when refers to an element of the structure of the environment and a cognitive dimension when refers to the representation of an individual [3]. The context gives meaning to the different postures and different gestures that takes the human body in different social situations.

2.3   Gesture

The gestures are hand and arm movements executed when people speak. Such movements may be extensive or minimal, but present during the communication process and are highly synchronized with the flow of speech [4].

A gesture has three phases: preparation, stroke and retraction (see Fig. 1). The preparation phase is considered the rest phase and is where you start the development

of gestural expression. The stroke phase can be regarded as the top or "climax" of gestural expression (what the movement actually "does" or what was "intended") and is the main content of the gesture. In that phase, the synchrony with speech is maintained by the interlocutor. Retraction is the phase in which the gesture begins to decrease once the stroke phase finished [5].
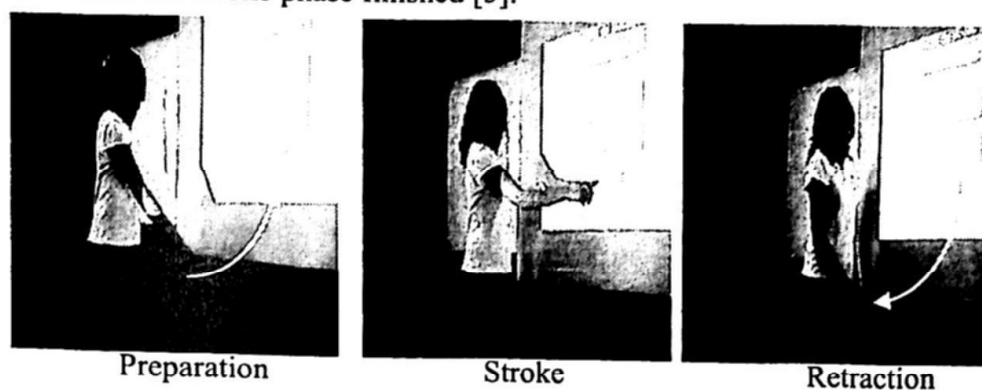

| Preparation | Stroke | Retraction |

Figure. 1. Example of gesture phases on a presentation context. (Deictic gesture)

Cadoz [6] divides gestural expressions into three groups, one that involves communication, a second one that integrates the handling and a third which includes movements of haptic[1] exploration. Since our goal is to create a virtual character that emulates nonverbal communication through arms and hands, we characterize the gestures which by their nature are closely related to acts of verbal communication. For this reason we will focus on defining *semiotic gestures*, which communicate meaningful information and results of the shared cultural experience that occur in parallel with verbal expressions. These gestures are intimately connected with verbal communication so as to complement the speech. McNeill [4] classifies semiotic gestures as follows:

Metaphoric: represents an abstract idea, the concept which represent has no physical form, the form of gesture comes from a common metaphor. An example can be found in the phrase "the talk was over and over again", accompanied by a hand that indicates movement of oscillation [8].

Deictic: are gestures that pointing to something or someone either concrete or abstract. These gestures locate something in the physical space in front of the narrator, can be discourse entities that have a physical existence or not. An example of this might be to point while we say "this dress" or "that gentleman over there" [4].

Iconic: these gestures representing a particular object or event. Having a close formal relationship to the semantic content of speech, illustrating what is said to describe any property relating to verbal expression [9].

Beat: are rhythmic movements that go along with speech, but the shape of the hand don't have relation with the content of speech. Such gestures have only two modes (up / down, in / out) [9].

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[1] Haptic Exploration is defined as perceiving information of surfaces and textures by touch [7].

2.4   Emotional State and Personality

Gestures, postures and facial expressions not only strengthen the dialogue, they also convey emotions. Show our emotion has important implications in the act of communication, so it's important to know how to express and interpret them.

The personality of an individual largely determines the way they speak and behave during the act of communication. Personality refers to the characteristic through patterns that persist across time and situations, and that distinguish one person from another [10].

We think that the integration of nonverbal communication, emotional state and personality into a gesture selection model for virtual characters will allow us, to achieve a faithful simulation of reality, matching gestures developed in virtual worlds with gestures expressed in a real context. One way to validate the credibility of the virtual characters is through the degree of immersion that causes the interaction with them in the virtual world.

2.5   Immersion and presence

The focus of this work is to carry out a social and emotional immersion through a believable virtual character, which executes gestural expressions with personality and emotional connotations.

The immersion is carried out when the user forgets that he is interacting with a virtual character and associates to him a personality, a feeling, a goal or a particular behavior as you would with a human being. The experience of immersion is not conditioned on the exact reproduction of the physical aspect of reality but it is linked to the emulation of social interaction. Morales and Pavard consider the factors involved in improving social and emotional immersion through virtual characters are nonverbal expressions, social behaviors and empathy expressions [10]. This acts that involve the communication process must be accurately represented by the virtual character.

3   Gesture Selection Model

3.1   Background

This work is an extension of the behavioral architecture for virtual characters proposed by Morales [11] (see Figure 2). In that research, Morales develops a kinesics model which includes a gesture, facial, postures and body expressions. In the internal structure of the kinesics model specifically in the gesture module of virtual character is where we tried to make a contribution in order to develop applications of virtual characters that interact through non-verbal expressions of arms and hands.

In the work of Morales the gestural expression module is implemented through an empirical weighting, for that reason we intend to implement a gesture selection model

with an emotional connotation associated to the personality using classification techniques with the aim of improving the gesture selection process.
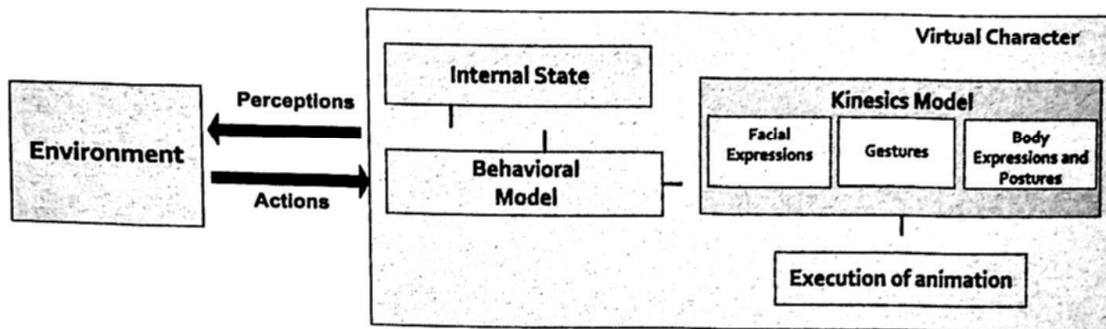

Figure. 2. *General view of the Behavioral Architecture for Virtual Characters proposed by Morales 2007 [11].*

3.2   Proposal of the Gesture Selection Model

Our proposal in this work is a gesture selection model that selects a gesture connected with a personality and emotional state associated with a context, and thus improves the way of human-machine interaction that currently lacks of this characteristic, producing an easy break of immersion. Our architecture consists of the following modules, which are integrated into the behavioral model proposed by Morales (see Figure 3):
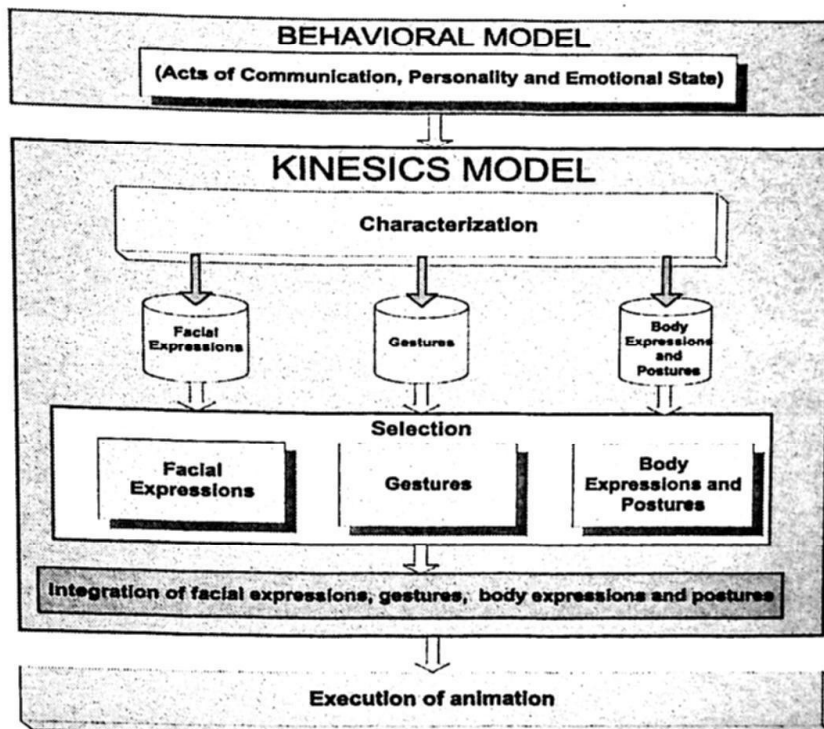

Figure. 3. *General architecture of virtual character animation.*

The architecture includes two main processes corresponding to the modules of *characterization* and *selection* of gestural expressions.

3.2.1   Characterization process

In this process we intend to characterize the attributes of gestural expression using causal models to reduce a dimensionality of the information and thus find the correlations between attributes to improve the selection of gesture.

On the characterization process, we identify the attributes that best characterize the gestural expression (see Table1). The gesture attributes are obtained through a video analysis with the ANVIL[2] tool developed by Kipp [9]. With the video analysis attributes we create a database with all gestural expressions that may be generated.

The characterization of nonverbal expressions allows us to identify the main characteristics of gestural expression to associate it to an emotion, intention or goal and thus, improve the quality of the gesture selection process. At this moment, we search the use of multivariate analysis and data mining techniques in order to solve characterization and selection problems.

Table 1. Composition of the attributes of the knowledge database used by the gesture characterization process.

ATRIBUTES	COMPOSITION
Image	
Gesture	Phase
	Type
Emotional State	Stress
	Arousal
	Valence
	Stance
Speech Acts	Locutionary
	Illocutionary
	Perlocutionary
Configuration	Right Hand
	Right Arm
	Left Hand
	Left Arm
Speed	

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[2] Annotation of Video and Spoken Language

3.2.2 Selection process

After of the characterization process, we select the appropriate gestural expression that we call an expression triplet, because join the expressions of each of the gesture phases (see Figure 4). In that process we will use a classifier in order to predict the most appropriate gesture to express a particular feeling and personality.

The triplet of gestural expression is the output of the kinesics model, likewise is the input for the animation process that will generate the animations of virtual characters, which in this case consist of three continuous animations, one for each one of the gesture phase that will represent the gestural expression.
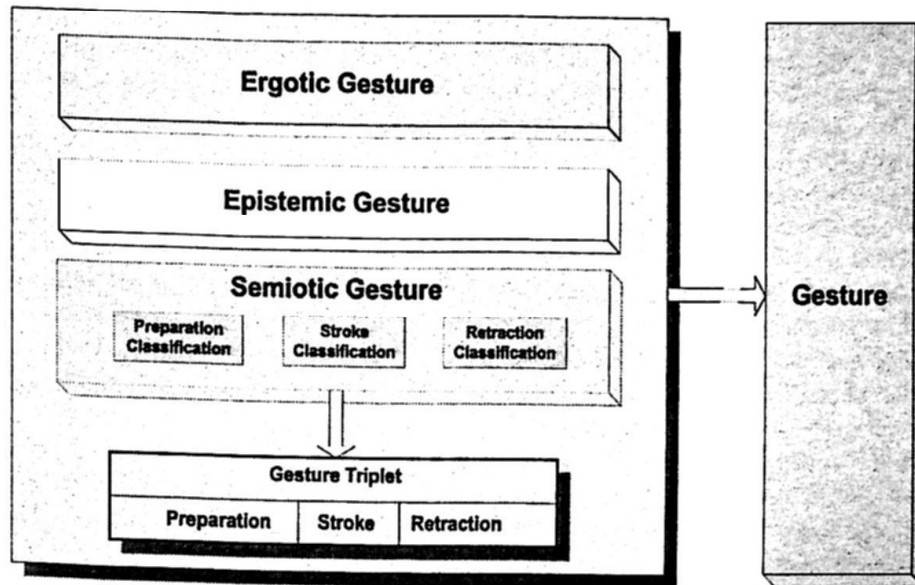

Figure. 4. Gesture selection model proposed

4 Conclusions

This paper puts forward a gesture selection model for virtual characters which focuses on semiotic gestural expressions associated to the personality and emotional state of the virtual character.

Our gesture selection model is based on the combination of a behavioral model for virtual characters that expresses emotional and social behaviors and a qualitative gesture model; their combinations allow us to create gestures with different qualities and characteristics which improve the credibility of gestural expressions for a virtual character.

We believe that gesture is an important element of communication process which can support or replace verbal expressions. We think that there are a relationship between gesture characteristics, personality, and emotional state when a gesture is executed. We propose the division of the gesture process selection using the phases of

gesture like in the face to face interaction. We think that if these features are provided to a virtual character could endow the virtual characters of credibility and increase the sense of immersion.

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