Making of Virtual Human Body —Virtual Human Body as Communication Interface—

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Abstract Virtual Humans play an important role in supporting communication between human beings through their gestures and facial expressions. We are involved in the study of Virtual Humans as communication interfaces to play such a role. Virtual Humans can be classified according to their particular roles with regard to some aspects of communication. The form and method of expression of Virtual Humans can differ greatly according to what is required, for example realism or simple representational communication. Communication efficiency and transmission efficiency should be considered to be digital data. Descriptions of function, form and syntax should be also considered. *J Physiol Anthropol Appl Human Sci* 24(1): 123–127, 2005 <http://www.jstage.jst.go.jp/browse/jpa>

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Introduction

Media technology has continually adapted to visual communication design as our information society has developed. Fields involving video picture performance and communication have also been spreading rapidly. Communication entails the sharing of semantic concepts between sender and receiver through an exchange of information. Senders send messages to receivers by transforming content into signs such as gestures and languages. For effective and accurate communication, content should be encoded in an appropriate manner, taking into account the receiver's particular decoding requirements and/or abilities. Sender and receiver must share a mutual understanding of the concept which the sender intended to send to the receiver in order to communicate in a definitive manner. Virtual Humans play an important role in supporting communication between human beings through their gestures and facial expressions. We are involved in the study of Virtual Humans as communication interfaces to which play such a role. Virtual Humans can be classified corresponding to their

particular roles with regard to some aspects of communication. The form and method of expression of Virtual Humans can differ greatly according to what is required, for example realism or simple representational communication. In one-to-many communication you have to consider about efficiency of data communications and the efficiency of semantic transfer. The virtual body can consider the function as a sign, the function as man's form or record of movement, and the function as a self-supporting simulator.

We will cover the first two types of Virtual Humans from the view point of communication design.

Virtual Human Which Plays a Role as a Sign

The virtual body as a sign is compensating the contents of communication by the character or expression. From the point of view of transmission efficiency, Abata and Emoticon are few data and it contributes to giving expression to a message. Virtual Characters in particular have unique facial expression abilities. Virtual Characters play the role of both sender and receiver. The virtual character used by broadcast needs to operate on real time, and transmits a meaning through the expression and the gesture which were emphasis-ized.

Genda (1997) investigates the relationship between facial expression and facial modeling problems through impression assessment using the Semantic Differential method. Three key factors have been established as follows:

- 1) the first is the likability factor concerned with points such as cheerfulness, delight, good-humored,
- 2) the second is the power factor implying things such as wildness, resoluteness,
- 3) the third is the intelligence factor concerning with things such as intellectuality, maturity, confidence.

The likability factor served as the first axis, the power factor served as the second axis, and intelligence factor served as the third axis. We carried out our study with a focus on points; wrinkles between the eyebrows, angle of the mouth, form of the mouth, cheekbones, opening and closing of the eyes, and the corresponding affect of various changes with regard to facial modeling (Fig. 1, Fig. 2). With our results, we were able

Fig. 1 Facial expression model for evaluation.

Fig. 2 CG modeling for experimental model.

to produce animation using a functional data glove, as well as an animation which uses real time facial expressions. These techniques are being utilized for TV characters and for 3D avatars on the web (Fig. 3, Fig. 4).

Virtual Humans Which Record Human Behavior

A realistic body expression is with the foundations of virtual human model work. The technique of expressing an actual nude body which seems real requires a particularly high artistic sense, and the kind of practical 3D modeling data which is rare in today's world. Configuration of the human body and efficient production of animated nudes are the key to create bodies through CG. There are many problems to be solved such as bone structure configuration, muscle deformation, skin and hair formation. For example, Tabata et al. (1998) tried to use the expression of kinetic representation of the 3D Human Shoulder with the virtual bone. Kono and Genda (2003) researched Wrinkle Generation Model for 3D Facial Expression.

It's also important to note the simple physical measurement data can't help in the expression of human traits such as dynamism or sexiness.

The creation of this animation involved, observing the living organism using dermatograph, collecting formation data using the whole body reference digitizer (Fig. 5, Fig. 6), picking up

Fig. 3 Virtual character with virtual set.

Fig. 4 Facial expression controlled by data glove and joystick.

the detailed data directly from each part of the human body using small 3D digitizer (Fig. 7), and finally filling in the gaps in the parts which are dead angles to the non-contact digitizer with plaster. Our unique method involves the reduction of the data so we can run these complicated and massive formations efficiently on computers allowing us to carry out expressive modeling. We also pay a lot of attention to the formation omission and the emphatic methods used by painters and sculptors.

Additionally we observe an actual person, measuring and viewing the body from a human engineering point of view, recording polyphonic images, measuring it in a three-dimension environment, obtaining all of the which motion data using photochemical motion capture, allowing us to produce a believable human body animation.

We obtained body form and physical motion data from 31 examinees of different age, sex, and body type. The examinees have unique motions characteristics as well as differing patterns of daily physical movement, which are related to their

Fig. 5 The whole body digitizer.

Fig. 6 Delmatograph.

Fig. 7 Digitized part of body.

particular lifestyles, etc. Different jobs perform different daily motions, i.e. fashion models, caregivers, karate fighters, street dancers, yoga performers, ballerinas, and fishermen (Fig. 8-1, Fig. 8-2, Fig. 9). We gathered high quality human body data which can be used for human engineering and the creation of attractive human body models which possess abundant powers of expression. Genda (2000) have edited and grouped the data

Fig. 8-1 Motion capture system (active infrared).

Fig. 8-2 Motion capture system (optical).

Fig. 9-1 Assembled and modified body (female).

Fig. 9-2 Assembled and modified body (male).

to make it possible to provide the data in commercially available CG software, after the addition of some artistic anatomy and human engineering points. We have also provided a database for human skins (Fig. 10, Fig. 11).

Fig. 10 Assembled and modified body (female).

Fig. 11 Assembled and modified body (male).

Application of Human Body Database

The data which we have created can be used for entertainment and various other visually oriented industries. We will gather even more precise skin data and further investigate anatomical formations in order to develop data which can be used more extensively. In “Edo no Monozukuri,” a specified study is being carried out by the Japanese Ministry of Education from 2001 to 2005, we have engaged in the creation of an archive featuring human movement from the

Fig. 12 Digital archives (KABUKI play).

Fig. 13 Digital archives (Korean traditional dance “Fumul”).

viewpoint of traditional techniques, motion and entertainment (Fig. 12, Fig. 13). We have started the development of a model for medical and educational use in cooperation with the Faculty of Medicine, Kyushu University. We are striving to create data which can be applied in a variety of uses and we aim to create the more man-like virtual body.

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