

Chapter 9

The Virtual World of Cerberus: Virtual Singer using Spike–Timing– Dependent Plasticity Concept

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ABSTRACT

While exploring autonomous evolution concepts for virtual worlds, we will present a new design Cerberus an avatar singer who can accompany a singer, perform alone and make his song evolves using simple past events. This 3D interactive facial animated avatar was made thanks to virtools software. The main originality of Cerberus is to develop his own melody by using learning machines and constantly improve his musical style and emotions. Cerberus is implemented using competitive learning rules to trained artificial neural networks in order to perform these self-improvements. Self-improvements is a key of our learning capacity, The challenge of building a virtual singer that could promotes his own improvisation is an open research field (Minsky, 2000). We will expose the difficulties of the synchronization in real-time between the voice and animation to generate the right emotion, also the difficulties of establishing a classification which could be in contradiction with the ontology of the musical fact. Also we will expose the necessity of developing avatars that use the amazing potentialities of spike-timing-dependent plasticity concept (Abraham, & Bear, 1996), that hence metaplasticity. This powerful concept enhance the potentiality of avatar design and give the impression that the avatar has a memory and simulate “feelings” linked to a context.

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INTRODUCTION

Virtual worlds are looking for new socialization experiences, emotions sharing and avatars (Damer, 1997) are made to enhance virtually your skills and personality. Virtual world is a place where you can be someone else (Schroeder, 2008). Cerberus is based on this idea of building a game using a sort of karaoke, where you can sing even you are not able to in the real life. The user helps Cerberus to find its voice and to improve its creation of melodies. Singing is a way to express a feeling, to communicate a sensation, to feel something different. Also it is a way to extrapolate and to develop a sense of originality, a sense of self (Mingers, J, 1994). How to simulate a singer? How to translate this special feeling (Minsky, 1979) into a virtual world?

To minimize the tasks and the calculus in order to obtain an avatar working in real time, we will restraint our avatar to a limited musical context and we will provide a simple classification for the emotions, musical phrases and gestures, as suggest by the Oslon method (Olsen, & Belar, 1961). The most interesting part of this research is the potentialities that offer the STDP concept which could offer a sort of footprint, a selective memory of the event inside the neural network we used. STDP is inspired by biologic model, it is a form of associative synaptic modification which depends on the time of synaptic spikes (Gerstner & Kistler, 2002). This “selective memory” is built in the structure itself using this principle: If the connection decrease in efficiency then the connection may disappear. In a way the Neural network is reshaping itself depending of the information. This potentially offers great resources in term of memory and neural networks (Schacter, 1989).

After describing the Cerberus engine, the problem of classification of the events, melody analysis (Xu & al. 2009), synchronization and Neural network implementation, we will present the perspectives of metaplasticity concept to create an avatar. At the end of this chapter, we will propose

in the future research section a discussion about the notion of avatar (Koda & al. 2009), feelings and expose our last problematic how could we claim that an virtual character could produce the impression to be self-conscious (Arrabales, & al. 2009), to generate creative gesture or self-design?

PROBLEM ANALYSIS

If we consider a simulation of a robot mimicking a singing gesture as mediating function between the actual act of singing and a more abstract to find inspiration using past events, is providing both a symbolic vocabulary and ideal objects, then it seems that it stands out as an effective way to know or even understand some of the music creation process (Barbaud, 1966). The main difficulty of such a system is the balance of shares that must be given to peculiarities inherent in this creation and the necessary generalization. As sketched out a first issue regarding the orientation of the program because it would, indeed utopian in the current research, as demonstrated in previous experiments Consider a system capable of generating imposed in a context, a complex musical phenomenon, regardless of any arbitrary choice beforehand. How then implement a decision unit capable of directing the genesis of an avatar engine?

Automated systems possess two qualities: the ability to deal quickly at the micro-compositional level, and that of acquiring a unit by the expression of certain ‘musical intentions’ (Miranda & Matthias, 2009). A singing avatar should have the abilities to “listen” to the proposition, to her public and to sing and improvise by itself. This virtual singer will is presented in the form of a visual interface to avatar 3D in order to articulate a phoneme while producing a sound (DiPaola, 1989). The main difficulty is to provide a real-time system which could evolve by itself, and simulate an accurate articulation and facial expression and a sound. Naturally, synthesis voice technical is used (it would be very difficult and time consuming

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