

## Chapter 4

# Character Animation: Past, Present and Future

**Verónica Costa Orvalho**  
*Universidade do Porto, Portugal*

**João Orvalho**  
*Face In Motion, Portugal*

### ABSTRACT

*Character Animation has a crucial role in modern videogames: it is essential to provide a realistic and immersive experience to the users. This chapter presents the main problems when preparing characters for animation, describes current solutions, and discusses published research and future directions in the fields of character rigging and animation. Its main focus is on facial animation, which is the key element to convey emotion and personality to a 3D character. It also describes a system we have developed and used on several productions, capable of automatically transfer the facial rig and animations between characters. After reading this chapter, you should have an understanding of the complexity involved in character animation process, especially of the face, and the reasons why it remains a challenge.*

### INTRODUCTION

How far the field of videogame character animation has progressed in the past 40 years! It has evolved so much since the arrival of Pong (Atari, 1972) - 2D or 3D characters did not even exist back then. Now, people demand an increasingly more immersive experience; character animation became a cornerstone in videogame technology.

We center this overview on how the face plays a key role to convey information and emotion, or to interact with the user. We focus on rigging as it is the bottleneck in any CG production and the biggest unsolved problem related to character animation.

The chapter describes the major problems related to facial rigging and animation encountered by the entertainment industry, and their current partial solutions. After that, comes an exhaustive analysis of the published literature and previous

DOI: 10.4018/978-1-60960-567-4.ch004

work. Then, it investigates the different applications and solutions available in the market. Near the end, it describes a system we have developed capable of automatically transfer the facial and body rig and animations between characters, at least an order of magnitude faster than traditional manual rigging. Finally, it discusses future directions of research in this area.

After reading this chapter, you should have an understanding of the underlying work that goes into building 3D animation tools. The true goal for this chapter is simple: it is the overview we wished we had when starting out our research on character animation years ago.

## ENTERTAINMENT INDUSTRY OVERVIEW

Facial animation is still an immature field, with no defined methodology or standard for character animation. The increasing number of completely computer generated (CG) films (*Toy Story* (1995, 1999, 2010), *Shrek* (2001, 2004, 2007, 2010), *Ice Age* (2002, 2006, 2009), *Finding Nemo* (2003), *The Incredibles* (2004), *Madagascar* (2005, 2008, 2012), *Up* (2009)), coupled with the requirement of more complex characters, have generated a growing demand for new and sophisticated 3D tools. But, the videogame industry is overtaking the film industry, according to Wallop (2009): “Videogames are now one of the biggest forms of entertainment in Britain, outselling films in 2009”.

Within the entertainment industry, the applications can be divided into *interactive* and *off-line systems*. Interactive systems, like dialog-based interfaces, virtual worlds and videogames, require real-time animations and limited realism, even though the quality of the characters is increasing. The ultimate goal for videogames is to obtain 3D characters with cinematographic quality. Off-line systems, mainly used for films, require high realism and accuracy to reinforce the spectators “suspension of disbelief”.

In **Films**, the face of the character plays the most important role in communicating with the audience and getting it involved in the story. The audience quality and realism expectations drive the development of technology. Facial expressions enhance the immersive experience of the spectator, so any inconsistency in appearance or non-realistic expression can ruin the atmosphere. To create believable characters, it is imperative that digital artists have artistic freedom in modeling and animating the models, independent of the style: human (*The Polar Express* (2004)) or cartoon look (*Monster House* (2006)), fantasy (*The Return of the King* (2003)) or live-action films (*The Matrix Revolutions* (2003)). Characters can be animated using two techniques: performance-driven or keyframe animation.

In **Videogames** facial animation plays an ever increasing role. At first, it was applied only in cut-scenes using the same techniques as the cartoon animation films (*The Curse of Monkey Island* (1997)). But, the biggest priority in videogames is interactivity, so it is a requirement that the animations run in real-time. Today, it is possible to achieve cinematic quality because of the improvements in hardware (more CPU power) and software (specialized algorithms), leading to the replacement of cut-scenes by scripted animations (*Need for Speed Carbon* (2006), *FIFA 10* (2010)). Also, high quality definition can be obtained with the help of motion capture (*Tiger Woods PGA Tour 10* (2009)). The videogame industry wants technology that speeds the rigging process and generates results that can be easily integrated in the game engine.

## CHARACTER RIGGING OVERVIEW

“*Rigging* is the process of taking a static, inanimate computer model and transforming it into a character that an animator can edit frame-by-frame to create motion” (Falk et al., 2004). The result is a rig that can be manipulated by a set of controls

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