HapFACS 1.0: Software/API For Generating FACS-Based Facial Expressions

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Abstract

In this article, we present HapFACS 1.0, a new software/API for generating static and dynamic three-dimensional facial expressions based on the Facial Action Coding System (FACS). HapFACS provides total control over the FACS Action Units (AUs) activated at all levels of intensity. HapFACS allows generating faces with an individual AU or composition of AUs activated unilaterally or bilaterally with different intensities. The reliable and emotionally valid facial expressions can be generated on infinite number of faces in different ethnicities, genders, and ages using HapFACS to be used in numerous scientific areas including psychology, emotion, FACS learning, clinical, and neuroscience research.

1 Introduction

Several databases\(^1\),\(^2\) have been developed providing standard sets of facial expressions, including different emotional facial expressions and faces with specific activated AUs. These databases commonly show the basic emotions [Ekman et al. 1983] (e.g., anger, fear, happiness, surprised) on faces. Although the faces in the databases are being used over the years for successful emotion recognition and expression research, they have some common limitations such as: (1) they don’t provide enough control over the possible facial actions; (2) they don’t provide all the possible intensities of different expressions; (3) facial expressions generally differ between different posers in intensity and underlying facial actions; (4) they don’t provide all the possible facial actions on faces of different ages, ethnicities, and genders; and (5) they mostly have static emotional expression (photographs). Ekman [Ekman et al. 2002] has coded all the distinguishable facial muscular movements that generate momentary changes in facial appearance as Action Units (AUs). Each AU can control a group of facial muscles independent from the others. Ekman’s Facial Action Coding System (FACS) includes 58 AUs, of which 44 commonly generate most of the facial expressions.

To the best of our knowledge, there is only one similar software to HapFACS which maps the FACS action units to a virtual character’s face called FACSGen [Krumhuber et al. 2012], which implements only 35 AUs, and can not activate the bilateral AU’s asymmetrically.

2 HapFACS 1.0

The HapFACS software/API is able to map the FACS action units to the facial and head variables of the Haptek\(^3\) characters used in different research labs\(^4\),\(^5\). HapFACS 1.0 is implemented in c# language and uses the characters created in the commercial software PeoplePutty\(^6\) (a product of Haptek company). Figure 1 shows sample HapFACS emotional facial expressions based on the emotional FACS (EmFACS\(^7\)) and individual AUs.

Figure 1: HapFACS sample facial expressions. (a) AU1C+ AU2D+ AU5B+ AU26E; (b) AU1C+ AU4D+ AU15D; (c) AU12E+ AU6C+ AU25C; (d) AU9E+A U15D+ AU16E; (e) AU1; (f) AU2; (g) AU22; and (h) AU61

HapFACS 1.0 provides various possibilities and controls over the facial expressions such as: (1) controlling 49 AUs including 12 upper face, 21 lower face, and 16 head and eye position AUs; (2) generating simple and complex facial expressions by activating individual AUs and composition of AUs with different intensities; (3) activating the AUs bilaterally and unilaterally; (4) generating faces with different lightings, backgrounds, and observer’s vantage points; (5) infinite number of facial appearances (skin textures) created by the PeoplePutty software; (6) using faces of different ages, genders, and ethnicities; (7) generating reproducible, realistic, 3D, static (photograph) and dynamic (animation) outputs; (8) generating the Haptek hyper-texts to enable the Haptek-based softwares to reproduce HapFACS facial expressions on their own Haptek character; (9) C# API to generate FACS-based facial expressions in any software that uses Haptek characters; (10) not requiring any prior computer or FACS profession, which helps the researchers in various disciplines to easily take advantage of the HapFACS. Therefore, HapFACS 1.0 can be used in applications such as FACS training, face simulation for psychological studies, face repertoire generation for image processing research, emotion research, clinical studies, etc.

References


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\(^3\)www.Haptek.com
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