

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

Reza Amini
School of Computing & Inf. Sci.
Florida Int'l Univ., USA

Ugan Yasavur
School of Computing & Inf. Sci.
Florida Int'l Univ., USA

Christine Lisetti
School of Computing & Inf. Sci.
Florida Int'l Univ., USA

Abstract

In this article, we present HapFACS 1.0, a new software/API for generating static and dynamic 3D facial expressions based on the Facial Action Coding System (FACS). HapFACS provides total control over the FACS Action Units (AUs) at all levels of intensity. HapFACS allows generating faces with an individual AU or composition of AUs activated unilaterally or bilaterally. The HapFACS facial expressions can be generated on infinite number of faces of different ethnicities, genders, and ages.

1 Introduction

Ekman [Ekman et al. 2002] has coded all the distinguishable facial muscular movements that generate momentary changes in the facial appearance and referred to them as Action Units (AUs). Each AU controls a group of facial muscles. The FACS includes 58 AUs, of which 44 commonly generate most of the facial expressions. Several databases^{1,2} have been developed providing standard sets of facial expression images/videos, including different emotional facial expressions and faces with specific activated AUs. These databases commonly show the 6 basic facial emotions [Ekman et al. 1983] (e.g., anger, fear, happiness, surprised).

Although these databases have been used for successful facial expression recognition and synthesis, they have common limitations such as: (1) limited facial movements are provided; (2) not all the possible intensities of different expressions are provided; (3) facial expressions generally differ between different posers in intensity and underlying facial actions; (4) not all the possible facial actions on faces of different ages, ethnicities, and genders are provided; and (5) most of the provided emotional expressions are static (images). 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 AUs asymmetrically.

2 HapFACS 1.0

HapFACS is an open-source³ software/API implemented in the C# language and uses the characters created in the commercial software PeoplePutty⁴. The HapFACS 1.0 is able to map the FACS AUs to the facial and head variables of the Haptek⁵ characters used in different research labs^{6,7}. For mapping, we match each AU introduced in the FACS manual to a combination of the Haptek registers as switches. Figure 1 shows sample HapFACS emotional facial expressions (based on the emotional FACS, EmFACS⁸) and individual AUs.

HapFACS 1.0 provides various possibilities and controls over the characters' facial expressions such as: (1) controlling 49 AUs (12

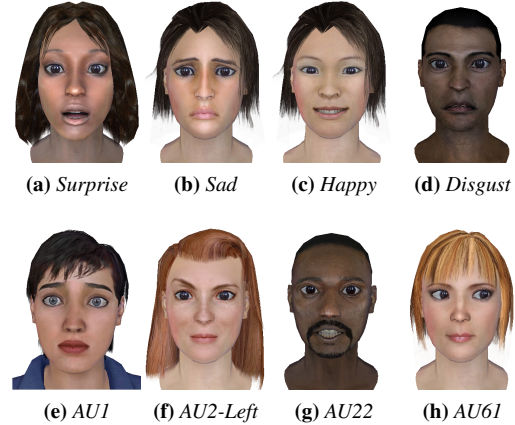


Figure 1: HapFACS sample facial expressions. (a) AU1C+ AU2D+ AU5B+ AU26E; (b) AU1C+ AU4D+ AU15D; (c) AU12E+ AU6C+ AU25C; (d) AU9E+ AU15D+ AU16E; (e) AU1; (f) AU2-Left; (g) AU22; and (h) AU61

upper face, 21 lower face, and 16 head/eye position); (2) 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) creating infinite number of facial skin textures with the PeoplePutty; (6) using faces of different ages, genders, and ethnicities; (7) generating reproducible, realistic, 3D, static and dynamic (video) outputs; (8) generating the Haptek hyper-texts to enable reproduction of the HapFACS facial expressions in other Haptek-based software; (9) offering a C# API to generate FACS-based facial expressions in other Haptek-based software; (10) not requiring any prior computer or FACS expertise, which helps researchers in various disciplines to easily take advantage of the HapFACS.

Haptek characters are integrated with lip-synched Text-To-Speech engine. HapFACS adds the possibility of creating valid facial expressions. Therefore, HapFACS can be used in applications such as face simulation and repertoire generation in affective computing, Embodied Conversational Agents research, psychology, emotion theory, FACS coding training, clinical and neuroscience research.

References

- EKMAN, P., LEVENSON, R. W., AND FREISEN, W. V. 1983. Autonomic Nervous System Activity Distinguishes among Emotions. *Science* 221, 4616, 1208–1210.
- EKMAN, P., FREISEN, W. V., AND HAGER, J. C. 2002. *Facial Action Coding System*, 2nd ed., vol. 160. Research Nexus eBook, Salt Lake City, UT.
- KRUMHUBER, E. G., TAMARIT, L., ROESCH, E. B., AND SCHERER, K. R. 2012. FACSGen 2.0 animation software: Generating three-dimensional FACS-valid facial expressions for emotion research. *Emotion* 12, 2 (Jan.), 351–363.

¹<http://www.er.uqam.ca/nobel/r24700/Labo/Labo/MSEFE.html>

²<http://www.emotionlab.se/resources/kdef>

³<http://ascl.cis.fiu.edu/projects.html>

⁴<http://www.haptek.com/products/peopleputty/>

⁵<http://www.haptek.com>

⁶<http://home.gwu.edu/~behrend/waveprojects.html>

⁷<http://camera.vu.nl>

⁸<http://face-and-emotion.com/dataface/facs/emfacs.jsp>