FACSHuman a Software to Create Experimental Material by Modeling 3D Facial Expression

Conference Paper · November 2018

DOI: 10.1145/3267851.3267865

CITATIONS
5

READS
613

3 authors:

Michaël Gilbert
Université de Vincennes - Paris 8
1 PUBLICATION **5** CITATIONS
SEE PROFILE

Samuel Demarchi
Université de Vincennes - Paris 8
44 PUBLICATIONS **73** CITATIONS
SEE PROFILE

Isabel Urdapilleta
Université de Vincennes - Paris 8
145 PUBLICATIONS **773** CITATIONS
SEE PROFILE

FACSHuman a Software to Create Experimental Material by Modeling 3D Facial Expression

Extended Abstract

Michaël Gilbert
University of Paris 8 - Vincennes
Saint-Denis
gilbert.michael@gmail.com

Samuel Demarchi
University of Paris 8 - Vincennes
Saint-Denis
samuel.demarchi@univ-paris8.fr

Isabel Urdapilleta
University of Paris 8 - Vincennes
Saint-Denis
isabel.urda@univ-paris8.fr

ABSTRACT

FACSHuman is a software that allows researchers to create, through three-dimensional modeling, experimental material that can be used in nonverbal communication and emotional facial expressions researches. It thus offers the possibility of practically manipulating all the Action Units presented in the Facial Action Coding System[6]. But also, the morphological parameters of the entire body and face.

CCS CONCEPTS

• **Human-centered computing → Virtual reality**;

KEYWORDS

Facial Expressions, Non verbal communication, Facial Action Coding System, Emotion, Avatars

ACM Reference Format:
Michaël Gilbert, Samuel Demarchi, and Isabel Urdapilleta. 2018. FACSHuman a Software to Create Experimental Material by Modeling 3D Facial Expression : Extended Abstract. In *IVA '18: International Conference on Intelligent Virtual Agents (IVA '18), November 5–8, 2018, Sydney, NSW, Australia.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3267851.3267865

1 INTRODUCTION

In some research on facial expression, the creation of specific experimental material is needed. Researchers often use the service of actors or databases of photographs and videos. However, these tools have a significant lack of flexibility in the stimuli variability presented to the subject. The software we have developed and will be presented (FACSHuman) allows researchers to create, through easy modeling, experimental material (image sets and videos) that can be used in their researches (mental health, communication, prevention ...). It offers the possibility to manipulate almost all Action Units presented in the Facial Action Coding System[6]. But also, the morphological parameters of the entire body and face.

2 THEORETICAL BACKGROUND

There are different coding systems for facial movements. The main ones are the facial animation MPEG-4 which is part of the Face and Body Animation (FBA) [9] and the Facial Action Coding System. The work presented here is based on the Facial Action Coding System (FACS)[6]. This system is mainly used in research on nonverbal communication and emotional facial expressions as well as in artificial animation creation projects[2, 4, 5]. It allows the coding and the analysis of the fine movements of the face. It facilitates the communication of the physical configurations of faces observed or used as stimuli for researches. The material used in researches on facial expressions usually consists of photos and videos that expose the faces of people whose expression seems to reflect their emotional state or intents of communication. It can be in the form of image banks and videos selected for emotional induction [3]. For facial expressions, it can be achieved by creating an acting game led by the research team, [8, 10] or by recording spontaneous reactions of subjects exposed to stimuli that are supposed to cause facial expressions targeted by research [11]. More recently, and to overcome the difficulties represented by the selection and constitution of the above-mentioned corpora, software for creation and modeling [1, 7, 12] have been made available to the scientific community. These software, are however not completely free of right of use because of dependency on commercial 3D rendering engines. Respectively Haptek 3D-character[1] for HapFACS software[2] [1] and FaceGen Modeller[3] for FACSGen[4] [7]. Furthermore they are no longer updated or available. FACSHuman which is presented here takes some characteristics of these two softwares while extending the possibilities of creation and modification by the exclusive use of free software (MAKEHuman[5], Blender[6], Gimp[7]) and a programming language of common use in academic research, the Python language. The source code of all the software as well as the ones presented here being free and shareable. It is possible for the research teams to modify them to adapt them to their needs. On the other hand the portability of the software is provided by the technologies used for its design and can be used on different operating systems.

3 FACSHUMAN SOFTWARE

FACSHuman[8] is made up of easy-to-use plug-ins for MakeHuman that allow the creation of complex facial expressions, sets of images and animations (2D or stereoscopic) by using mesh relaxing algorithm and linear interpolation. It offers the ability to define the

IVA '18, November 5–8, 2018, Sydney, NSW, Australia

ACM ISBN 978-1-4503-6013-5/18/11.
https://doi.org/10.1145/3267851.3267865

[1] http://www.haptek.com
[2] http://ascl.cis.fiu.edu/hapfacs-open-source-softwareapi-download.html
[3] https://facegen.com
[4] http://www.affective-sciences.org/static/facsgen/
[5] http://www.makehumancommunity.org/
[6] https://www.blender.org/
[7] https://www.gimp.org/
[8] https://www.michaelgilbert.fr/facshuman/

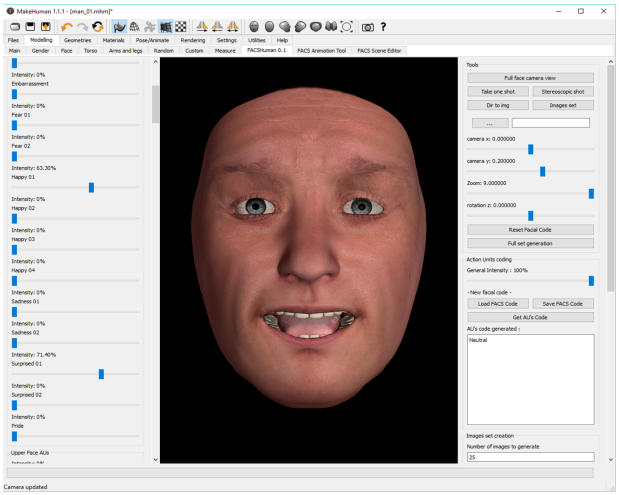

Figure 1: FACSHuman Software interface

muscular movements of the face, skin, eyes and pupils. As well as those of the jaw and head, or mix facial emotional expressions (EmFACS) [6]. It can manipulate physical characters such as age, weight, ethnicity and the intensity of the compound facial expression.

3.1 Main module

The first FACSHuman module (FH) (figure 1) allows the manipulation of the intensity of Action Units. The user can define the number of images he wishes to create. This allows him to gradually do variation of the expressive intensity. The image sets of the expression created can be used in experiments on detection thresholds. The different Action Units implemented in the software are combinable and can be mobilized on a time frame for the creation of macro and micro expressions and complex animated expressions. Animations and images created have a transparent background (PNG files) and can be made in stereoscopy. Researchers thus have the freedom to stage the avatar on a background color or an image of their choice. Image sets can be exported as videos (MP4 format). The size of images and the frame rate of videos produced are fully customizable.

3.2 Animation tool

The Animation module is designed to easily create complex facial movements. Control time-line and sequences of as many Action Units as needed. Intensity, speed for Macro and Micro expressions. These animations can be combined in the main module to produce image sets and videos.

3.3 Scene editor

With Scene editor module the user can place as many lights as he wants as in a photographic studio. The user can control position, intensity, colors and temperature of each lights.

3.4 Emotional mixer

An emotional mixer is also available in addition to the various manipulable Action Units. It takes up the main emotions described in the literature[6]. The separated three-zone division, for the emotions that require it, allows the user to compose complex facial expressions of emotions.

3.5 Interoperability

FACSHuman can be combine with FACSvatar[9] for the creation of complex facial expressions. In FACSvatar the Action Units movements are analyzed and recorded or transmitted via ZeroMQ which create realistic and rich facial movements.

4 CONCLUSIONS

FACSHuman is an open source software which can be extend and improved by the community. It can be used on different systems and is shareable. It was designed for research in non verbal communication and social behavior but can be used in game development, 3D creation and more.

REFERENCES

[1] Reza Amini, Christine Lisetti, and Guido Ruiz. 2015. HapFACS 3.0: FACS-Based Facial Expression Generator for 3D Speaking Virtual Characters. *IEEE Transactions on Affective Computing* 6, 4 (Oct. 2015), 348–360. https://doi.org/10.1109/TAFFC.2015.2432794

[2] Casey C. Bennett and Selma Šabanović. 2014. Deriving Minimal Features for Human-Like Facial Expressions in Robotic Faces. *International Journal of Social Robotics* 6, 3 (Aug. 2014), 367–381. https://doi.org/10.1007/s12369-014-0237-z

[3] Tanja Bänziger, Marcello Mortillaro, and Klaus R. Scherer. 2012. Introducing the Geneva Multimodal expression corpus for experimental research on emotion perception. *Emotion* 12, 5 (2012), 1161–1179. https://doi.org/10.1037/a0025827

[4] Sébastien Dalibard, Nadia Magnenat-Talmann, and Daniel Thalmann. 2012. Anthropomorphism of artificial agents: a comparative survey of expressive design and motion of virtual Characters and Social Robots. In *Workshop on Autonomous Social Robots and Virtual Humans at the 25th Annual Conference on Computer Animation and Social Agents (CASA 2012)*. https://hal.archives-ouvertes.fr/hal-00732763/

[5] Loza David, Marcos Pablos Samuel, Zalama Casanova Eduardo, and Jaime Gomez García-Bermejo. 2014. Animation of Expressions in a Mechatronic Head. In *ROBOT2013: First Iberian Robotics Conference*, Manuel A. Armada, Alberto Sanfeliu, and Manuel Ferre (Eds.). Vol. 253. Springer International Publishing, Cham, 15–26. https://doi.org/10.1007/978-3-319-03653-3_2

[6] Paul Ekman, Wallace V. Friesen, and Joseph C. Hager. 2002. Facial action coding system. 00022.

[7] Eva G. Krumhuber, Lucas Tamarit, Etienne B. Roesch, and Klaus R. Scherer. 2012. FACSGen 2.0 animation software: Generating three-dimensional FACS-valid facial expressions for emotion research. *Emotion* 12, 2 (2012), 351–363. https://doi.org/10.1037/a0026632

[8] Oliver Langner, Ron Dotsch, Gijsbert Bijlstra, Daniel H. J. Wigboldus, Skyler T. Hawk, and Ad van Knippenberg. 2010. Presentation and validation of the Radboud Faces Database. *Cognition & Emotion* 24, 8 (Dec. 2010), 1377–1388. https://doi.org/10.1080/02699930903485076

[9] Igor S. Pandzic and Robert Forchheimer (Eds.). 2002. *MPEG-4 facial animation: the standard, implementation, and applications*. J. Wiley, Hoboken, NJ.

[10] Hanna Samuelsson, Karl Jarnvik, Hanna Henningsson, Josefin Andersson, and Per Carlbring. 2012. The Umeå University Database of Facial Expressions: A Validation Study. *Journal of Medical Internet Research* 14, 5 (Oct. 2012), e136. https://doi.org/10.2196/jmir.2196

[11] Anna Tcherkassof, Damien Dupré, Brigitte Meillon, Nadine Mandran, Michel Dubois, and Jean-Michel Adam. 2013. DynEmo: A video database of natural facial expressions of emotions. *The International Journal of Multimedia & Its Applications* 5, 5 (2013), 61–80. https://hal.archives-ouvertes.fr/hal-00939067/

[12] Sergi Villagrasa and Antonio Susín Sánchez. 2009. Face! 3d facial animation system based on facs. In *IV Iberoamerican Symposium in Computer Graphics*. 203–209. http://upcommons.upc.edu/handle/2117/6944

[9] https://github.com/NumesSanguis/FACSvatar