# ARTNATOMY
# (anatomical basis of facial expression interactive learning tool)

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## Abstract

This resource has been designed and constructed in the context of the investigation of new methodologies in the general scope of the Fine Arts studies, to make easy the teaching and the learning of the anatomical and biomechanical foundations of the facial expression morphology. It does not try to add new data on the study object (we sent to the bibliography), but to order of graphical and textual form the already existing ones, taking advantage of the digital resources (attended animation, multimedia presentation techniques and interactivity) to make easy the visual understanding and the diffusion of the knowledge.

We begin by describing the main goals of the application, how it can be useful in general for people studying those matters (professors, students, fine artists, animators, etc) and also for institutions and professionals not equipped at all. We then describe the basis of each level on the application and the use of the interface and the different functions. Finally we add a short technical description of the application.

Keywords: education, educational software, fine arts, facial animation, interactive resource.

## 1    Application overview

I begun to project this english/spanish interactive tool (which I have designed, draw and developed) by necessity, as a "war tool" for my pupils, by the time I taught at a little Fine Arts University, in order to provide them the minimum information, and also make my job easier. The resource has been designed and constructed to take advantage of digital technology in the context of Fine Arts anatomical study. It is intended to facilitate the teaching and learning of the anatomical and biomechanical foundation of facial expression morphology.

The primary goal is to provide the student and those interested, a convenient reference tool, facilitating familiarity and experimentation with the underlying anatomical structures using correct biomechanical representation of the different facial expressions.

The task of the professor is also facilitated by the use of an expandable animated image (employing a projector connected to the computer), in addition interaction (controlled by the professor or students) is multifunctional, since the different levels and independent functions allow connection of the application contents to any educational program, providing real time delivery of examples to the student.

This is a compact tool, providing a basis for dealing with potential problems related to the proper representation of facial expression, eliminating the need for cumbersome teaching aids such as slides and photocopies etc. Additionally this digital presentation tool provides a complete supporting document solution for those institutions not equipped with such resources.

Because I think information is a human being patrimony for share, the tool it is distributed free online at:
 http://www.artnatomia.net

## 2    Content "Level I": Muscles of the head acting on the face.

### Basis

We use two extreme levels of representation of the face to study the muscles and their action: in the "Model scheme", by means of graphical simplification, the common characteristics are indicated to any face solely, to concentrate our attention on the naked mimic gesture, when later we will study the action of muscles; in the "Naturalistic Model", resorting to halftones and adding detail to the representation, we emphasize the general importance of the individual expressive factors, although it is by means of a prototypic and random example (that corresponds here to the Caucasian-Mediterranean stock, with proportions designed according to the western classic canon, and archetype and asexual characteristics).

The muscles of the head that act on the face are divided in two groups: those that move the skin of the face (the Subcutaneous Muscles) and those, which move elements from the skeleton (the Masticators Muscles). By their greater implication in the modification of the facial characteristics, in the present study the ones pertaining to the first group are analyzed of detailed form solely.

### Use of the Interface

The main illustration, contemplates two interchangeable options "Model scheme" and "Naturalistic Model", that activate by pressing the corresponding button and both illustrate the extreme levels of representation of the face, which we will use to study the muscles and its action.

To make easy the understanding and the learning of forms and actions, in the first Level, the teacher or student will find two controllers of opacity who at any time let as much superpose, with greater or smaller degree of transparency, a graphical representation of the "Skull" as of the "Muscles of the face".

The user will also find a complete listing of the muscles that take part in the different face expressions. Pressing on each one of the muscles buttons you will find graphical and textual information relative to the "Etymology" of the name, "Situation", "Form", "Origin and Insertions", "Actions" and "Expressions".

In the section relative to the "Actions" of the muscle, the user will find illustrative animations that can be activated by an only "Play" controller (if there is more than one action, all will appear numbered and, to activate it, it will be necessary to select the chosen option first). By combining and pressing corresponding buttons, actions can be combined and executed in different halves of the face

By pressing "Expressions" button, you will find enunciated the more common expressive metaphors traditionally associated to the action of each muscle.

In the Main Menu (upper left margin), the user will find a button "Basis" that connects to the textual summary of the general anatomical foundations on which each level of this application is

based. Also there, the button "Help" will allow in each level to quickly remember the function of each element and button of the interface.

## 3   Contents "Level II": Analysis of expressive movements of the face.

### Basis

Once assimilated, in the first level, the general morphology and isolated action abilities of each muscle, we advance one more step in this second level and illustrate the variations and possibilities of association or combination of the different actions from muscles of all the regions of the face, in addition to its respective or possible expressive interpretations.

Insisting, once again, on which as much both models, as the illustrations of movements and the list of "Expressions" are merely examples and do not try absolutely to limit the infinite expressive shades which a face is able, nor its possible interpretations. It will be either important, at any moment, to make the student understand how, at the time of solving any problem of representation, it becomes essential to study the permanent characteristics (the individual factions of each person), as much as the variable characteristics (his mimic behavior); in the same way, how although the plastic artist must take advantage from any kind of association, he neither has to ignore the fact that different cultural archetypes will grant different metaphorical values from the expressions.

The essential is that the student becomes familiar with the muscular mechanisms that originate the deformations of the face, to foment his habits and observation capacity, and to provide stimuli to him so that intensifies his practice of the drawing and thus, develops its own language.

We will found three directories from the left to the right:

*Agent muscles:* When selecting a muscle of the directory that we already know, the Movements which its action plays are emphasized and, next, the conceptual archetypes, metaphors of expression meaning more often associated.

*Expressive movements:* This directory illustrates more common movements (product of the action of subcutaneous muscles that we already know) as indicating factors from expression and meaning. When selecting a movement, it appears illustrated. The Muscles that make it possible and the more often associated metaphors of expression are emphasized in addition. But the most interesting feature is to compose own expressions selecting movements from the different regions.

*Examples*: The intention from the beginning was to complete in this level the illustration of each one of the movements with at least one example of photography (adding therefore a "third degree of figurative", the one of the photographic realism, to both levels that already contemplate the illustrations of the application), and, following the general exposition, two reproductions of works fragments belonging to the Art History that would provide an example of schematic type work and another one of naturalistic type. The objective, as always, is to make the student understand the utility of its efforts (how the implicit knowledge of the details that are studied may produce very different graphical results, but always much more rich) and as much to develop his capacity of observation of the reality as of artistic works.

We regret that effective laws of copyright prevent us to not even reproduce fragments of works of art of the most recent History. We must show here our personal conviction of the necessity of a reform of the laws that does not burden with taxes the transmission of the knowledge, and that contemplates the necessity to foment and to maintain free ways of access to the education like a basic condition at the time of fighting against the conditions of injustice and inequality that affects the world-wide population. We doubt so much, in addition, that some of the authors of the works whose benefit their new administrators insist on receiving to the humanity, had found inconvenient to disclose it.

Consequently, with the purpose of completing this section with examples, we invite all the creators to send us reproductions of their plastic works or their photography that illustrate the different movements from the face. It can be original works or work recreations of History. The clarity in the representation and identification of the movement will be valued. The selected works will be comprised within the application (that is free distributed under a Creative Commons license) and will appear signed.

*Associated metaphors/meant:* The most common expressions are illustrated and, in both previous directories, the combination of movements and muscles that make it possible appear emphasized.

### Use of the Interface

Main Menu remains the same functions as in the "Level 1". We found three directories from the left to the right:

*Directory "Muscles":* It also remains the complete listing of the muscles that take part in the different face expressions. This time, by pressing on each one of the muscles, all the actions in which it takes part, although it is of complementary form, will appear emphasized in the central directory "Movements"; also, the "more common expressions" that each muscle contributes to compose will appear emphasized in the right directory.

*Directory "Movements":* The basic utility of "Level 2" is provided by this central directory that tries to enumerate all the individual actions from the different regions of the face which, combined, solve the mimic expressive movements of the face.

The directory has been designed for a two kind of use:

*a) Selecting a single movement:* When selecting a movement of the central directory, the user visualizes the general modification of the characteristics in the affected zone. To the right of the movements buttons and their scheme, it will appear two halves buttons that we already know: those that allow hiding one of both half faces in each movement.

Simultaneously, in the corresponding directories will appear emphasized the muscles that make the selected movement possible and the more common expressive metaphors traditionally associated to it. Also, a total of three numbered buttons will unfold next to the chosen movement to show an example of a real photography and two reproductions of fragments from Art History works (that provide, following the general basis, a work example of "schematic" style and another one of "naturalistic" style).

*b) Combining several movements:* It is possible to visualize the movements one by one, although the movements of each region of the face are independent from the others to provide the more developed function in this directory, which is the one that allows the user to compose his own expressions, adding and combining movements of the four main zones in the face and both halves independently.

In the same way as when we selected only a movement, if several are selected simultaneously, stood out in red in the corresponding directories will appear all the muscles that also make possible the resulting gesture of that combination, and the more common expressive metaphors traditionally associated to such.

Also in red (in the vertical directory, between the Muscles directory and the Movements one), the names of the regions of the face to which selected movements belong will appear emphasized. For "erasing" the visualization of one or several movements it will be enough to click on the name of the region of the face that we

want to set invisible or, for a "general erasure", it will be enough to click on the button "Level 2" in the Main Menu.

*Directory "Expressions":* The right directory "Expressions", gathers the more common expressive metaphors traditionally associated to the action of each muscle. By selecting one, we will visualize a predefined, merely orientative, elaborated composition by means of the sum of movements selected from the different Regions of the face. Also, in the central directory the "Movements" that compose it and in the left directory the "Muscles" that make it possible will appear emphasized.

To "erase" the active visualization it will be enough to click button "Level 2" in the Main Menu.

## 4   Technical description

The application was projected in Macromedia Flash MX, developing all functions with Action Script language. Flash software allowed interactivity and also to mix different kinds of file formats to be executed on real time on the web. Illustrations were drawn on Adobe Photoshop with the help of an electronic pencil. Animations on "Level 1" were done using software Moho (Lost Marble), a 2D vector-based animation application.

## 5   Conclusion

Since we disclosed the application by the Internet, we have received an excellent response from students, teachers, institutions and professionals working in the scopes of Fine Arts, Animation 2D and 3D, but also doctors, psychologists and even actors. The big demand has encouraged me also to provide an auto run (Flash Projector file for Macintosh or PC), which will be soon available at a low cost that will allow to continue financing this kind of works and the big traffic of the server (the free version is going to stay online any way).

This response also encourages us to continue working and develop new resources in this way with the conviction that digital tools open new and powerful ways for the diffusion of the knowledge.

## 6   Acknowledgements