EmoCoW - An Interface for Real-Time Facial Animation

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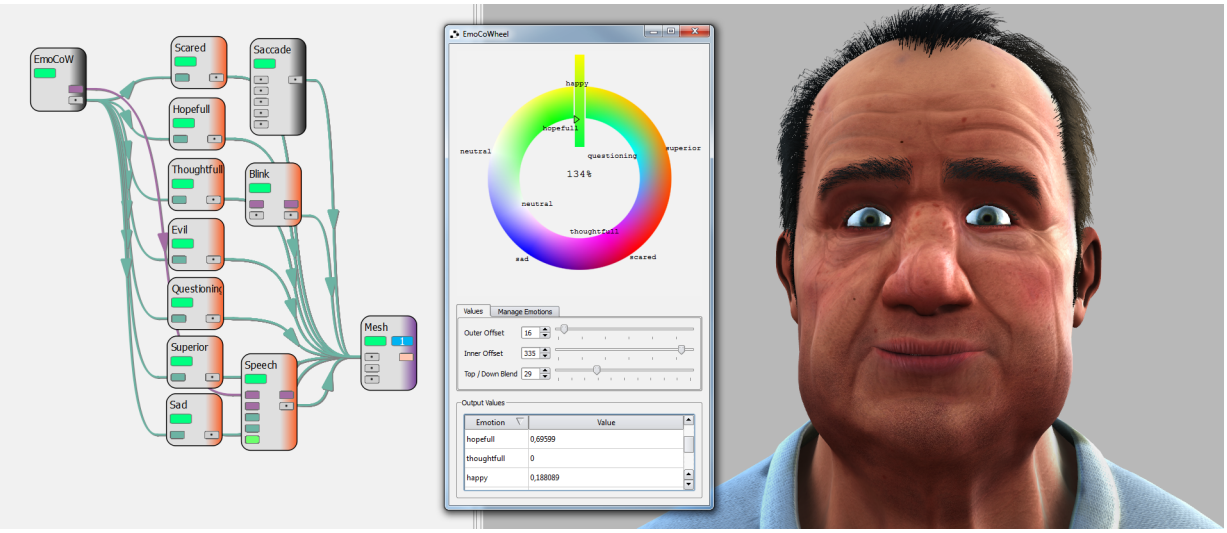

Figure 1: *The Emotional Color Wheel*

Abstract

We present an original graphic interface approach for animating a virtual character using expressions in real-time. The Emotional Color Wheel (EmoCoW) is an innovative and, to the best of our knowledge, unprecedented approach to tangibly controlled real-time facial animation. The system is programmed in C++ employing the Qt framework and is compiled as plug-in for Frapper[1] as testing and development platform. The tangible device in use is a 3DConnexion Space Navigator[2], a commercially available 6-axes mouse for less than 90€ / 100$.

For the interface, two sets of expressions are mapped on a circle each, with one circle nested into the other. The artist controls the rotation of both circles as well as vertical blend slider cutting the two topmost positions, thereby blending between two shapes on each circle and between the inner and outer circle, respectively. With a proper setup, it is possible to blend between any two emotions in the model without triggering unwanted ones in the process.

CR Categories: D.2.2 [Software Engineering]: Design Tools and Techniques—User Interfaces

Keywords: facial animation, interface, real-time, emotion

1 Introduction

Inspiration for this tool is a current project entitled "Animated Fiction" by Cinemakers Technology in Berlin, Germany, which targets to provide technology for a workflow, that allows a film crew to produce animation using a real-time virtual film set, much like a life-action production. While cameras and most other modern on-set technology can quite easily be translated to virtual equivalents, actors cannot. Taking that character animation is one of the greatest challenge of traditional CG productions as it is - finding a way to animate characters in real-time is not a trivial task.

Several attempts were made to develop techniques for real-time facial puppetry that already yield impressive results ([Kouadio et al. 1998], and more recently: [Weise et al. 2009]). However, all of them require a significant overhead of technical equipment and maintenance. We present an alternative for rough, previz-stile blend shape animation of virtual faces in real-time using only a conventional home computer and a low priced, one-handed input device.

For the animation process, we use the Adaptable Facial Setup [Helzle et al. 2004] – a standardized facial rig, driven by a set of non-linear deformations. While the interface does also work with blend shapes or even animations, this approach provides greater realism through its nonlinearity.

2 Mapping expressions to a dynamic interface

In contrast to "truly interactive" applications, action on a virtual movie set is largely predefined by the script or disposition and leaves only a narrow range for the crew's creative genius in performing their art. Therefore it is possible to prepare the shooting of a scene upfront and simplify the time-critical process on set. In the case of real-time facial animation, this means that an animator would never need every single blend shape at hand – only the ones required by the scene. And preferably somewhat ordered by their appearance.

A first notion might be to simply map all required expressions to a mixing console, such as employed in sound editing – basically a tangible equivalent to a generic facial rig. While this solution offers most flexibility, it is far from being the best option. With the reduced set of expressions, the animator would be forced to re-

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[1] http://research.animationsinstitut.de/57.0.html
[2] http://www.3dconnexion.com/products/spacenavigator.html

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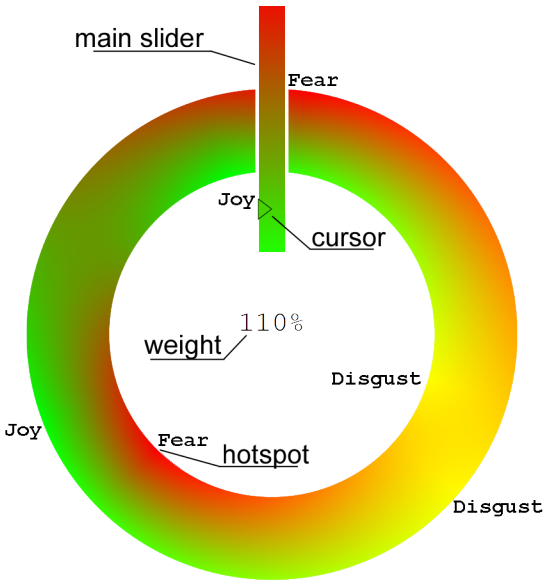
memorize the mapping of the parameters for each new scene. Alternatively, one could discard this advantage altogether and simply use all available expressions in one interface, thereby confronting the animator with a large number of sliders that could be physically impossible to operate. Moreover, there is no protection mechanism against overdriving expressions, that would basically rip the mesh apart.

The other extreme is a mapping of expressions along a line, that the animator would just scrub through as the scene progresses. As a clear artistic disadvantage, this system requires extensive preparation and provides no flexibility at all.

3 The Emotional Color Wheel



The idea for the Emotional Color Wheel (EmoCoW) originated from the concept of mapping emotional states (expressions) as color coded "hotspots" onto a 2D space, with related states closer together and unrelated further apart.

The cursor of the interface lies alongside the y-axis, shifting on a line between the top of the outer and top of the inner circle, thereby blending the influence of the two circles on the resulting mix. The line is expanded to a rectangle to give the animator a better display of the emotions on the slider, as well as more space and finer on-screen sampling of his blend values. In addition to the color coding, the names of all registered emotions are displayed alongside their hotspots bordering the color wheels, for better readability. By making both circles rotate independently, one is able to blend from any point on one circle to every point on the other.

Emotions can be added to both the outer and inner circle, but only once on every wheel. While no duplicate names are allowed, the color can be chosen freely – although, of course, strong and intuitive coloring of the wheel is advised.

4 Performing with EmoCoW

During a performance, EmoCoW blends 4 emotions at most and at least one. More regularly though, the final blend is affected by 2, if the mix-slider is maxed out on one of both sides or 4, if it is somewhere in the middle. If one places the inner and the outer circle precisely over an emotional hotspot each, one can also blend between exclusively one emotion on the inside and one on the outside.

No matter how many output values are involved, their weight always sums up to 1. Therefore, if all expressions are valid by themselves, it is impossible to over-weight the rig. For setting performance accents, EmoCoW has a global multiplier (the percent value in the middle of the wheel) that is influenced by the sideways movement on the 3D Mouse, giving the animator more flexibility while reducing over-weighting safety.

5 Conclusion

After initial testing, the conclusion of EmoCoW as a tool for real-time facial performance is guardedly optimistic.

On the one hand, the approach does suffer from the expected disadvantages of a tangible device and the use of a limited amount of expressions. The character animation feels somewhat stiff, any movement of facial features is unnaturally smooth and synchronized. Operating a virtual face with a 6-axes mouse, although simple, is not very intuitive and requires some practice. Moreover, the operator has to keep his eyes fixed on the interface most of the time instead of on the virtual face he is animating.

On the other hand, though, the hardware setup is quick and the interface potentially powerful enough to be employed in a real-time animation scenario. If the content of a scene is known beforehand, it is possible to prepare the hotspots on the wheel accordingly and to allow a skilled operator to mix up to 2 added emotions into the mimic during the course of the performance. And since working with the device only occupies one hand, the animator still has capacities to operate a mouse or other gear.

For the future, procedural animation based on the character's emotional state would be well worth investigating. At the moment, EmoCoW links any emotion directly with one, fixed expression or animation. Instead of the global weight in the center, it would also be advisable to see the actual face that is animated as part of the interface and not in a separate window for easier handling.

Ultimately, while probably not revolutionizing the way animation will work in time to come, EmoCoW proves that facial animation in real-time is possible and can be realized with today's technology and relatively small cost, money- and time-wise. As an animation interface, it presents an unique alternative to a classic slider setup.

Acknowledgments

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