Yale Child Study Center

Face Morphing Tutorial:
From Models to Morphs
[For use with the Morph Age® software package]
From the Social Affective Neuroscience and Development Laboratory (SANDL) @ Yale
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This tutorial is designed for use with the Morphage® software package. By morph we mean, “to undergo transformation from an image of one object into that of another especially by means of computer-generated animation” (Merriam-Webster, online). This tutorial is designed to guide you in the morphing of human faces. Why bother morphing human faces? We do this mainly for research purposes. Our main interests lie in studying how people, children and adults, read emotion. We want to know how the capacity for reading emotion in the faces of others might impact socialization processes. We believe that most of us probably come to know the minds of others, in part, by reading the emotions of others. Some people are particularly good at reading emotions, some are about average and others struggle with reading emotions. With the Morphage® software, we can gradually modify the image of a person’s neutral face into an emotionally expressive face. Then we can use the still images, or the video rendered from this process, to study emotion reading ability. We can ask people to tell us what emotion they are seeing and how confident they are. We want to know who reads emotion more quickly and how. Some individuals have a heightened sensitivity for specific emotions. For instance some work suggests that physically abused children have a reduced threshold for seeing anger in faces. Other individuals, such as psychopaths have difficulty reading fear and sadness in other people. But we need not focus just on trauma and psychopathology. We have important questions to answer about how facial affect reading happens in normal development. We want to know how mothers read their infants faces and how children read their parent’s faces. Is there something special about learning to read faces in the context of a new relationship such as with the birth of a child or when romantic relationships begin? Do stress, depression, trauma or drugs disrupt these processes? We believe that applying the morphing technique will allow us to develop person specific stimuli that will help us to understand not just how people process emotion generally, but also in the context of socially meaningful relationships. Lastly, we are social neuroscientists. We use the face morphing techniques to develop images (stimuli) that we can use to study the brain systems that underlie emotion reading abilities and the broader social emotional and attachment-based brain systems that support this important human ability. We have designed this manual to facilitate, for our group and for you, what we believe is an important line of work in developing stimuli for use in studies of face processing and emotion discrimination.
I. Taking Pictures for Your Morphs

Here are a few things to keep in mind when taking emotion pictures:

1. Make sure the model keeps their head completely still while displaying an emotion. Nodding or turning their head left or right can distort the morphed image. This is particularly important if you intend to export still images of the morph.

2. Obtaining a tripod and creating a studio area with the same neutral background (gray for example) will help to keep the pictures from varying between subjects.

3. Use the same zoom for each of the emotions and models as to eliminate variation in head sizes.

4. Make sure the models are not wearing any jewelry.

5. Ask the model to keep their hair the same and not to adjust their hair in between pictures. Ask models with long hair to place it in a ponytail; otherwise hair may randomly appear or disappear during the morph.

6. Some people may have trouble conjuring up an emotion without some sort of motivation or cues such as pictures of others expressed emotions. We recommend creating vignettes to help elicit emotions and to show the model prototypical emotional faces for them to mimic.

7. Load the pictures onto a computer and make sure all the shots are acceptable (i.e., the participant kept their head still) before the model leaves.

8. If the pictures are not acceptable you will need to redo them. Retaking the pictures saves an enormous amount of time during the editing process, and helps reduce the likelihood that one of the exemplar faces is unusable.
Here are two examples of photographing subjects to help explain the process.

**Image 1**

In Image 1, the model in the Neutral picture has their head, shoulders, and neck in one position and a completely different position in the Happy picture. This will cause the resulting morph to blur between transitions.

Other concerns with image 1 include; the neutral is somewhat happy and the “happy” picture is blurry. This is why it is important to take several photos and review them on a computer before the model leaves.

**Image 2**

Image 2 includes much better images for morphing emotion. The head and body in Example B are steady in both the Neutral and Angry picture. This will create a smooth transition when morphing the pictures. Using a barbershop smock can also help distract clothing from showing.
II. Tools

These are the tools that will come in handy when creating the morphs.

The Curve tool will allow you to connect dots with a line. This will be the primary tool for outlining the hair, face and other features.

The Circle tool permits you to create round and oval shapes. This tool will be useful for the outline of the eyes and mouth.

The Square tool will be used to outline the entire picture. This will keep the sides of the picture from bending, thus providing a smooth morph transformation.

The Insert Point tool is useful for placing additional points on existing ellipses, lines, or squares.

The Select / Move tool allows you to move the points around once they have been initially placed in the picture. Furthermore, you will be able to bend, expand and contract lines or circles.

Playing the morph can help find problems with the morph, (i.e., ghost images, distortions), use the preview screen to view the morph.
III. Morphing Pictures

Drag a neutral face picture into Image A (left box).

Drag an emotion face into Image B (right box).

Begin with Image A, or the face with the neutral expression. When the majority of the marking on the first image is complete, then switch to Image B, or the target expression. This will save time by avoiding the need to go “back and forth” between the two pictures.
When a point is placed on one image, the program creates a corresponding point on the other image.

Place corresponding points in the same exact location on the face in both images. For example if a point is place on the corner of the lip in Image 5, then its corresponding point needs to be placed at exactly the same location on Image 6, regardless of where that lip corner has moved.

Begin working on Image B once all the features of Image A has been outlined. Use the Select /Move tool and place the outlines for Image B in their correct location. Use command + Z to undo most recent mistakes.
Step 1: Picture Outline:

Use the Square tool to outline the entire picture. This will prevent the background edges from distorting during the morph.
Step 2: Hair:

Using the Curve tool, place marking points along the hairline at the top of the forehead and the outer edges of the hair. There should be at least two independent lines. This step does not have to be too precise. However, do not hesitate to use more points than usual if the hair is especially wavy or spiky. Look for grooves in the hair that can be marked in order to help fit these lines accurately (see Image 10).

Occasionally the hair will move drastically between images. To better illustrate this example; refer to Image 6 in which only the middle tuft of hair above the forehead changed significantly across both images above. To create a more accurate morph, reposition the points on Image B to match the corresponding points on Image B. Keep a reasonable distance from the ears with each line. At the same time do not mark the borders between the ear and hair (see Image 11).

The model’s hair is the least well-defined feature you will work with on a face. It is nearly impossible to remove all the fuzziness that emerges during a morph. The fuzziness will be addressed and adjusted later in the tutorial.
Step 3: The Chin and Ears:

Like the hair, marking the chin and ears is straightforward. Using the Curve tool mark along the chin. There are no steadfast rules for the number of points you should use. In this example we use 11 but as few as 7 or as many as 15 may be needed depending on the situation.

Use a similar approach when marking the ears. A good strategy is to use the groove of the ear itself as a reference for repositioning points on the image (see Image 12). Often the ears can move and stretch during the morph. Importantly, make sure the points are attached to the same place on the ear across images is. If necessary, expand or condense the lines to make a best fit.
Step 4: The Mouth:

Outlining the mouth requires a different approach. Using the circle tool, make a circle around the entire mouth, including the lips. Place at least two additional points on this circle using the add tool to account for the peaks of the upper lip right under the nose. Position the points as shown below.

For more precision, try to zoom in and use the handles that protrude from a selected point in order to manipulate the outline of the circle to fit the curves of the lips.

Lips often stretch between expressions, and if the mouth opens it may become much more difficult to properly place points (see Image 17). Use the preview feature and watch the morph of the mouth closely until you're sure that all the points are placed and toggled as best as they can be.

Using the preview feature, iteratively modifying points and previewing until you achieve a transition that looks smooth.
Step 5: The Nose:

Marking the nose is usually a quick step, but for accuracy zoom in when placing points. One challenge with the nose is that it tends to noticeably fade out and then fade back in. Unless it is marked well, a person in mid-morph can sometimes appear to have extra phantom nostrils. The following “nose job” method provides a smooth transition.

Use the Curve tool, and create three separate lines, two along the outside of the nose and one that follows the border of the nostrils. For the border of the nostrils, more points in the line will lead to a better morph (see Image 18).

For some facial expressions the nostrils will flare or expand. Make sure to expand (or contract) the lines in order to compensate in the second image (see Image 19).
Step 6: The Eyes and Surrounding Areas:

This step is the most critical in making your morph appear natural. The slightest mistake in marking will result in a noticeable transition error, but these are quite easy to fix once presented. The procedure is the same for each eye and its surrounding area, but in a mirror image. One technique is to leave one eye unmodified and then view the morph to observe the differences between the modified eye and the one that is not.

First, zoom in and use the Circle tool to create a circle around the white of the eyeball. Four points around the eyeball will be sufficient (see Image 20).

Position the points as shown, taking care to place the points accurately and toggle the line into position as best you can. Avoid having any part of the line run into the skin.

Also, use three separate point lines (2-3 points each) to mark the white in the pupil and form a “cup” around both sides of the iris (see Image 21). Try not to modify the curvature of the lines around the iris between the two images, since the curvature of the eye does not change. Just grab the whole line and move it to where it fits. It’s often easier to place the iris lines on the image that has the most squinted eye (in our case the expressed emotion). As in the example above, placing the lines on the emotion image first and then repositioning the lines on the neutral image works better. This minimizes the problem of having to delete a line that doesn’t fit and repeating the process.
The next step is to mark around the eye and eyebrows. Use the Curve tool to place an outline along one side of the eyebrow (see Image 21). Two lines along each side of the eyebrow may be necessary to reduce the fuzziness that can occur during the morph (see Image 22).

Another important location to mark is the crease where the eyelid connects to the face. Mark this spot with another line. Also, if the individual face has a noticeable color difference under the eyes, it helps to mark these as well. Lastly, consider placing a small line along the border of the upper nose. The finished product should look similar to what is shown (see Image 24).

Some eyes may be so severely squinted that drawing a line around one or both sides of the iris is very difficult or even impossible. Using the preview feature can be a great help in determining where these lines should go in order to make the morph appear smooth. In a worst case, just delete the iris line and move on
Step 7: Wrinkles, Blemishes and More:

The next step in morphing the face is to mark anything that stands out, such as a birthmark or a random bundle of hair. Without marking, these areas tend to fade out and then reappear in a different location during the morph.

Use a short, 2-point line to mark small blemishes and birthmarks and then simply move that line to its proper location on Image B.

This step resolves the fading problem, and the mark will appear to move naturally during the playback rather than fading out and in. In other cases, removing a particularly noticeable blemish, or mole can be done with Adobe Photoshop before morphing the image.

Marking wrinkles can improve the quality of your morph, especially for emotions where facial wrinkles can be common, (i.e., anger). Find the crease in the forehead on the neutral image that becomes this wrinkle and use a multi-point line to mark it. Watch the preview to make sure you positioned it correctly.
If thick strands of hair fall over the forehead, it is best to mark them. It may be necessary to break the line that marks the hairline above the forehead into multiple segments – this change usually won’t detract from the quality of your morph. Make sure not to cross these lines through one another.

Image 27

If the hair still looks fuzzy during the morph playback, look for identifiable sections of hair, such as highlights and large curls. Mark these with lines as shown in the Figure X. This modification can improve the quality of the morph. It is important that the section of hair is present in both Image A and Image B. Otherwise not marking it seems to work better.

Image 28

Mark facial hair, such as beards and mustaches, along their outlines in as much detail as necessary. A face with a mustache can reshape a great deal in many expressions. This detail needs to be accounted for to produce an accurate morph.

Image 29
Step 8: Check Your Work:

The final step is checking your work. When marking with dozens of points it is easy to overlook a misplaced point. Use the preview movie and examine each facial feature closely through a complete morph before rendering a movie or stills. If there are any fading, smearing, or other inaccurate events in the morph, it will be necessary to identify the problem on the image. Some faces are more difficult to morph than others.

Some faces are more difficult to morph than others. For example, a feature that is very prominent in Image A (Image 30) could be significantly less visible in Image B (Image 31). This can be handled by:

1. Adding more lines to the area that needs touching up.
2. Using the morph playback iteratively to improve the smoothness of the morph.

Certain events, such as the fading of teeth in opening mouths, irises in widening eyes or the movement of hair over ears, are impossible to fix in Morph Age without extensive work. The easiest way to repair these issues is to retouch the exported images using a picture-editing program such as Adobe Photoshop®.
IV. Additional Techniques

Sometimes applications require generating multiple morphs with one initial picture and several different “end point” pictures. We find that an efficient way to handle this is to place the neutral and all emotions onto the same morph. Start by placing outlines on the neutral face then adjust the outlines for each emotion, one after the other.

Image 32
For fine adjustments of points and lines, use Preview and adjust the time marker manually. Use one side to switch between Image A and Image B.
Use full screen mode for detailed editing to and around the face. To get back to the original screen just press the esc button.
V. Common Problems

The common problems we describe below can be solved and managed with the techniques we describe above.

Doubling Effect:

The doubling effect can occur if lines or points in one image are not aligned between the two images.
“Broken Glass”

If two or more lines are crossing, or if there is a discrepancy between the corresponding lines / points between Image A and Image B, there will be an appearance similar to looking at a broken glass mirror during playback.
Teeth:

When transitioning from a close mouth to an open mouth position (e.g., smiling), a discoloration of the teeth can be seen.

Adding two lines along the mouth is helpful, but additional editing using Photoshop® is the best way to eliminate the problem.
VI. Appendix

Stripping the background from the picture

The following retouching tutorial was created using Adobe Photoshop CS3. Any other version of Photoshop may require different tools.

Open the Photoshop program, which is typically located in the HD Macintosh/Applications/Adobe Photoshop CS3 folder. Open the neutral picture in Photoshop (⌘ + O) and begin removing the background from the image.

First select the quick selection (W) tool and click part of the background on the picture. You will notice an outline that borders the edge of the face, and runs along the edge of the picture. You will have to click a few areas of the picture in order to outline the surrounding face.

The X represents areas to click for this picture.
Next, select the background erase tool \( (E) \) to erase part of the background. You may have to cycle through the eraser tool to find background eraser \( \square \). Now hit delete and you will see a large portion of the background has been erased.

You can erase the rest of the background, smock and part of the neck by either clicking on the section with the magic wand tool and then delete or switch to the eraser tool and then erase \( (\text{Cmd} + E) \) until you see \( \square \).
Once you have removed the majority of the background, use the rectangular marquee tool (⇧ + M) to copy the face onto a new background. First create a small box and hold down the spacebar to move the box to the up most left hand corner. Then continue to expand the box until it covers the entire screen and copy the face (⌘ + C). Create a new document (⌘ + N) and rename the file (keep it the same folder as the original file). Once the new document has been made, paste the face (⌘ + V) onto a new layer in the new document.

**Rename the new document** (Ex. IDgender_Neutral_C.psd).

Note: before you create a new document, make sure the background is set to black. Look at the bottom of the tool bar. The background can also be specified in the “New Document” dialogue within the “Background Contents” drop down menu.
Finally, save the stripped file as a Photoshop file (*.psd extension). It can be placed in the emotion folder (i.e., Fear Open Mouth) or you can place it under the ID folder (i.e., 18M). Click the red button to save, or do save as (Shift + ⌘ + S).
Baby Morphs

Provided below are the marking points that created the morphs for the tutorial cover.

Image A

Image B