



Logic Pro X

Elemental Morphing in Alchemy

White Paper
August 2015

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Overview

Most people are familiar with the concept of morphing images and 3D graphics. We've all seen the videos of a human face morphing from one to another, or transforming from a young to older version of the same face. The idea of morphing between sounds is less familiar, and musical instruments or effects that featured some type of morphing are not very common. In devices that offered morphing, it generally referred to an ability to interpolate between the values of a fixed set of parameters. For example, morphing between two sounds might involve transitioning between the respective filter values, envelope shape, or amount of reverb for each sound.

The Performance controls in Alchemy, particularly the Transform Pad, make effective use of this type of parameter morphing, often moving between multiple synth and effect settings simultaneously to produce dramatic changes to the sound. But Alchemy can also perform a deeper and more powerful form of morphing referred to here as Elemental Morphing. This white paper provides an introduction to Elemental Morphing which includes guided tutorials showing how to use these exciting new tools with different kinds of content.

What is Elemental Morphing?

Elemental morphing is an advanced form of morphing that operates at the sound generation level, making it possible to combine core characteristics of different sounds, technically referred to as cross-synthesis. It allows new sounds to be created by mixing and matching elements from different source sounds. Elemental morphing expands the possibilities for creative sound design well beyond what is possible with the parameter morphing described above.

The additive, spectral, granular, and formant synthesis engines in Alchemy are key facilitators for this type of morphing. Each synthesis method has inherent strengths and weaknesses, making them more suitable for certain sound types than other synthesis engines. Having them all available in one instrument is one reason Alchemy is such a unique and powerful morphing tool.

Another critical component for elemental morphing is Alchemy's ability to reconstruct audio using the synthesis engines, a process referred to as resynthesis. Resynthesis makes it possible to perform elemental morphing on any audio, because it creates a synthesized version of the original which is intrinsically more malleable than a static sample. Without resynthesis, elemental morphing would be limited to sounds built from scratch within Alchemy.

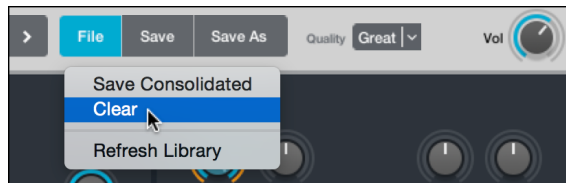
Successful morphing depends on developing at least a general understanding of which engine is best suited for the type of audio material you are working with. The choice also affects the type and number of sound shaping options available. A detailed explanation for each of the synth engines will not be part of this paper, but a basic explanation for the choices made within each tutorial will be provided.

Morphing Drum Beats

This tutorial will guide you through the process of importing two drum beats and then morphing between them, first by morphing all elements collectively, then each individually.

1. Reset all settings for the preset

Open Alchemy and select Clear from Alchemy's File menu. This resets Alchemy's settings and makes it easier to build sounds from scratch.

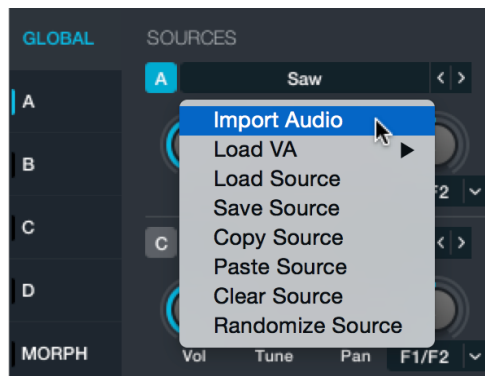


2. Switch to Advanced view



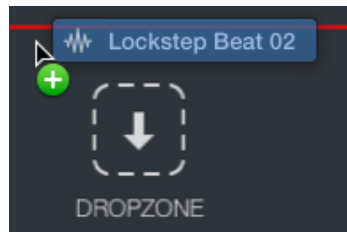
3. Open Import Audio window for Source A

Click on the waveform / import audio menu for Source A and select "Import Audio"



4. Add first audio sample

Open the Apple Loops browser and type 'Lockstep' in the search field. Drag the loop "Lockstep Beat 02" * over to the Drop Zone area within the Import Window.



Before you click the Import button, you need to select the Analysis Mode you wish to use. This determines the synthesis engine that will be employed for the resynthesis of the audio sample. As mentioned previously, selecting the option best suited for the type of audio material is key to getting good results. We're going to use Spectral and Formant engines for for this exercise, so select those two tabs in the lower left area of the window in the image below.

Spectral + Formant is a good general purpose option which will work well for these drum loops. It's also the default setting when you create a new instance of Alchemy. Click the button labeled "Import" when you're ready.

When the analysis is complete, you should be able to trigger the loop at its native pitch by playing C3 on your keyboard.

5. Add second loop

Find and drag the loop "Insider Groove Beat" to the controls area of Source B. This will trigger the Import process automatically and use the Analysis Mode previously selected, saving us the step of going to the Import Window.



Playing C3 should now trigger both loops at once. The loops are 8 beats long and have a native tempo of 120, so they play nicely in sync. Though there are techniques for tempo matching loops you import, bringing in matched files like this simplifies the process and improves the potential for getting good results with minimal effort.

Note: The loops used for this example are from the Electro House and Tech House loop libraries. If you do not find the loops, you'll need to download these additional content packages. To do so, go to the "Download Additional Content..." menu selection found in the Logic application menu.

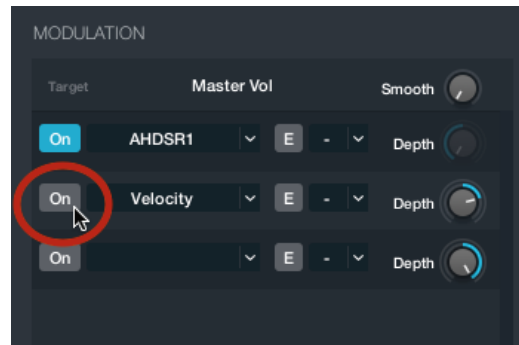
6. Set beats to loop continuously

It will be helpful for this exercise to set each of the beats to loop continuously as long as you hold down the note. To do this for the Source A loop, click the tab marked with an 'A' in the left column under the word "Global". Then select "Continuous" from the menu labeled "Loop Mode". Repeat this step for Source B loop.



7. Disable Velocity control of playback level

When triggering loops, it can be helpful to disable velocity control of the playback level so the loops trigger with the same loudness regardless of how hard you play. This can be easily done by clicking on the 'ON' button next to Velocity in the window showing Modulation controls for the Master Volume.



Note: If the Modulation area doesn't appear this way, it indicates the focus of the Modulation section was changed to show the modulation sources for another control. To return to this view, click the Global tab, then click the center of the Master volume knob that will be visible in the upper right hand area of the interface.

8. Switch to Morph section

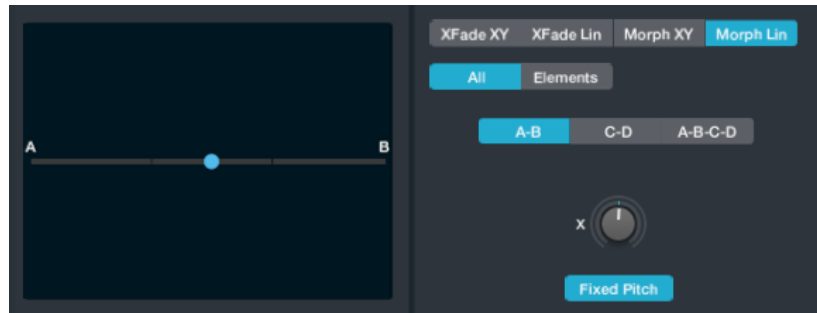
The morphing section of Alchemy can be easily accessed by selecting the tab marked "Morph" in the left column of the upper section.



When you switch to the Morph section you'll see an XY control to the right of the basic Source controls. This is the default view with the XY set to simply crossfade, not morph, between the sources. Drag the puck in the middle of the screen to the top of the control area and drag it from left to right. You'll hear the level of each source decrease and increase, as you expect with a simple crossfade control.

9. Morphing all Elements simultaneously

You need to select one of the two morph tabs in the Morphing section in order to access the elemental Morphing controls. Since we're currently working with just 2 sources, we'll select the Morph Linear option, then click on the A-B button to limit morphing to those two sources.

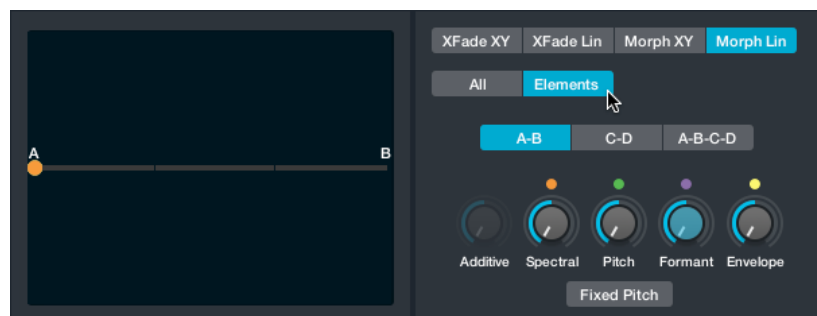


Now dragging the puck between the two sources while holding a note creates a fundamentally different effect than when simply crossfading between them as in the previous step. What you now hear is a true morphing between discrete components of each sound. Now the transition is not simply between the overall amplitude of each sound, it's between the levels of multiple narrow bands of frequency, and between the formant characteristics of each sound. Sometimes this sounds a bit like one sound is "playing" the other, like a sophisticated filter effect.

Drag the puck all the way to the left, then listen as you move slowly to the right and you'll hear a phantom shaker-like rhythm which doesn't exist in either loop by itself. The sound is being generated by the frequencies of the syncopated noise sweep within Insider Groove Beat pushing against the long tail of snare hits in the Lockstep Beat. Once you're done exploring, move the puck back to the far left, to 'A', before moving to the next step.

10. Morphing Elements independently

Click on the Elements tab in the Morph area. This provides access to the controls for morphing between different elements of the sounds independently, as opposed to morphing them all at once as in the previous step.



While triggering the sound, move the Spectral control from left to right. As you do, the spectral components of the first loop transition to those of the second beat. The change is similar to what we heard in Step 10, but notice that the phantom shaker rhythm is clearer, and the kick sound from Lockstep Beat 2 remain intact longer. In fact, something about this combination actually causes the kick to change tone and become more pronounced at beat 1 of each bar. When the Spectral control is fully to the right, the original kicks are gone entirely and replaced by the pronounced 'thump' at the head of each bar.

11. Morphing Pitch and Formants

Drum beats don't generally have a lot of pitched information in them, so moving the element control for Pitch may have negligible results. When you move the Pitch control for this example all the way to right, you hear the high tom that is prominent in the Insider Groove Beat on the "and" of beat 2 trying to make itself heard. Only the tail of the pitch pushes through however, creating an 8th note rhythm that starts on beat 3. It seems there is just not enough energy in the Lockstep beat at the "and of 2" for the pitch to be heard.

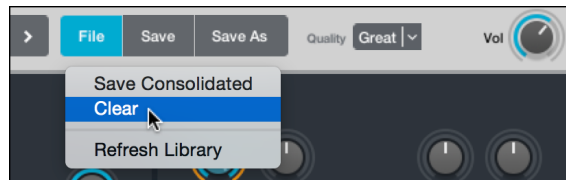
This changes as you turn up the Formant control. By the time the Formant is at 50% the onset of that pitch is easier to hear, and by the time you're at 75%, it's quite clear. As another interesting exploration, turn the Formant all the way to 100% and then turn the Spectral control back to 0%. Now you hear the arc of the tom hit, but without the tonal characteristics since there's not much Spectral material at that point in the Lockstep loop. This demonstrates that the resonances in a sound play an important role in the prominence of pitch information.

Morphing Sounds with Melodic Content

Sounds that contain melodic or harmonic material, i.e., are not purely drums or percussion, present a few more challenges when morphing. In these cases, it's especially important to understand some of the limitations, and to know which synthesis options will render the best results. This tutorial covers morphing between sounds that contain melodic material produced by monophonic instruments such as a solo voice, synth leads, or orchestral instrument like a flute or oboe. As with the previous tutorial, the example files have the same basic length, which makes the results more predictable than if the lengths were quite different.

1. Reset all settings for the preset

Open Alchemy and select Clear from Alchemy's File menu. This resets Alchemy's settings and makes it easier to build sounds from scratch.



2. Switch to Advanced view



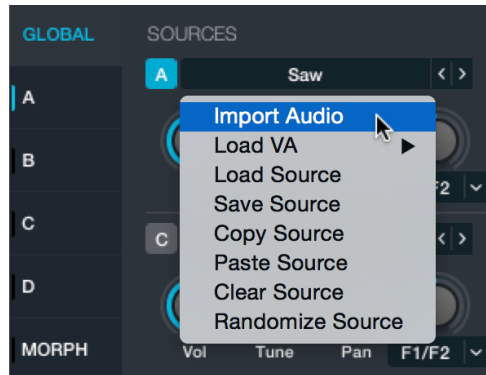
3. Select Source A Editor

Click the A tab in the source section. This displays the detailed edit controls for Source A.



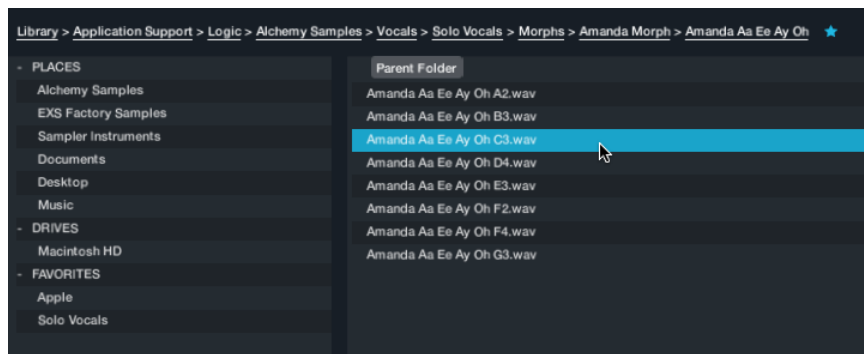
4. Open Import Audio Window

Click on the waveform / import audio menu and select “Import Audio”



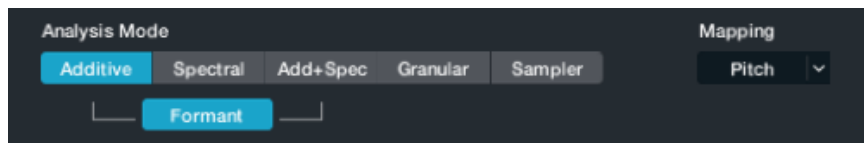
5. Add first audio sample

Find and select “Amanda Aa Ee Ay Oh C3.wav” from the file directory shown below in the Import Audio window.



Before you click the Import button, select the Analysis Mode you wish to use. This determines the synthesis engine that will be employed for the resynthesis of the audio sample. As mentioned previously, selecting the option that is best suited for the type of audio material is key to getting good results. It's also generally best to select the same Analysis Mode for all audio you plan to morph between. Otherwise, the primary synthesis element morphing control will be non-functional when morphing between sources analyzed with different engines. For example, you can't perform Additive morphing between a Source generated by the Additive engine and another generated by the Spectral engine.

For this tutorial, we will be using Additive + Formant. This combination is generally best when you are working with melodic, monophonic audio files as we are here.

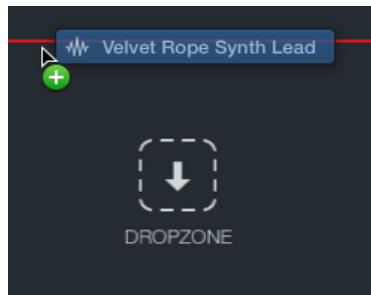


Once you've made the selection, click the Import button in the lower right corner to begin analysis and import the loop into Source A.

Once it has completed the process, play C3 on your controller keyboard to hear the sound played at its original pitch. It's important to understand that what you're hearing is not the original audio file, but a resynthesized version which is being generated by the Additive synthesis engine and further shaped by the Formant engine. This resynthesis technology is precisely what makes it possible to execute the kind of morphing techniques we're exploring in this paper.

6. Add second audio sample

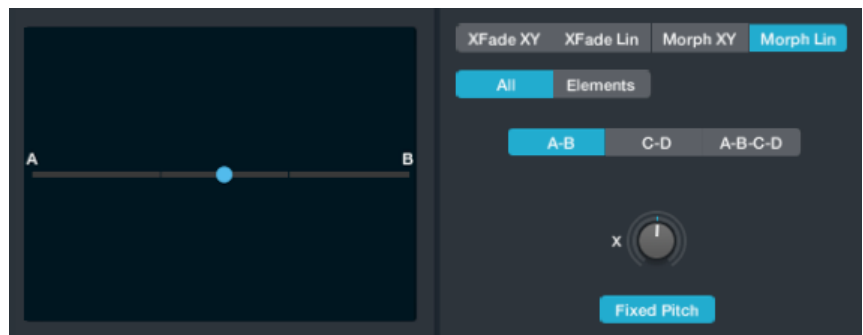
Since we're using the same Analysis Mode as in the previous step, we can import our Source B audio file in the same direct way we did in the previous tutorial. Open the Apple Loops browser and find the file "Velvet Rope Synth Lead." Click and drag the file to the Source B controls area.



Once it is imported, it would be useful to set the loop mode to Continuous for both Source A and B, as per the instructions in Step 5 in the previous tutorial.

7. Switch to Morph section

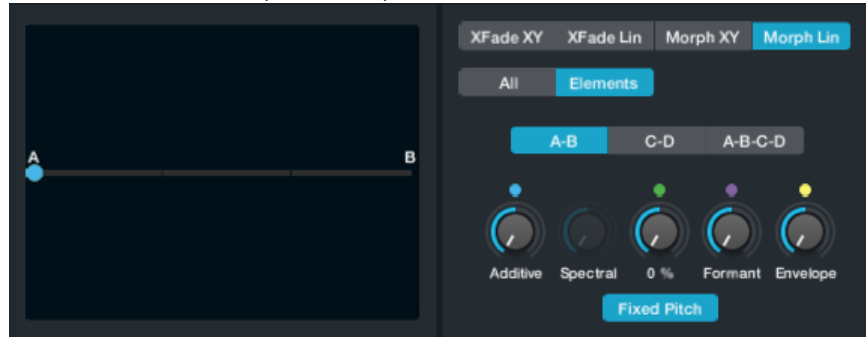
Select the tab marked "Morph" in the left column of the upper section. As in the previous tutorial, this changes the view to the Morph section with the X/Y control pad. The default mode is XFade XY. In this mode, the XY control will just crossfade between all 4 Sound sources. To access elemental Morphing controls, click on the tab labeled "Morph Lin." Since we're morphing between just two sources, Source A and Source B, click on the tab labeled "A-B."



Now drag the puck between the two sources and you will hear it morph from the vocal sample on the left (Source A), to the synth lead on the right. (Source B)

8. Pitch Morphing

Click on the Elements tab in the Morph area to access the controls for morphing between different elements of the sounds independently, as opposed to morphing them all at once as in the previous step.



If you went through the previous tutorial, you might notice that in the set of elemental controls that are available has changed. We now have access to the Additive control, but the Spectral control is greyed out. This is the result of choosing Additive, and not Spectral, when we imported the file.

Play and hold C3 then turn the element control for Pitch fully counter-clockwise. When the note starts again, you'll now hear the vocal sample "singing" the melody provided by the synth lead phrase in Source B!

The pitch morph is particularly effective because the Source A material contains no chordal content and is not changing pitch, and the Source B material has a very clear melodic phrase that the pitch analysis could easily track. If you have experience with Flex Pitch in Logic, you know that the pitch of certain kinds of audio can't be easily deciphered. In general, files that work well in Flex Pitch will work well for Pitch morphing applications in Alchemy.

9. Additive Morphing

Elemental morphing can sometimes lead to sudden and dramatic level changes. Before we start adjusting with the Additive control, double-click Global tab, then double click on the Volume knobs for Source A and B respectively. This will set them to -18db respectively.

Tip: Double-clicking any control sets it back to a default state.

Once you've done that, return to the Morph tab and move the Additive control to the right while playing C3. As you move it, the harmonic partials of the vocal sample will start to transition to the partials of the synth lead. This doesn't always produce the most pleasing result, as partials in one sound may emphasize noise or artifacts in the other sound. The workflow is often one of sonic exploration in search of 'happy accidents' than it is a predictable process. As you're experimenting, be sure and try playing notes and chords above and below C3. When you're done exploring set the Additive control to about 30%. At this point, the element controls should appear like the image below.



10. Further tone shaping with Additive Controls

Click on the tab to return to the Source A subpage controls. Then click on the tab labeled 'Additive' to access the Additive Element controls.



Move the knob labeled 'Fundamental' to the left. This will attenuate the fundamental partial which in this case, has the effect of brightening and clarifying the sound by letting the higher frequency partials be more more pronounced. Turning down the Odd/Even partials creates a more hollowed out sound and seems to allow the partials of the synth lead to have more prominence. Experiment with the other controls to get a sense of how they effect the sound. Try playing octaves and fifths as you're experimenting. C2 - G2 - C3 for example.

11. Envelope morphing

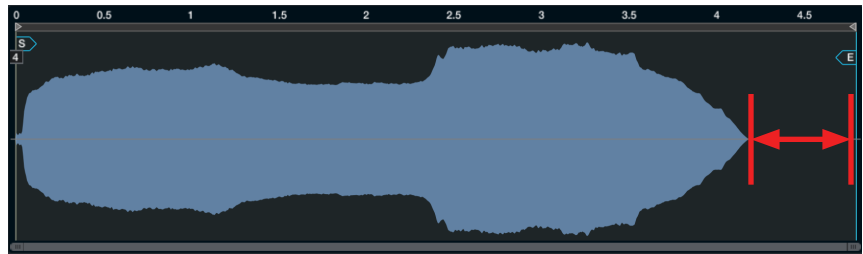
Return to the Morph tab so we can experiment a little with the Envelope control. This control could also be labeled 'Timing', as by default, the primary effect it has is to morph between the timing of one Source to the other. As we have been working with files with about the same length, there is very little effect when moving this knob. This behavior will change therefore if we change the playback length of the file.

Note: Before moving on, make sure the Envelope control is all the way to the left.

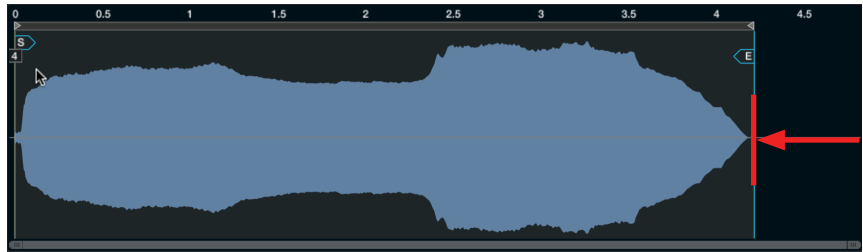
Click the Source A tab again and click on the Edit button to the right of the Source A file name.



This should take you to a window that has the Key Map editor and a view below that for adjusting a rendered waveform representing the output of the synth engine. You'll notice that there's a gap at the end of the vocal sample. This explains why the phrase from the synth layer has been dropping off in our previous exploration.

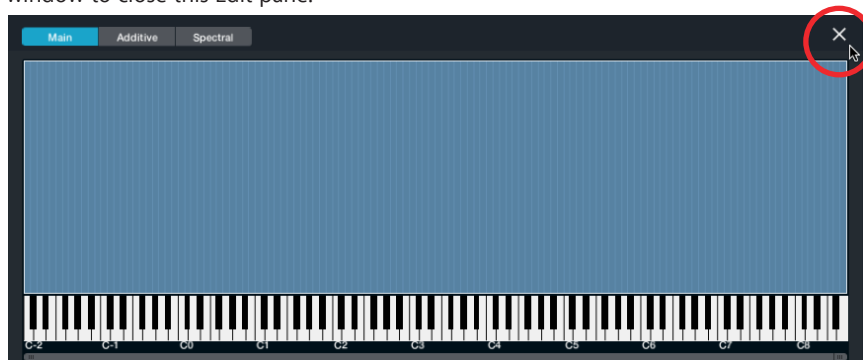


Grab the marker labeled 'E' at the end of the waveform and move it left to the end of the waveform until it looks something like this:



Now play C3. The first thing to notice is that the phrase plays faster because the timing for the sound is currently based on the timing of the vocal sample. You'll also notice that now you're hearing the entire synth lead phrase - it doesn't fade away at the end. If you move the end marker further left, notice that you still hear the entire phrase of the synth part, only faster.

When you're done with this section, click the 'X' in the upper right hand corner of this window to close this Edit pane.



12. Understanding linked parameters

A green arc around a parameter indicates that it is also getting "parameter" morphed when you are moving the morph controls. Setting these to different values for each Source provides another technique for influencing the morphing result.



- Click the tab for Source A, then the Formant tab. Adjust the Smooth knob to the left until the Amanda vocal starts to break up and sound "fluttery."
- Click on the tab for Source B and set the Smooth control in its Formant section up to full.
- Return to the Morph section and rotate the Formant control back and forth while playing the sound. You should hear the "fluttery" effect appear as you move toward the left side, but disappear as you go to the right.

Conclusion

This paper introduced the concept of elemental morphing and its powerful potential for creative sound design. The tutorials acquainted you with the primary morphing controls and provided guidelines on how to approach the workflow and get the best results, such as:

- The time-alignment of sounds is crucial to achieving good morphing results so selecting sounds with similar timing and loop characteristics tends to deliver the best results.
- It is best to choose the same analysis mode for all morphed sources.
- Though you can morph using any synthesis type, the best morphing results are achieved with the spectral or additive engines.
- Spectral is the most suitable import method to use for the majority of audio material.
- Use Additive or Additive + Spectral import options when using melodic material.
- A green arc around a knob indicates the value of that parameter will also be morphed.

Some additional tips not covered in this paper:

- Morphs that move from 100% of all elements in a sound to 100% of another sound can often be suitable for sound effects, but may be more difficult to shape into new playable instruments. You may find it better to mix individual elements.
- Enabling the Formant button when importing sounds generally results in a higher quality morph.
- If you are not creating a pitched instrument that requires the root note to remain at the default pitch, irrespective of the morph position, turn off the Fixed Pitch button, because this will result in a higher quality morph.
- It's best to have similar loop durations and location for the samples within each source.
- The chain glyph that appears on some buttons and menus indicate that the setting must be the same for all sources.

Morphing is a complex process with many variables that can impact the results. As with any form of synthesis, the more you work with it and the more familiar you become with its strengths and weaknesses, the easier and faster it is to create the sounds that you have in mind.