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Adaptive Music

The Secret Lies within Music Itself



Chapter 1

Satellite Image

**Game Developers
Conference®**

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San Francisco, CA

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The Entertainment Experience



The Entertainment Experience

More than a video game,

we are creating an

entertainment experience



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More than a video game,
we are creating an
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What is the **Quality** of that experience?



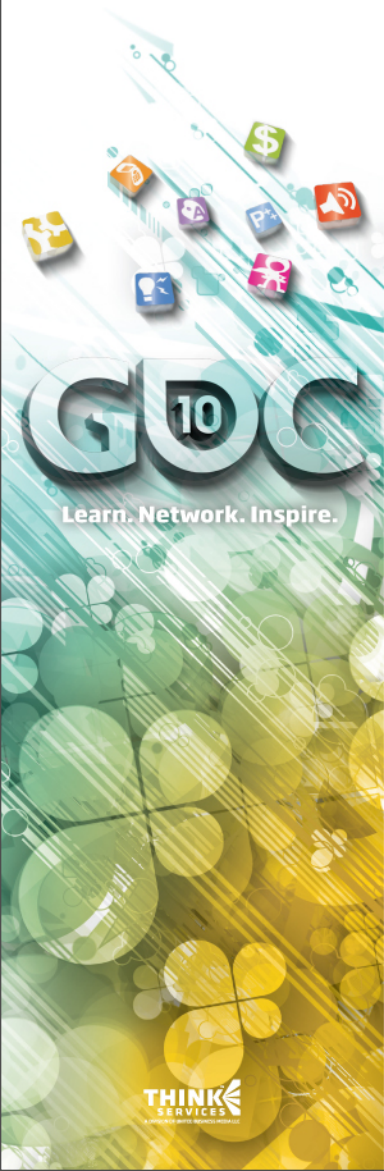
The Entertainment Experience

The Power of Sound and Music

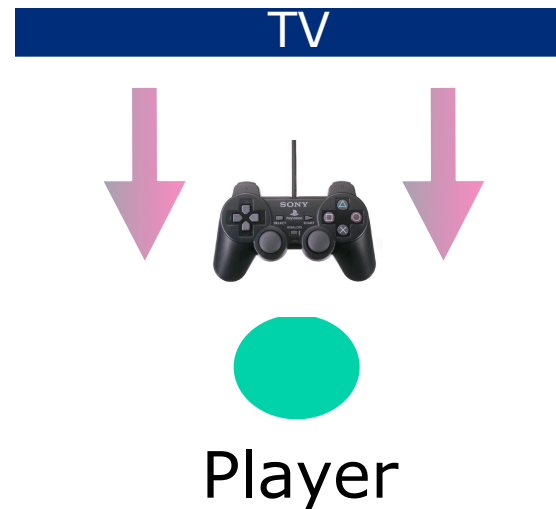


The Entertainment Experience

The Power of Sound and Music



Player





The Entertainment Experience

The Power of Sound and Music



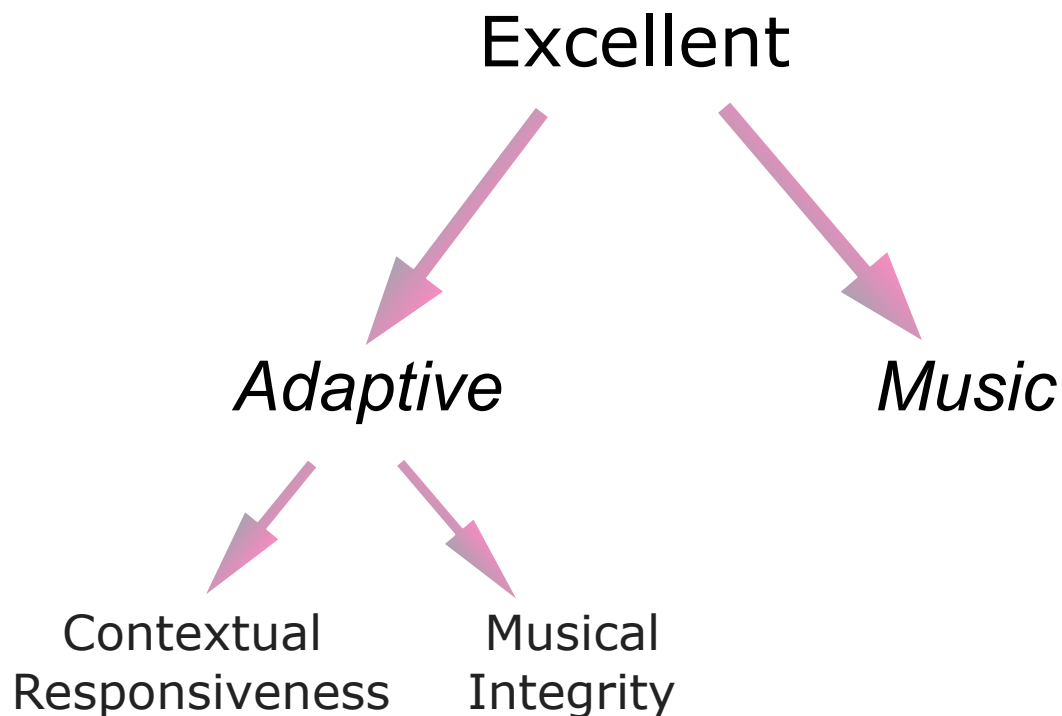


The Entertainment Experience

The Power of Sound and Music



Excellence in Adaptive Music



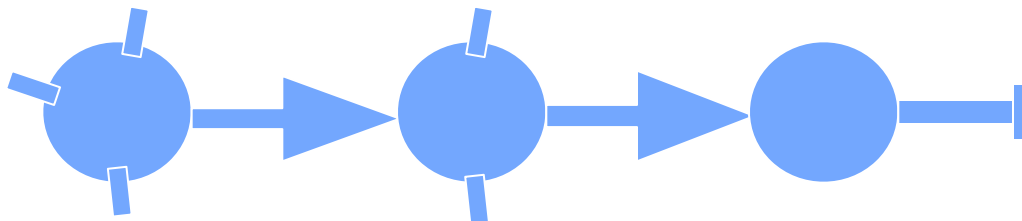


Chapter 2

Moment of Change

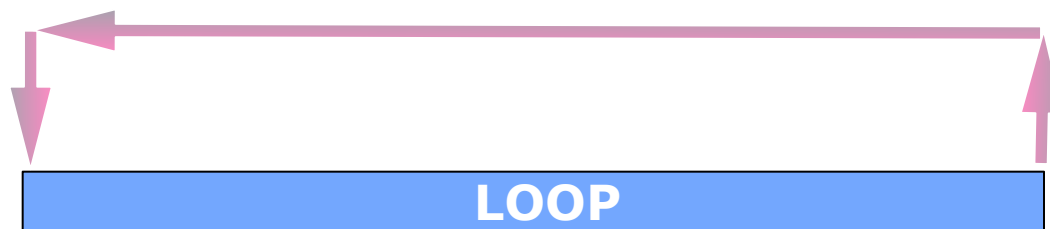
Adaptive Score in Abstract

- ▶ An adaptive score is a game-driven interchange between musical states, junctures and segments.
- ▶ State (unchanging constant stationary)
- ▶ Juncture (opportunity for musical change)
- ▶ Segment (change with finite duration)



State

Basic Loop



- ▶ Simplest form of a State
- ▶ There is only one repeating segment
- ▶ Can be overly repetitive
- ▶ One technique is to edit loop to be more substantive, long-lasting



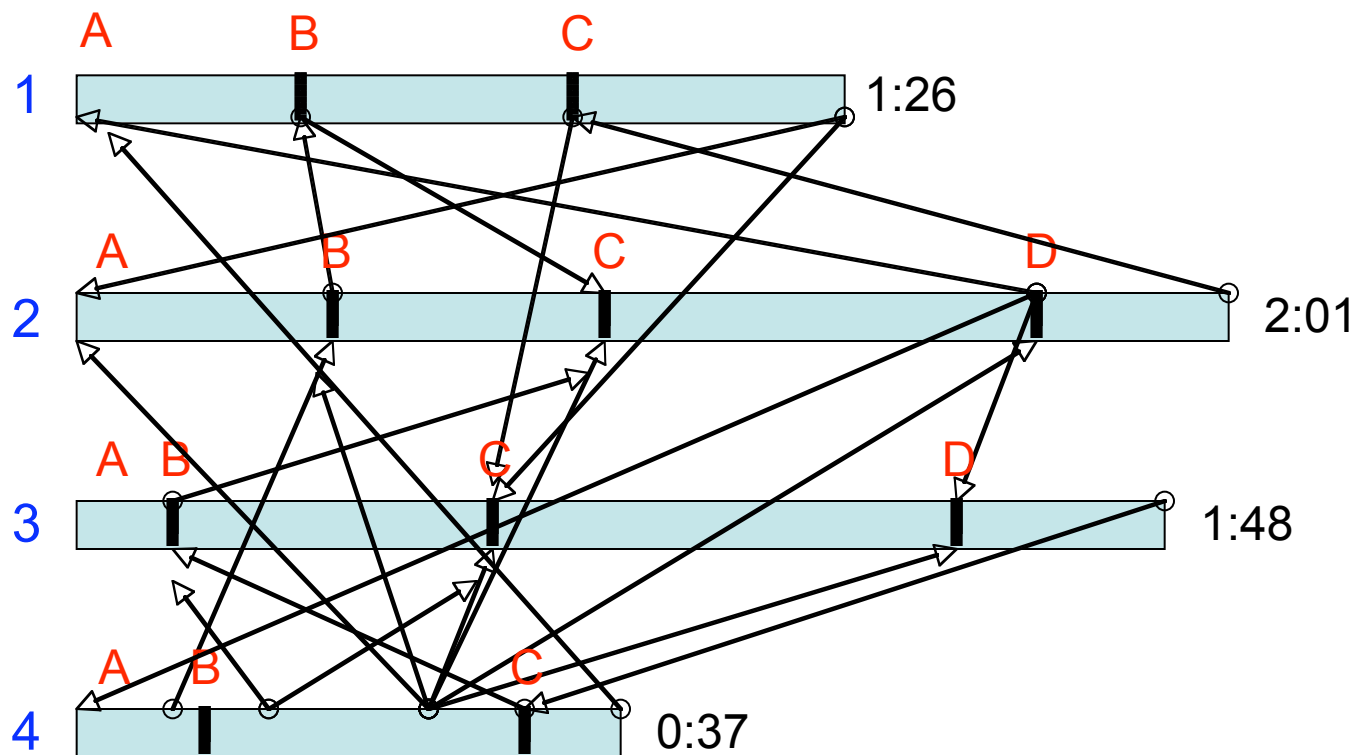
State

Persistent Complex

- ▶ A more complex form of a State is a persistent complex
- ▶ Network of multiple segments, among which are numerous pathways of musical connectivity defined by author
- ▶ Persistent complexes are very long-lasting - 'set it and forget it'



Persistent Complex State



Multiple segments with with numerous defined junctures (entry and exit points) and legal connections



Juncture




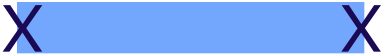


An Opportunity for Change

- ▶ A turn in the **game** that is 'felt' to be an option for musical change in the **score**
- ▶ Opportunity for musical change can be felt not only by adaptive music author when spotting the game, but also by the end user when playing it
- ▶ Junctures are often worked out with dev team, and even when established, do not necessarily require musical change



Segments

All can cut into / transition out of a State

- ▶ Intro Tag 
- ▶ Ending Tag 
- ▶ Stinger 
- ▶ Transition 
- ▶ In game cutscene track 
- ▶ Pre-rendered video track 



State Environment



Juncture

Game Event



Scoring Treatment

4 Options

- ▶ No change at all
- ▶ State transitions to new state
Savannah-Empty state → Savannah-with-Lion state
- ▶ No change in State but Lion has 'stinger'
- ▶ Transition segment to new state where
transition also serves as a Lion 'stinger'



Transition

Musical Change at Unpredictable Times



- ▶ We cut into currently playing State at an unpredictable time
- ▶ Moment of connection between current music and new music can be rough, grating
- ▶ This is the toughest musical moment to control for the adaptive music author and there can be thousands of these in a game!





We don't know

where we are coming from ...

But we always know

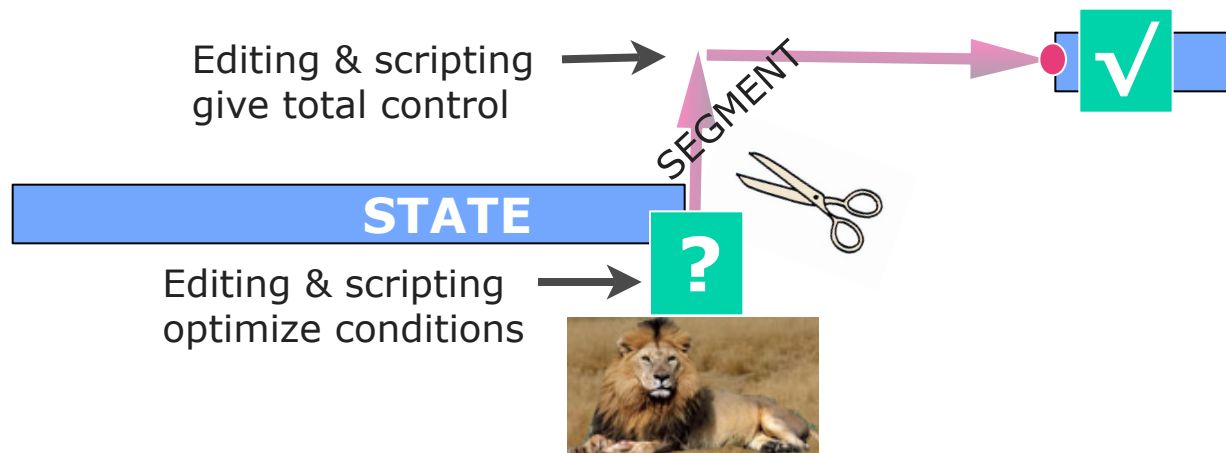
where we are going

We don't know

where we are coming from ...

But we always know

where we are going





Chapter 3

Ambition



Perfection

Is this what we want?

State

Transition



A

B

C

D

E



Chapter 4

The Real World

Musical Texture

"...the quality given to a musical work by the combination or interrelation of parts or elements".

- ▶ Understanding and manipulating textural elements is **key** to authoring good musical transitions
- ▶ Editing with multitrack “stems” is **key** to adaptive music best practice
- ▶ Texture can vary greatly per musical genre, style, piece, and section (even per bar and beat)



Textural Elements

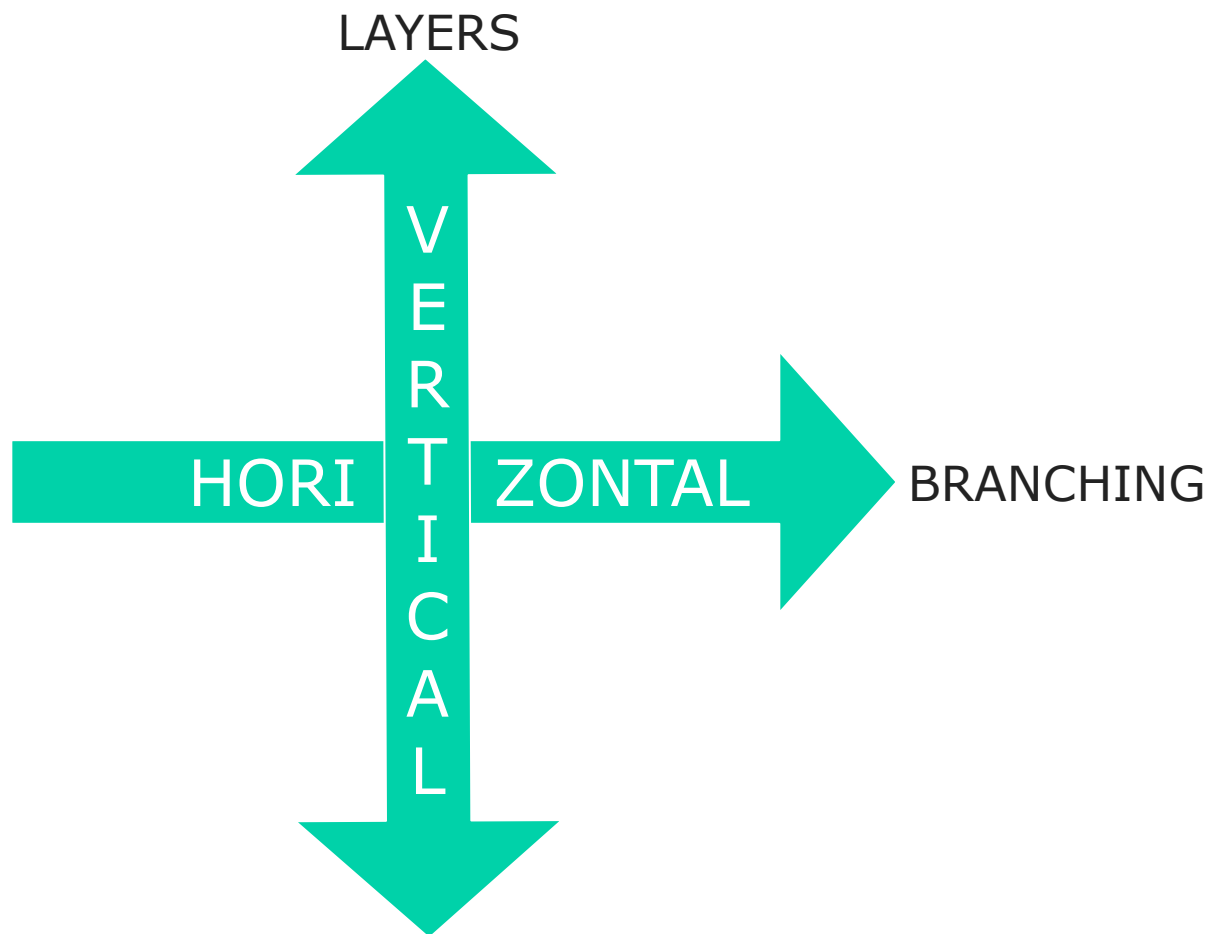
At the Moment of Change

- ▶ Melody
- ▶ Harmony
 - rhythmic pitch
 - sustained pitch
- ▶ Bass
- ▶ Percussion
- ▶ Instrumentation
- ▶ Time
 - tempo, meter, pacing
- ▶ Density
- ▶ Intensity
 - combination of components, including Loudness



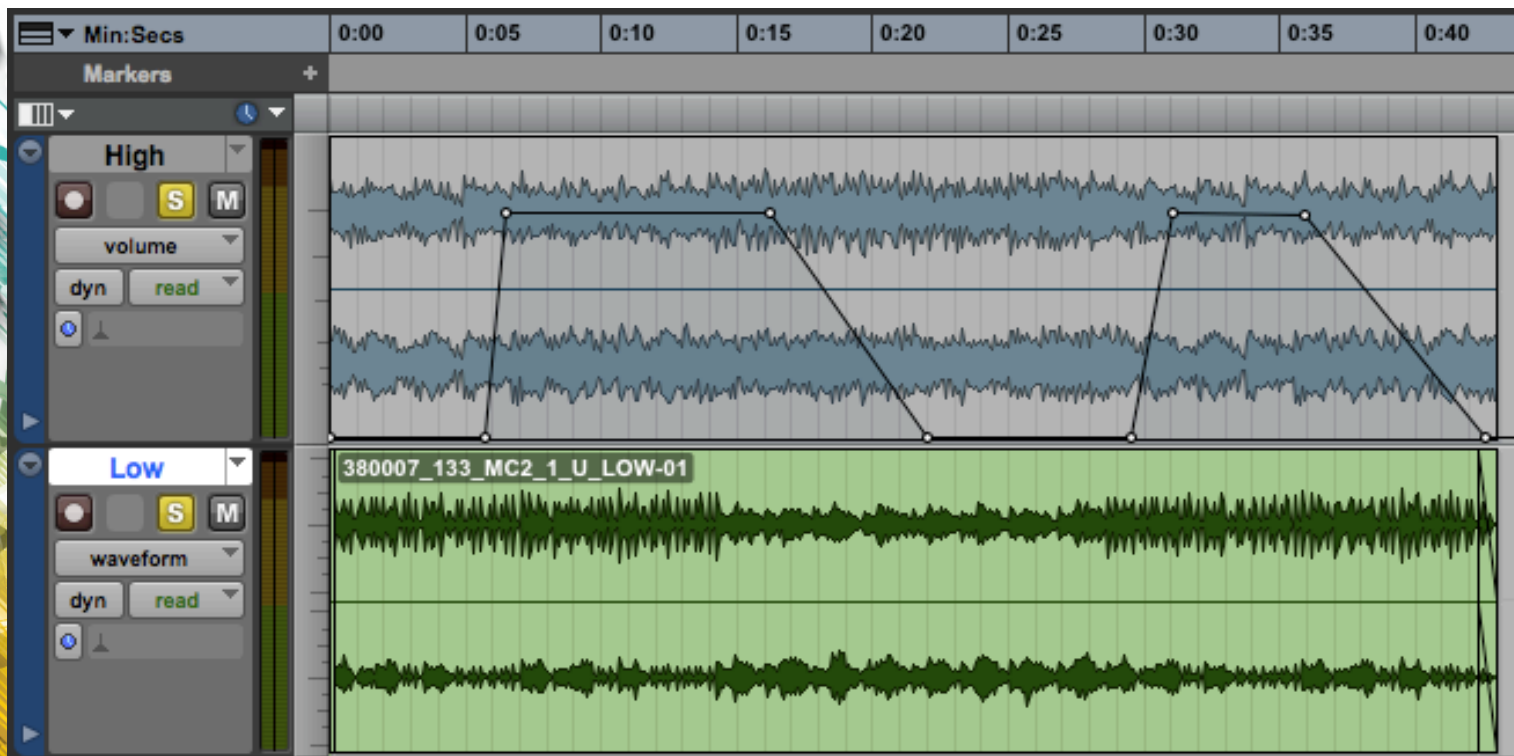
Domains of Change

Vertical & Horizontal



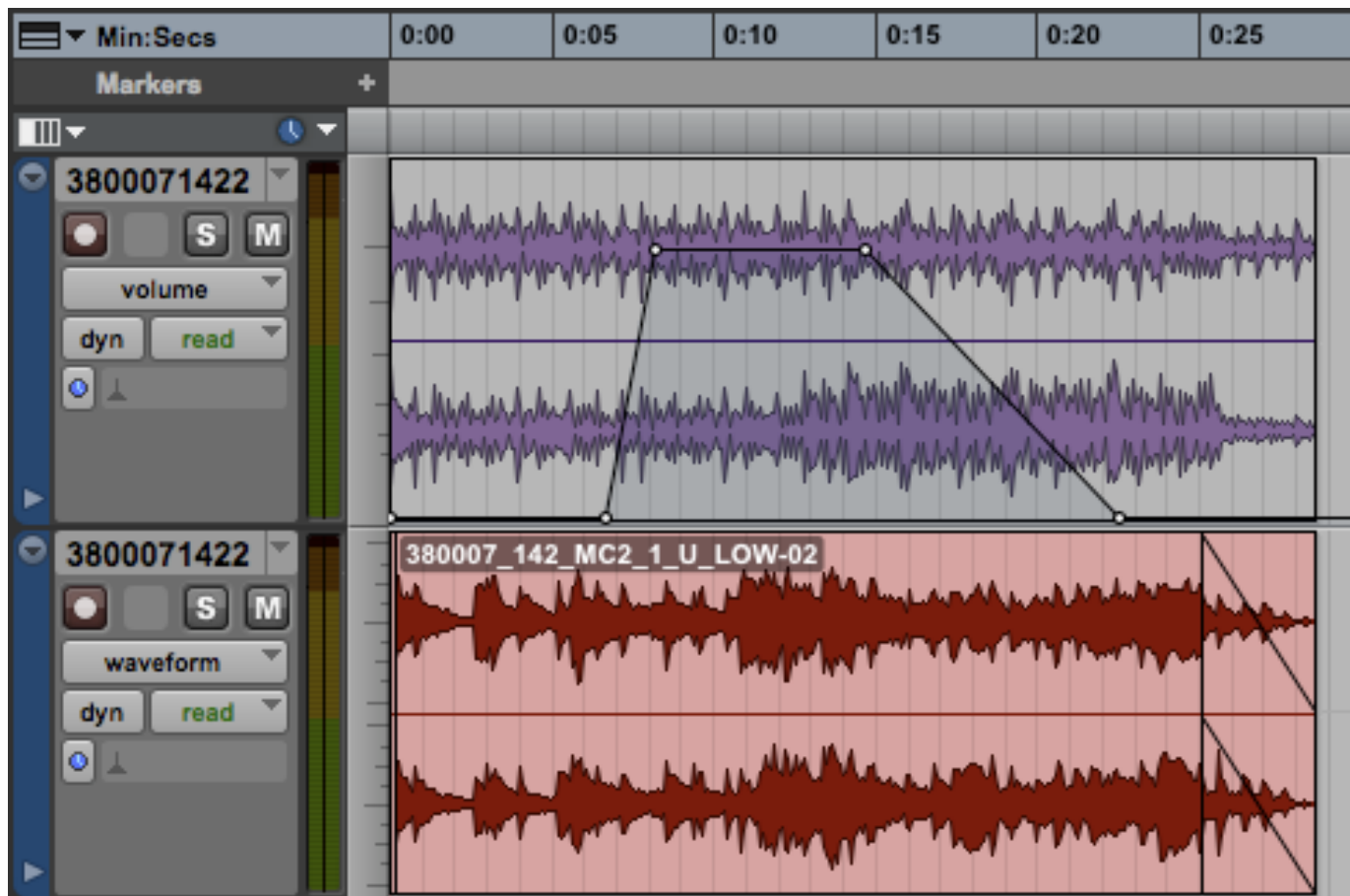
Vertical Domain

'A - B' Piece

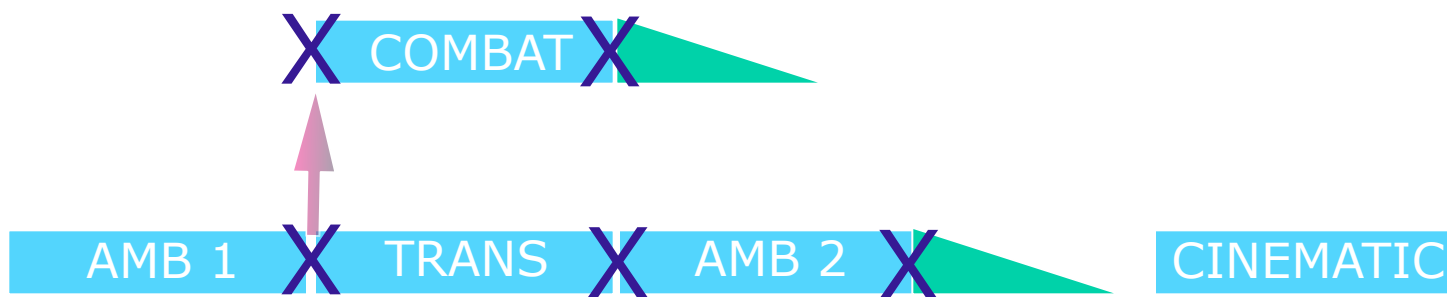


Vertical Domain

'A - B' Piece



Horizontal Domain

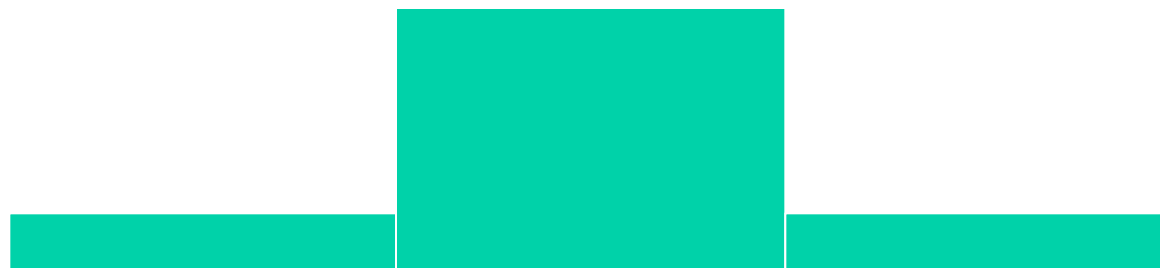


- Linear sequence of looped and non-looped segments often with crossfade



Horizontal Transition

Conducting Intensity: Fast Up, Fast Down (bad)



Low

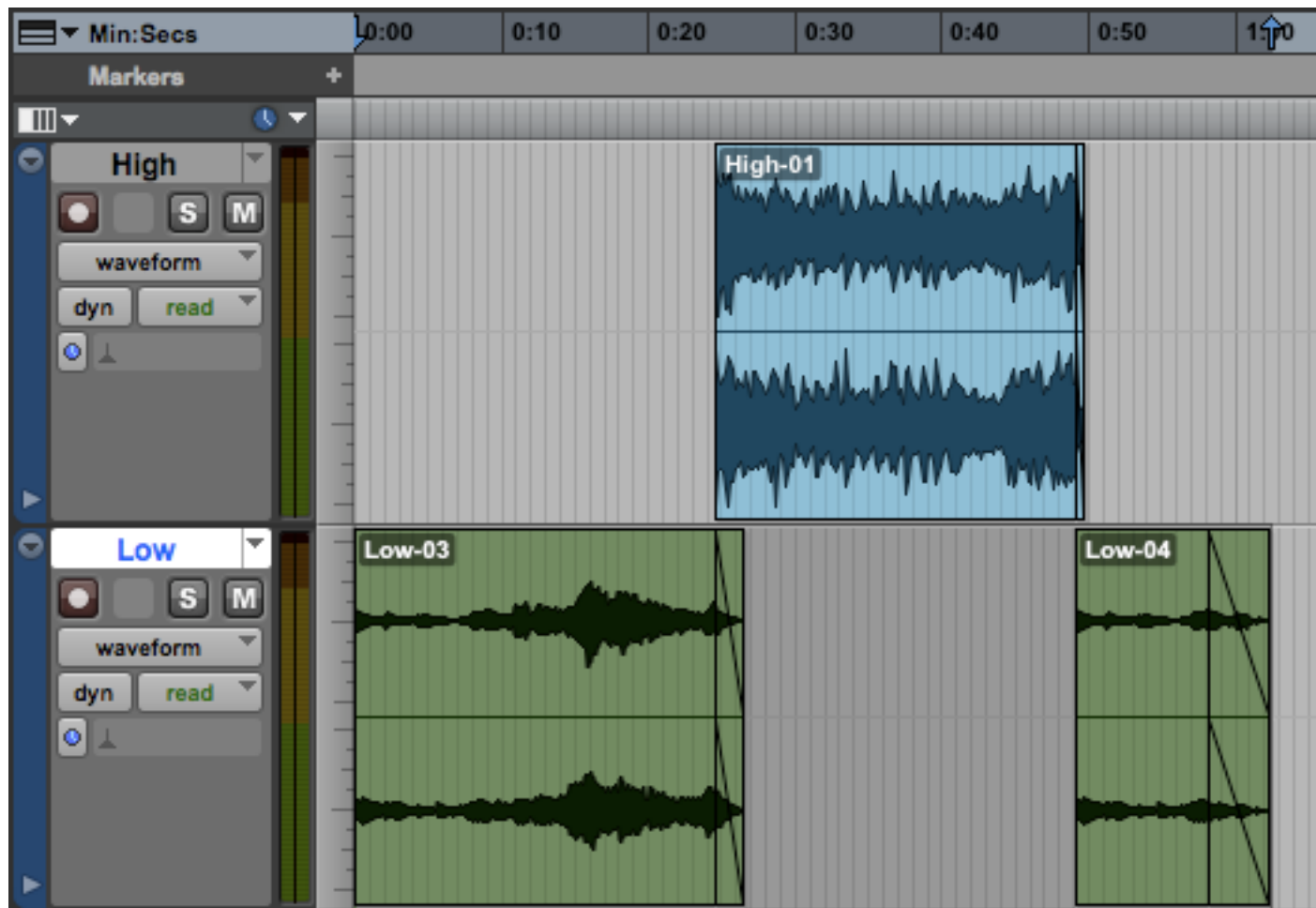
High

Low



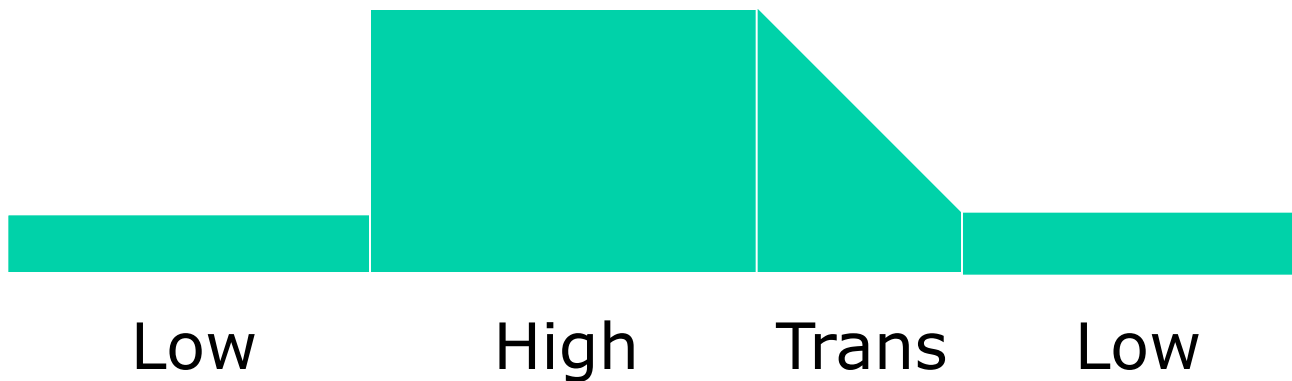
Musical Intensity

Fast Up, Fast Down (bad)



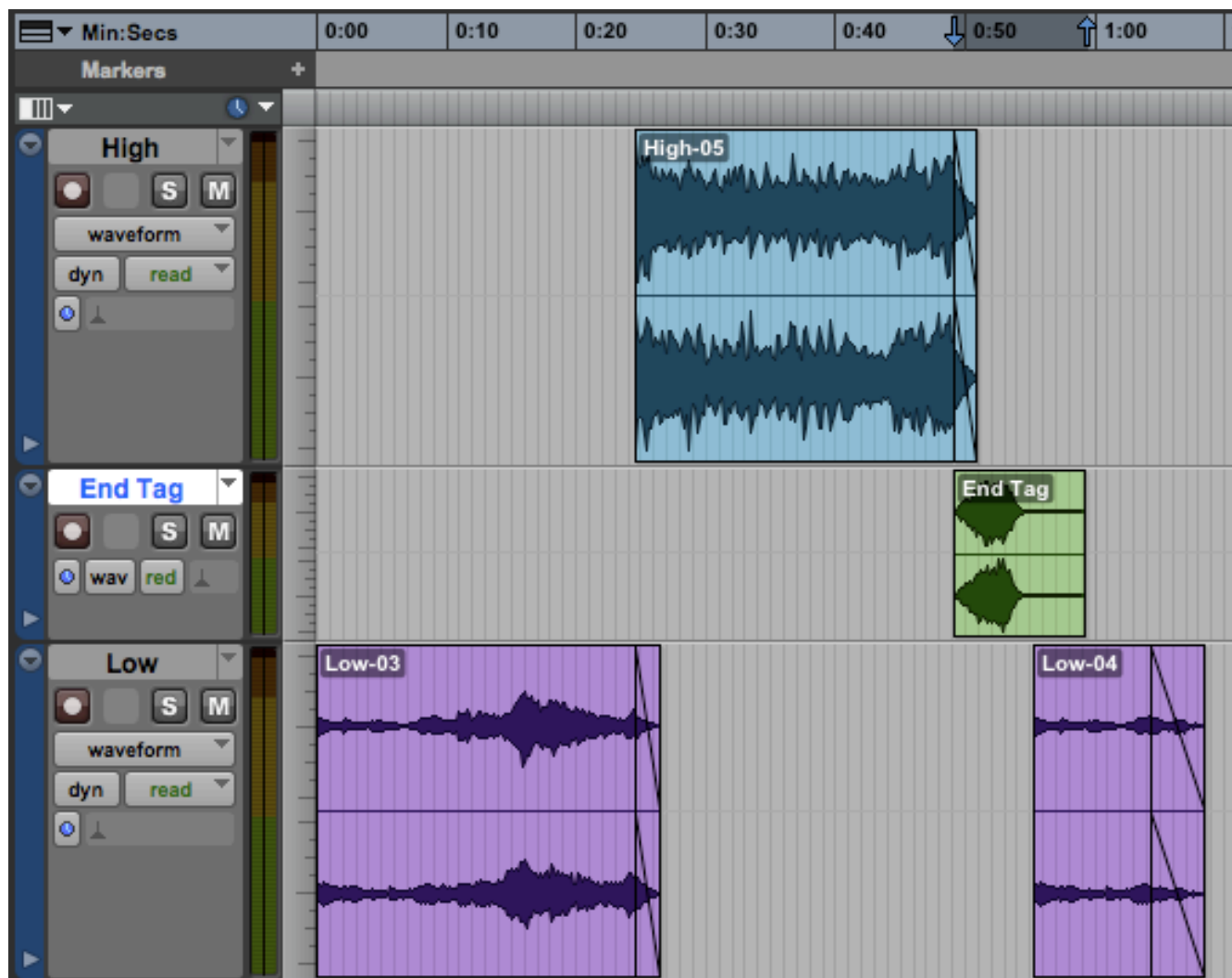
Horizontal Transition

Conducting Intensity: Fast Up, Trans Down (better)



Musical Intensity

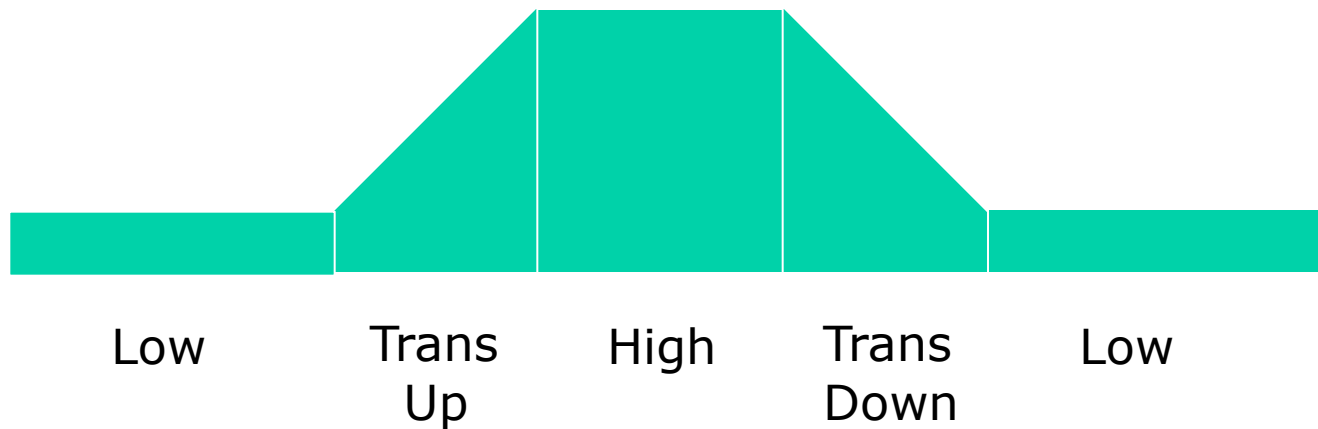
Fast Up, Trans Down (better)





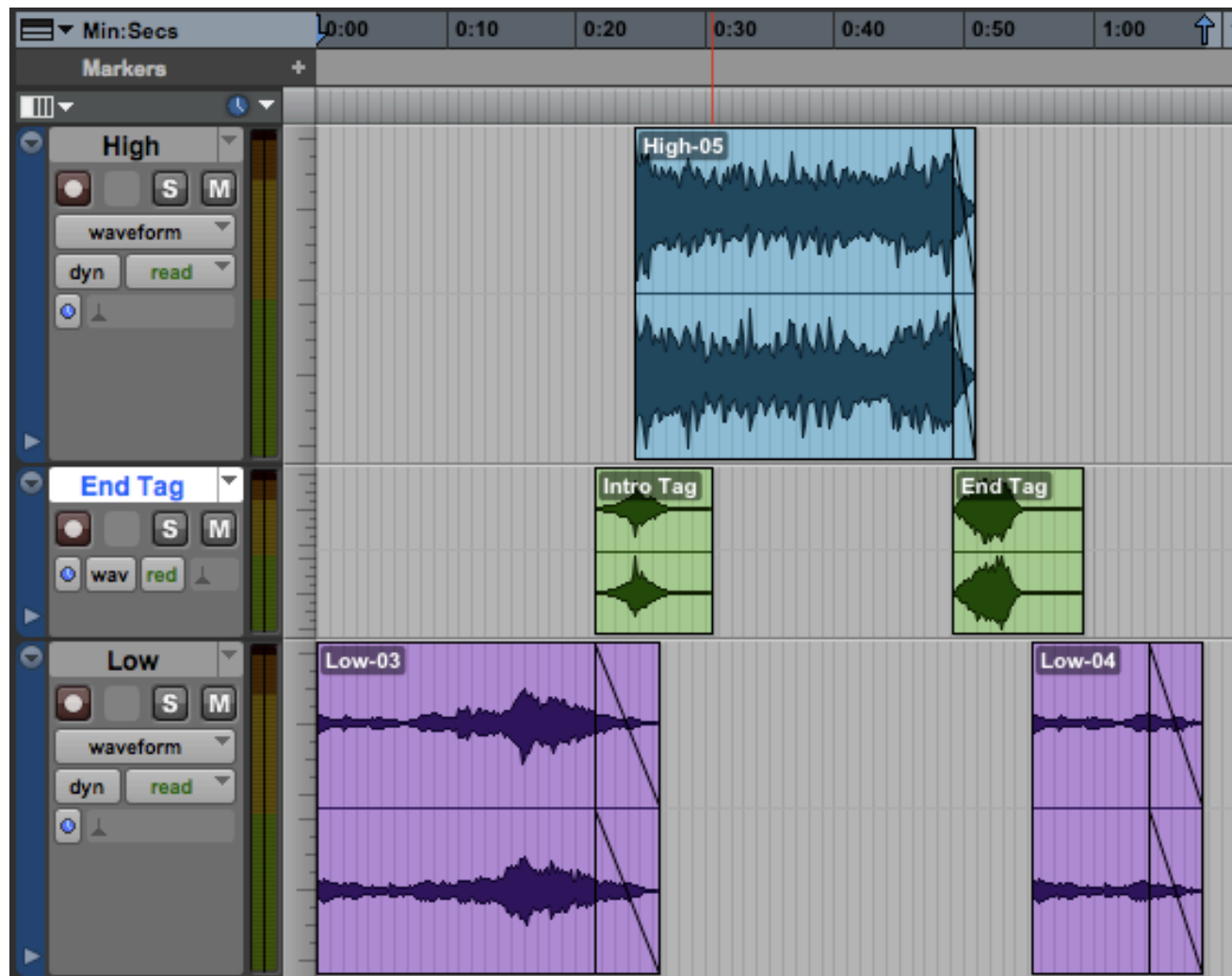
Horizontal Transition

INTENSITY: Trans Up, Trans Down (best)



Musical Intensity

Trans Up, Trans Down (best)



Musical Intensity

Perc Track to All (no trans)



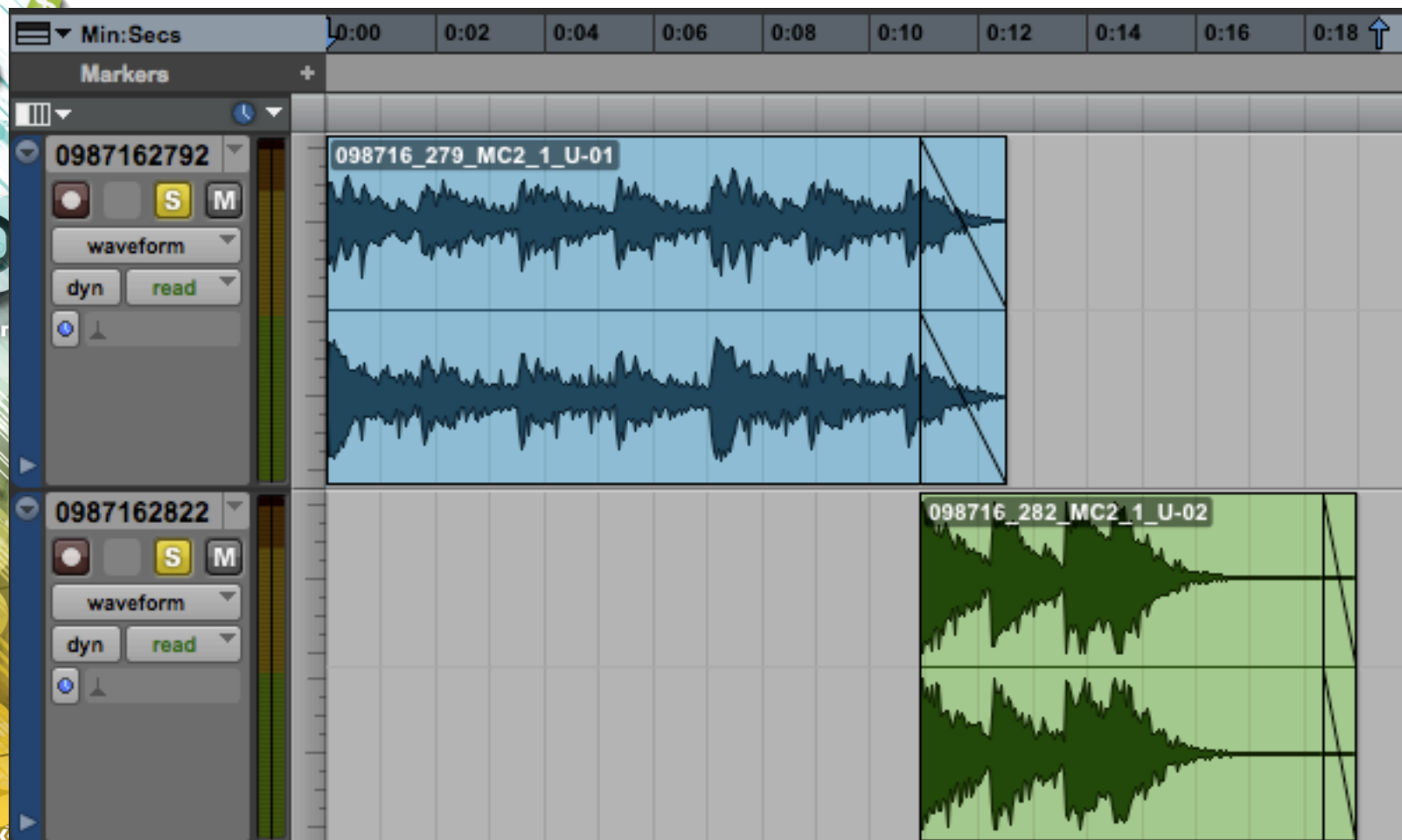
Musical Intensity

Perc Track Trans to All (with trans)



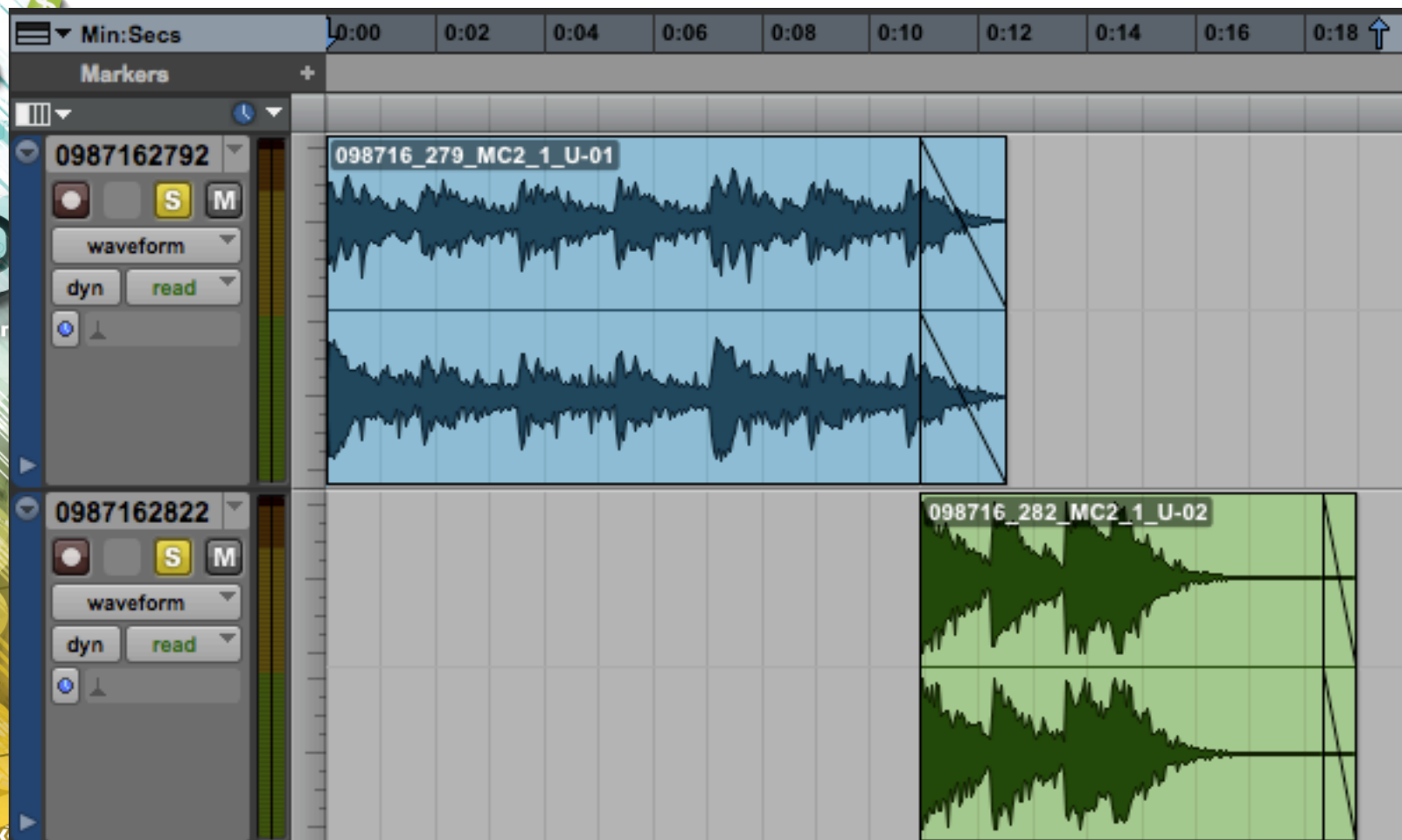
Beat Synchronization

End Tag with No Beat Synch (bad)



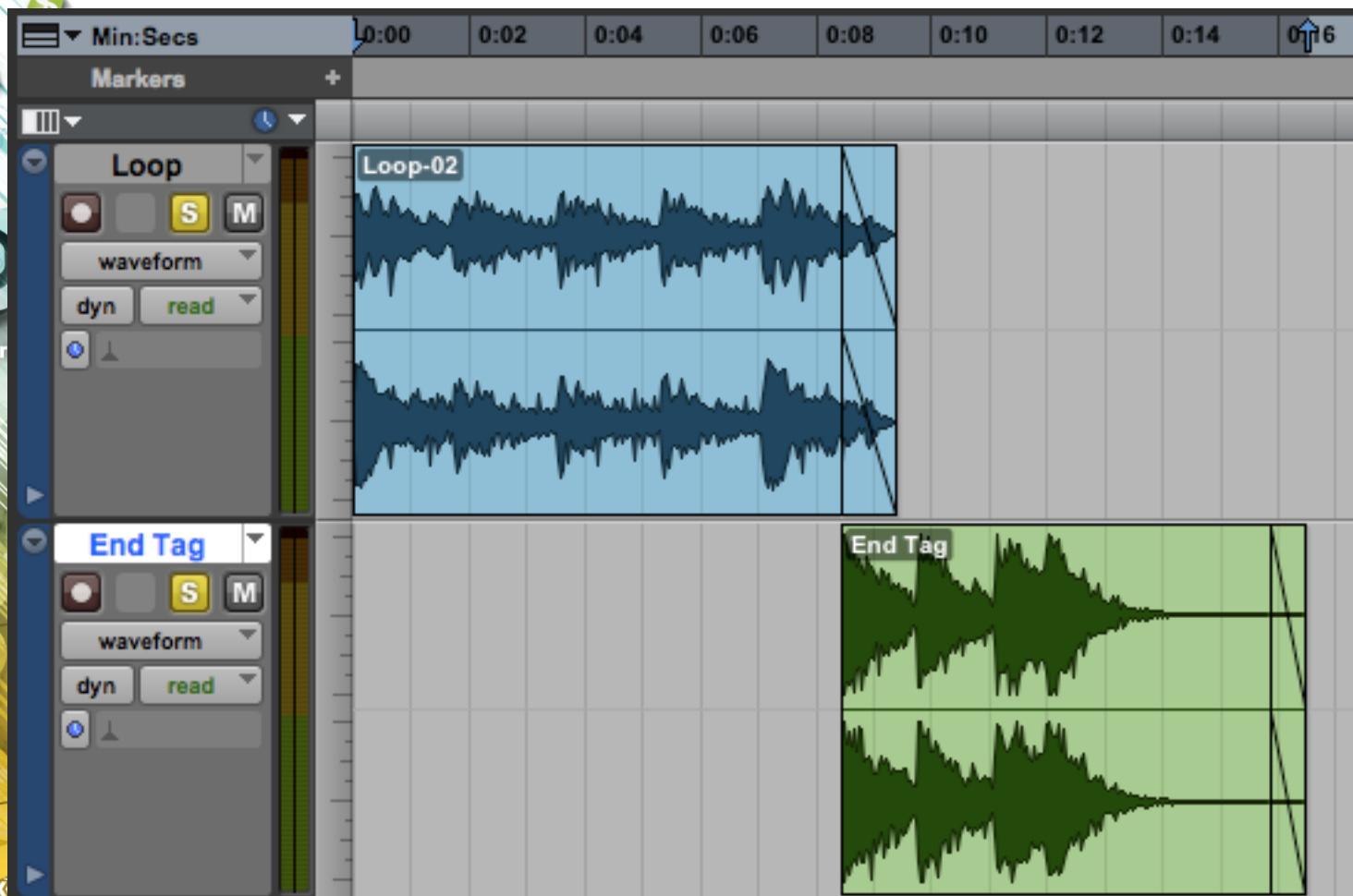
Beat Synchronization

End Tag with No Beat Synch (bad)



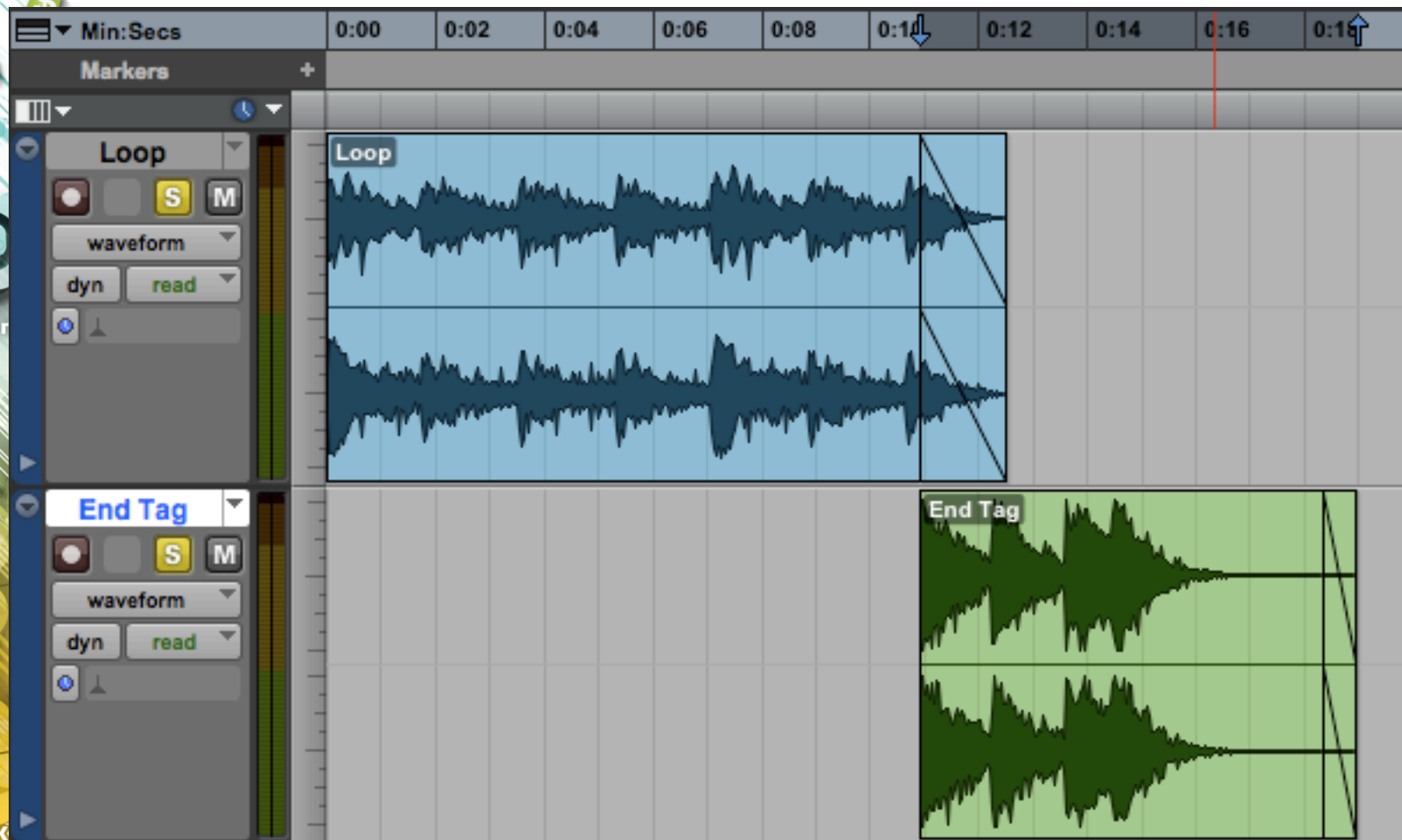
Beat Synchronization

End Tag with Beat Synch (better)



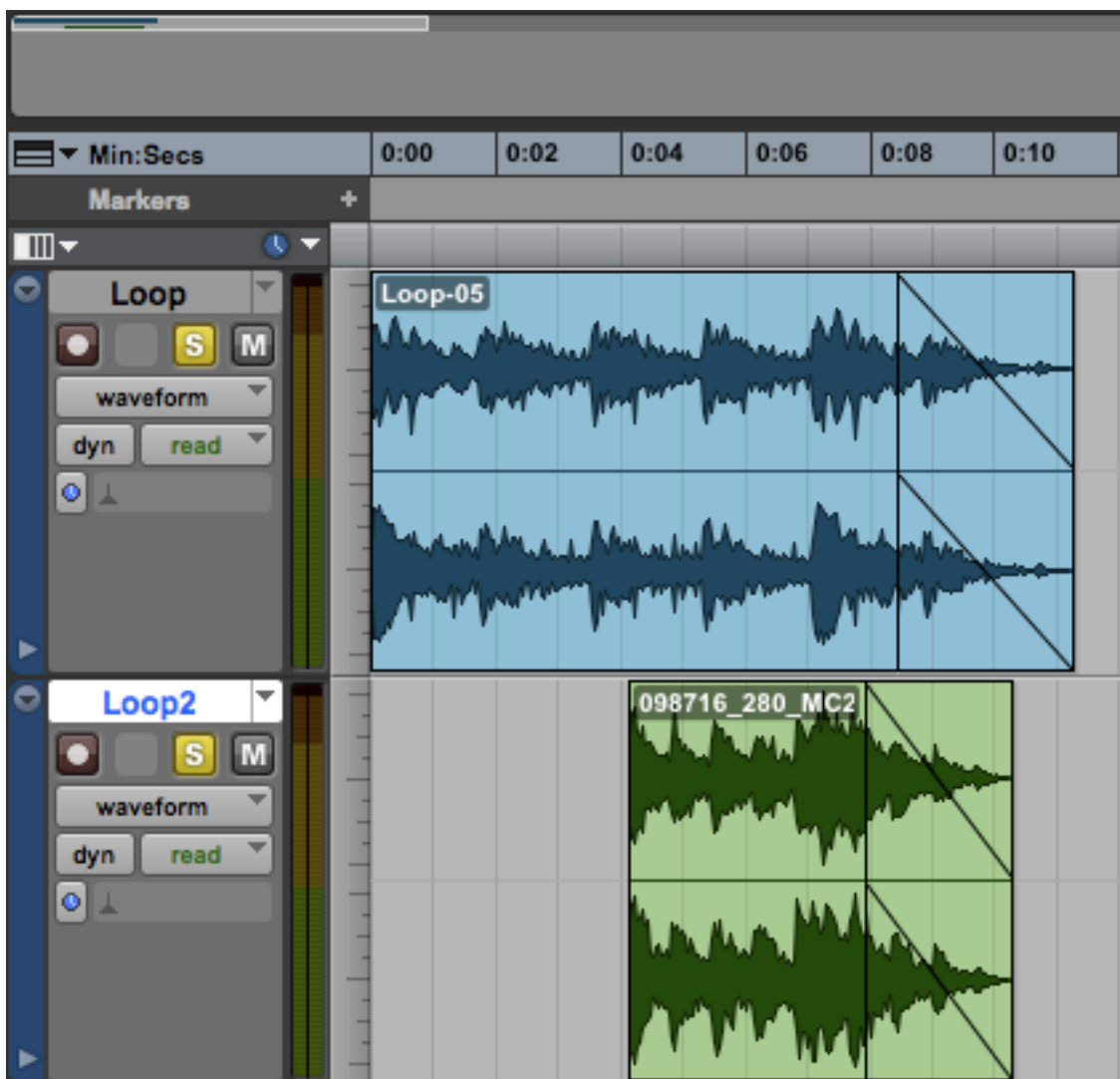
Beat Synchronization

End Tag with Downbeat Synch (best)



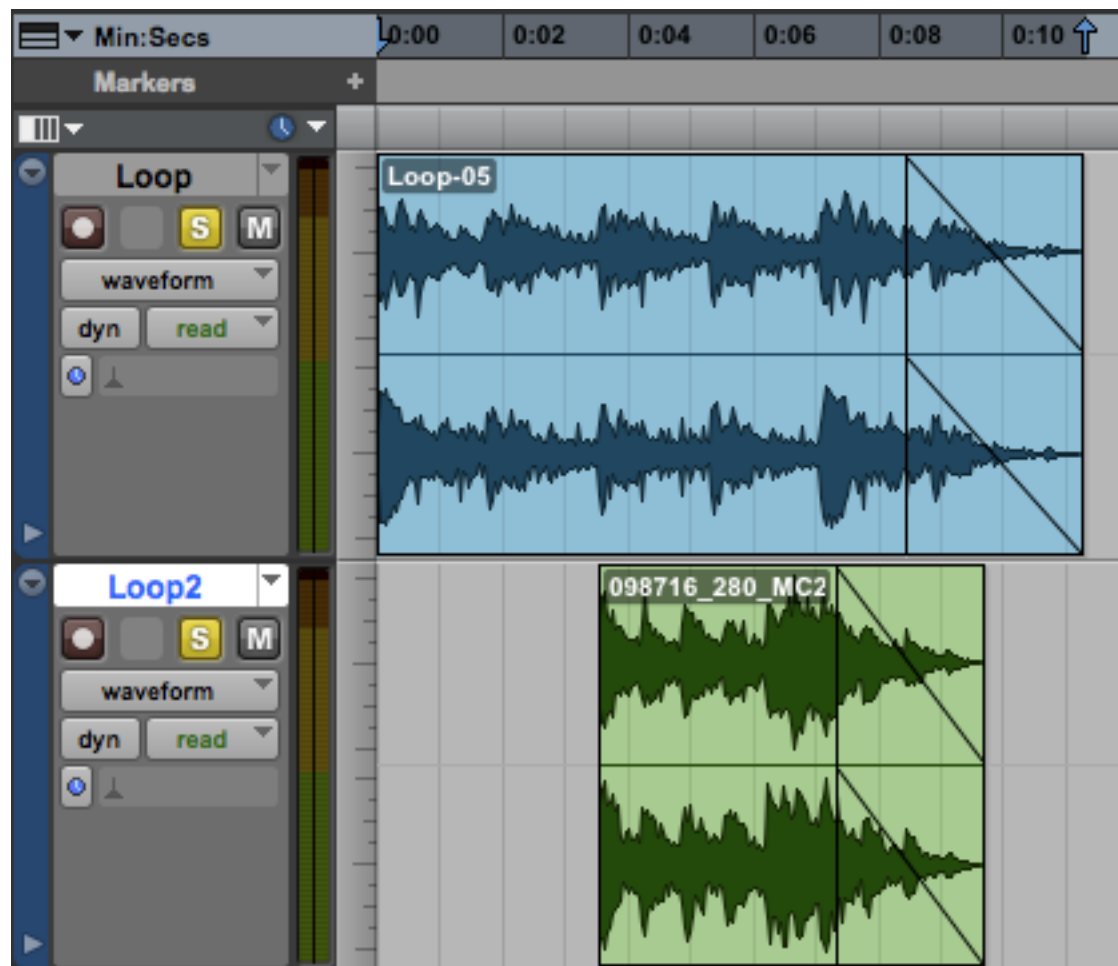
Meter, Rhythm Layering

No Synch (bad)

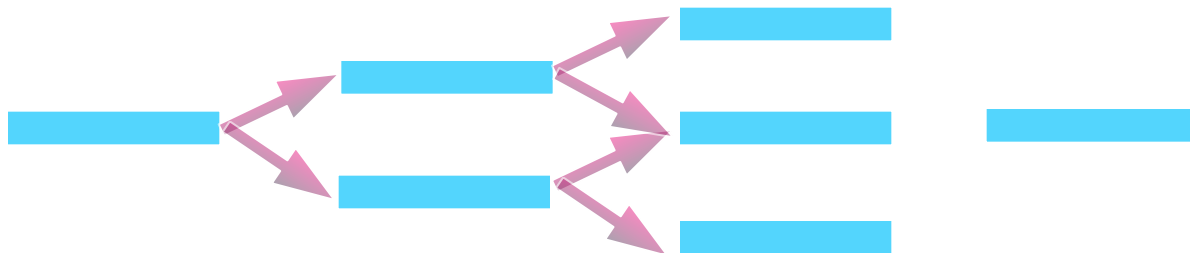


Meter, Rhythm Layering

Synch (good)



Horizontal Chunk System



	A	B	C	D	E	F	G
1	['CURRENT']	['H1']	['H2']	['M1']	['M2']	['L1']	['L2']
2	START	Fa1.Ha01.at3	Fa1.Ha01.at3	Fa1.Ma01.at3	Fa1.Ma01.at3	Fa1.La01.at3	Fa1.La01.at3
3	Fa1.Ha01.at3	Fa1.Ha02.at3	Fa1.Ha02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
4	Fa1.Ha02.at3	Fa1.Ha03.at3	Fa1.Ha03.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
5	Fa1.Ha03.at3	Fa1.Ha04.at3	Fa1.Ha04.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
6	Fa1.Ha04.at3	Fa1.Ha05.at3	Fa1.Ha05.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
7	Fa1.Ha05.at3	Fa1.Ha06.at3	Fa1.Ha06.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
8	Fa1.Ha06.at3	Fa1.Ha07.at3	Fa1.Ha07.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
9	Fa1.Ha07.at3	Fa1.Ha08.at3	Fa1.Ha08.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
10	Fa1.Ha08.at3	Fa1.Ha09.at3	Fa1.Ha09.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
11	Fa1.Ha09.at3	Fa1.Ha10.at3	Fa1.Ha10.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
12	Fa1.Ha10.at3	Fa1.Ha11.at3	Fa1.Ha11.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
13	Fa1.Ha11.at3	Fa1.Ha12.at3	Fa1.Ha12.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
14	Fa1.Ha12.at3	Fa1.Ha13.at3	Fa1.Ha13.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
15	Fa1.Ha13.at3	Fa1.Ha14.at3	Fa1.Ha14.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
16	Fa1.Ha14.at3	Fa1.Ha15.at3	Fa1.Ha15.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
17	Fa1.Ha15.at3	Fa1.Ha16.at3	Fa1.Ha16.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
18	Fa1.Ha16.at3	Fa1.Ha17.at3	Fa1.Ha17.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
19	Fa1.Ha17.at3	Fa1.Ha18.at3	Fa1.Ha18.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
20	Fa1.Ha18.at3	Fa1.Ha19.at3	Fa1.Ha19.at3	Fa1.Ca03.at3	Fa1.Ca02.at3	Fa1.Ca03.at3	Fa1.Ca02.at3
21	Fa1.Ha19.at3	Fa1.Ha20.at3	Fa1.Ha20.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
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26	Fa1.Ha24.at3	Fa1.Ha25.at3	Fa1.Ha25.at3	Fa1.Ca03.at3	Fa1.Ca02.at3	Fa1.Ca03.at3	Fa1.Ca02.at3
27	Fa1.Ha25.at3	Fa1.Ha26.at3	Fa1.Ha26.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
28	Fa1.Ha26.at3	Fa1.Ha27.at3	Fa1.Ha27.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
29	Fa1.Ha27.at3	Fa1.Ha28.at3	Fa1.Ha28.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
30	Fa1.Ha28.at3	Fa1.Ha29.at3	Fa1.Ha29.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3
31	Fa1.Ha29.at3	Fa1.Ha30.at3	Fa1.Ha30.at3	Fa1.Ca01.at3	Fa1.Ca02.at3	Fa1.Ca01.at3	Fa1.Ca02.at3

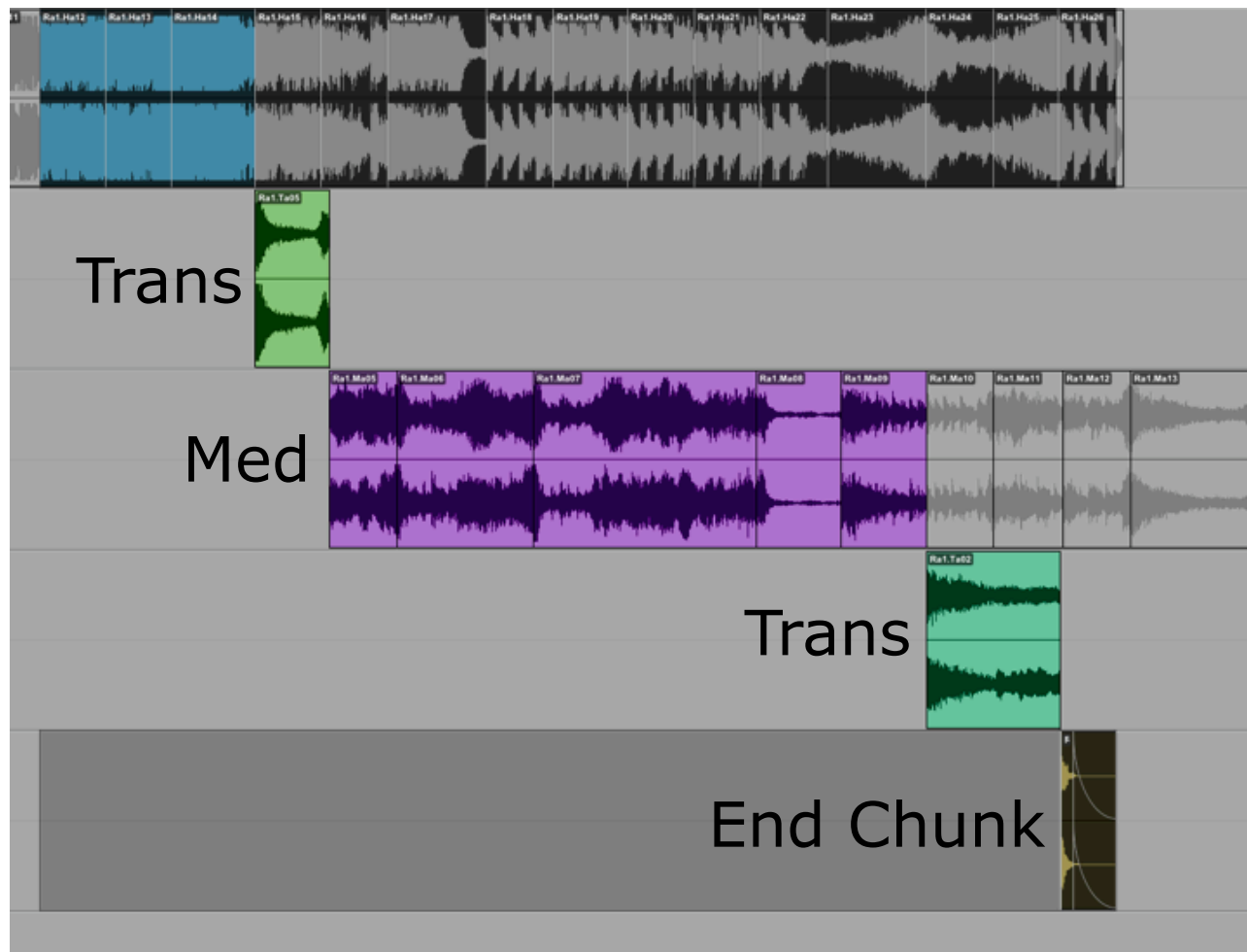


Horizontal Chunk System

Transition Down



High



Trans

Med

Trans

End Chunk

In chunk or marker based system, you do know where you're coming from, but...

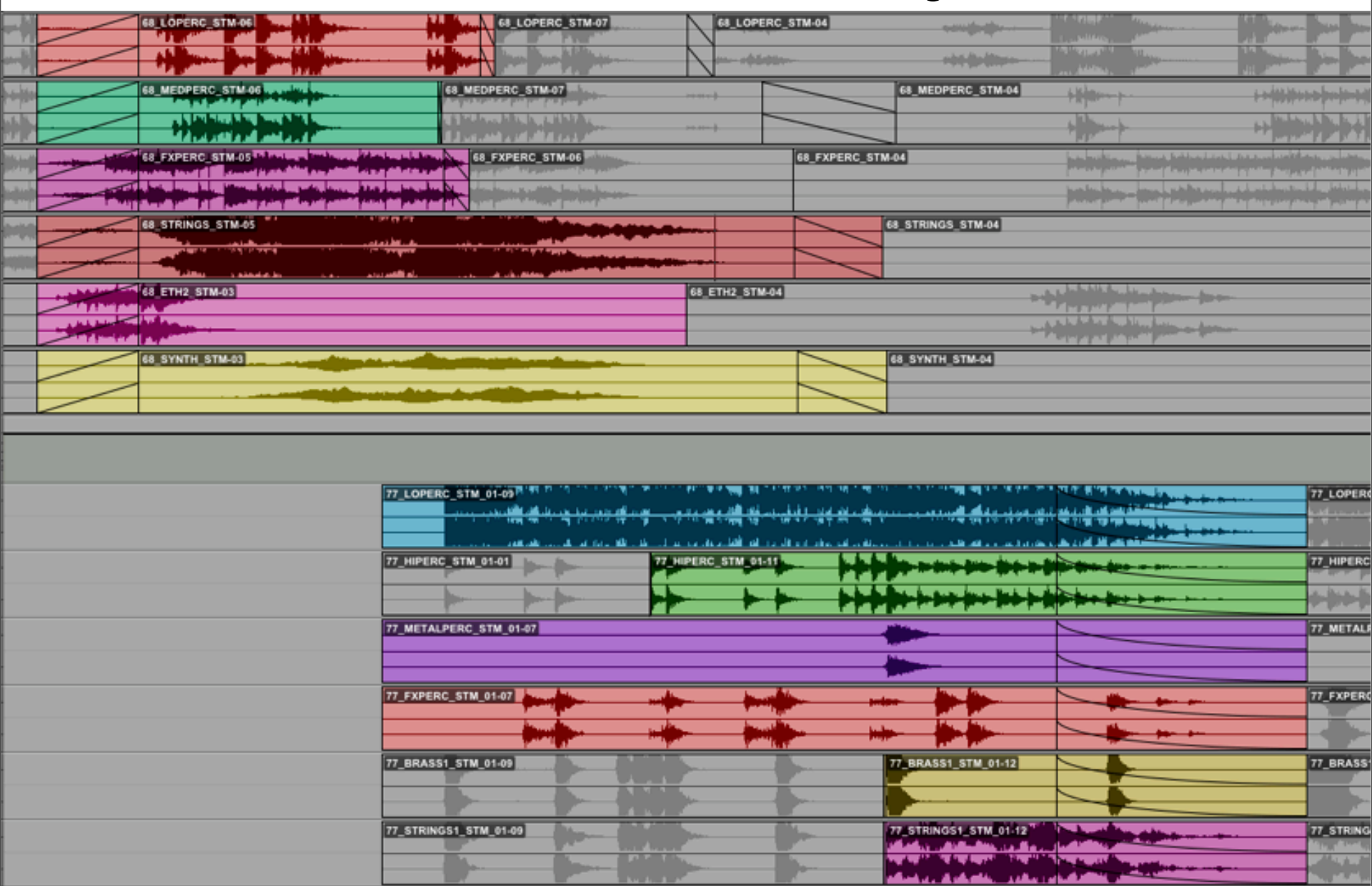


Musical Transition Low to High

Simple Stereo Crossfade at Edit Point

Musical Transition

Custom Stem Edit: Low to High no Trans



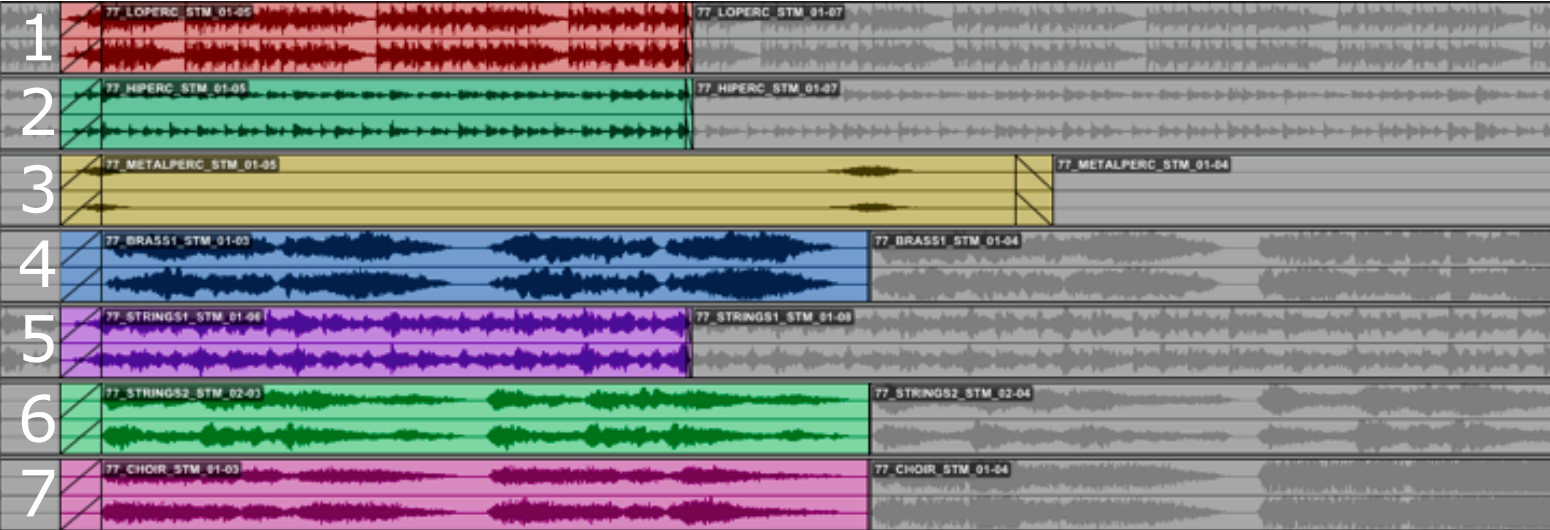


Musical Transition High to Low

Simple Stereo Crossfade at Edit Point

Musical Transition

Custom Stem Edit: High to Low no Trans



Can we do this
in real time?



Points on Editorial

"...you have to lead in to a tempo, and stagger the introduction of new elements unfolding in stages".

- ▶ Sonic 'cohesion' between connecting segments
- ▶ Frequency content of connecting segments - engineers are on the look out for incongruities
- ▶ Sometimes adding a sound like a cymbal
- ▶ 3 sec. XFade is better than 1 sec. XFade, but *"you're still not fooling anyone"*
- ▶ While it may not yet be practical to do real-time stem-based transitions, we can at least prepare them offline in editorial



The 'A B C' Rule

"...like elements in connecting segments are the most dangerous to a smooth transition - if compatible they can crossfade, if not, only one can rule at a time."

Segment 1

A
—
B
—
C



Segment 2

A
—
B
—
C

where A, B and C represent like textural components in each segment

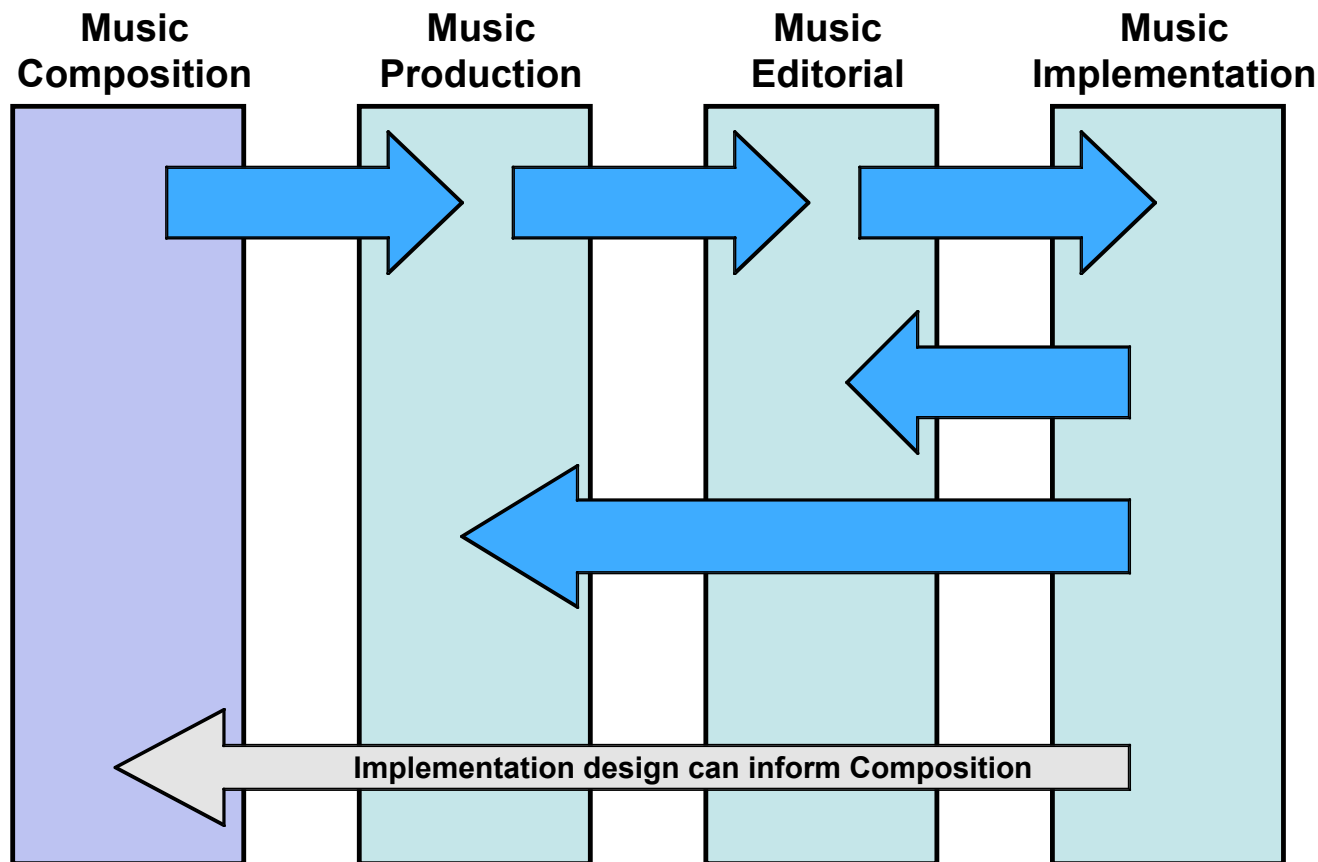




Chapter 5

Collaboration

Workflow in Adaptive Music





Chapter 6

Discussion Q & A

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