University of Missouri-Kansas City

Compositional Exploration Through Tape Looping

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CONSVTY 433: Senior Composition

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Background:

Until a couple of years ago, I never thought I would get into open reel tape decks. I always thought, “records are great, what do I need reel to reel for?” Little did I know that the tape recorder is an incredible musical instrument and would become an integral piece of my compositional voice. As a lifelong fan of The Beatles and 1960s/1970s rock music, I’ve always had an interest in tape manipulation and looping techniques such as those used on *Tomorrow Never Knows* and *Being for the Benefit of Mr. Kite!*, but for many years I didn’t consider how I could apply them to my own music. I acquired my first reel to reel machine in June of 2021, an Akai X-150D, and a Sony TC-630 a few weeks later. This paper will first discuss five analog tape looping techniques and then explore how I’ve used these techniques in my own composition. Working with tapes loops is a physical and tactile experience that enhances my compositional process, and manipulation of the medium yields unique sonic results that can be difficult to achieve through digital means.

For anyone getting into reel-to-reel tape recording, one of the first things to consider is the age of these machines. Some of the most common machines date back to the late 1960s and 1970s. Due to their age, some mechanical and electronic restoration may be required, and I’ve personally had to fix various issues with my own recorders. This in and of itself has been an excellent educational experience and a channel through which my father has lent me his

knowledge of machines and electronics. I otherwise likely would not have the same interest in the practical side of the way some technologies of our world work.

Catalog of techniques:

Tape looping techniques can be organized by their relative increasing levels of complexity. The scope of this paper will primarily address techniques that can be performed on a typical 3-head (erase/record/play) 4-track 2-channel ¼ inch stereo consumer-grade deck, since these are among the most accessible types of reel-to-reel tape recorders (see figure 1).

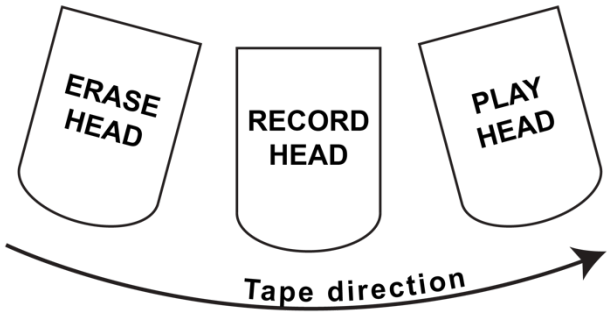

Figure 1: The three heads of a tape recorder and the direction of tape movement. The positioning of the play head after the record head makes it possible to listen to the tape as it is being recorded.

Almost all consumer-grade recorders can run at two speeds: 7 ½ inches per second (IPS) and 3 ¾ IPS; many also have a slower 1⅞ IPS speed. Faster tape speeds result in higher fidelity recordings, but the 3 ¾ and 7 ½ IPS speeds are most common on consumer grade recorders because of their good recording quality to cost effectiveness ratio (Mignolia). Most of these techniques are replicable to some degree on a 3-head cassette recorder given it has the appropriate inputs and outputs. The techniques are as follows:

- Basic looping
- Sound on Sound looping
- Sound on Sound looping with stereo delay

- Generation loss looping
- Start and stop looping

Of course, there are additional variables that can be changed to produce a wide array of possibilities within each of these techniques.

Basic looping:

There are two ways to use a tape loop in its most basic function on a tape recorder. The first is as a loop of recorded sound. This is quite exactly what it sounds like: a tape loop that has sound recorded on some or a portion of it that when played on a tape recorder will repeat until stopped. Basic Loops of Recorded Sound (LORS) are the most directly analogous to an ostinato in conventional music terms, and therefore the two can be thought of in the same way. Ostinati can serve as rhythmic, textural, or harmonic devices in a piece or section of music. Their musical function is entirely dependent upon the material they are comprised of, and the time length of the loop depends on the length of tape used as well as tape speed. It is up to the composer how they want to use repetition (see examples 1a, 1b and 1c). Basic LORS are excellent tools for conceptualizing ostinati as a cyclical device rather than written out in a linear fashion on the page due to the visual connection a composer has with the medium; they can see the *physical* endless loop of tape continuously moving. Composing strictly with notation can sometimes feel restrictive, and I often find it liberating to write music through improvisation and recording.

Example 1a: A recording of an acoustic piano and electric piano at its original recorded speed, 3 3/4 IPS

Example 1b: The loop from Example 1 played at half speed, 1 7/8 IPS.

Example 1c: The loop from Example 1 played at double speed, 7 1/2 IPS

The second method of using a basic tape loop is as a Continuously Recording Effects Loop (CREL). As the name indicates, this method is intended to be used as an effect on another sound source i.e., as a delay effect on an electric guitar. A CREL can be used for live saturation, delay, and echo effects, and can be used for Artificial Double Tracking (ADT) and flanging effects in conjunction with a Digital Audio Workstation (DAW) in a studio setting. Instead of the loop simply being played back, sound is being continuously recorded onto the tape, played back a short moment later by the play head, and then erased when it loops back around to the start since tape recorders will always engage the erase head when recording. This allows for a

continuously empty recording surface. CRELs are useful for putting an effect on a sound without having to use much tape, unlike recording the entirety of the sound onto a reel of tape; live analog delay, echo and saturation effects are feasible without having to waste precious tape.

Sound on Sound Looping:

Sound on Sound (SOS) recording is a type of overdubbing function. It is important to recognize the difference between synchronized overdubbing and Sound on Sound overdubbing. The term "overdubbing" simply refers to the act of recording of one sound alongside the playback of another pre-existing sound on the tape. Synchronized overdubbing indicates that the overdub will be recorded on a separate, empty track at the exact same time other sounds on the tape are being played back. This is only possible on tape recorders that have a designated sync function, most of which fall in the semi-professional and professional ranges. Since the play head on typical consumer grade recorders is positioned after the record head in the tape transport, and the record head has no sync capabilities, it is impossible to monitor an overdub and the pre-existing sounds at the same exact time; there will always be a slight amount of delay between the two. Sound on Sound overdubbing refers to a recording technique in which the overdub is recorded *directly* on top of an existing recording on the tape, therefore blending the two sounds together (see example 2a). SOS overdubbing yields incredible results when used on a continuously recording tape loop (see example 2b). One problem remains, however: the erase head. Since the tape is always being erased each time it passes the erase head while recording, it must somehow be bypassed or disengaged in order to layer sound on sound. Disengaging the erase head is far simpler than one may first think; it does not require any rewiring or permanent modifications to the recorder, rather all that is needed is a small piece of aluminum foil. By

covering the erase head with aluminum foil and threading the tape normally, its electromagnetism is deflected and therefore does not erase the contents of the tape. It is worth noting that the foil should be as flat as possible and carefully placed as not to damage either the erase head or the tape loop.

Example 2a: A tape loop of layered soprano saxophone recordings made using SOS overdubbing.

Example 2b: A solo violin being overdubbed using SOS recording onto a continuously recording tape loop. Note how the material played earlier in the recording is heard when the tape loops around. The recording is a mix of the live performance and the tape, as if heard in a concert hall.

Sound on Sound with Delay/Echo:

The Sound-on-Sound technique lends itself to numerous more specified techniques revolving around the same principle. A simple yet extremely effective way to enhance SOS recording is to introduce a delay or echo effect. Some recorders have a built-in echo circuit, but the same results can be yielded with the use of an external mixer with auxiliary sends. By routing a signal through one channel on a mixer, out to the recorder via the auxiliary send, then sending the recorder's output though another mixer channel, this allows for the recorded signal to be heard from the play head in addition to the original source signal, thus creating a delay due to the

physical distance between the record and play heads (see figure 2).

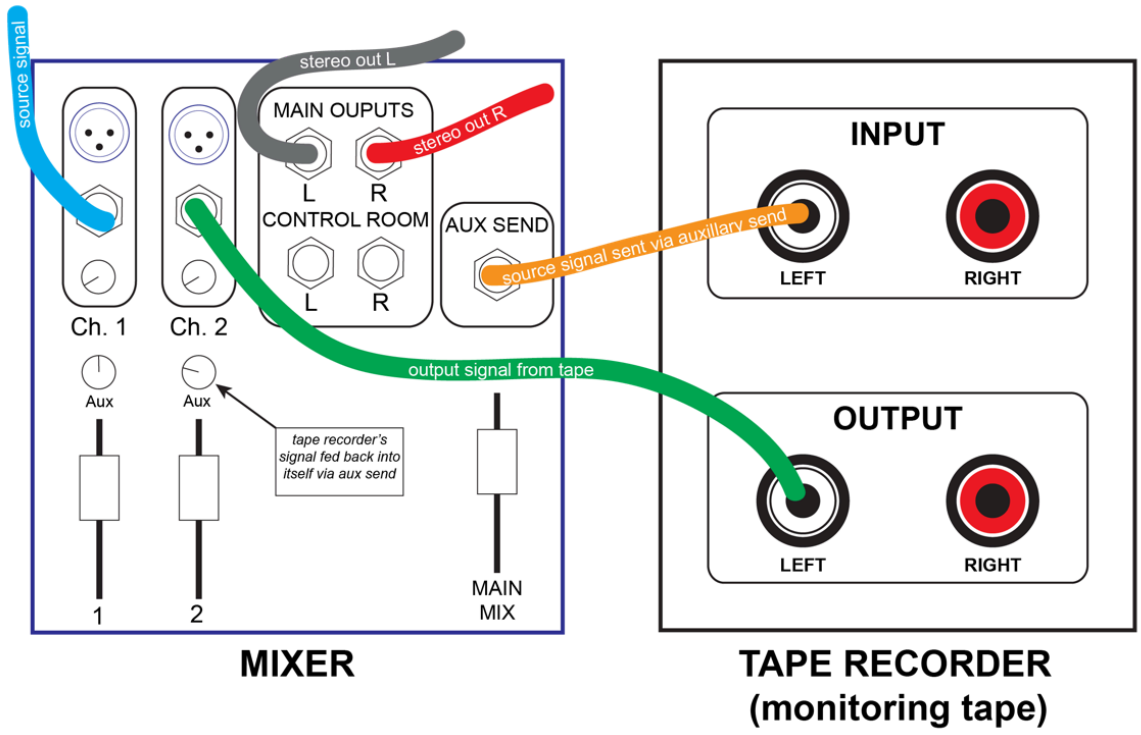

Figure 2: A diagram showing the signal routing for a tape echo effect with a mixer. The input signal is being sent out from the mixer on both the main output and auxiliary send, allowing it to be sent to the tape recorder, recorded, and played back moments later by the recorder's play head against the original source signal.

If the recorder's output is fed back into itself via the auxiliary send, a repeat echo effect can be achieved. Sending a high enough echo signal to the recorder can result in extreme saturation of the tape thus accentuating various harmonics that were previously unnoticeable (see example 3).

Example 3: An electric guitar overdubbed using SOS recording on a continuously recording tape loop with a tape echo effect. The recording of echoes upon themselves quickly produces a large textural wash of sound. The change in register on the guitar allows for each musical idea to be heard before it is absorbed into the fuzzy texture.

Stereo Delay:

The inclusion of mono delay and echo already lends itself to a slew of compositional possibilities. But these effects can be further altered for additional sonic possibilities. A stereo delay/echo effect in conjunction with SOS recording starts to incorporate the element of panning and the stereo field to the composition (see example 4). This can be achieved by sending a mono signal from a mixer to the left channel input on the tape recorder, then splitting its left channel output via a Y cable. One signal goes back to the mixer, and the other is patched to the recorder's right channel input. Its right channel output is sent to the mixer. By patching the left channel output to the right channel input while recording this creates a two-point delay (see figure 2). Then, by feeding the signal from the mixer back into the recorder via the auxiliary sends, a repeat stereo echo is created.

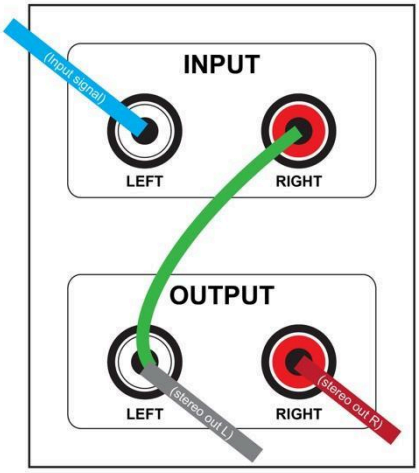

Figure 3: Illustration of the patching modification for the stereo delay/echo effect. The left channel output is being sent to the right channel input and the stereo output by use of a splitter cable. The recorder is monitoring the recorded tape in both channels.

Example 4: An electric guitar overdubbed using SOS recording on to a continuously recording tape loop and a stereo tape echo effect. Notice how the input signal appears on the left channel and is then duplicated moments later on the right channel.

Generation Loss Looping:

Generation loss is a phenomenon present in analog recording and playback mediums. It refers to the loss of fidelity as a result of duplicating a signal from its copies as opposed to making duplicates from the master recording. With each duplicate more noise is introduced and the high frequencies of the original signal become less defined. This is analogous to making a photocopy of a document from a photocopy; with each copy the document becomes less clear and more distorted. In the heyday of analog recording studios, this phenomenon is the reason bouncing tracks together was done as few times as possible. Even on studio-grade recorders running at 15 or 30 IPS, generation loss is still present and is simply an inherent part of analog recording. While this may be considered a negative phenomenon in some fields, generation loss can be embraced as an extremely unique and effective compositional technique and yields beautiful results. The setup for generation loss looping is like that of stereo delay looping, in that the mono signals from each channel are being recorded onto each other. Begin with a mono LORS on the left channel and bypass the erase head with aluminum foil. Patch the left channel output to the right channel input and set both channels to be recording, with the input levels equal. Begin recording onto the loop, and just before the loop finishes, reconfigure the patch cable so that the right channel output is now being sent to the left channel input. By repeating the

process of switching the channel input/output configuration, the original mono recording will lose its fidelity, and eventually become nearly unrecognizable. The downside to manually plugging and unplugging the patch cable is that it will introduce pops and signal buzz, however a simple switchbox could be constructed as to minimize these sounds. At the same time, they could be useful sounds for some composers. I've found generation loss looping to be an extremely effective method of creating beautiful, hazy textures from very short musical ideas.

Example 5: A mono recording of a piano being copied back and forth between the left and right channels on a continuously recording tape loop at 3 ¾ IPS. Note how with each iteration the recording loses clarity and becomes less defined.

Start and Stop Looping:

Tape recorders are imperfect in their running speeds, and while quality recorders are built to minimize speed variation (called wow and flutter), it is simply inherent to their mechanical nature. When put into "play" or "record," many machines take a short period of time to get up to running speed, usually less than a second. The age of a machine can exaggerate this time frame, and some recorders may take one to two seconds to reach the selected speed. Variables such as the lubrication of parts and condition of the electronics do have an effect, but many machines will have some small imperfection when starting up. This fault can yield an incredibly unique tape warble sound effect. By recording a signal while the machine is getting up to speed, this stretches the signal across a shorter length of tape than is intended. When played back at the intended speed, this section of sound will appear to start fast and then drop down to the correct

speed (see example 5). As with the other techniques the “hiccup” effect works well in combination with other effects.

Example 6: A looped recording of a piano being fed onto a tape loop using SOS recording. The recording tape loop is periodically stopped and restarted while the piano signal is still being fed to the machine, thus interrupting the rhythmic scheme with “hiccups.”

Compositional application of the techniques:

Having a catalog of tape looping techniques is only part of the compositional equation; a composer must create sound material to populate these techniques and discover how their original material interacts with itself within the recording medium. The type of material a composer creates and feeds into the tape looping technique exists on a spectrum from completely improvisatory to precisely calculated for a particular compositional result. Furthermore, the sonic qualities of the material have an impact on the effectiveness of any one of these techniques.

It is important to remember that the tape loop is not altering the fundamental material it is being fed, and therefore is completely dependent upon user input, much like a calculator. A calculator is only as useful as its user needs it to be and isn’t fundamentally changing any numbers typed in; it outputs the correct solution to an equation and nothing else. The tape recorder is similar in that it doesn’t fundamentally change the pitch, rhythm, interval content, harmony, or any other similar parameter of its input. If a source signal is manipulated using the recorder through many different processes, it can alter timbre through phenomena such as

generation loss; however, this is simply a byproduct of its nature. Therefore, the composer's material will always be at the forefront of any tape loop-based work.

The use of these tape looping techniques reveals the different ways a composer's musical material can interact with itself. These interactions are known as musical counterpoint. Counterpoint can be broadly defined as "the interplay of agreement and disagreement between the various factors of [a] musical texture" (Piston 9). Since a majority of music makes use of multiple combined elements (whether it be instruments, notes, rhythms, etc.) "most music is to some degree contrapuntal" (Piston 9). In this study of tape looping techniques, counterpoint can be viewed as working in additive layers. These layers are derived from three unique components of music: pitch, rhythm, and timbre. *Pitch* is the subjective perception of *frequency* and *frequency* is the objective discrete measurement of acoustic phenomena (Rudy). *Pitch* is a human interpretation of sound; it is relative, while *frequency* is a machine-like understanding of sound (Rudy). *Timbre* is the "quality of tone distinctive of a particular [sound source]" (Merriam-Webster). Lastly, *rhythm* is perhaps best defined as discrete events a listener perceives horizontally across time (Rudy).

The first contrapuntal layer is that which is present in the composer's material, whether melodic, rhythmic, or harmonic; these are the typical elements one may associate with conventional "counterpoint." The second layer is where looping techniques get involved. By feeding material to a Sound-on-Sound loop, the superimposition of the input material upon itself creates its own counterpoint. The input material is directly related to this layer of counterpoint, as how it interacts with itself is completely dependent upon the compositional choices of material; it can be anything from purely improvisational to meticulously planned out so that certain notes and rhythms will line up with each other. Counterpoint is not strictly limited to the

interplay of different rhythms, pitches, and chords but also different timbres. Timbral counterpoint makes up the third layer and can vastly expand the sonic breadth of a work beyond the proverbial "notes on the page." Timbral variation can come from a modulation of the original sound source or could be the result of tape manipulation. Generation loss, start and stop recording, changing the recording/playback speed and tape feedback are all ways to alter the timbre of a given sound source, albeit some more drastic than others. The above-mentioned musical components of pitch, rhythm, and timbre in conjunction with contrapuntal layers creates *space* in music. The concepts of rhythm and musical space are undeniably tied to each other, as *space* is the accumulation of rhythmic and timbral events that give music dimension (Rudy). Pitch and timbre also have a role in creating musical space, as they too are linked to each other, though not always directly discernable. The presence of different pitches and their unique timbres affect how *space* in a piece of music is perceived by the listener. The musical concept of *space* becomes more intricate when working with electronics and stereo recording mediums, as the composer also has the stereo field as another component of musical *space*. From this a quasi-fourth layer of "spatial counterpoint" can be considered, as the perception of *space* can be altered though not only rhythm, pitch, and timbre, but also choices and alteration of sound placement in the stereo field.

As stated earlier, the composer's original material is the most important element of tape looping music, and each of the techniques will respond differently based on what material is inputted. In improvised music, the composer or performer has free range over rhythm, tempo, note duration, etc., and it's not particularly important that certain notes coincide with others on the tape. On the other end of the spectrum, a composer can take advantage of strict tempo, rhythms, note durations, tape loop length, and tape speed to know how their material will interact

with itself. To make these precise calculations, the composer must first know the following information:

a) The length of the tape loop (in inches)

b) The tape speed (in inches per second)

c) The tempo of their material (in beats per second).

Knowing these variables makes it possible to calculate the delay time in beats between subsequent layers of sound recorded on top of each other. The formula is as follows (Pennell):

$$\frac{tape\ length\ (inches) \times tempo\ (beats\ per\ second)}{tape\ speed\ (inches\ per\ second)} = length\ (in\ beats)\ of\ the\ tape\ loop$$

By knowing how many beats long the loop is, a composer can figure out what type of rhythmic scheme will result from layering sound on sound. The decimal in the yielding number represents the perceived delay between subsequent layers. For example, if the tape loop takes 16.64 beats to make one revolution, the resulting delay between layers of sound will be perceived as nearly ⅓ of a beat. Rhythmically speaking, this scenario will create a perceived triplet delay. This information is useful to a composer as it allows them to write input material that when layered with itself using Sound on Sound looping, creates *specifically desired* musical ideas within a rhythmic scheme. What this formula doesn't (and can't) consider is the imperfection of tape recorders. Their analog, mechanical function introduces slight variations in tape speed, resulting in the delay between subsequent layers of sound becoming ever so slightly different than indicated by the formula. This shift occurs over several minutes and begins very subtly.[1]

I have used all these looping techniques at some point in my own composition, and even on repeated use across many pieces.[2] They never get stale to my ears because each work of music itself is different. Furthermore, using these techniques not only in combination with each

[1] Steve Reich's *Come Out* (1966) shows how two tape recorders running simultaneously will fall in and out of phase with each other over time due to their inherent mechanical imperfection.
[2] Such pieces include *Acknowledgement Triptych* and *Moirés From My Screened In Porch*.

other, but with completely different sets of compositional tools opens an infinitely larger sonic world. Using these looping techniques in conjunction with digital recording software, other live performers, or additional analog recording methods are some ways they become infinitely powerful techniques. Example 7 demonstrates how a handful of looping techniques (LORS, SOS looping, and stereo delay) can be used as building blocks for a larger work assembled in digital recording software. I recorded the individual instruments using my selected looping techniques and then digitized those recordings to reposition them, adjust their EQ, volume levels, and panning to ultimately create a complete piece. My input material consists of short, repeated musical ideas which are further developed by the effects of looping techniques.

Example 7: A short minimalist piece named "Puzzle Pieces" that utilizes basic loops of recorded sound, SOS looping, stereo delay, and SOS overdubbing on reels of tape. The individual parts were digitized and further assembled in Logic Pro.

Conclusion:

The more I have worked with tape recorders I've realized they are the perfect melding of man and machine. They represent a great historical leap in our ability to capture the sounds of our world in high (or low) fidelity, and to have the ability to instantaneously listen to them in high fidelity, realistic playback. However, like humans, tape recorders are not *perfect* in their function because they are an analog mechanical device unlike digital audio recorders. The imperfections of tape are perhaps why I'm so attracted to the medium as a composer; it's the perfect representation of the human condition. People aren't perfect, whether it's in our ability to

keep metric time when playing music or in the ways we interact with certain people in our lives. We've learned to build digital machines that can perfectly record and reproduce data and perform tasks we need them to, but the people behind our own creations can be messy and flawed. However, we grow and improve as people when we recognize the imperfections of life and make beauty from what may otherwise be considered a fault. After all, I'm not looking for absolute perfection in the music I create, but rather to make beauty from limitations and embrace imperfections in art.

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