Choice Manipulation in Music Technology
(arguments against the defaults inherent in music composition technology)
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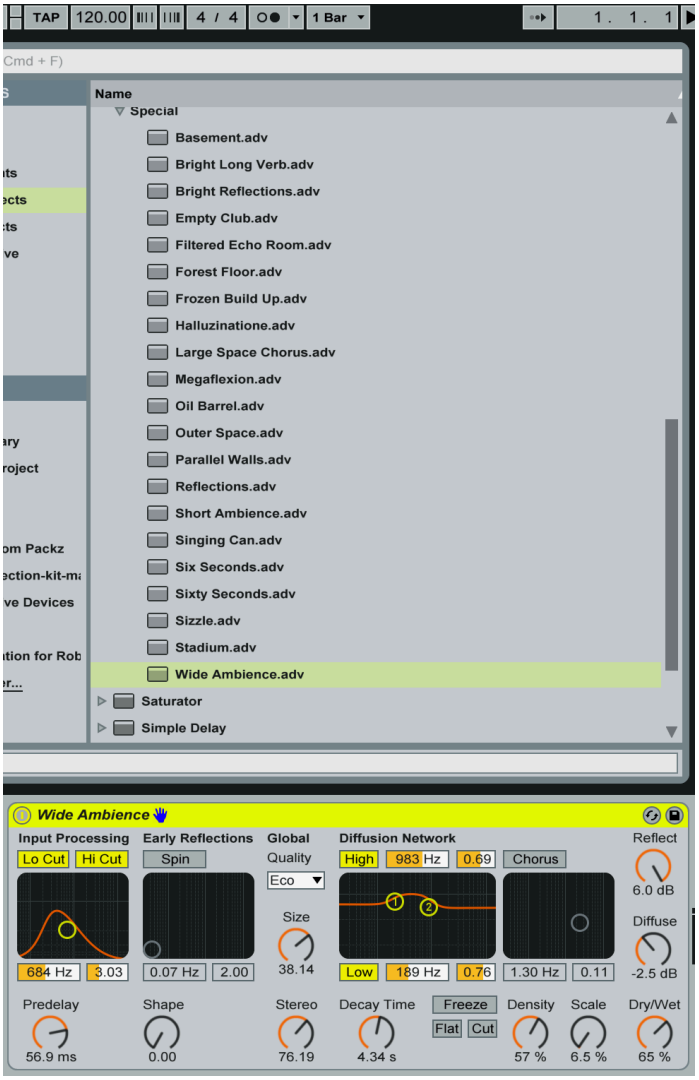
MUSICAL COMPUTER PROGRAMMING: STARTING POINT FOR PEDAGOGY OR TEDIOUS DISTRACTION? (A CONVERSATION OVER LUNCH)

Recently, a fellow tech-savvy composer and I discussed the merits of teaching the visual programming language Max[1] to undergrad composers. I discovered Max at the tail end of my undergraduate degree and have been a committed evangelist ever since, whereas my friend valued Max only as a 'gateway' tool for teaching music students a modicum of computer programming. My friend's main complaint against Max was that for the uninitiated student, the beginning lessons in Max seem disconnected from music in the extreme and the student who finally conquers these lessons learns to their ultimate dismay that their efforts to build a complex system (for instance, a patch for adding reverberation to an incoming audio signal) are pointless, as any Digital Audio Workstation (DAW) worth the digits it is coded in can call up any number of better examples of such a device. For instance, Ableton Live 10's Standard version comes equipped with more than fifty different preset reverb units, each with around thirty controls for tweaking the effect to the user's preference. A student could spend the rest of their career using only the built-in reverb devices that came standard with their favorite DAW and still produce professional level work.



Ableton Live 10 Standard, some reverb devices.

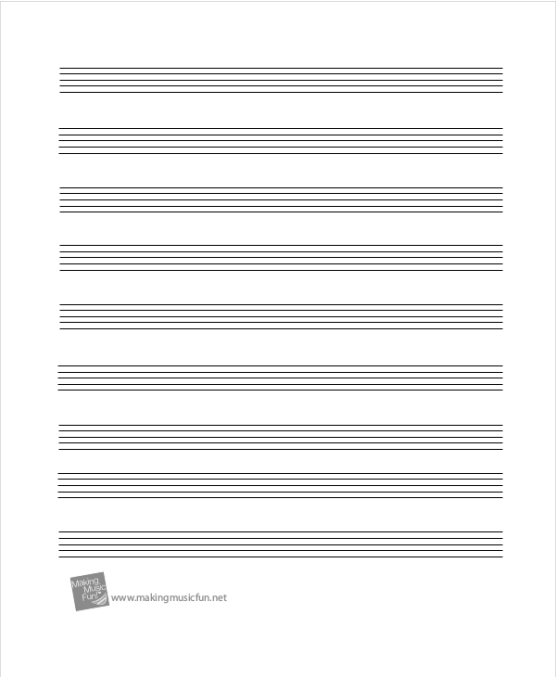
[1] https://cycling74.com

At first blush I could not disagree with my friends' assertion. Over the years I have discovered the truth of his statements again and again in various experiments with music-based computer programming languages, including CSound[2], OpenMusic[3], Puredata[4] and ChucK[5]. One studies long and hard to learn the ropes of coding in these environments and, after weeks of study, one is able to produce a sine wave, change its pitch and add a dynamic envelope. Unfortunately, the novelty quickly wears off and many casual students will abandon these avenues for creative expression in favor of more well-worn paths.

Though these arguments are all valid, the more I thought about this conversation, the more I disagreed with my friend's position. Upon further inspection, it occurred to me that this argument is really just the latest incarnation of a debate I used to have with my own composition mentors. Furthermore, the present discussion is not a new symptom of the current generation's over-reliance on musical technology, it is the standard debate between an aging generation and their descendants who tend to be early-adopters of the next wave of technological solutions without noticing the inherent limitations of choice and freedom these tools engender.

ANCIENT MUSIC TECHNOLOGIES: MANIPULATING US ALL ALONG

Imagine you are a composer in the first half of the 20th Century. As you begin a writing a piece of music, chances are good that you begin by acquiring two standard notational tools. Pictured to the right is what is most likely your standard medium:



Free staff paper from https://www.template.net/business/paper-templates/printable-staff-papers/

[2] https://csound.com
[3] http://repmus.ircam.fr/openmusic/home
[4] https://puredata.info
[5] http://chuck.cs.princeton.edu

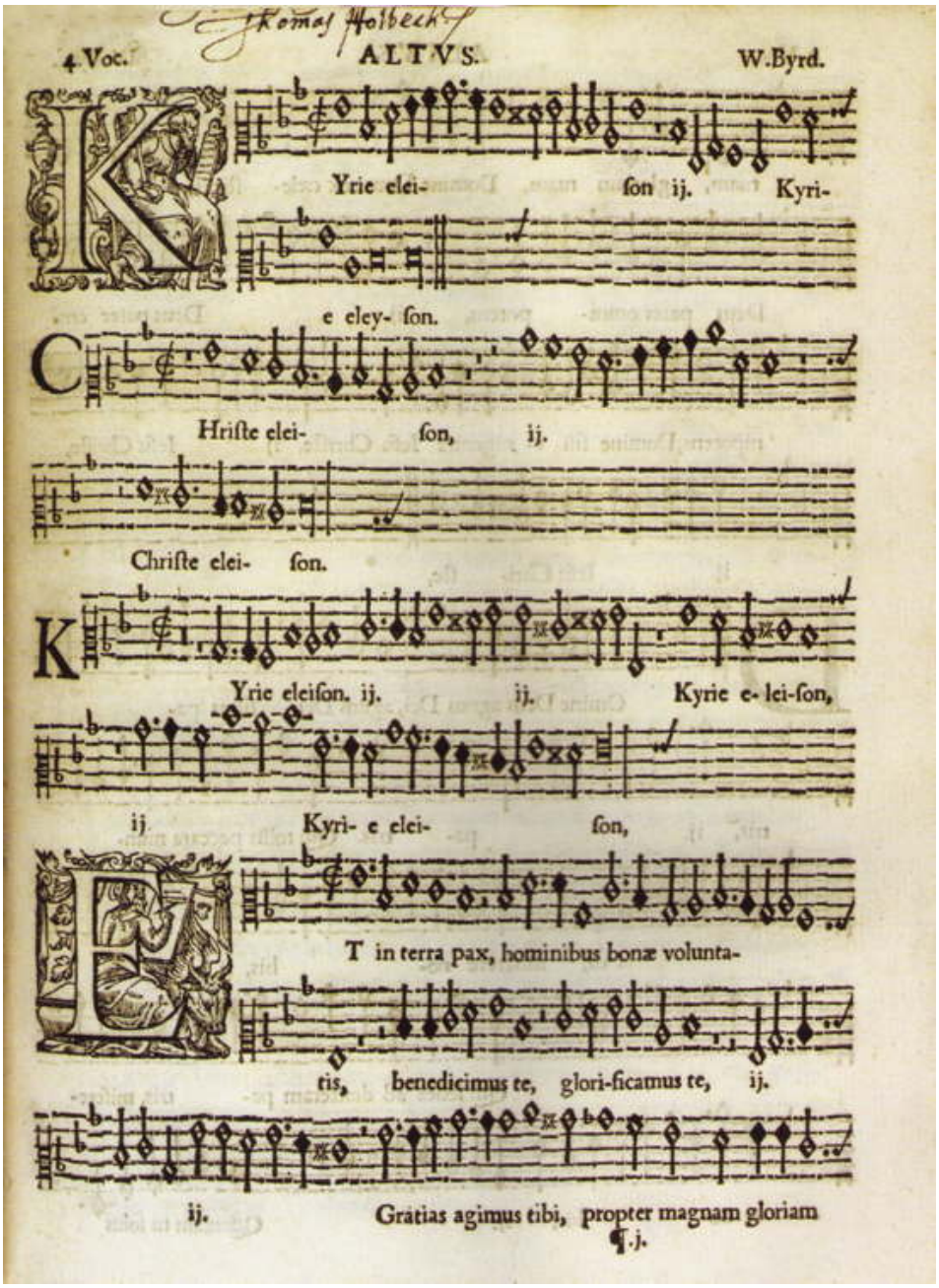
Pictured below is another standard tool of the hand writing composer:

Image courtesy of https://www.duvalunionconsulting.com/how-many-people-does-it-take-to-make-a-pencil/

If you were anything like my own orchestration teachers (back in the late-twentieth century), you would have a preference for Mirado Black Warrior pencils, which are still advertised as the "World's Smoothest Pencil, GUARANTEED!"

The Mirado Black Warrior, https://pencilgrinder.wordpress.com/2008/04/07/the-mirado-black-warrior-a-step-in-some-direction-part-i/

The Mirados are still fabulous pencils and are quite smooth indeed. However, note how the choice of these materials limits the composer in a major way. The choice of the five-line staff limits the composer to notational standards that have been increasingly common in Western culture since the late Middle Ages.



William Byrd, Messe; http://www.omifacsimiles.com/brochures/byrd.html

These standards imply the following for any music composed on this paper:

1. As there are five lines per staff, this implies a range of notes covering a limited number of octaves (though the range of human hearing stretches from 20Hz. to 20kHz.).
2. The notes utilized will fit most easily on the staff if they adhere to the standard "Equal Temperament" intonation practices common in most of the Western World. Microtonal intervals are difficult in the extreme to notate or understand, so the

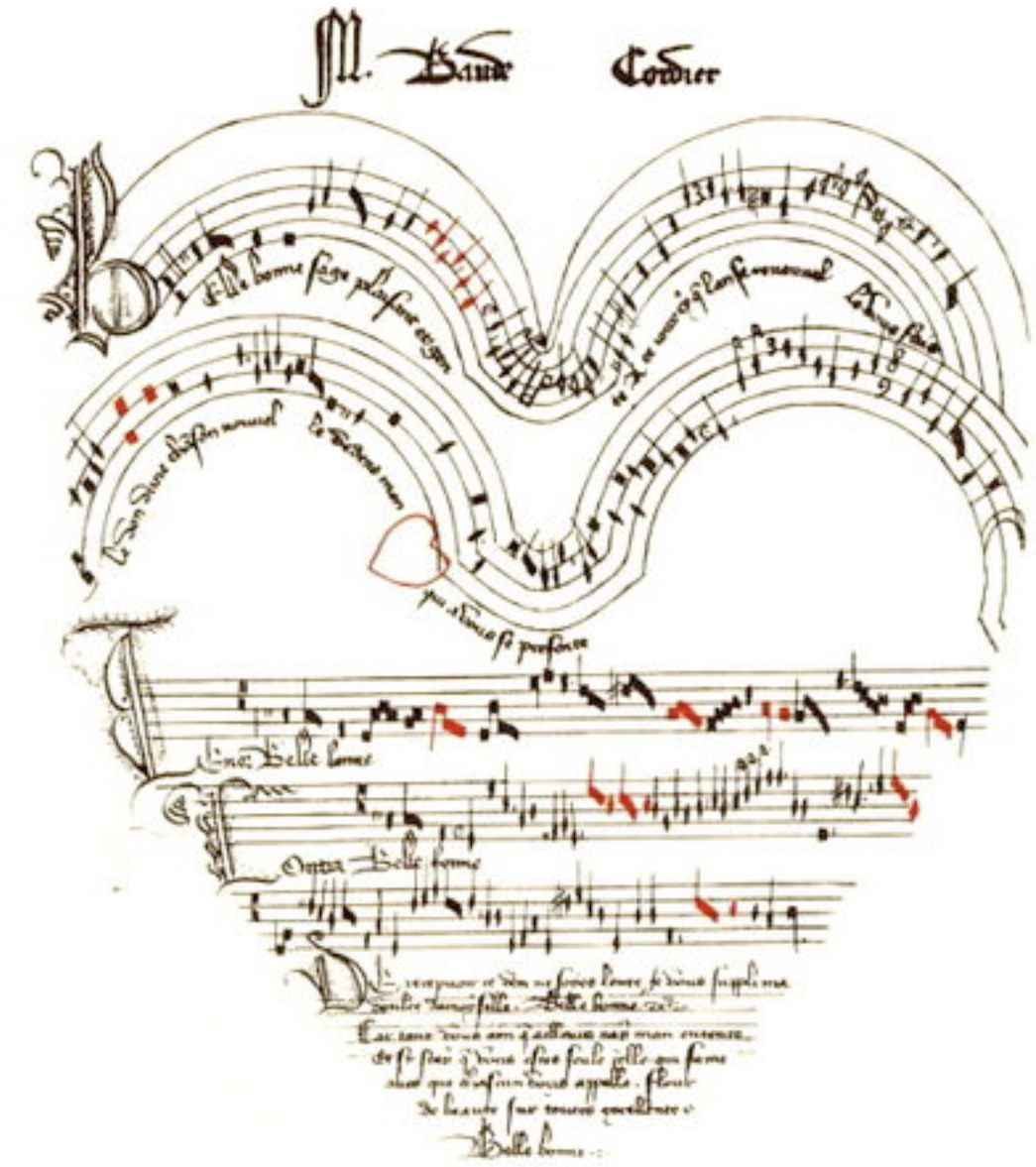
composer is somewhat shoe-horned into composing music which utilizes only twelve notes per octave by the adoption of the five-line staff.

3. Modern music notation was developed to accommodate music that, for the most part, used fewer than twelve pitch classes (standard diatonic tonal harmony allows only seven), so by adhering to this system we are *encouraged* to further limit our choices to pitches within the tonal system by the limitations which follow.
    a. To ensure clarity and decrease clutter on the page, it would be best to make use of a key signature so that most of the notes written contain one notational element (the note, placed in a certain spot implies a definite pitch / frequency, whereas notes *outside* the tonal system must be notated using TWO bits of information, a pitch AND an accidental).
4. This system developed a handy way of notating rhythms, which we are encouraged to use in conjunction with the melodic/harmonic system mentioned above. This system encourages us to think of time as a grouping of repeating beats, some of which are louder than the rest. Thus, we have also been encouraged to use a regularly repeating time signature.

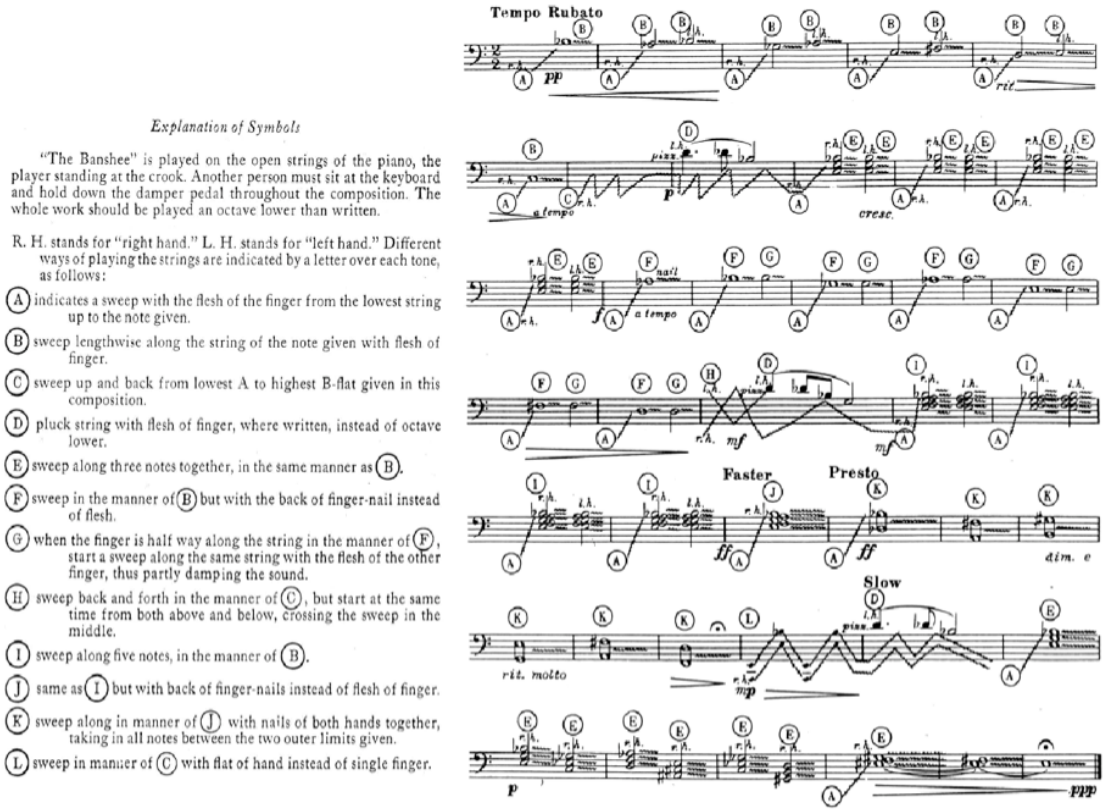
Once we have agreed to all of these limitations, we are a simple mental skip away from taking on the standard Western Culture notational system as a whole, with all of its adaptations for articulation, dynamics, lyric placement, tempo markings, etc... It's important to note that these assumptions are a wonderful thing in many situations. When a composer wants to write a piece for a middle school band, this is the best place to start. If a composer wants to arrange an E minor pop tune in 4/4 for his adventurous string quartet in search of a quick encore to play at the end of a show, this is the best place to start. But it is also important to notice the costs involved in adhering to these systems inherited from antiquity.

1. Adhering to these systems from antiquity will cause antique sounding music to be easy to play and modern music to seem difficult, even on the surface.
2. Musicians brought up with these limitations will tend to be under the mistaken impression that, since the bulk of the music they have encountered *may* be expressed in this antiquated system, anything that pushes the boundaries of this system (or even more startlingly ABANDONS it) must be of lesser worth, the product of confused individuals, wastes of time and perhaps even not music.

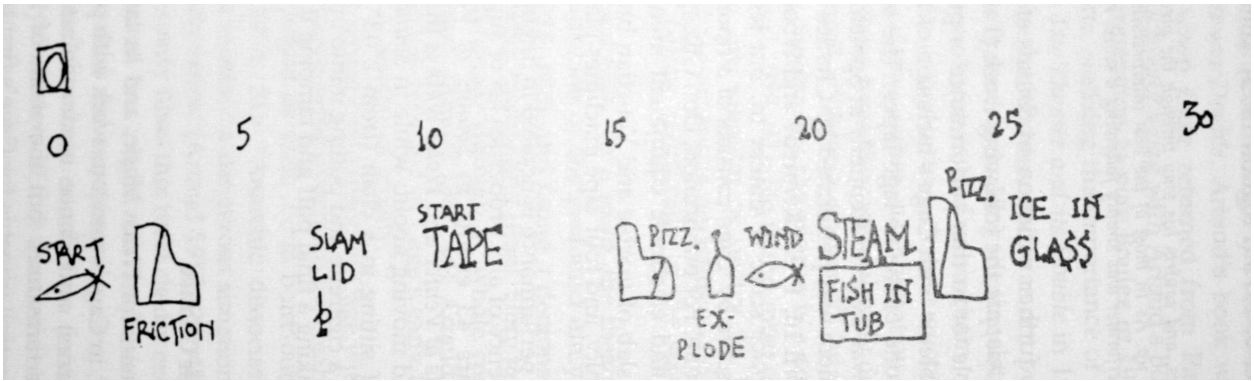
A quick scan of music history will show us that there have always been composers and musicians who refused to make the Faustian bargain with the notation system, choosing instead to begin afresh with each new piece of music and continually push the envelope of how a composer can go about communicating her intentions to the performer on paper.



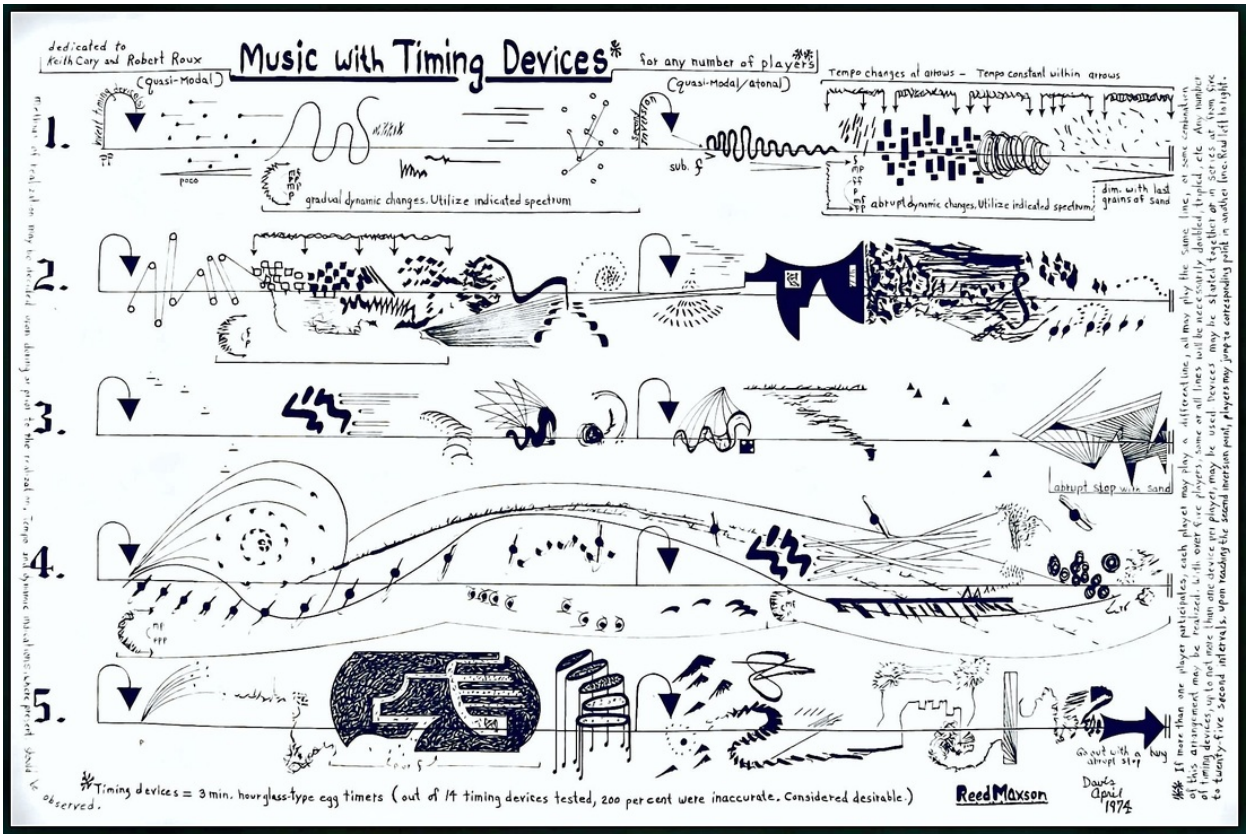
Baude Cordier, Belle, bonne, sage (14th Century); https://www.replicaprints.com/product-page/belle-bonne-sage



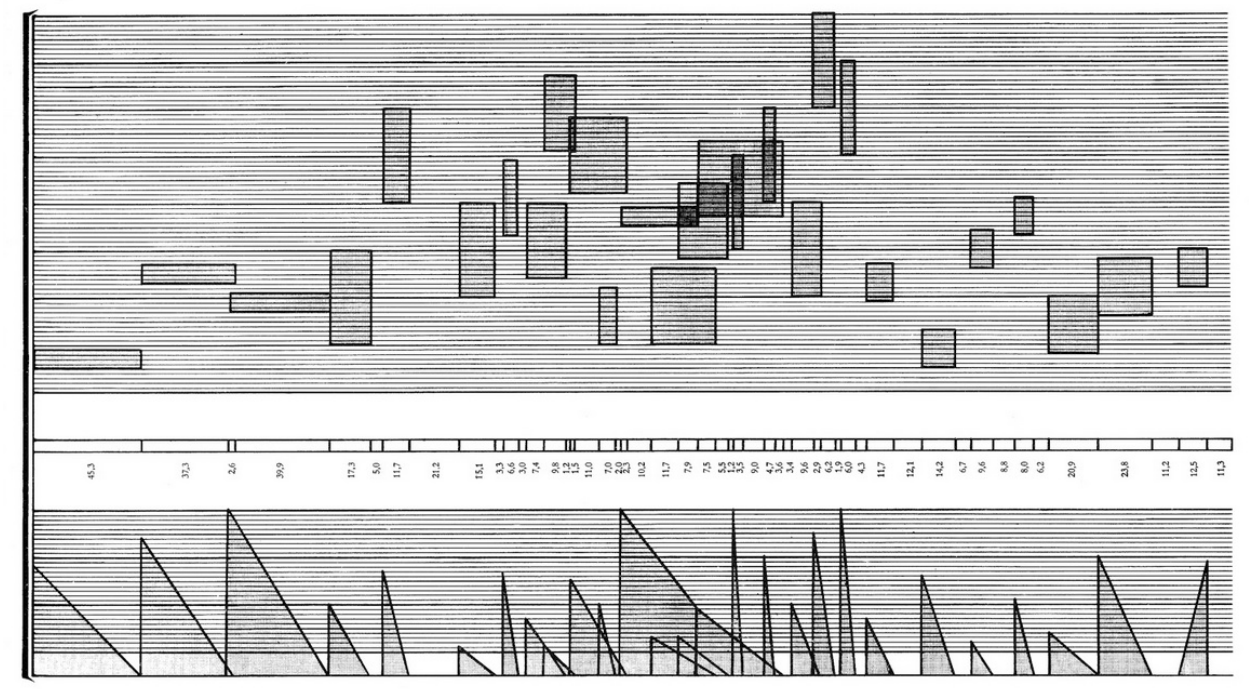
Henry Cowell, The Banshee (1925); http://www.sevenstring.org/threads/graphic-notation.244552/



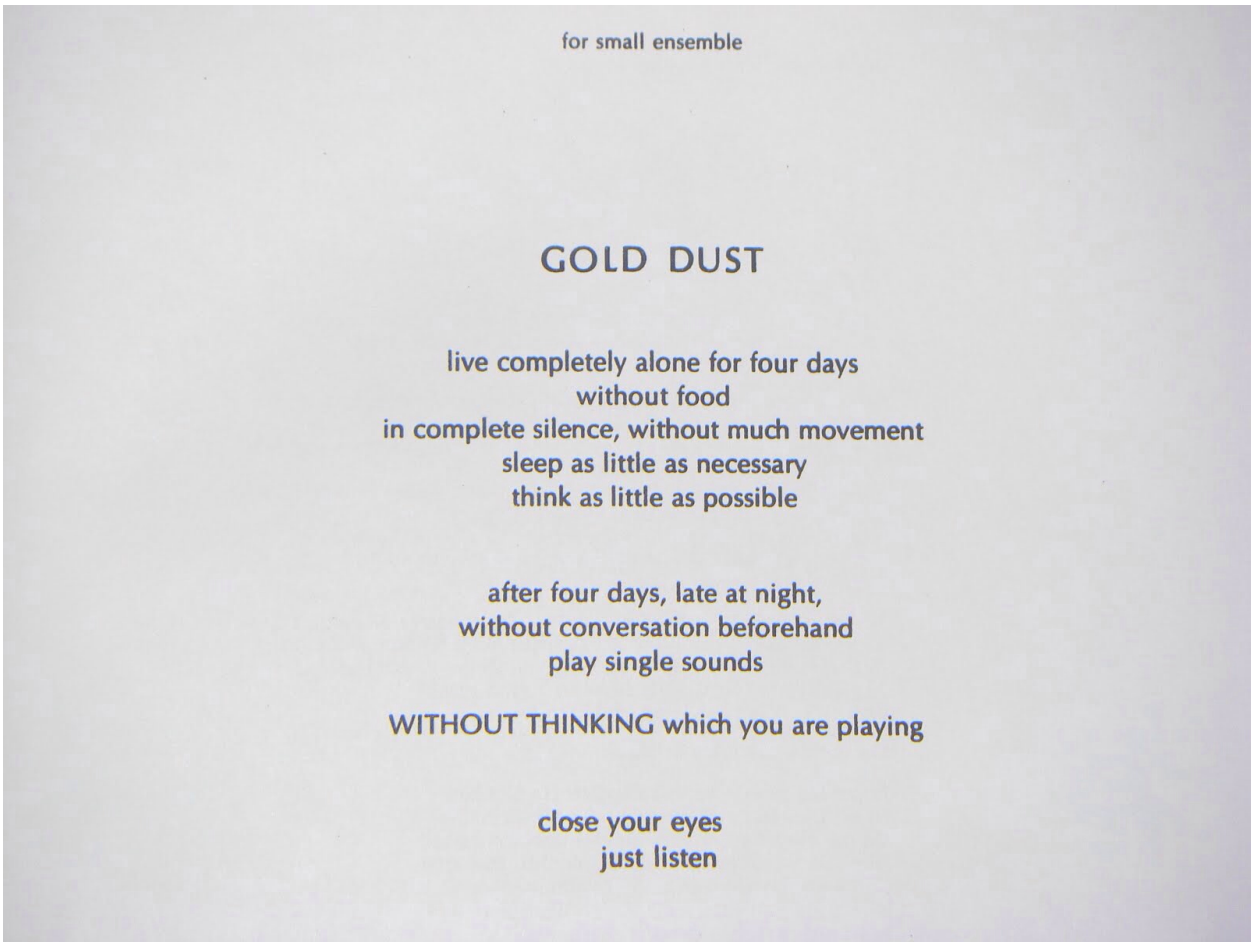
John Cage, Water Walk (1959); http://exhibitions.nypl.org/johncage/taxonomy/term/44



Reed Maxson, Music with Timing Devices (1974); https://www.reedmaxson.com/graphic-scores.html



Karlheinze Stockhausen, Zyklus (1959); https://bestarts.org/see-the-sound-musicians-graphic-scores/



Karlheinze Stockhausen, Gold Dust, from Aus den Sieben Tagen (1968); http://jeffsdailypicture.blogspot.com/2011/06/gold-dust.html

It is interesting to note that music which pushes the envelope of notation is often also relegated to the sidelines by performers in Western culture. Could it be that along with limiting our notational choices, we are limiting our ability to appreciate music which doesn't follow the rules?[6]

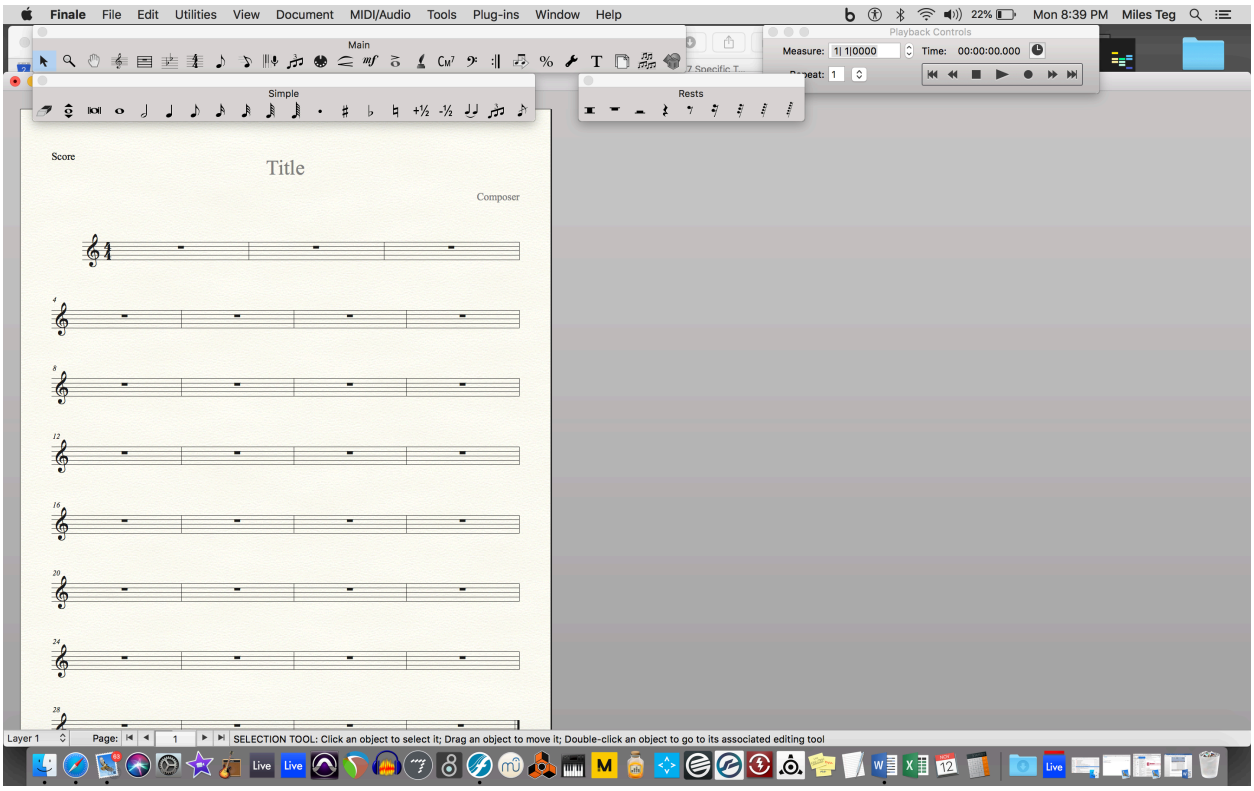
CHOICE MANIPULATION, THE SILENT NUDGER

This process by which a menu of options limits our creative or decisive choices is what is called choice manipulation by behavioral psychologists. Choice manipulation is continually being used by apps like Instagram, Tinder and Facebook to keep users engaged with social media environments despite the often deleterious effects of staying engaged.[7] Many

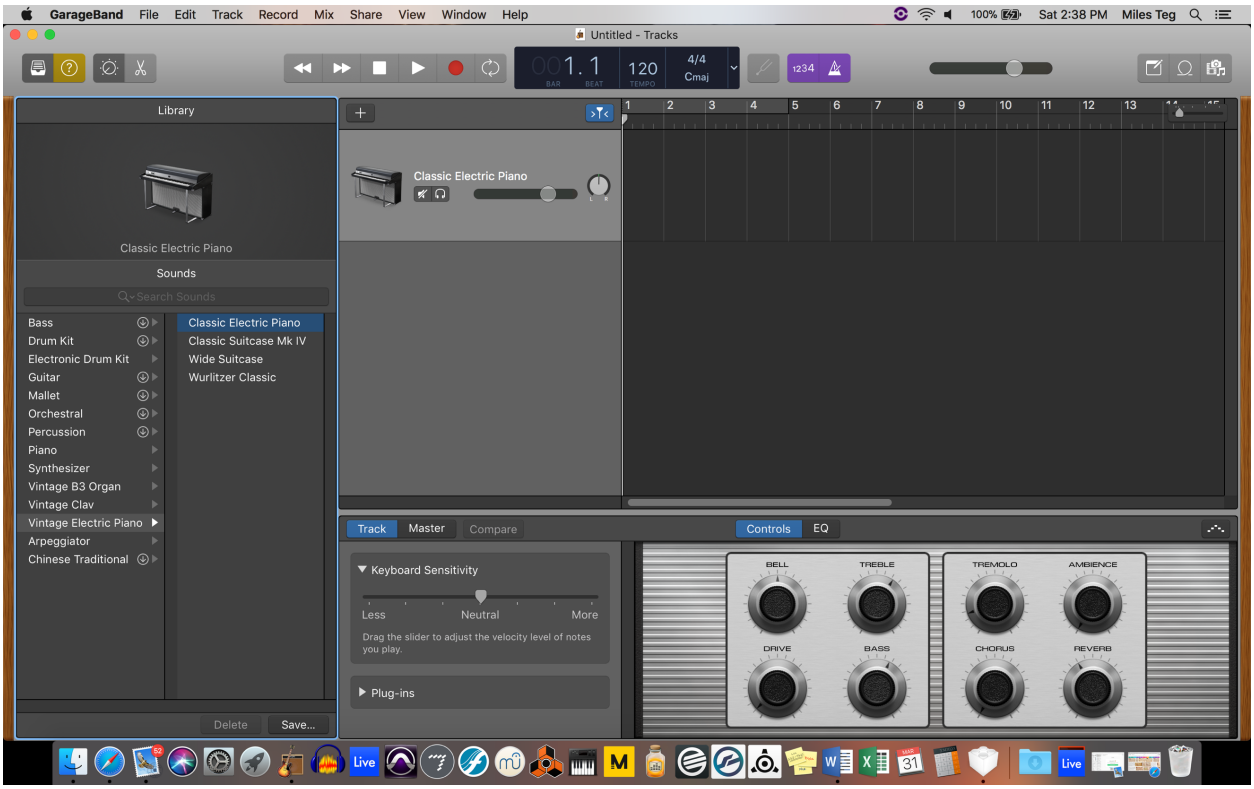
[6] https://www.smithsonianmag.com/arts-culture/5-12-examples-of-experimental-music-notation-92223646/
[7] https://www.kqed.org/futureofyou/397018/7-specific-ways-social-media-companies-have-you-hooked

readers will have heard the common complaint from social media users who engage with a specific app in order to answer a question such as, “what did my friend think of my status?,” a situation which often ends with the user in question staying on the app for much longer than was intended. The time spent engaging with a social media app, seemingly against one’s will often occurs to the detriment of real-life interactions with other humans. Ultimately, this situation likely arises from a company and their customers having conflicting goals. The company’s goals are, “Keep users engaged with the app as long as possible to increase the likelihood of ad dollars or sales,” whereas the user’s goals are more likely personal and seemingly frivolous (to be entertained, informed or connecting with friends, etc...).

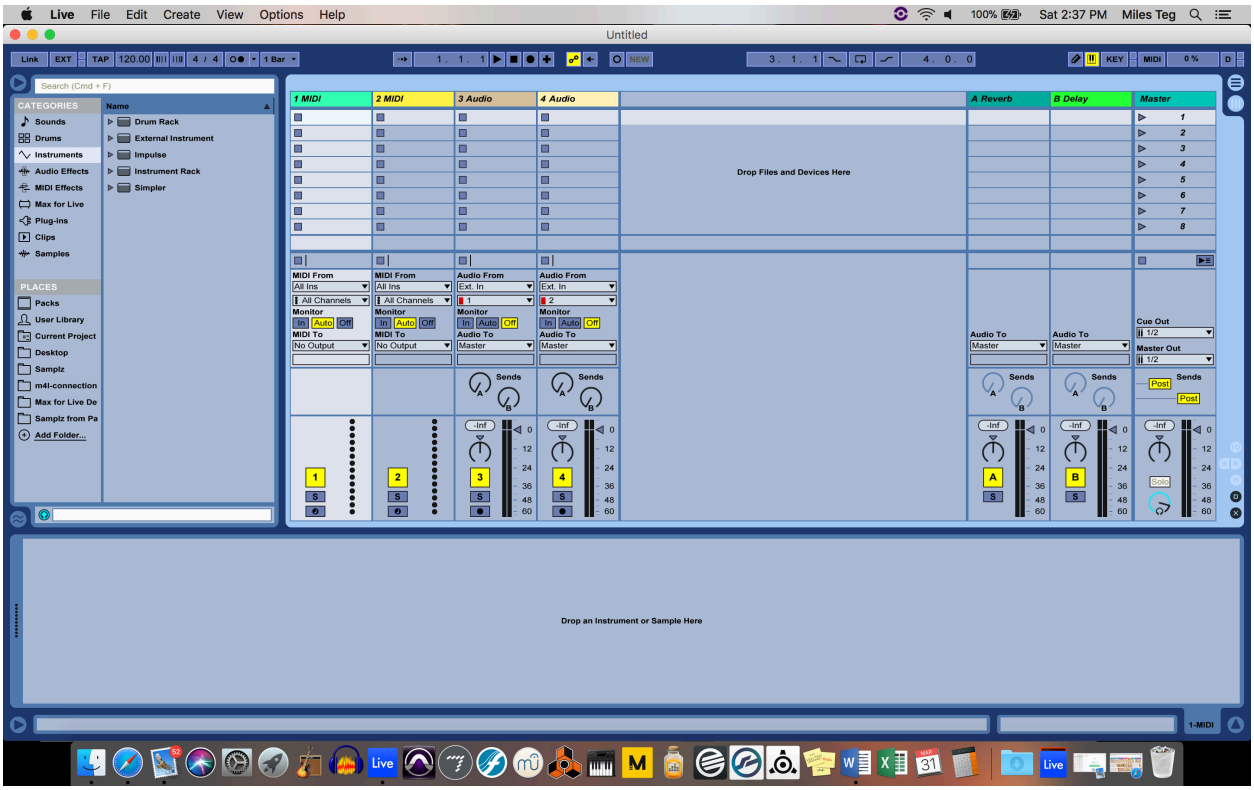
Now imagine you are you are an electroacoustic composer in the first half of the 21st Century. As you begin a writing a piece of music, chances are good that you begin not by grabbing your Mirado Black Warrior and some blank staff paper, but by accessing one of a small list of software-based composition tools, a variety of which are pictured below.



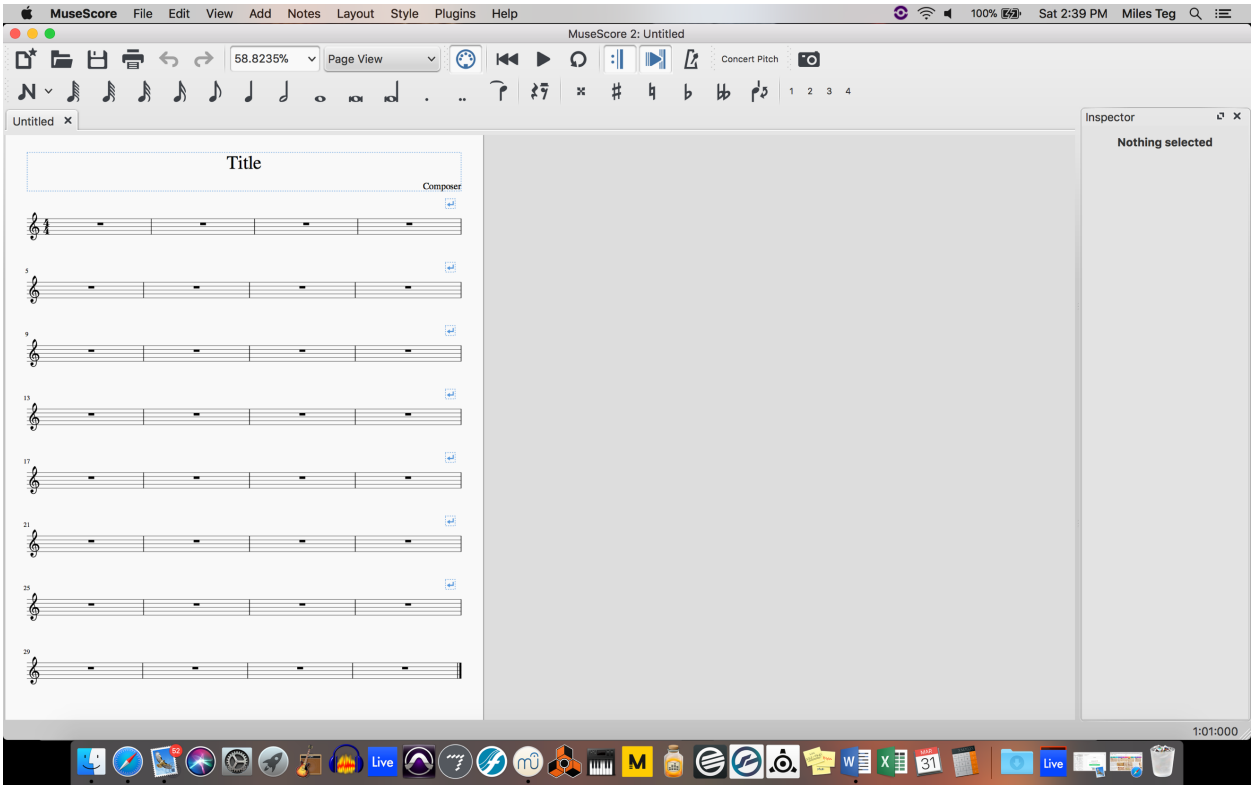
Makemusic’s Finale, Version 25.; Music notation software.



Apple's [Garageband](); Digital Audio Workstation.



Ableton Live, Version 9-Standard; Digital Audio Workstation.



Musescore; Music notation software.

These examples are only a small collection which could also include such programs as Sibelius, Dorico, Pro Tools, Bitwig, Reaper, Audacity and Reason. Much good work could and is currently being done via each of these programs throughout the music and production world. From a pedagogical standpoint, any of these programs can be a useful starting point with which to teach composition, notation, arranging, production, recording, mixing, mastering or any number of other musical subjects.

Now notice the limitations inherent in all of these tools:

1. Each program defaults to a tempo of 120 beats per minute.[8]
2. Each program defaults to a time signature of 4/4.
3. Each program defaults to C major.
4. Each program defaults to a twelve-note octave in Equal Temperament.
5. Each program defaults to a two-channel (stereo) audio environment.

The notation programs (Finale, MuseScore, Sibelius and Dorico) have some added limitations.

[8] Quizzically, Image-Line's popular DAW FL (still called Fruity-Loops by those who remember such things) features a default tempo of 140 bpm. For this reason, FL is largely left out of the complaint this article addresses.

1. This nascent piece already has a "Title."
2. This piece has a single "composer."
3. The instrument which will play this piece utilizes one of the standardized clefs.
4. The composer will be using standard accidentals, rather than microtonal/xenharmonic accidentals.
5. The composer will be using the standards of Western Culture notational, handed down from antiquity.

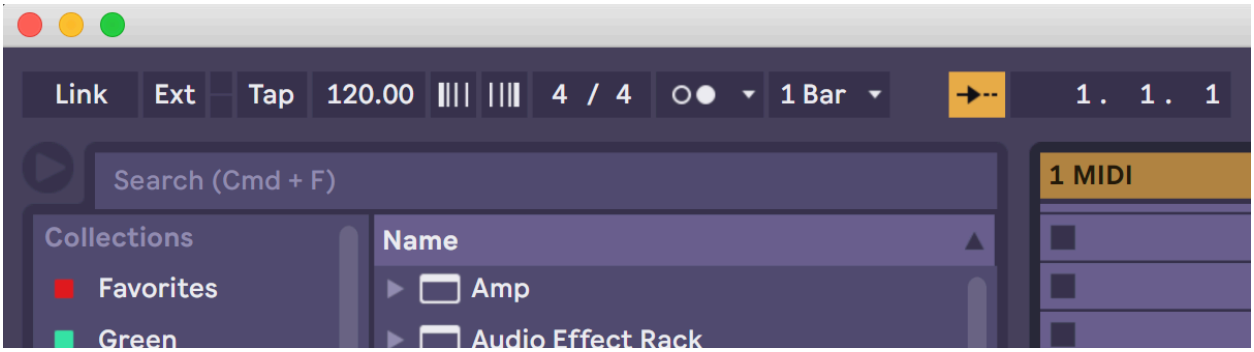
Each of these systems will allow the user to adapt and change the settings of the new file, changing the 4/4 to odd time signatures such as 5/16, 3/64, or 7/1 if he so desires. Other limitations like the 120-bpm tempo and the key signature can be changed easily. The composer can choose to ignore the C major key signature and compose 12 tone music using accidentals on every pitch. He can even adapt the notation programs with non-standard accidentals for microtonal intervals (though it is often much harder to get the system to play these intervals accurately). Most of these notation programs will even allow graphic notation to a certain degree (though again, it is next to impossible to get such things to be interpreted by the playback system).

That these systems are excellent for 90% of average compositional needs should go without saying. Many composers go their whole lives using nothing but Finale or Sibelius to make fabulous look parts. But the inherent choice manipulation in these systems comes with a number of costs, which, as educators of composers and technologists, we should absolutely be aware of.

Ableton Live is commonly hailed as the most forward-looking composition DAW on the market. I would not disagree in the slightest. It is easy to use both as a studio tool (using the Arrangement view) and as a live performance and improvisation tool (using the Session View). While for the standard university composition program, there is the inherent limitation that (unlike Live's main competitor, Avid's *Pro Tools*) there is no notation system built in, it is quite easy to use Live in conjunction with Finale, Sibelius and Dorico, using Propellerhead's ReWire protocol.[9] This situation may even suit new users better, as contrary to having to learn Pro Tools' antiquated notation system, Live allows you to notate your musical score in the notation program you already know and still play loops, audio and video files through Live's user-friendly composing environment.

If the reader is a veteran composer/technologist, he has most likely been aware of the limitations outlined above, and thus will see the easy integration of Live's audio functions with the notation software of their choice as something of a godsend. However, limitations still exist in this workflow. We are still defaulting to 4/4, C major, 12 tones to an octave, stereo audio, etc...in essence, we are still victims of the choice manipulation we started with above.

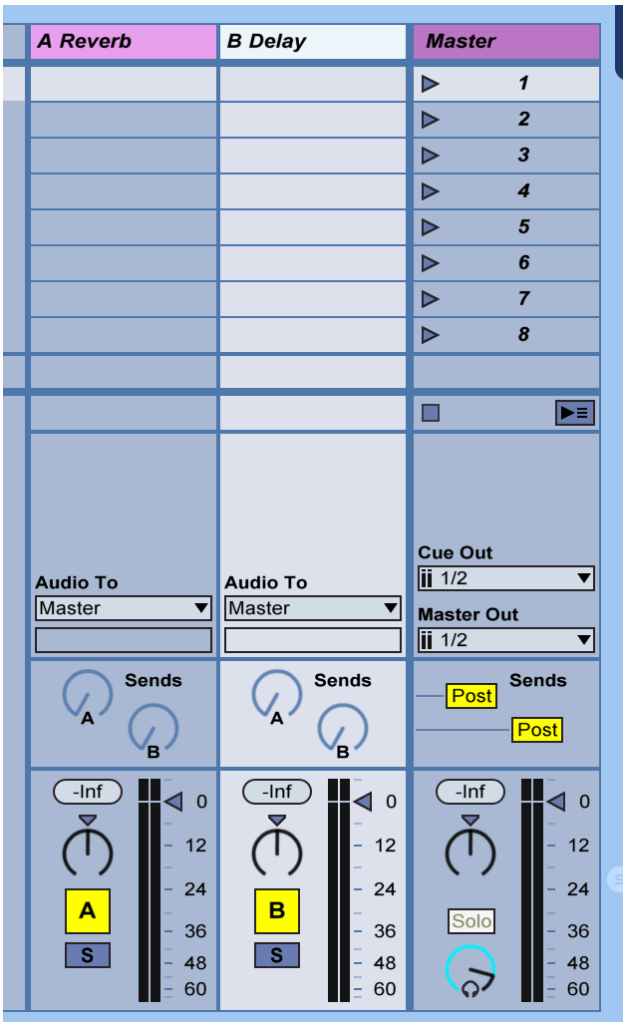
[9] https://usermanuals.finalemusic.com/FinaleWin/Content/Finale/ReWire.htm



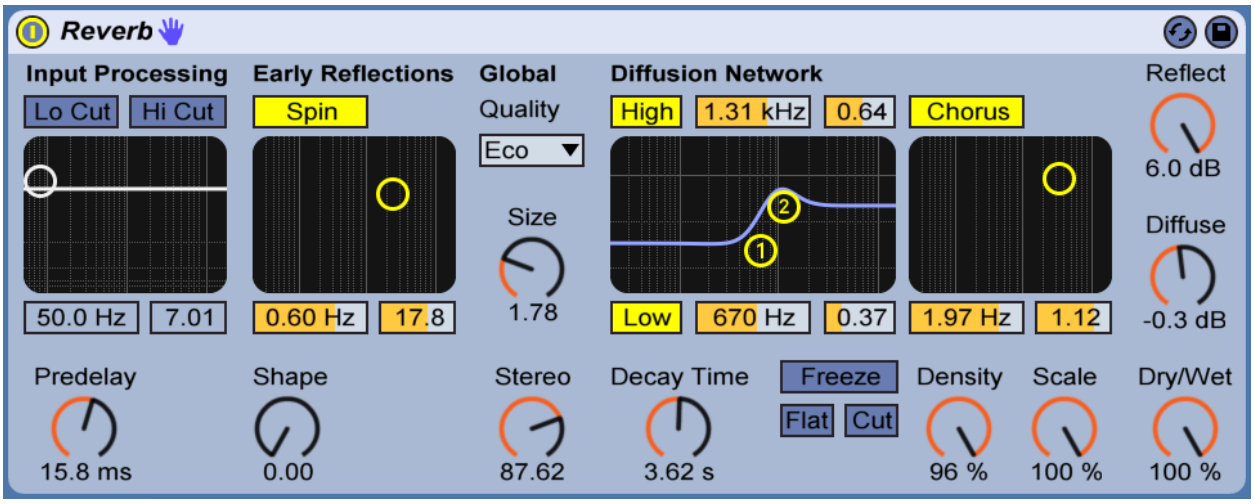
Live 10-Suite; Default document.

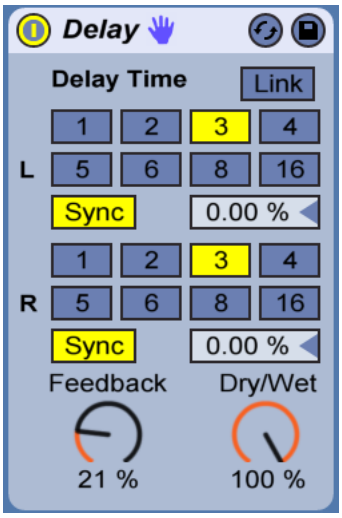
A complex environment like Live comes with even deeper inherent assumptions...

It assumes the user most likely desires every file to contain at least two effect return channels (Reverb and Delay):



...and that the user assumes they should be set up in the following manner...



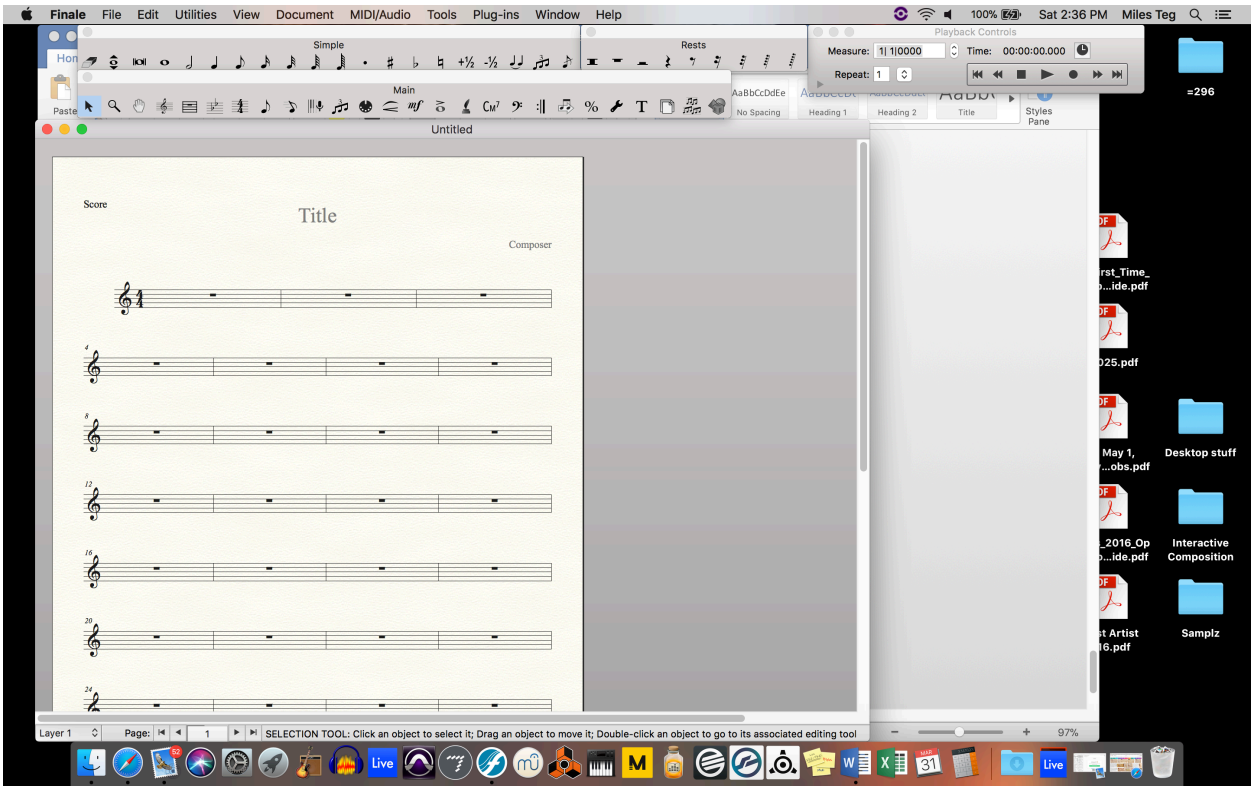


This is not intended as a criticism of Live as a DAW, or as a compositional tool. On the contrary, I believe wholeheartedly that Live is the best DAW for teaching music technology. In my position teaching at the Department of Music and Arts Technology at Indiana University-Purdue University Indianapolis (IUPUI), Ableton Live is fully integrated as the central piece of software students learn throughout the entire BSMT curriculum. Elsewhere in the music world, Ableton has insinuated Live into the setups of pop music artists, nightclubs, prestigious music technology conferences, IRCAM[10] and (perhaps most surprisingly) Sunday services at your local community house of worship.[11] However, as the software is marketed toward ease of use by all levels of users in these many different situations, we come closer and closer to a "standard" way of using Live as a DAW. If Live is not your preferred DAW, the effect is the same. No matter the reach of the software environment, notation system or DAW, the sheer number of users and simple market forces will drive the programmers to whittle down the unconventional pathways for music-making in favor of bland defaults.

[10] https://www.ableton.com/en/packs/ircamax-2/
[11] https://churchfront.com/blog-churchfront/2018/2/10/faq-about-leading-worship-with-ableton-live

As with the paper notation system above, if all a composer wants to do is produce music for "average" situations, the defaults are perfectly capable of handling the majority of compositional tasks. But academic rigor demands that educators not be in the business of teaching students to do that which (with ever-increasing ease) comes easiest. Academics, as a species, must reject defaults. And so, to the 20th Century composition students my teachers advocated abandoning the computer notation system as the default and returning to paper composition as it frees the user up to imagine in many (though, as illuminated above, not all) directions.

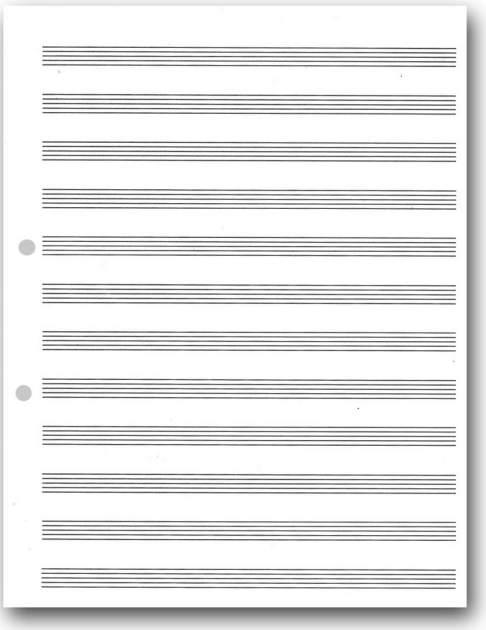
Thusly, my teacher Frank Felice at Butler University[12] said instead of beginning this way:



Makemusic's Finale, Version 25.; Music notation software.

I should begin with this:

[12] https://www.butler.edu/directory/user/ffelice



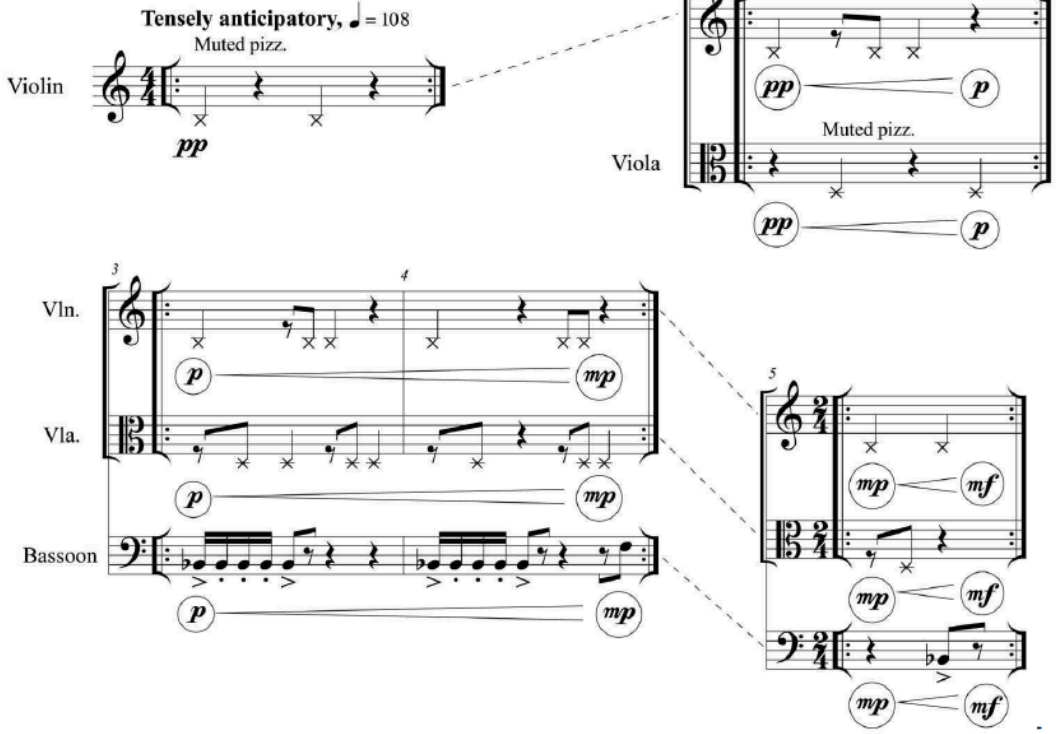
Being a young upstart composer, I resisted this for a very long time, but by the time I was hearing the same advice from Steve Rouse at the University of Louisville,[13] I relented and began to compose paper-first, entering the results into the computer afterward. This taught me firstly to never set ANY limits on my ideas as a composer (especially when beginning a piece) but also taught me to seek out newer and stranger ways to manipulate the defaults in the notation system to arrive at interesting adaptions of what the given system can do:

[13] http://louisville.edu/music/faculty-staff/Faculty/steve-rouse

now we are murderers as well

jason palamara

Play each measure 2-4 times before moving on. Measures should "line up" (i.e., beat 1 should be the same for each instrument, etc...). If one instrument moves on before another the second instrument should move on as soon as it seems prudent so that no one gets more than 1 measure ahead of anyone else. Players may periodically need to "fudge" certain measures to make sure their measures line up with other players. In general, violinist should cue downbeat of each measure.

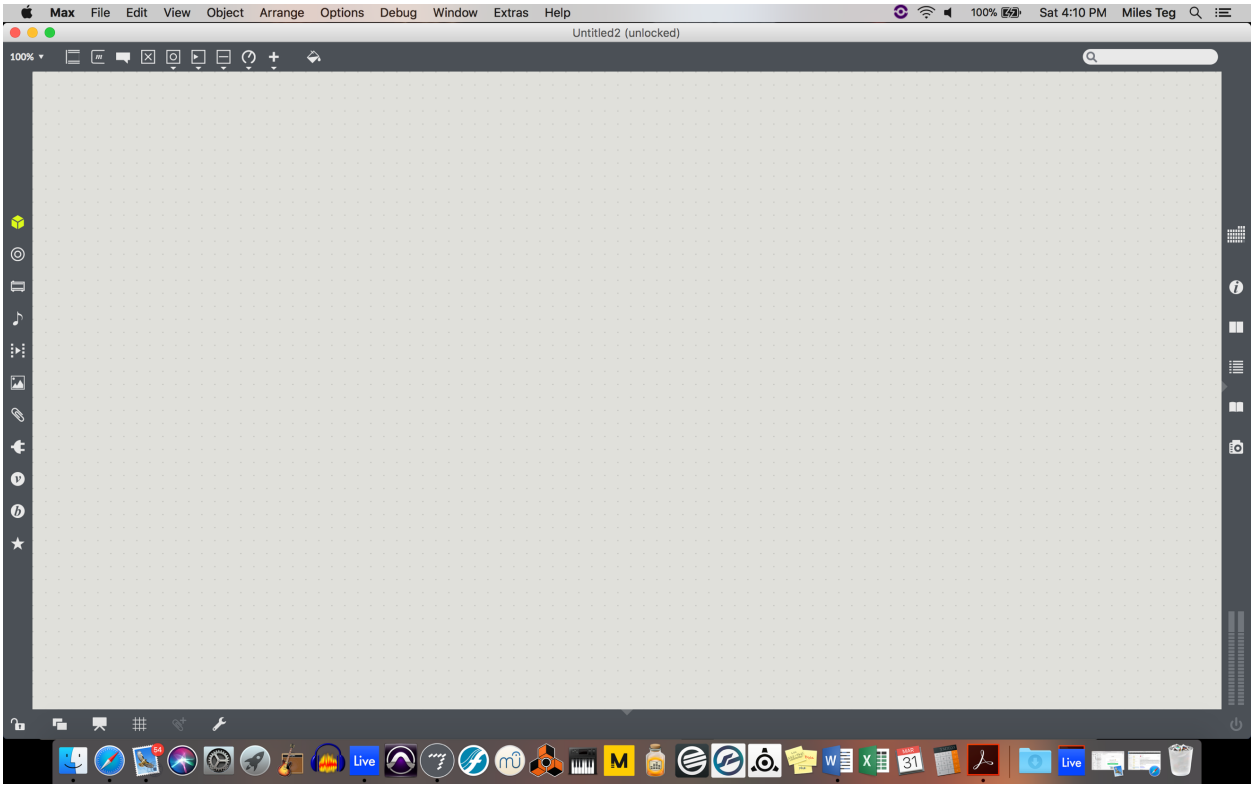


Jason Palamara, ...now we are murderers as well... (2014); A piece produced using a blend of techniques, paper-composed, but rendered with Finale, Adobe Photoshop, custom fonts and hand writing:

Unlike my various mentors, who foresaw the dangers and limitations of the all-digital composing environment, I will admit that the ship has largely sailed on this argument. I still see the value in teaching acoustic composers to abandon limitations by composing in a paper environment. But I no longer see any value in teaching composers who see a distinction between acoustic music and electronic music. Every student (not just composers, but theorists, musicologists, performers, music therapists, etc...) need to understand music technology at basic levels.[14] In essence, there is no more acoustic music realm separate from the electro-acoustic music realm. Technology is pervasive and thus music technology has pervaded the musical landscape. If the reader is an academic at a university or college, it makes a lot of good sense to consider the composition department of your institution as the avant-garde of this offensive. As composers were the first to bring electronic media into the concert hall, they must also be the ones to bring technological knowledge to the classroom at large.

The 21st Century equivalent of paper composing is musical computer programming.

The default file that results when you open Max looks like this:



[14] A great argument for this is made in V.J. Manzo's *Max/MSP/Jitter for Music*.

Like the blank staff paper, this environment gives us not limitations, but multitudinous options. It is true that in order to teach composition with Max, you first need to teach a student a LOT of other things. The Max environment begins as a *tabula rasa* even less structured and limited than the blank staff paper. However, I have found that after only a semester of concentrated Max study, most students can start to experiment with compositional procedures they would NEVER invent in Live, Finale or any of the other options listed above. Add in the fact that Max works seamlessly with Live (Ableton recently purchased Max's parent company Cycling 74, and has recently released Live 10, which was completely rewritten to accommodate Max at a fundamental level), and one starts to see an unbeatable workflow for student composers, from a notation program of their choice (for interfacing with human performers via the standard paper score), audio production and playback via Live and envelope-pushing experiments driving innovation via the Max language. This workflow can be run the opposite direction or start in the middle or cut out one of the elements ("Maybe for this piece we don't need a score." or "maybe we don't need a weird interface for this DJ set") but prudence seems to suggest that any composition program at an academic institution must teach all three of these things simultaneously.

To do otherwise is to take a step back from innovation, back toward the past, which will undoubtedly be easier, but ultimately less meaningful and less fulfilling. The step backward will make it easier to accommodate our students' default understanding of "the way music usually works." The step backward will most likely not start arguments. The step backward might even end in more funding for your department. However, it will not edify, develop or even attract the next generation of composer-innovators.