AUMI: Adaptive Use Musical Instrument

Turning Motion into Sound. Musical Improvisation for Every *Body*.

version 2.2.0

The Adaptive Use Musical Instruments (**AUMI**) software interface enables the user to play sounds and musical phrases through movement and gestures. This is an entry to improvisation rather than "hitting the right notes" or playing set pieces of music. Instead, the software uses music as a way for participants to express a range of affects, both by themselves and in response to, or in conversation with, others.

The original focus of the **AUMI** interface was on children with profound disabilities and their teachers, therapists, caregivers, and families. In taking these participants as its starting point the project attempts to make musical improvisation and collaboration accessible to the widest possible range of individuals and communities. This approach also opens up the possibility of learning more about the relations between ability, the fullest possible range of bodies and minds, creativity and improvisation, from within a cultural context that does not always acknowledge or accept people with disabilities. The AUMI user base includes adults with and without disabilities, seniors, participants of independent living centers, artists with and without disabilities, and participants of mixed-ability, cross-generational community jam sessions, and many others.

AUMI continues to be revised and improved with feedback from anyone who uses it. We want to hear from you. Send feedback to info@aumiapp.com .

AUMI for iOS was developed for the Deep Listening Institute by Henry Lowengard, and adapted from the desktop version of AUMI, which is also available for download from aumiapp.com

If you see a word with a dotted underline, it's a Glossary item. Touch it to get a quick hint about the term. Touch it again to dismiss the window.

AUMI websites:

- The Official AUMI for iOS Web site is at http://aumiapp.com.
- **AUMI** also has a presence on Facebook at :https://www.facebook.com/AdaptiveUse.

You can get software support by emailing: info@aumiapp.com

This link points to a PDF copy of these instructions. You can export them to iBooks or print them out for reference.

AUMI was developed with the support of the The Gould Family Foundation, Improvisation, Community, and Social Practice (ICASP), and International Institute for Critical Studies in Improvisation (IICSI). Further AUMI development is supported by a grant from the Craig H. Neilsen Foundation.

This is AUMI for iOS version 2.2.0

Screenshots used in these instructions are taken from various models and simulations of iOS devices and may not look exactly like what is displayed on your device!

AUMI for iOS is also available for MacOs 12.4 and later on Apple Silicon devices in a somewhat untested but workable capacity.

USING AUMI

This section is a broad overview of setting up and playing AUMI. Many more details are covered in specifically related sections.

SETTING UP THE AUMI PLAY SPACE

AUMI uses either the front- or back- facing camera to track motion to control which sounds are played. For this to work optimally, good lighting, a neutral background, and a steady support for the iPad, iPhone, or iPod Touch being used are needed. The more neutral the background, the better **AUMI** will be able to find intentional motion. The Apple iPad folding case is a pretty good support, but you can also use commercially available stands and mounts, and in a pinch, some big rubber bands, a chair or a pole, and some creativity will also do.
Good lighting means your subject is not backlit, which will obscure details that need tracking for motion and face tracking and dulls colors for color tracking. Make sure there is no prominent coloration in your lighting, which can happen if the **AUMI** player is shadowed by a colored tent or window.
By turning on the "See Spots" feature of the Motion tracker, you can visualize what that tracker thinks is "interesting" and make adjustments so that an **AUMI** player's motion is emphasized. More hints for this are covered in the Motion Tracker section of these instructions.

PREPARING YOUR DEVICE

AUMI runs on all iOS devices - iPhones, iPod touches, iPad, iPad minis, iPad PRO - running iOS 9.3 and above which have cameras. *You will need to confirm that you want to use the camera when a permissions dialog box appears the first time you use AUMI.*
For a better experience, you may want to:

- Adjust the screen brightness for the ambient lighting in the room
- Turn off gestures that relate to multitasking and the dock (iPad only). This is controlled in the Settings app, under "General", then "Gestures", then turn off the 4 and 5 finger swipes. Sometimes I find it useful to switch back and forth to MIDI instruments running in the background, but usually, multi-touch gestures are used to play and control AUMI and shouldn't be misinterpreted!
- Turn off keyboard clicks. In the Settings app, look for "Sounds" then "Keyboard Clicks"
- If it's an iPhone or iPad with cell service, and you are in a performance situation, go into "Airplane mode" and it won't spend time looking for cell service or WiFi, which **AUMI** doesn't need for performance. You will need networking if you intend to download new AUMI Instruments, though.
- Some MIDI instruments may need to be started before you start **AUMI** if you want **AUMI** to play them.
- AUMI supports "Dark Mode" in iOS13 and beyond. These instructions mix light mode and dark mode screenshots though.

PLAYING AUMI

You can play AUMI right away when it starts up, or by using the **Play AUMI** tab bar button to change the screen to the play screen. You will see a live video image, a circle with a red dot in the center (the Cursor), and a number of rectangles (the "sound_boxes").
The Cursor moves when AUMI detects movement in the video image. When the Cursor enters a sound box, a sound plays. You can put the Cursor anywhere on the screen with a single touch, and play AUMI with a single touch to move around the Cursor just as you can with video tracking.
The sound boxes can be rescaled by touching the corners of the box that encloses them with two fingers.

You can change various aspects of these interface elements with the Looks button.
You can hide and show all the toolbars, and make a completely clean (and therefore safe to touch) screen by tapping with three fingers.
There is an optional notice that warns you that it's about to hide the screen. You can cancel that action with "DON'T", approve it with "YES", or keep the optional notice from coming back with "Don't show this notice again". The notice will time out after 6 seconds and "Not approve" the action. If the notice is set to not show again, it will approve the hiding action.

If the Cursor goes to the edge of the screen for 2 seconds, it will automatically recenter itself!

Two important buttons are also on the play space:

- The **SILENCE** button will immediately silence all sound and MIDI events.If you slide off of the button while it is touched, it will remain silenced until it its tapped again.
- The **RESET** button loads the setup named Default so that **AUMI** can be put in a predictable state. You can save any setup as "Default" and it wil use that. If you erase the setup named Default, one will be created that uses a motion tracker to play the Piano.

CONFIGURING AUMI

There are four major sections that configure AUMI's processing and UI:

- **INSTRUMENTS** is where you choose an instrument, as well as the number of available notes, polyphony options, scales, runtime parameters like volume, cutoff time, and velocity, and MIDI parameters.
  This button is on the main video screen for iPads and in the tab bar on smaller devices.
- **CAMERAS & TRACKERS Settings** selects the camera to use and its zoom amount, which tracker to interpret the video stream, and parameters to refine that tracker. Trackers are algorithms that detect different kinds of motion that moves the Cursor. There are a number of adjustments that can be made to the tracker software that can help it work best for your device and the environment it will be working in.
- **TIMING & CHORDS**, can turn a single choice of a sound box into a specific rhythm and chord combination. This can help make a continuous texture of sound to improvise over. These controls can solve some problems with getting an intended sound choice to be played in a specific rhythm.
- **LOOKS** controls the placement and colors of the interface elements on the play screen.

USING SETUPS

A Setup stores all the parameters for an **AUMI** session: the instrument, its looks, a fully configured tracker, and any timing and chords that are to be used.
Setups are maintained by using the Setup screen.
This includes naming, renaming, loading, deleting, and sharing setups either in a peer-to-peer fashion or as a shared document.

REPORTING

AUMI has the ability to store some data associated with its use, and export this data as CSV files to be used with reporting software. This reporting is associated with the Setup name, which could be set to name a user and a session name for particular tests, and other metadata useful in data in making the reports.
By default, all reporting is disabled. If you are considering the use of reports, please see the LEGAL document. If you are not interested in reporting, you can leave the metadata information spaces blank.

The name is also used to identify saved instrument setups. If you have already saved some setups, you can load one from a list with the "List Setups" button.

The Setup page in no way affects the ability to play **AUMI**, nor is this information sent to any server.

AUMI can refine the way it turns the Cursor position relative to the sound boxes into sound. Read the Instruments section to find out more.

SOME TIPS AND HINTS

Some **AUMI** users are only capable of extremely limited voluntary motion. **AUMI** can be adjusted to accommodate their needs in a number of ways:

- You can rescale the sound boxes by "pinching" the screen. If you put a lot of sound boxes in a small space, smaller motion is more likely to initiate a sound!
- You can zoom the camera in to get faster response. It's not really "zooming" as much as taking an excerpt of the middle of the image, but that may help **AUMI** find the motion it needs to play sound.
- The "Mult" slider multiplies the amount of motion that the motion tracking software finds, so that it can move the Cursor more with each motion. Even an eye blink or a tongue movement can control the music.
- AUMI can make the timing of its note events regular so it can play with a regular beat.See the TIMING & CHORDS configuration section
- You can get feedback on what **AUMI**'s trackers are "interested" in tracking by turning on the "Show Spots" (or "Show Areas" if using color tracking) button in the VIDEO CAMERA AND TRACKER SETTINGS screen.
  For the Motion tracker, the screen will display little labels at the positions of the tracking spots it has found. The blue labels are points that have moved enough to be considered for moving the Cursor, while the paler ones are currently being ignored until they move more later.
  For the Color Trackers, areas with the selected colors are shown as a paler version of itself.
- **AUMI** can play over other music making programs and synthesizers if they can play in the background. Improvise with **AUMI** over a Music track!
- **AUMI's'** MIDI playing feature allows a user to play anything that understands MIDI "Note on", "Note off", and "Program selection" commands which are not only synthesizers and samplers, but lighting consoles and other media devices. **AUMI** can control other MIDI instruments on a laptop connected via Wi-Fi, for instance, in Apple's Garage Band, and also other MIDI apps running on the same device. When hosted in iOS based hosts, those other apps can add effects, recording, and sharing features missing from **AUMI**. That said, **AUMI** is not an Audio Unit (AUv3) plugin or Inter App Audio (IAA) provider.
- The Color Tracker is very fast and precise. If you make a circle layout and use a scale of your choice, you can actually play a melody. Using the timing feature can help keep the melody regularly timed.

RECORDING VIDEO

As of iOS11 and Yosemite (Mac OS X 10.10) or later on a Mac OS system, you can record directly from a connected iPhone or iPad by using the QuickTime Player app. Simply select "New Movie Recording" and in the on-screen control, pick the devices name in the drop down menu (the "v") for both video and audio. Then record and trim as usual.
If you have another kind of computer that can record from an HDMI stream, you might be able to do it by using hardware: an HDMI adapter and cable to a video recording device. Modern iPads and iPhones can transmit video and audio over WiFi to an AirPlay(™ Apple) equipped device, such as a flat screen TV or video recorder.
In MacOS Ventura and later, there is built in AirPlay emulation on your Mac. See "AirPlay Receiver" in the "AirDrop & Handoff" section of the System Setting menu. There is also AirPlay emulating software for older versions and other operating systems: the device transmits video (and audio) over to a computer that can pick it up and record it, using a program called AirServer, among others. Sometimes it's a little finicky, but that's how I've made some earlier videos of AUMI.

I'd suggest just using an external video camera to record both AUMI and the real performer using it, which gives a better idea about what is happening!

INTERFACE

This is a quick overview of the toolbar and interface buttons. Click on them for more details!

MAIN TOOLBAR

	Play AUMI The interactive video interface.
	Instruments Pick Instruments, set the volume, pick a scale and other instrument related features. On iPhones, this is in the toolbar, and on iPads, this is accessed from the side menu.
MIDI	MIDI Configure AUMI's MIDI playing features. On iPhones, this is in the toolbar, and on iPads, this is part of the instruments dialog box.
	Instructions Leads to these instructions
AUMI	Setup Load and Save AUMI settings like scales, instruments, video and timing, send and receive Setups to other devices, set logging metadata, enable logging to create reports, and read and export reports.

AUMI PLAY PAGE TOOLBAR

Looks	Looks Change aspects of how AUMI looks, such as colors, sound box layouts, and sizes. This is launched from the "Looks" "button at the left of the main video screen.
Instruments	Instruments Pick Instruments, set the volume, pick a scale and other instrument related features. On iPhones, this is in the toolbar, and on iPads, this is accessed from the side menu.
Sound Order	Sound Order Assign sounds to sound boxes. This is launched from the "Sound Order" button at the left of the main video screen. This button does not appear when using melodic instruments, which order sounds by using scales.
Cameras & Trackers	Video Camera and Trackers Settings Change the size, resolution of the video cameras, choose tracker, and adjust tracking parameters.
Timing & Chords	Configure Timing & Chords Change the options and speeds of AUMI's timing quantization feature. It also configures chords and arpeggios.
SILENCE CLEAR MIDI	SILENCE or CLEAR MIDI Immediately stops the playing sound, whether it's from AUMI or via MIDI. Sliding off the button will lock it, it will rename itself to "RESUME", and a "SILENCED" message will appear on screen. Tap it again to resume playing.
RESET	RESET Will load the Setup named **Default**. This will help you reset the system to a known state. You could also go to Setups and load any other Setup you like, but this is right there on the play screen. If there is no setup named Default, one will be created that is a Piano with a Motion Tracker. Touching this button will show an optional notice that warns you that it's about to reload the Default setup. You can cancel that action with "DON'T", approve it with "YES", or keep the optional notice from coming back with "Don't show this notice again". The notice will time out after 6 seconds and not approve the action. If the notice is set to not show again, it will approve the resetting action.

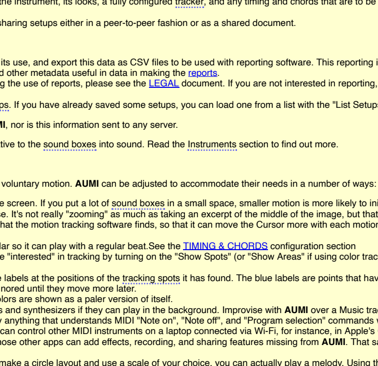
The user interface is different on iPads and iPhones. On iPhones, the **Instruments** and **MIDI** buttons are on the **MAIN TOOLBAR**. On iPads, the **Instruments** control button is part of the **AUMI PLAY PAGE TOOLBAR**, and contains the MIDI controls as well.

AUMI works on iPhones and iPod touches, but is best on iPads, iPad Pros, and iPad Minis. Newer models will be faster, especially for tracking!

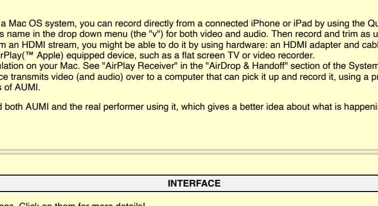
AUMI occasionally puts up notices which can be dismissed by tapping the "done" button. Most of these informational notices go away by them selves after two seconds, and the "optional" notices go away after 6 seconds. Notices about movement and event reporting, though, require a manual confirmation.

The official **AUMI** Web site at aumiapp.com is here, featuring more information, videos, support, news, and tips and hints.

SETUP



iPad setup screen



iPhone setup screen

On the Setup Screen, you can save and load instrument and other configuration data, which together is called a **Setup** , by using the "Save Setup" button and the list of already saved setups.
The **Save Setup** button saves the current instrument and its layout, colors, and sound order to a file named `[setup name].aumi`. It is in Apple "plist" format, related to XML.

That saved file is visible in AUMI's section of the Files app, and also seen if the device is connected to a MacOs computer and seen as a device in the Finder. Older devices may need to use the iTunes Document interface.
The list of setups has an automatically created description line that tells

- Which category of instrument it is as seen in the instrument menu, by using icons
- The instrument name
- Which scale it's using if it's melodic
- Which tracker it's using
- Which timing style it's using, if any
- How many steps or echos it's using, if any
- Which chord type it's using, if any

You can organize instrument setups for an AUMI user by adding a user name to the setup name, e.g. `Clara K. sitar`.

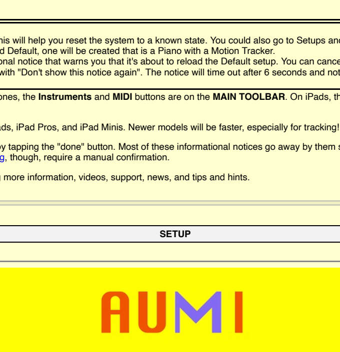
Listening and Sending
AUMI can be configured so that you can send a Setup from the device it's running on to another copy of **AUMI** running on a different device. This allows one device to change aspects of another device without needing to touch the screen.
This feature works even if the receiving device has a screen in Installation Mode that can't be easily unlocked.
Listening and Sending is using Apple's "Multi-peer Connectivity" feature. That means all the devices involved should be on a local network, or have Bluetooth enabled.
You can designate a device to listen for setups by touching the "Listen for Setups" button. You can actually do this with up to 7 devices!
On another device running **AUMI**, you can then send the current Setup on that device to the listening device(s) by touching "Send Setup". You'll be presented with a list of "nearby" devices that are listening as it discovers them. Touch the device names of the devices you wish to send the Setup to. It should connect and change the Setup on the listening device, and put up a notice that tells you so. If it fails for some reason, there will be another notice telling you that.

AUMI can tell the listening device to load an AUMI Instrument that it doesn't have if it knows where to get it from. "Send Setup" has either a "smiley face" or an "X smiley face" next to the name if the Setup is using a user loaded instrument. If that instrument is an "AUMI Instrument" file loaded from a website, there will be a "smiley face", meaning that the receiver can attempt to download it from the original source if it's not on the device already. If there's an X, that instrument cannot be sent. AUMI will not send audio data in a Setup, it only sends the URL of where to find audio data. If you send a setup that has User Sounds in it, it will work if the receiving device has those sounds installed under the same name. If the sender is sending an AUMI Instrument that was loaded on that sending device, it will tell the receiver to load that instrument (because it remembers where it was loaded from), but otherwise, it will use the Piano.
Once the setup is received, it can be saved on the device that received it by tapping "Save Setup".

Another way to distribute setups is to use the "Share Setup" button. This is a way to send a Setup through messaging, email, AirDrop, or third party tools that share documents. Since they are special temporary documents, they are named with the suffix "_EXPORT.aumi". These in turn can be collected as setups in a cloud-based directory, or on a website, so that people using AUMI remotely together can easily load Setups used for their performances.

Reports
The **Setup** page is also where those who are using the reports feature may set up the metadata used in recording activity during an **AUMI** session.
The report button brings up an interface for exporting the AUMI report files. These files are a comma separated value files (CSV), supported by most spreadsheet software. See the reports section for more details. See the legal section prior to enabling the reports feature.

PLAY AUMI



This is the main interface to be used while playing **AUMI** (iPad version).

Over a live video image, **AUMI** shows a set of rectangular "sound_boxes" and a circular Cursor, which is what initiates sounds as it moves into the sound boxes.
You have the choice of either showing the live video on the screen, or replacing it with a neutral background. Some users prefer not to see themselves while playing, while others enjoy the visual feedback of watching their movements interact with the Cursor and Sound Boxes. Others go back and forth, sometimes turning off the video to reduce the distraction of trying to make a movement make a particular sound, in order to focus more on listening, or to turn the attention of a group from watching individual screens to relating to one another.
You can also set the position of the Cursor by touching the screen, and use this method exclusively for controlling AUMI. There is a tracker designed solely for use by touches, that does not use video at all, called the Touch Tracker.

For most instrumetns, when the Cursor enters a sound box, the corresponding sound is played, and the box highlights relative to the volume of the sound that is playing.
For Loop instruments, the nearness of the Cursor to a Sound Box controls the mix of a sound loop playing in that box.
For Relative Instruments, the relative motion of the Cursor chooses which sound to play.

AUMI's Motion Tracker works by detecting and tracking the movement of "interesting" parts of a video image. "Interesting" in this case usually means high contrast and angular shaped parts of the image.
The Motion Tracker works best when there is clear lighting, and a blank background behind the user.

The relative motion of the tracking spots moves the Cursor on the screen. The Cursor has *no direct* relationship with the tracking spots. This allows any motion it detects in the image to control the Cursor, and thereby initiate the sounds.
There's a toggle button, "Show Spots," ("Show Areas" for Color Trackers) in the Video Camera and Tracker Settings screen, that makes the tracking spots visible when clicked. Click it again to hide the spots.
For the Face Tracker, little eye and mouth icons show the position of the eyes and mouth that it finds.
For the Color Tracker, you can see the areas that are the selected group of colors highlighted in paler versions of themselves.

The Face Tracker detects faces with machine learning and put the Cursor right on the face's nose. It's not as flexible as the motion tracker, but it is pretty fast - which might make it the right tracker for your situation!

The Color Tracker detects colors and put the Cursor in the middle of where the largest block of that color is onscreen. While it's very fast, you need to select the color to track by double tapping the screen and sliding your finger around to pick up variants of that color.

The Distance Tracker is the same as the Color Tracker, except the Y axis is replaced with value derived from the area of the largest block of color. That roughly corresponds to distance, and so morion towards and away from the screen (camera) can be used!

The Touch Tracker uses just a single touch to play the screen, with no video used at all. The video image is replaced with the background color.

You can change the size and shape of the rectangle the sound boxes are laid out in by touching the screen with two fingers. The touch points move the closest corners of the top and bottom of the containing rectangle.
The layout of the rectangles can also be changed, except for Loop and Relative instruments, by using the Looks screen controls. The layouts are Horizontal, Vertical, Gridded, and Circular. The Gridded and Circular layouts enable users to play notes out of their usual order.
The Looks" screen controls can change the color, transparency, and thickness of the sound box outlines, and the color, transparency, and size of the Cursor.

On an iPad, the "Instruments" button appears on this screen, while on an iPhone, that button is on the navigation bar.

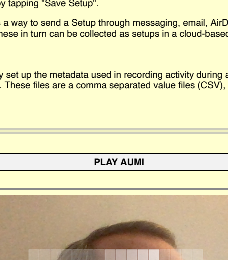
There is a big red "SILENCE" button in case you want to stop the sound that's playing and clear the queued Timing based notes. While it's held down, the trackers and sound will be disabled and even loops will stop playing. This is called "Silent Mode". You can lock it in "Silent Mode" by sliding off of the button and then lifting your finger. When you let go, or tap it again if it's locked, the trackers will work again and the loops will play. While in "Silent Mode", the button label will change to "RESUME"
If the instrument is a MIDI instrument, this button will change its label to "CLEAR MIDI" and will silence MIDI notes.

To reset AUMI to a predictable configuration, tap the "RESET" btton. It actually loads a Setup named "Default". "Default" is automatically added to the list of Setups, but you can save any setup you like under that name, and the Reset button will load it.

You can hide and show all the toolbars, and make a completely clean (and safe to touch) screen by tapping with three fingers.

Note: in iOS 13 and on, a three finger tap is now interpreted as a part of a cut, copy, or paste operation. To do a three finger tap that will be recognized in AUMI, you may have to put each finger down slowly (one-uh-two-uh-three-uh) for it to be detected properly. This was fixed in iOS 13.1 and later!
When AUMI is used in a public installation there's a chance that you may want to lock its control interface. One way would be to put it behind glass, but if the device is exposed, it needs another method.
There is an **Installation Mode** which locks the screen from revealing the toolbars. This is enabled and disabled by touching down and holding two fingers - possibly resizing the Sound Boxes' bounding rectangle - while moving a third finger a long distance of more than 100 pixels. When enabled, it prevents a "normal" three-finger tap from revealing the controls, and also disables a four-finger tap from locking or unlocking the size of the bounding rectangle. This is designed to be a little obscure! It also locks the Sound Boxes' rectangle size, even when you go back to showing the normal interface.
There is an optional notice that warns you that it's about to go into installation mode. You can cancel that action with "DON'T", approve it with "YES", or keep the optional notice from coming back with "Don't show this notice again". The notice will time out after 6 seconds and "Not approve" the action. If the notice is set to not show again, it will approve going into installation mode.

INSTRUMENTS



On iPads, the Instruments screen is accessed with a button on the left of the **Play AUMI** screen. On iPhones and iPod Touches, it's in the tool bar at the bottom of the screen.
The Instruments screen is where you select an instrument and its properties, and set the general volume, and a few other options.
A big scrolling instrument picker is divided into five parts. Some instruments don't use all the parts, so they are blanked out.
Instruments are collections of sounds that AUMI can play in a number of ways. AUMI comes with a good variety of sounds, some conventional, some unconventional. AUMI does not currently play audio though Apple's Inter App Audio or Audio Unit interfaces, nor with Audiobus, but it can send MIDI to apps which do support these features.
Instruments are categorized into sections, each with its own icon and background color, accessed by the scrolling control on the far left. The instruments associated with those categories are correspondingly colored.

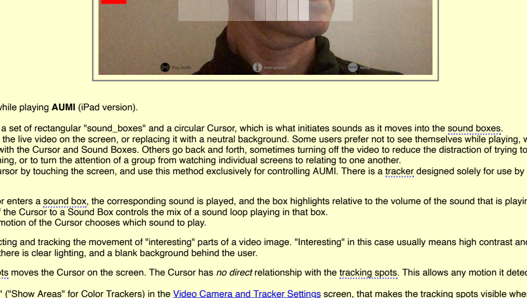
- Melodic instruments (green): They have a range of chromatically tuned samples that can be used to play melodies. Most melodic instruments have a range from MIDI note 36(C2) to MIDI note 96 (C7).
- Sample or percussive instruments (blue): They simply play sounds that are not tuned or in any particular order. The order can be rearranged by using the Sounds button.
- Looped instruments (yellow): All the sounds play simultaneously in a continuous loop. The closer the Cursor is to a sound's sound box, the louder that sound will play. If you make the size of the Cursor bigger, it will cover more sounds and you will hear more of them simultaneously in the mix. The choices for loop sounds and the number of them on the screen can be changed by using the Sound Order screen. There is a maximum of 32 sounds.
- Relative instruments (light purple): These sounds are played by using the relative motion of the Cursor, instead of its absolute position. The sounds are the same as all the melodic and all the Sampled sounds, and can be selected by using the Sound Order screen. However, only four sounds can be played.
- MIDI MIDI instrument (blue): Makes no sound by itself. It sends MIDI messages to other programs or devices.

User instruments are made by importing sound files. If they follow certain naming conventions, they can be organized into individual instruments. If there are no User instruments, the background color for those options are gray.

- Melodic User instruments (green): like the built-in melodics, they can be organized into scales and tuned.
- Sampled/Percussive User instruments (blue): like the built in samples, they can be reordered in the same way.
- Looped User instruments (yellow): like the built-in loops. This uses the non-melodic sounds. You must have at least 4 sounds for looping to be enabled. They can be reordered to choose which sounds to loop by using the Sound Order screen. There is a maximum of 32 sounds.
- Relative User Instruments (pink): like the built-in Relatives. You must have at least four sounds for this to be enabled.

The other parts of this control are as follows:

- An instrument selector. Each instrument name has a small image in front of it to help identify it.



  The instruments are:
  - **Melodic sounds: these can use scales in different keys.**
    For reference: MIDI note numbers for these pitches: `c2=36, c3=48, c4=60, c5=72, c6 = 84, c7 = 96`
    - **Piano**: piano, C2-C7
    - **Guitar long**: synthetic strings, C2-C7
    - **Guitar short**: synthetic strings, shorter than before, C2-C7
    - **Tines**: a sampled music box, C4(60) to C7(96)
    - **Reedy**: synthetic reed instrument, C2-C7
    - **Bowed**: synthetic string instrument, C2-C7
    - **Fifths**: Looping Fifths, pulsing every second, C2-C7
    - **Steel Drum**: C2-C7
    - **Kalimba**: C4-C7
    - **Synth Drum**: C2-C7
    - **Woodblock**: C2-C7
    - **Orchestra Hit**: C4-C6
    - **Sitar**: C2-C7
    - **Timpani**: C2-C4
    - **Tubular Bells**: C2-C7
    - **Glockenspiel**: C5-C7
    - **Tenor Recorder**: C3-Ab4
    - **Hand Pan**: C3-B4, C5-C6 have harmonics (Thanks, Jesse Stewart)
    - **Singer Henry**: A2-D5
    - **Singer Eleni**: D3-D6
    - **Choir**: a mixed choir C3-C6
  - **Non-Melodic sounds: these can be arranged in any order, but do not have scales.**
    - **Percussion**: sampled percussion sounds.
    - **Noises**: experimental rock band noises (Dr. Nerve's Nerve Events).
    - **Kitchen Percussion**: sounds of pots and pans (The Institute of Contemporary Music).
    - **Cartoon Sounds**: cartoon sound effects. (Screwy Squirrel, MGM)
    - **String Quartet**: The Soldier String Quartet and vocalist Shelley Hirsch.
    - **Dogs**: Dogs barking (http://www.freesfx.co.uk).
    - **Cats**: Cats meowing (from a YouTube compilation).
    - **On The Farm**: Farm animal sounds (https://freeanimalsounds.org/farm-animals/) .
    - **Waterphone**: Waterphones from Jesse Stewart's *Xenophora: Music for Solo Waterphone.*
  - **Loops: these are a circle of continuous sounds that can be mixed together.**
    The closer the Cursor is to a box, the louder the loop it represents will play.
    This way, slow movements can still play along with other musicians playing loops as the same rate, although some loops are more ambient and do not mesh synchronously with other loops.
    There can be from 4 to 32 sound boxes to play with loops. You can adjust the number with the slider in the Sound Order screen. The sounds are laid out like a clock, atarting from the top of the circle and choosing the next sound in clockwise order.
    - **Loops**: An instrument where the mix of 2 second long loops is controlled by the Cursor position.
    - **Marsh Loops**: The sounds of a marsh, from Dave Soldier's *Marsh Fugue*
    - **Fifth Loops**: Looping Fifths, pulsing every second which are arranged so they harmonize
    - **Tran Phu**: Recorded in Vietnam by Kala Pierson
    - **Pin Pia**: A traditional Thai instrument recorded by Dave Soldier
    - **Synthy Loops**: A collection of 2 second electronic loops.
    - **LP Lock Grooves**: A collection of loops that will synch with vinyl lock grooves at 33 1/3 RPM. (1.8 second loops)
    - **Glyptodont**: Sounds from a recording of Skip La Plante's *Glyptodont.*
    - **Troglodytes**: Sounds from Deep Listening Band's recording *Troglodyte's Delight.*
    - **Widow Jane Mine**: Tenor Recorder played in the Widow Jane Mine.
    - **Waterphone Loops**: Waterphones from Jesse Stewart's *Xenophora: Music for Solo Waterphone.*
    - **Leaf Drums**: Drumming loops from Leaf Miller. 110 BPM..
  - **Relative Motion**: All the sample playing instruments - melodic or not - can also be used in relative motion mode. Relative Motion versions of these instruments are marked with a "REL" sign at the end of their names. Relative motion uses the tracker to determine whether the motion was left, right, up or down, and plays a sound corresponding to that motion. The same Sound Order screen is used to assign sounds to the directions (in the order **Down, Right, Up, Left**). "Relatives" are limited to four sounds.
  - **MIDI**
    - **MIDI**: This will send MIDI events to either a connected MIDI device (via the "Camera Connection Kit" or other MIDI interface), or to a software MIDI synth running on the same device or within the network.
      Read more in the MIDI section.
  - **User Instruments**
    Adventurous users can add their own sound files to **AUMI** to be turned into instruments. An aesy way to do this is to touch the More button. Read the User Sounds section for details.
- The base note, if the instrument is melodic. This is like the tonic of the "key" of the selected scale. Note that many of the scales are a little more complicated than usual major, minor, and chromatic scales.
- The kind of scale to use if the instrument is melodic:
  - **Chroma**: a chromatic scale
  - **Major**: a major scale
  - **Penta**: a pentatonic scale
  - **Minor**: a minor scale
  - **Maj Triad**: a major triad I-III-V scale
  - **Min Triad**: a minor triad I-IIIb-V scale
  - **7th**: a seventh I-III-V-VIIb scale
  - **up down**: a melodic scale that goes in a pattern of up a major third, up a minor third, down a fourth, and up a minor third again.
  - **Blues**: a bluesy scale
  - **Pelog**: a beautiful scale based on Pelog Selsir, a Javanese scale.
  - *Modes: diatonic scales that start on other notes*
  - **Ionian**: Ionian mode.
  - **Dorian**: Dorian mode.
  - **Phrygian**: Phrygian mode.
  - **Lydian**: Lydian mode.
  - **Mixolydian**: Mixolydian mode.
  - **Aeolian**: Aeolian mode.
  - **Locrian**: Locrian mode.
  - *Fifth repeating scales: like "up down", they don't repeat by octaves but by fifths. These names are to make it easy to refer to them, and are non-standard.*
  - **Sun**: a major second, a minor third, a major second
  - **Earth**: a minor third, a major second, a major second
  - **Star**: a major third, a minor second, a major second (like Pelog)
  - **Moon**: a major third, a major second, a minor second
  - **Whole**: a whole tone scale

  The assignment of sounds to sound boxes is built dynamically from the scale picked, base note (key) for that scale, and what sound samples are available for the instrument. They start on the "base note" and create the scale by adding a cycle of intervals to that base note.
  If that base note is lower than the lowest note available in an instrument (like C4 for the Tines), the scale will be played in the base note's key, but only using notes within the range of the instrument. If the scale is a "mode", and the base note you choose is lower than the first note available in that instrument, it will start the scale on that base note in the first higher octave that is available for that instrument.
  The Chord feature, found in the Timing dialog, takes advantage of the scales choices to build chords and arpeggios.
- The number of sounds to put on the screen in "sound_boxes". Loop Instruments can play from 4 to 32 sounds or the maximum number of sounds available if less than 32. You can also set the number of sounds from within the Sound Order control.

Other controls are:

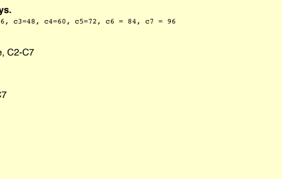
- **Show/Hide Names**: This controls whether labels show up in sound boxes.
- **Volume (Vol)**: The volume for playing internal instruments. If you are playing a MIDI Instrument, it will send a MIDI channel volume message.
- **Cutoff Time**: Some sounds play for a long time, and overlap each other. This can keep a user from hearing that their motion has started a new sound. By setting the cutoff time, the sound will stop playing after that time in seconds has elapsed. Cutoff time is roughly set in tenths of a second, and runs from 0.1 to 3 seconds. Setting it to 0 will let the sound play its natural length. You can set the time with the slider, and get more precise by using the "<" and ">" buttons, which change the time in 0.1 second increments.
- **Use/Ignore Velocity**: Normally, the Cursor's motion doesn't control the loudness of a sound. If this switch is set on, melodic instruments and sampled instruments will play more loudly if the Cursor moves into it faster!

  There are two sliders that set the range of the velocity. The **Velocity High**("High Vel" on iPhones) is probably more important. If you set it to a low value, it will take more velocity to make it play loudly (and it will be more sensitive!), whereas setting it higher means nearly any movement will be loud. The **Velocity Low** ("Low Vel" on iPhones) sets a level for the least velocity, so if this is higher than 0, you should always hear something, but it might be very quiet.

  Normally, MIDI instruments will use the direction perpendicular to the layout direction the sound areas to control MIDI velocity. If the velocity switch is set on, the speed of the Cursor will be reflected in the MIDI velocity of the played notes. Even when the Velocity switch is off, the low and high values are used as the low and high values of the sound boxes. You can actually set the "Low" value higher than the "High" and it will work backwards perfectly well!
  The setting for "volume" is also figured into the MIDI "velocity" value.
- **Polyphony** AUMI has a number of ways to control how long a sound is playing. This affects Melodic, Percussive, and to a lesser extent, MIDI instruments.
  - **(♬) Polyphonic** Normally, when any Sound Box is entered by the Cursor, its associated sound plays until it's done or until its cutoff time is reached. This can make for a lot of chaotic sound!
  - **(♩) Monophonic** When monophonic mode is on, only a single sound plays at a time. However, a chord will play that may have been set up with the Timing control screen, but only one chord at a time. This works best if there's no quantization going on. Entering a new sound box will immediately cut off the sound playing and play the new sound.
    In MIDI mode, staying in a Sound Box will keep the MIDI note playing until you leave the box, that is it will ignore the MIDI Off Delay setting. This is a good way to play MIDI sounds hat have a lot of evolution or arpeggiation!
  - **(|♩|) Monophonic Whole** This is a variant of Monophonic where the whole sample always plays (or as much as the Cutoff time allows). While the sound is playing, it's not interested in starting new sounds. This is a very specialized way of playing, designed for playing whole musical phrases, sentences, or words or phonemes, one at a time, that need to be played in their entirety. It acts like Monophonic in MIDI Mode, since there's no way to know when a MIDI note is over.

These parameters are saved in the user's setup file (see Setups).

LOOKS



The Looks screen controls lets you change the sizes, layouts, and colors of some interface elements.
Pick which element you want to change from the "Cursor", "Boxes", or "Backgr. (background)" selector button.

By touching in the array of colors, you change the color of the selected element.
The box under the Opacity slider will show you the current color setting.
The "Opacity" slider lets you change the color's opacity (transparency).
For Boxes, this chooses the color that the sound box is colored. Boxes are always transparent, but you can make them more transparent with the Opacity slider.
The top line is purely black and white, the line underneth shows very subtle shades of color!
The "Size" "slider is used to change these sizes:

- For **Cursor**, you can change the size of the Cursor with the slider. It can be set from 70 to 300 pixels.
- For **Boxes**, you can change the size of the sound box borders with the slider, from 1 to 20 pixels.
- For **Background**, (Backgr.) you can change the color of the background when you are not showing live video.

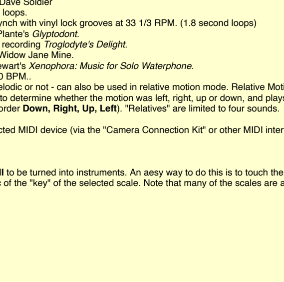
It's quite possible to set all the colors the same for a really minimal and rather mysterious kind of screen.

The **Lock** switch locks the shape of the layout. This disables the ability to rescale the bound box of the layout with **two-fingered touches**. This switch can also be interactively turned on and off with a **four-finger touch**, if the screen is not in Installation Mode. The best way to do this is to put one finger down on the screen and use the other hand to do a three finger tap! This way, you don't accidentally resize the layout.
Another way to toggle the layout lock is to resize as usual with two fingers, then keep holding them down until more than 5 seconds has passed. This is also true if the layout is already locked, just touching and holding for 5 seconds will unlock it.
When the layout is locked, the Looks button will show a Lock icon on it to remind you of that fact.

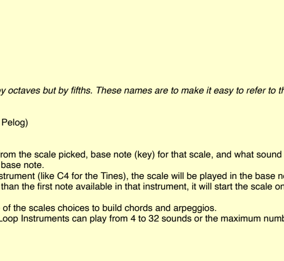
The **Video** switch lets you choose between showing live video or just using the background color. It has the same function as the "Hide Video" switch in the video camera and tracker configuration dialog.

The **layout buttons** select whether the sound boxes are laid out horizontally, vertically, in a grid, or in a circle.
The **direction arrow** is used to reverse the order that the sounds are laid out in for the Horizontal, Vertical, and Circular layouts.

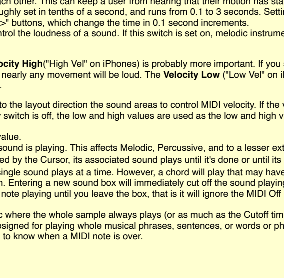
Vertical



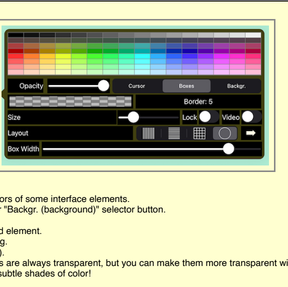
Horizontal



Grid



Circle

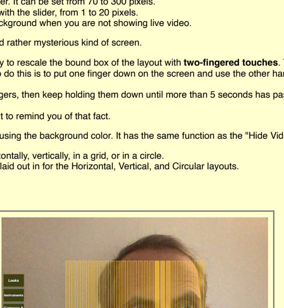


The **Box Width** slider can be used to make the sound boxes skinnier, thus putting more space between them. This way, it's easier not to play an adjacent sound box by mistake! AUMI will play the sound if you cross over a box quickly as well, even if it's only 1 pixel wide, so being skinnier is not a disadvantage that way.

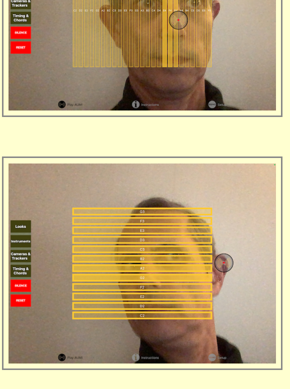
When you are using the MIDI instrument, and you are not using the Cursor's velocity, and if your layout is vertical, the position between top and bottom of the row of sound boxes is used as the note's "velocity," so that near the bottom of the grid is "low velocity" and near the top of the row is "high velocity". For a horizontal layout, left is "low velocity" and right is "high velocity"." These values are taken from the low and high velocity settings in the Instrumnet control.

To dismiss this control on an iPad, tap anywhere outside the popup. To dismiss this control on an iPhone, tap "Done".

Notes about the Grid



This gridded layout assigns notes in a special order that tries to associate nearby pitches with nearby Sound Boxes. This picture gives an idea of how the notes are ordered chromatically.



In the image, you can see they make more sense to observe cases.
There will be up to 15 "sounds available".

SOUND DRIVER

The screen is activated by touching the "Sound Driver" button on the "File Edit" screen.
Sounds can be loaded from the "Factory" or "Backup" sources, or deleted, renamed, Restored, Cleared, and Renamed. Rotation instruments, because the sounds of these instruments do not sound good when they are cleared.

Sounds can be sent to other devices, or received from other devices, using the "Device" button. Sounds can be scrambled, so they can be exchanged safely, and the sounds can be playing and other people can hear it. The scrambling function of sound the recording will be similar to the way of the voice.

Sounds can be "Cleared" (deleted) or "Restored" (reset to factory settings). Sounds can be "Renamed" (renamed). Sounds can be "Saved" (saved) and "Loaded" (loaded) from the "Factory" (factory) and "Backup" (backup) sources. The sound of the factory cannot be changed, but the sound of the backup can be changed. The factory sound is used when the sound of the backup is not saved. The sound of the factory is used when the sound of the backup is not saved.

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John Sullivan

For the AUMI Consortium: Prof. Sherrie Tucker (University of Kansas), Prof. Eric Lewis (McGill University, Montreal), Thomas Cuifo (Mt. Holyoke), Dr. Ellen Waterman, Gillian Siddall, and Jesse Stewart.
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- Dave Soldier and the Soldier String Quartet for the Marsh Loops, Pin Pia, and Soldier String Quartet Excerpts from "Sequence Girls", "Paris 1919" (featuring Shelley Hirsch on vocals), and "The Impossible String Quartet".
- Skip La Plante for Glyptodont .
- Deep Listening Band for Troglodyte's Delight.
- Kala Pierson for Tran Phu.
- The Institute of Contemporary Music for Kitchen Percussion. (via ccMixter.com)
- Free SFX for the Dogs
- Funny Cats and Kittens Meowing Compilation 2013 [HD](You Tube) for the Cats
- Farm animal sounds (https://freeanimalsounds.org/farm-animals/)
- Jesse Stewart's *Xenophora: Music for Solo Waterphone* and the Hand Pan sounds.
- Eleni Reyes, singer extraordinaire!
- Leaf Miller, AUMI pioneer and drummer!
- and Henry Lowengard of jhhl.net supplied the Music Box, Synthy Loops, LP Lock Grooves, Tenor Recorder in the Widow Jane Mine, Fifths, male voice, and prepared or synthesized the other samples and loops.

Many more "AUMI Instruments" can be found online aumiapp.com's AUMI Instrument page (http://AUMIapp.com/aumiinst.php) .
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Audiobus is © Audiobus, https://Audiob.us.
The feature tracking software is derived from KLT (Kanade-Lucas-Tomasi) from Stanford University.
The tutorial on Apple's Audio MIDI Setup Utility is "Using Your iPad as a Wireless MIDI Controller" by Joe Stallings.
The unzip code "SSZipArchive" is licensed as follows:

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AUMI websites:

- The Official AUMI for iOS Web site is at http://aumiapp.com.
- **AUMI** also has a presence on Facebook at :https://www.facebook.com/AdaptiveUse.

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Developed by Henry Lowengard
compile date: build version: