

Creating High Quality Audio for Listening Materials

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This paper introduces a practical step-by-step process for the creation of high-quality audio materials for use in EFL listening materials. The paper begins by explaining a simple approach based on using the built-in functionality of smartphones, showing in detail how to record and edit audio for use in language-learning activities. The use of effects such as equalization, compression, and noise reduction is explained, and the reader will learn how to export audio. By the end of the paper, the reader will have an understanding of the entire process of turning scripted or unscripted listening materials into a complete high-quality product that can be used in the classroom or for online learning activities.

本稿では、EFLのリスニング教材に使用する高品質な音声教材の作成手順を紹介する。まず、スマートフォンの機能を利用したシンプルな方法で、音声の録音や編集の方法を詳しく説明する。また、イコライザーやコンプレッション、ノイズリダクションなどのエフェクトの使用方法について解説し、読者にオーディオエクスポート機能が教示される。本稿の終わりには、スクリプトの有無に関係なく、リスニング教材を教室やオンライン学習で使用できる高品質な製品に仕上げるためのプロセス全体が理解できるようになる。

Many EFL teachers find that they need to create listening materials to meet the needs of their students. While most textbooks include professionally produced audio programs, and there is a wealth of useful listening material on YouTube and other

sites, these may not always be able to meet the specific learner needs that the teacher can recognize in his or her own students. Over the last decade, recording equipment has fallen greatly in price and accessibility to the point that teachers can afford to set up their own recording equipment, and the main challenge is no longer one of cost, but rather of understanding the technical issues of creating high-quality audio.

This paper introduces a step-by-process for the creation of high-quality audio materials for use in EFL listening materials. The paper begins by explaining a simple approach based on using the built-in functionality of smartphones, showing in detail how to record and edit audio for use in language-learning activities. Part 2 explains the use of effects, such as equalization, compression, and noise reduction. By the end of the paper, the reader will have an understanding of the entire process of turning scripted or unscripted listening materials into a complete high-quality product that can be used in the classroom or for online learning activities.

Aim of This Paper

The aim of this paper is to introduce and explain a practical step-by-step process on how to create high quality listening materials. The authors will walk the reader through the basic equipment needed and how to edit audio using DAW (Digital Audio Workstation) software. Additionally, they aim to show you how to export and efficiently share projects to make them available for your students either online or in the classroom.

The description of the creation of audio materials is divided into two parts below. Part 1 is probably the most beneficial and accessible section for most people because it involves simply recording audio using your smartphone or tablet and then editing the audio using DAW software. It is likely that most people have already used the voice memo application or a similar application on their smartphone at some point and are familiar with its basic use and principles. This is a great way to record audio, but the editing can be quite cumbersome within this application and many useful audio editing

features are not available on a smartphone. Part 2 explains how to enhance audio using EQ, compression, noise reduction, and other effects. It also explains how to export your audio.

Part 1. Simple Recording and Editing

In order to keep things as simple as possible, this section will be demonstrated using only a smartphone and a computer equipped with Audacity.

Basic Equipment for a Simple Setup

Most new smartphones/tablets have excellent microphones and are capable of capturing audio that is more than adequate in quality for use by educators. It is also possible to edit audio on a smartphone/tablet but is still quite cumbersome in most cases. Therefore, many people may find it easier to record on their smartphone/tablet and then edit their audio on a computer in separate DAW software such as Audacity. Also, a very simple and inexpensive way to immediately increase the audio quality is to invest in a USB microphone which can plug directly into a smartphone/tablet or computer. With that being said, here is a list of basic equipment that could be used in a simple setup:

- Smartphone/Tablet with voice memo, GarageBand, or other audio recording application
- Computer equipped with DAW software
- USB microphone (optional, but easy to use and a very effective way to increase audio quality)

Recording Audio on a Smartphone

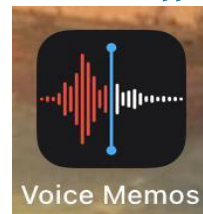
For this explanation, the Voice Memo application for iPhone will be used to demonstrate the process of recording audio with screenshots included. Many of the same principles applied in the Voice Memo application can be applied using other apps on Android or other phones/tablets.

Step 1. Open the Voice Memo Application

This is generally shown by the icon in Figure 1 which represents a sound wave. If you do not see it on your phone, you may need to search and download a suitable voice recorder app from the Apple Store or Google Play Store.

Figure 1

Voice Memo Application Icon



Step 2. Click the Record Button

Click the record button, usually a large red circle (Figure 2a). The app will immediately start recording audio. When the recording begins, it will start to create *waveforms*. Waveforms are a visual representation of the recorded audio and can give you some clues as to the quality of the audio being recorded. If the waveforms are too big, such as in (Figure 2b), it means you are either too close to the device or the source sound is too loud. If the waveforms are so small that you can barely see them (Figure 2c), it means you are too far away from the device or the source sound is too quiet. In general, if the waveforms are too big, it is basically impossible to repair later in editing. If they are too small, it may be possible to amplify the sound later. Figure 2d shows an ideal size for waveforms when recording listening materials. This principle can be applied in any audio recording application. If you are doing multiple recordings, be sure to keep them organized and name each file appropriately so that you can keep track as it is easy to get confused later. On the Voice Memo application, you can swipe left on a recorded file and easily delete any unnecessary recordings (Figure 2e).

Figure 2a
Record Button



Figure 2b
A Clipped/distorted Recording where the Recording Level is too Loud

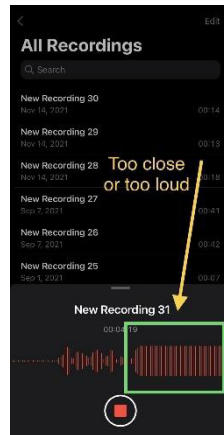


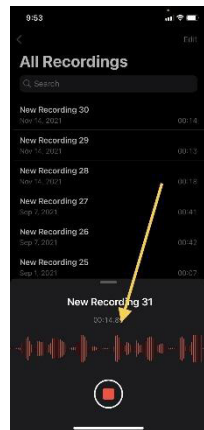
Figure 2e
Deleting a Recording



Figure 2c
Level is too Low.



Figure 2d
Appropriate Recording Level



Step 3. Exporting Audio to Computer

Once you've finished the recording, you now need a way to export it to your computer for editing. On the Voice Memo application, you can find a button with three dots (Figure 3a). If you click this, it will give you a list of options including *copy*, *share*, *edit recording*, and so on. Click on *share* (Figure 3b). Once you click *share*, it will give you a list of applications that you can use for sharing (Figure 3c). Any application can be used, but it may be easiest to send it as an email to yourself (Figure 3d). That way it can be easily opened and downloaded on your computer.

Figure 3a
Exporting a Recording

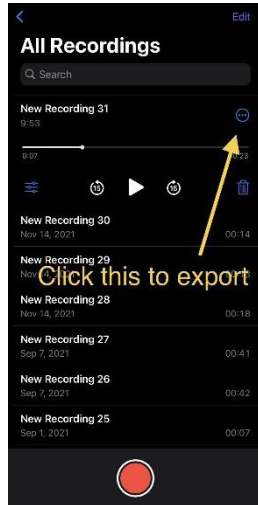


Figure 3b
Sharing a Recording

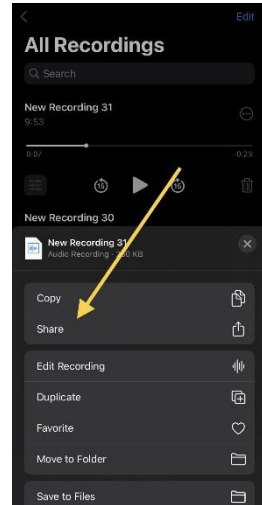


Figure 3c
Apps Available for Sharing

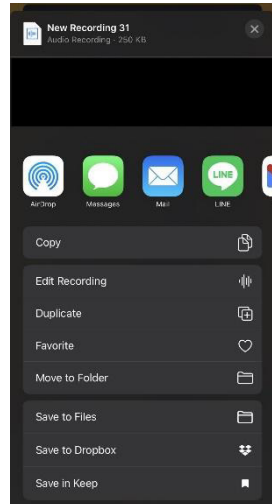
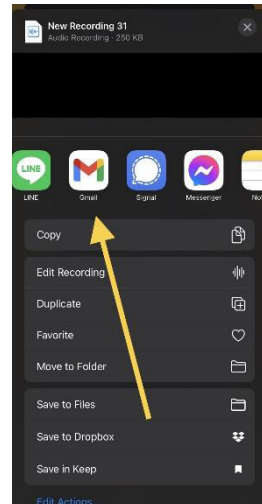


Figure 3d
Emailing a Recording



Editing Audio on a Computer With Audacity

Once you have recorded the audio on your smartphone and emailed the file to yourself, you can save it in an appropriate location on your computer. It is very easy to get confused by different files and versions of files, so be sure to name and organize your audio files in folders in a way that you can easily identify later.

Step 1. Installing the Audacity Software

Audacity is free DAW (digital audio workstation) software that can be downloaded at audacityteam.org. Audacity has a huge range of useful tools for manipulating audio, but we will focus only on simple editing tools. There are many alternatives to Audacity, and the basic tools and principles described below can usually be broadly applied to all other DAWs. Mac users could also use the same functions in Garageband, although the individual tools may go by different titles and have different keyboard shortcuts. There are also a myriad of more versatile DAWs available for purchase, but for the basic editing of audio for listening materials, a free DAW should be more than adequate. It should be noted that all modern DAWs can produce professional quality audio and the choice of DAW does not affect the quality of the sound.

Step 2. Importing Audio

To import audio into Audacity, go to File → Import → Audio, then select the audio you want to import (Figure 4a). If you recorded your audio on the Voice Memo application on an iPhone or iPad, you may get an error message because the file was saved as an mp4 (Figure 4b). In this case, you'll need to convert the file to an mp3 using a website such as cloudconvert.com (Figure 4c). After you've successfully imported the audio, it should look like Figure 4d.

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Figure 4a
Importing Audio into Audacity

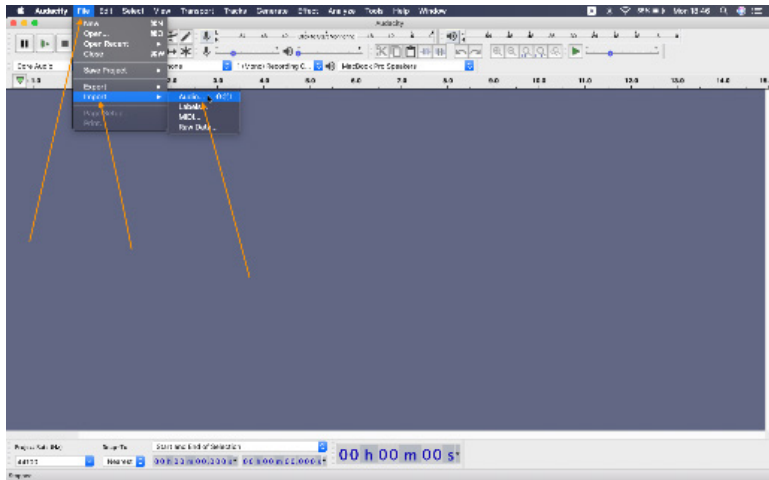


Figure 4c
Converting an mp4 to an mp3 on cloudconvert.com

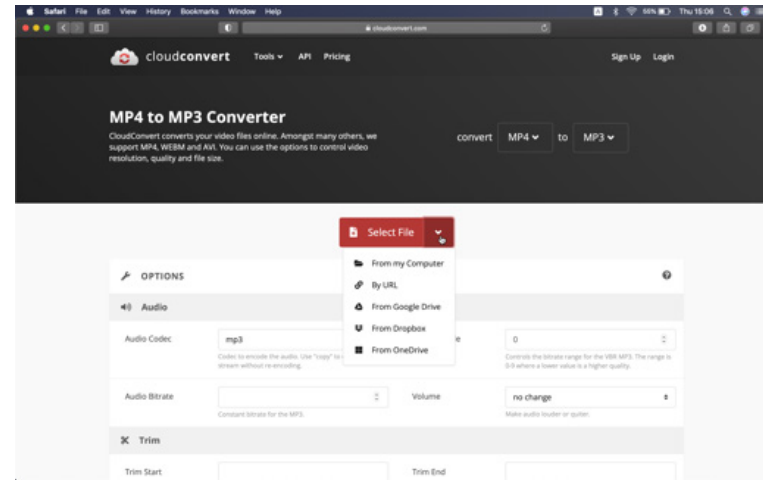


Figure 4b
Error Indicating Incorrect File Type

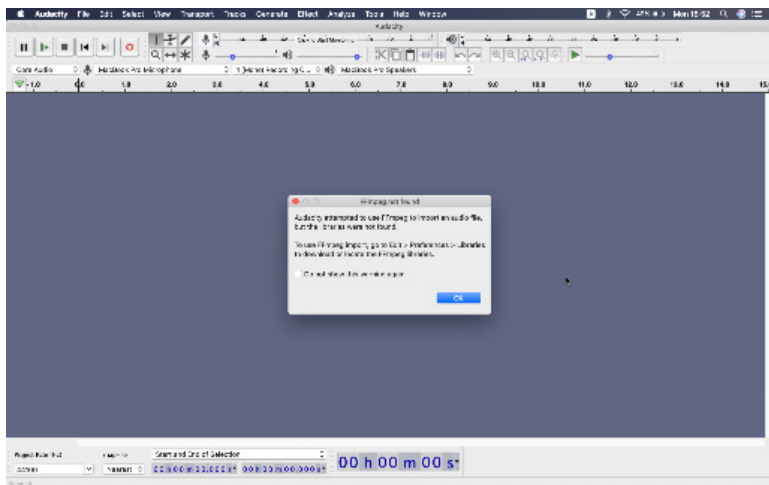
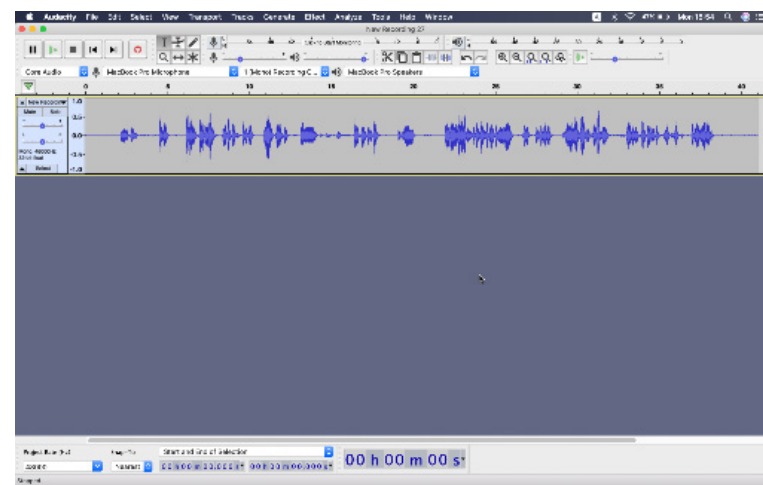


Figure 4d
Successfully Imported Audio



Sometimes, you may have multiple sound files that you want to merge to form a single listening track. You can import these into the same Audacity file and edit them into the appropriate place using the editing tools described below. If the sound quality of the two tracks is different, you may want to use the tools such as EQ, compression, and noise reduction that we describe in Part 2. If the file formats are different, Audacity may automatically convert it, or you may need to convert one of the files using a site like cloudconvert.com.

Step 3. Editing Tools/Shortcuts

The first aspect of Audacity that you will need to grasp is the transport controls (see Figure 5a). It has commands for *pause*, *play*, *stop*, *skip to start*, *skip to end*, and *record*. The most useful of these commands will be play/stop. The keyboard shortcut for play/stop is the spacebar. The other controls such as pause and record are similar to many music players.

Slightly to the right of the transport controls, you can see the six editing tools (Figure 5b). From upper left to lower right, they are: Selection tool, Envelope tool, Draw tool, Zoom tool, Time shift tool, and multi-tool. In general, you will probably find the selection tool, the zoom tool and the time shift tool to be the most useful for basic audio editing.

Figure 5a
The Transport Controls

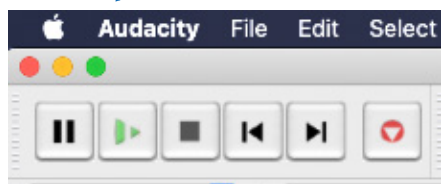
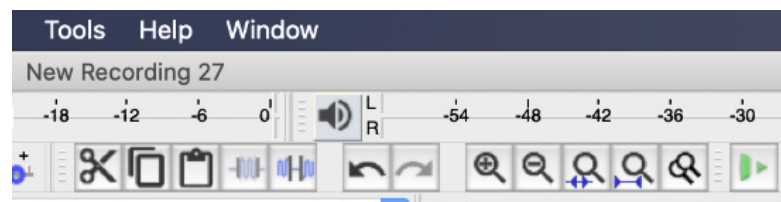


Figure 5b
Editing Tools



Figure 5c
Editing Tools



You can also see the cut (shown as a scissors in Figure 5c), copy, paste, undo and zoom tools. It will speed up your workflow enormously if you take the time to learn the keyboard shortcuts for these (for a PC, use the CTRL key instead of ⌘).

- Cut: ⌘X (for a *split cut* ⇧⌘X)
- Copy: ⌘C
- Paste: ⌘V
- Undo: ⌘Z
- Zoom in: ⌘1
- Zoom out: ⌘3

When editing in Audacity, you might find it more useful to use *split cut* rather than *cut*. The difference is that a simple cut will merge the two pieces of audio after you input the command, and a split cut will leave space between them. The meaning and importance of this is illustrated below and will become clearer when you start editing your audio data.

Step 4. Editing Strategy/Technique

Once you have a grasp of all the editing tools, you can begin editing. Here is an example of before and after using split cuts (Figures 6a and 6b). You can see that a lot of dead space has been removed by the split cut and now you are free to move the individual pieces of audio and adjust the timing to your liking. This particular audio has two different speakers recorded on the same track, so we'll add an extra track by clicking Track → Add New → Mono Track (Figure 6c). After a new track is made, you can use the

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time shift tool to move things around (Figure 6d). In Figure 6e, you can see what the two tracks look like after they have been cut, split into two tracks, and have had the spacing adjusted. Also, you can see that the tracks have been renamed to the speakers' names. You can rename a track by clicking on the triangle and then clicking *name*.

Figure 6a
Before a Split Cut

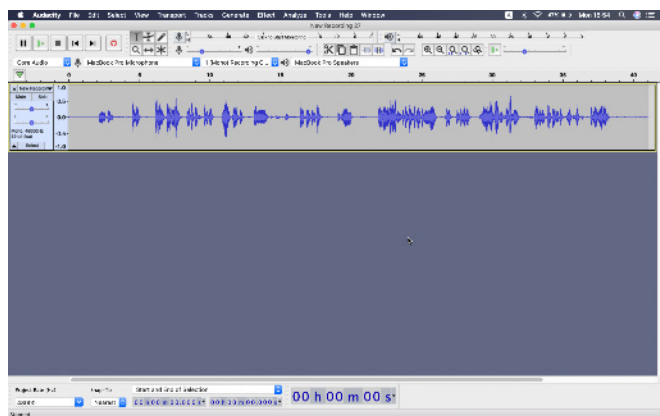


Figure 6b
After a Split Cut

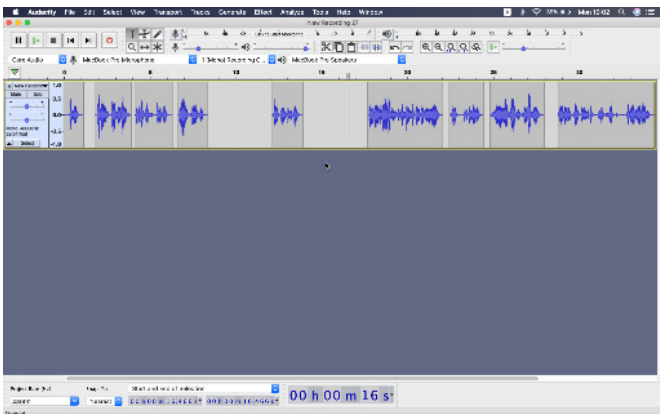


Figure 6c
Add an Extra Track

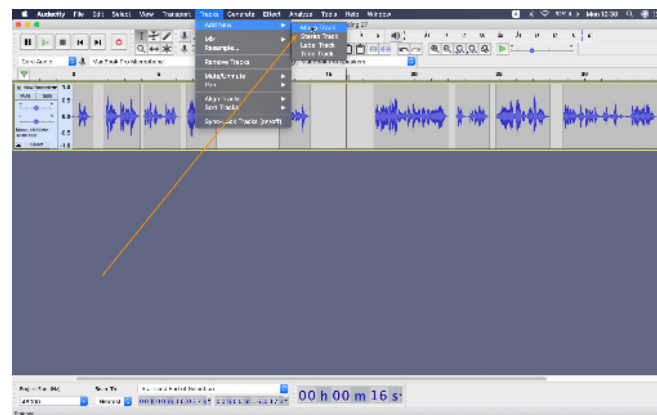


Figure 6d
Moving Audio with the Time Shift tool

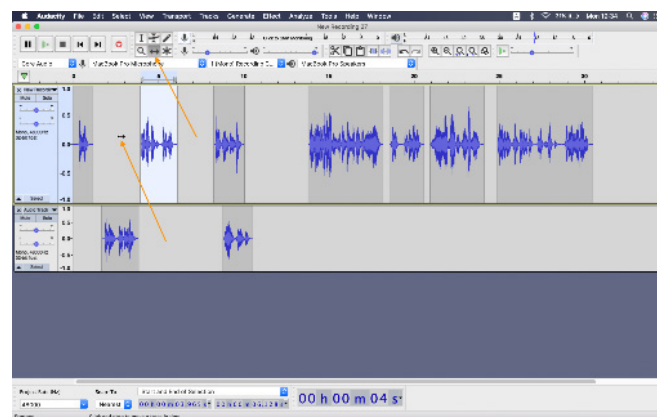


Figure 6
Audio after being Divided into Two Tracks and Time Shifted to Appropriate Positions

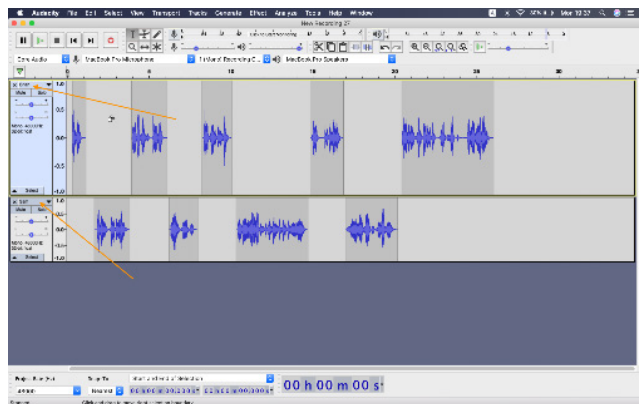
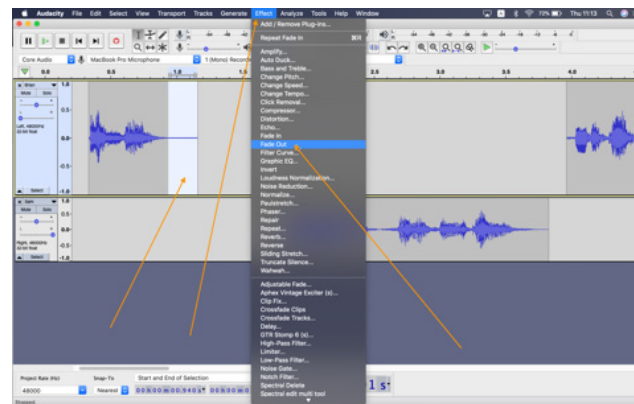


Figure 7
Adding a Fade Out



Step 5. Fade Ins/Fade Outs

Another set of useful editing tools are fade ins and fade outs. In some situations, once you have made all the cuts in the audio, you may experience clicking or popping noises. Many audio engineers will put a small fade in at the beginning of every audio region and a small fade out at the end. To insert a fade in or fade out, first highlight the exact section that you want to be faded, then go to effect → fade in/out. As soon as you click it, it will be executed (Figure 7).

Part 2: Enhancing and Exporting Audio

For many teachers, the basic editing tools described in Part 1 above can be sufficient to create listening materials for your students, but there are other tools that can be used to improve the quality of audio and some of these are explained below.

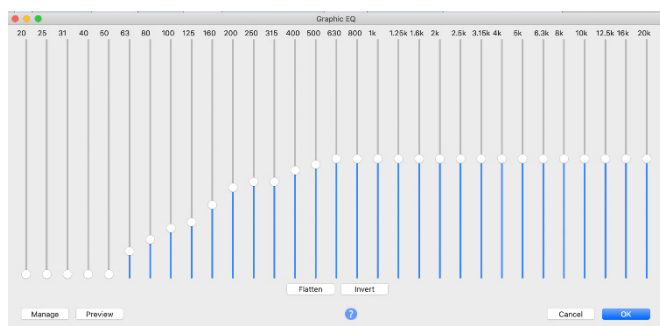
Understanding the Concepts of EQ and Compression.

After all the editing is complete and the spacing has been adjusted as described above, it could stand alone as a usable audio recording. However, there are more tools that engineers use to make audio sound much better than what can be accomplished with just the raw recording. The most commonly used tools are EQ and Compression.

EQ is short for *equalization* and refers to increasing or decreasing individual frequencies. For example, you've probably seen a stereo that had controls for *treble*, *bass* or maybe even *mids*. This is a basic EQ with three control parameters. More advanced EQs have many more controls, such as the EQ in Figure 8. The farthest left control would be the lowest, or “most bassy” frequency, and they get higher until the farthest right control, which would be the “most trebly”. The most common situation where EQ would be used for listening materials is *rolling off* some of the lower frequencies, which is also represented in Figure 8. This will eliminate some of the sound of the room and could also remove “echoey” or “boomy” sounds. If the recording sounds “harsh”, you

should experiment with rolling off some of the higher frequencies, and if the recording sounds “boxy,” experiment with some of the middle frequencies. It takes time and experience to get used to EQ, so feel free to experiment, but also use it gently because it can dramatically change the sound of audio.

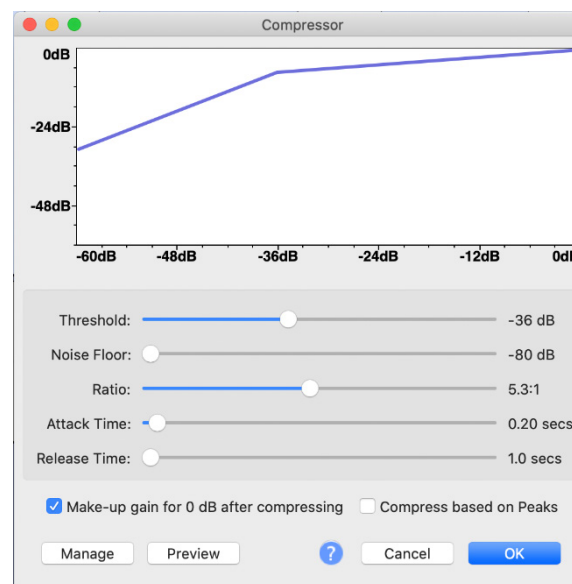
Figure 8
EQ Bands and “rolling off” Lower Frequencies



The other commonly used tool is compression. Many educators have probably used a YouTube video or other audio source where the audio at the beginning of the video was very quiet, so you turned up the volume. Then suddenly, a much louder sound occurs, such as people bursting into laughter, and the audio becomes blaringly loud, so you turn the volume down again. Then after that, it returns to the original quieter volume, and you’re forced to then adjust the volume once again. Compression is the tool that solves this problem by automatically adjusting the volume in these situations. It sets a certain *threshold* with a minimum and maximum frame which does not allow the audio to get too loud or too quiet. In a sense, it “sandwiches” the audio. A few common parameters on a compressor include the threshold, ratio, attack time, and release time which can all be seen in Figure 9. The most important controls are threshold and ratio. As mentioned before, a compressor sets a minimum and maximum threshold through which the audio is allowed to pass. The threshold is what sets that maximum. So, the lower the decibel (dB) level this it is set at, the faster it will kick in. Once it kicks in, it needs to know how much it should compress. If it eliminated any sound after the maximum threshold that you set, it could sound unnatural. This would be called *brick wall* compression and is what you would experience if you adjusted the ratio to its maximum setting all the way

to the right at 10:1. The ratio parameter controls how much the volume is decreased after it hits the threshold that you’ve set. Most engineers prefer more natural sounding audio, so it’s best to play around with the ratio control until it sounds natural to you. For listening materials, anywhere from 3:1 to 5:1 may sound acceptable. As for the attack and release times, the attack time is how quickly the compressor kicks in and the release time is how long the compression lasts. The attack time is usually quite fast and is measured in milliseconds. For listening materials, it should be set to a fairly fast time, such as the default in Figure 9 at 0.2 seconds. The release time must always be longer than the attack time. The default of 1.0 seconds in Figure 9 is adequate in this situation.

Figure 9
Compression

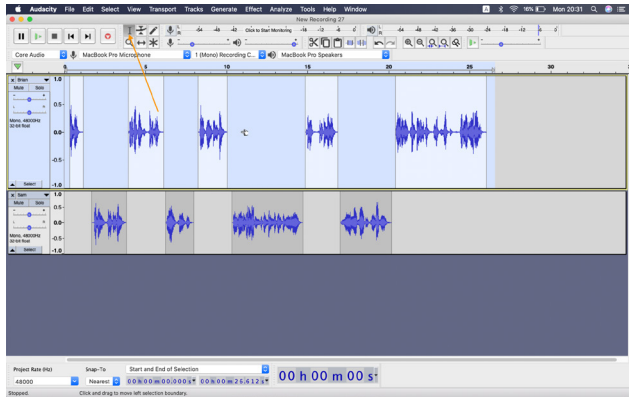


Applying Effects to Enhance Audio

In this situation, we’re going to apply both EQ and compression. First, you’ll need to select the audio using the selection tool (Figure 10a).

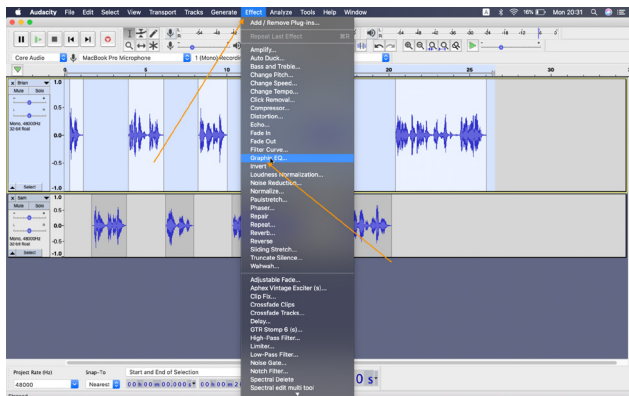
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Figure 10a
Selecting Audio with the Selection Tool



Then choose Effect → Graphic EQ (Figure 10b) and reduce the low end of the sound as shown. This can help to remove any low frequencies such as air conditioner sounds without affecting the frequency range of the voice. Also take a moment to see the wide range of effects that are available in Audacity.

Figure 10b
Choosing from the Effects



To add compression, first highlight the audio you want to compress and go to Effect → Compression (Figure 11a). After applying the effect, you should notice that the waveforms look different. It should look bigger and have a more standardized volume across the whole track (Figure 11b).

Figure 11a
Finding the Compression Effect

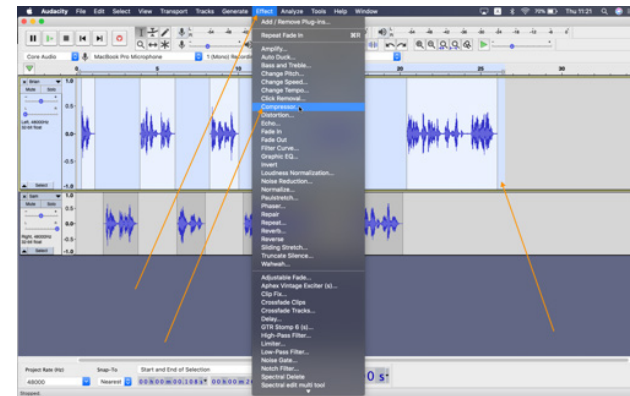
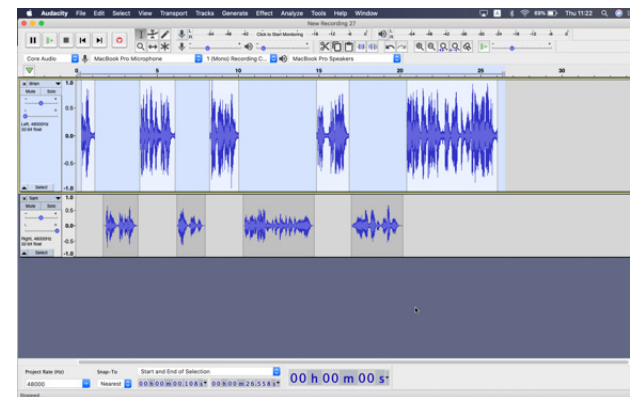


Figure 11b
What Waveforms Look like after Adding Compression



Noise Reduction

Noise reduction can be useful in situations where you have continuous background noise from an air conditioner, refrigerator, traffic, or other source. In Audacity, noise reduction is a two-step process.

Step 1. Select a section of the audio that only contains the noise. Choose Effect → Noise Reduction (Figure 12a). Click on *Get Noise Profile* (top half of Figure 12b). This will save the noise profile and close the dialogue box.

Figure 12a
Selecting the Noise Reduction Effect

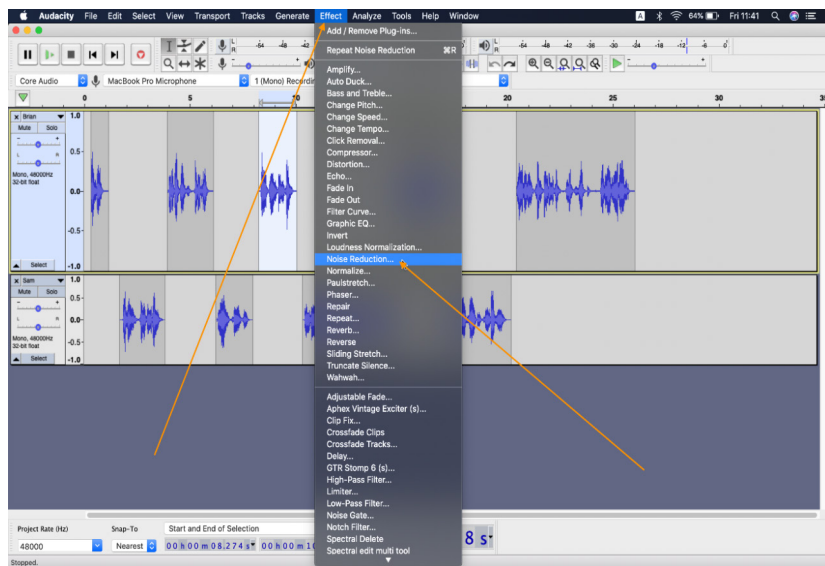
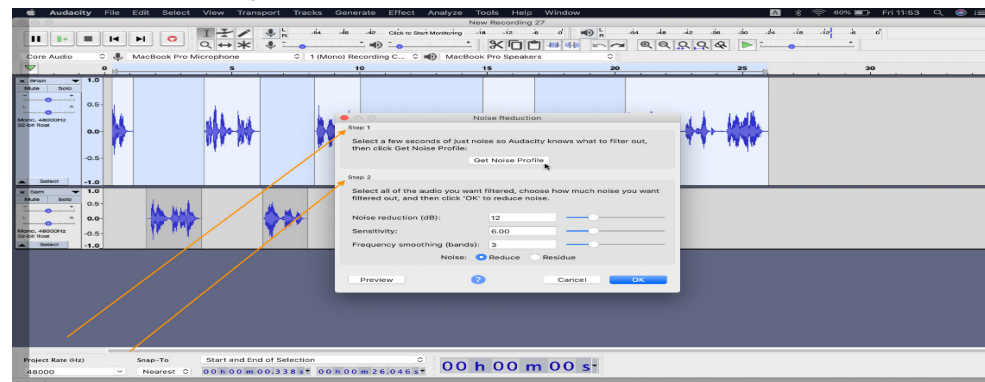


Figure 12b
Noise Reduction Dialogue Box



Step 2. Select all the audio in which you want to reduce the background noise. Again, choose Effect → Noise Reduction. Look at the bottom half of the dialogue box (Figure 12b). The default values are probably suitable for most situations. Press OK and the effect will be applied. The Preview option is also useful.

Reverb

While EQ and compression are the most useful tools to enhance the clarity of audio, there are a wide array of other processing tools available (Figure 13a). Reverb is a tool that can make your audio sound like it is in a larger room.

If you want to add reverb to the sound, first select the audio you want to affect and go to Effect → Reverb (Figure 13a). This will open the reverb tool and you will see several parameters (Figure 13b). The two most important parameters are *Room Size* and *Reverberance*. Room size simply changes the size of the room and reverberance changes how much the sound reverberates. For example, if you set it to the largest possible room size, but put the reverberance at 0, the audio would not be affected much. If you put the room size at a lower level, such as 10, and put the reverberance at the maximum setting, the speakers may sound like they're in a small yet reverberant space such as a bathroom.

Figure 13a
Finding the Reverb Effect

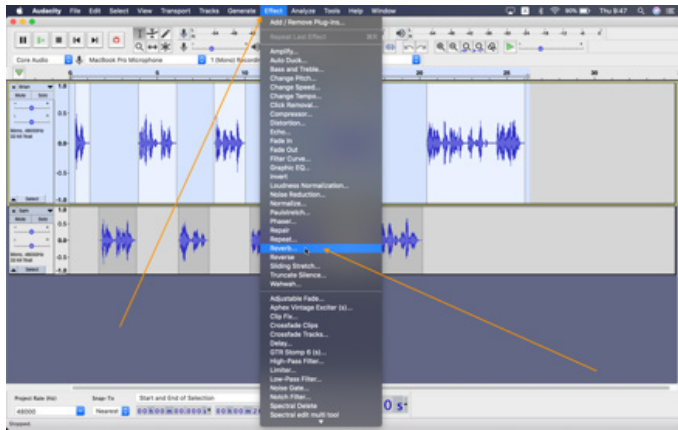
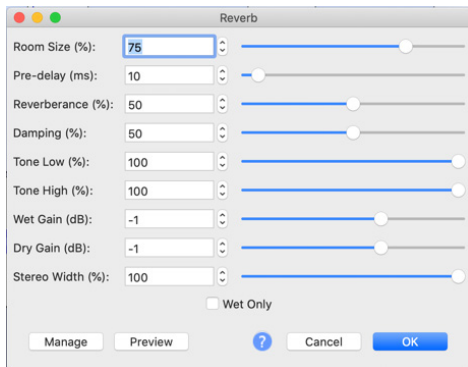


Figure 13b
Parameters of the Reverb Effect



Delay

Another effect which is similar to reverb is delay. Delay creates an echo where the source audio is repeated multiple times after the original audio. In Audacity, the delay function is called *echo* (Figure 14a). It has only two parameters – *Delay time* and *Delay*

factor (Figure 14b). The delay time is the amount of space in between each echo. If you set it to 1 second, you will hear the echoed sound 1 second afterwards. The delay factor alters the speed of the decay. A natural echo sound should gradually get quieter with each repeat. If you set the delay factor at a lower number, it will decay faster. If you set it at a high number, it will repeat more times and the volume of the repeats will not decay as quickly.

Figure 14a
Finding the Echo Effect

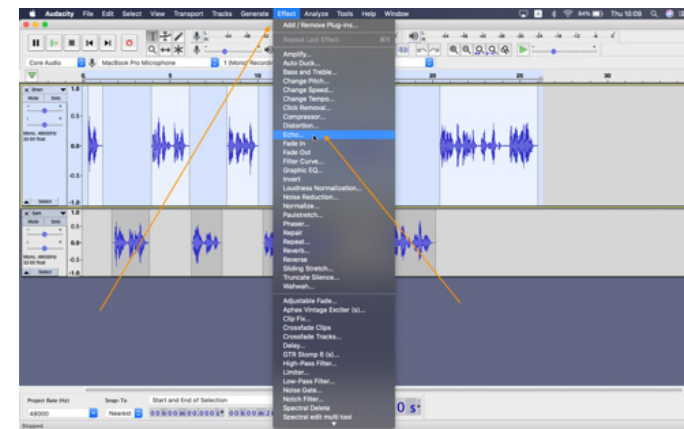
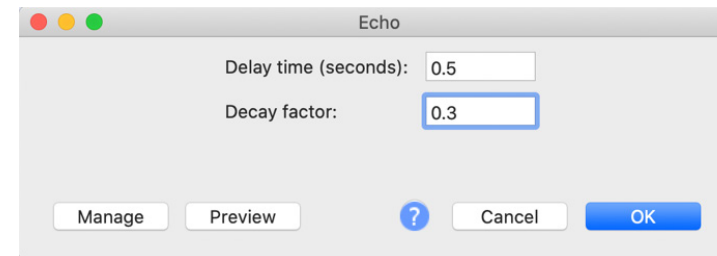


Figure 14b
Parameters of the Echo Effect



Exporting Audio From Audacity

Once you have finished your project, you will need to export the audio and find the best way to get it into your preferred medium. For example, if your plan is to upload it to YouTube, you will need to research which file type it needs to be in.

First, let's consider how to export the file. Go to File → Export and you will see a few different options for file types (Figure 15a). You can choose different export settings (Figure 15b and 15c) including different file type and bit rate. The most common file types are Mp3 and WAV files. Most audio is originally recorded in WAV files because they are the highest quality. The reason they are the highest quality is because they contain a lot of data. This large amount of data will quickly fill up hard drive space and also may take a long time to send over the internet. An Mp3 file eliminates some of the data that is unlikely to be picked up by the human ear, thus dramatically reducing the size of the file. Technically, this reduces the quality of the audio. However, in most cases the reduction in quality is unrecognizable by those who do not have extensive experience in audio engineering. Depending on your version of Audacity, you may need to install the Lame framework in order to export Mp3 files (<https://lame.sourceforge.io/>).

When you are exporting your file, you can also add metatags such as Artist Name or Song Title (Figure 15d). These can be useful in a large projects such as creating audio for a textbook because these tags will show up on the listeners' device.

For Apple users, you may have issues with some file types depending on how old your computer is. AIFF files and Mp4 files are sometimes easier to use with Apple products. While there are several more file types available, breaking down the differences between all of them is far beyond the scope of this paper. When necessary, you can use a site like cloudconvert.com to convert file formats. Issues with audio file types is much less troubling than it used to be and many platforms are now able to accept a wide array of types.

Figure 15a
How to Export your Finished Project

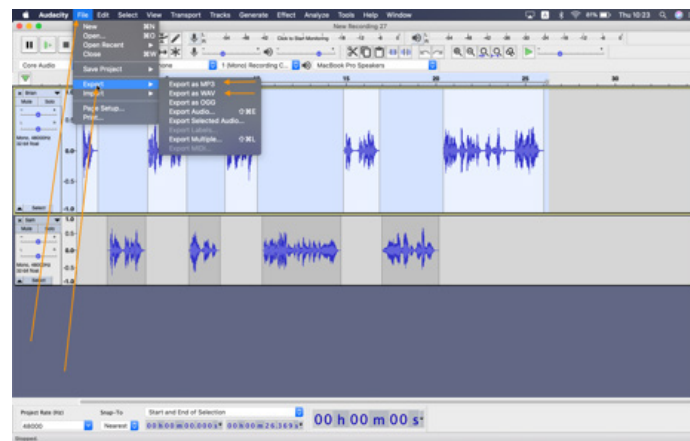


Figure 15b
Exporting a File

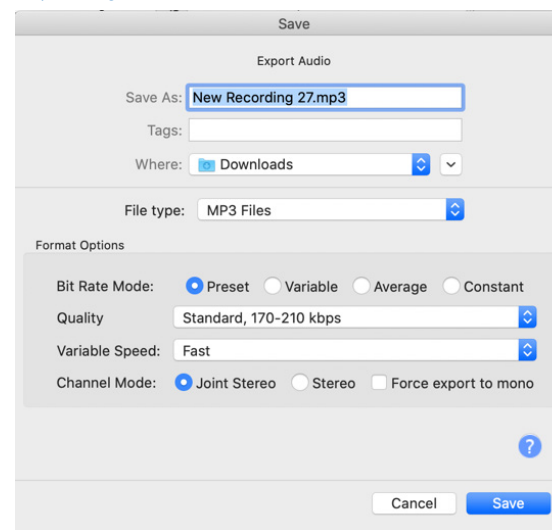


Figure 15c
Different File Types Available for Exporting

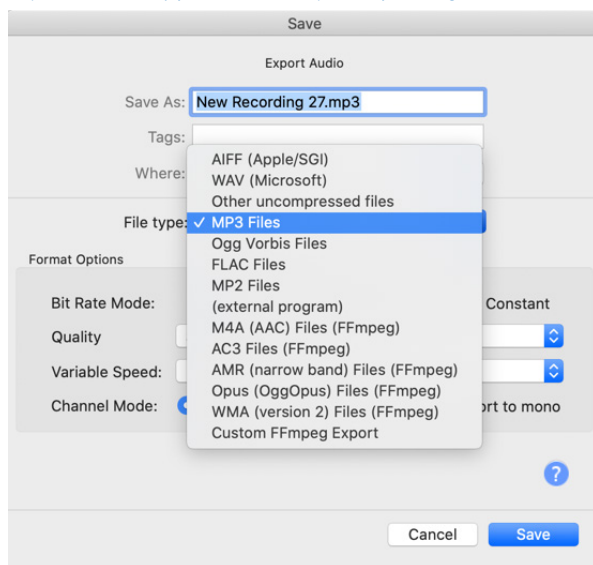
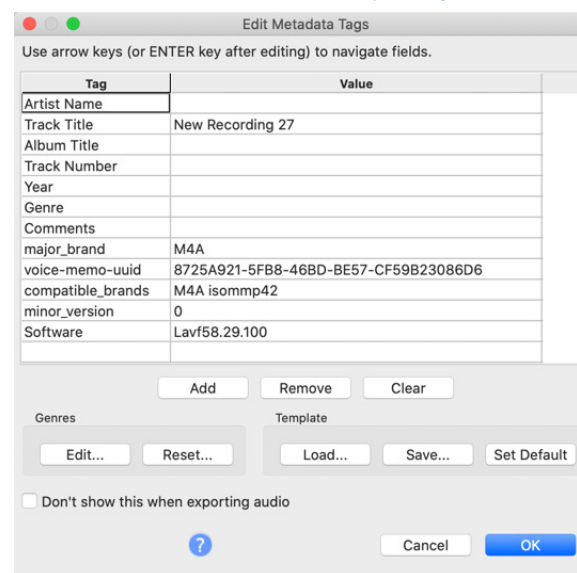


Figure 15d
Chance to add Metadata when Exporting



Conclusion

We hope that we have been able to provide a valuable guide for producing listening materials. The video accompanying this paper is also available at <https://youtu.be/h-SWe-YIHpk>. Most of the information provided is not specific to the software used in the demonstrations and can be applied to other platforms. If you use this guide as a starting point for understanding the fundamentals of audio recording/editing, you can experiment until you find a system that works well for you.

Bio Data

Sam Keith is a trained sound engineer with many years of experience running his own recording studio. He is also a musician and plays guitar and other instruments in local bands.

Brian Cullen has been creating listening materials for EFL textbooks for over 25 years, including children's education, high school, and university-level books. As a musician, he has been involved in many commercial music projects as well as his own releases.

Further Reading and Useful Links

- Cheng, M., & Taylor, M. (2017). Lame framework for exporting mp3 format files. <https://lame.sourceforge.io/>
- Keith, S., & Cullen, B. (2021a). Video recording of the processes described in this paper. <https://youtu.be/h-SWe-YIHpk>
- Keith, S., & Cullen, B. (2021b). Video recording of the processes described in this paper (shorter version). https://youtu.be/Khz_gsrPmqQ
- Lunaweb GmbH. (2022). Cloud convert: An online file convertor. <http://www.cloudconvert.com>
- Mazzoni, D., & Dannenberg, R. (2022). Audacity: Free, open source, cross-platform audio software. <http://audacityteam.org>