

Script for

Audacity Course

Digital Editing

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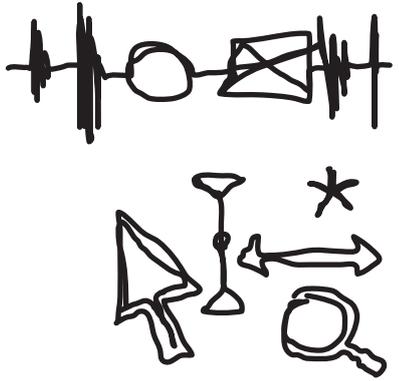
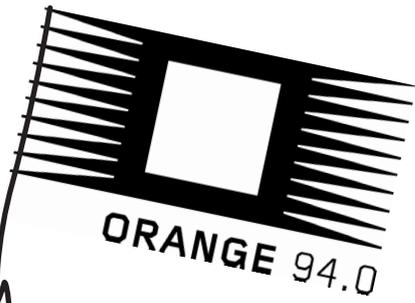
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1 AUDIO BASICS

Analogue Sound Recording

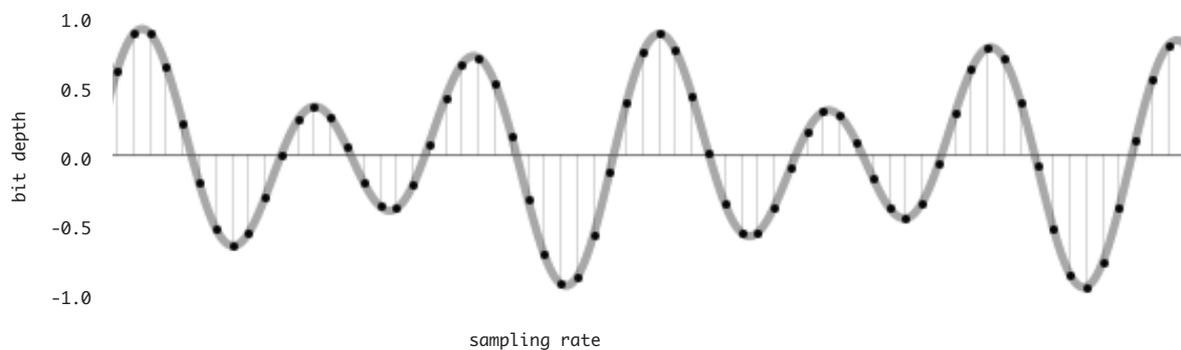
Just like human ears, a microphone contains a diaphragm which is moved by air pressure differences and a mechanism that transforms the movements of the diaphragm into electric oscillations. Generally, the greater the air pressure differences, the stronger the electric signal and vice versa.

A tape recorder or cassette deck, for example, transforms the electric signal once again into a magnetic signal and saves it to tape. When the tape is played back later, the process is reversed: the magnetic signal is transformed to an electric one, which is transformed by the diaphragm of the loudspeakers and by means of an electromagnet into modifications of the air pressure. The originally recorded sounds can then be heard again.

Digital Sound Recording

Tape recorders and cassette decks are examples of analogue sound recording. Analogue here means that the electric or magnetic signal is of the same size as the respective air pressure difference. Audacity, on the other hand, works with digital audio data which can be processed by computers.

A main component of digital sound recording is the analogue-to-digital converter (ADC), located on the sound card. It takes thousands of "snapshots" of the electric signal per second and saves the respective values as numbers to the computer. The more snapshots per second are taken, the better the reproduction of the original signal will end up:



Each point in the figure represents a snapshot. The technical term for this is **sample**. There are two factors which are crucial for the quality of a digital sound recording:

Bit depth

This is the maximum number of possible vertical steps. An audio CD has a bit depth of 16 bit. This corresponds to a number of 2^{16} (two to the power of sixteen) = 65.536 possible steps.

Sample rate (or sampling frequency)

The number of samples per second measured in Hz (hertz). Hertz is the unit for frequency and measures the cycles (repetitions) per second in a periodic signal. An audio CD, e.g., has 44.100 samples per second = 44.100 Hz. It is the most frequently used sampling rate and hence the default setting of Audacity.

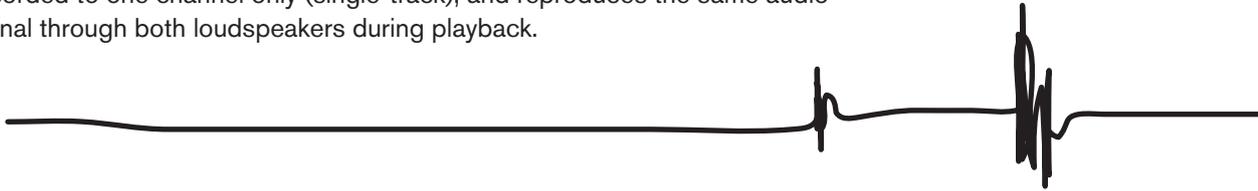
Application In digital recording, higher sampling rates facilitate the recording of higher sound frequencies. The sampling rate should be at least twice as high as the highest recorded sound frequency. Humans are able to hear frequencies up to 20.000 Hz. As a consequence, recording with 44.100 Hz has become an established standard. In the preferences (menu item: PREFERENCES > **QUALITY**) of Audacity you can check if the sampling rate is set to 44.100 Hz and the bit depth to 32 bit.

Decibel (dB) is a unit used for measuring sound intensity and other physical quantities, such as intensity or power. In acoustics, decibel is used for measuring the sound pressure.

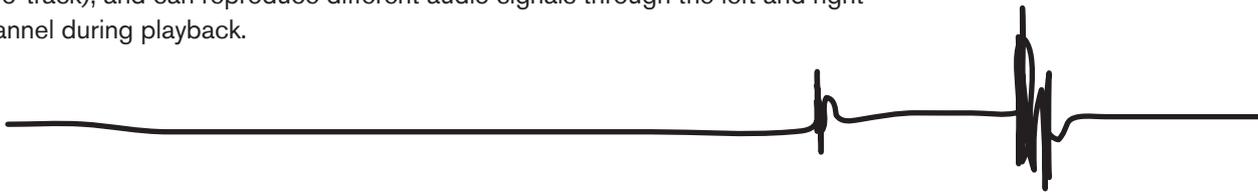
For the sound pressure level in decibel (dB SPL), the lowest sound pressure perceptible by the human ear is used as a reference point. The softest sound that humans can hear lies usually at 0 dB SPL (auditory threshold). In practice, "dB" is often used when "dB SPL" is meant.

2 MONO / STEREO

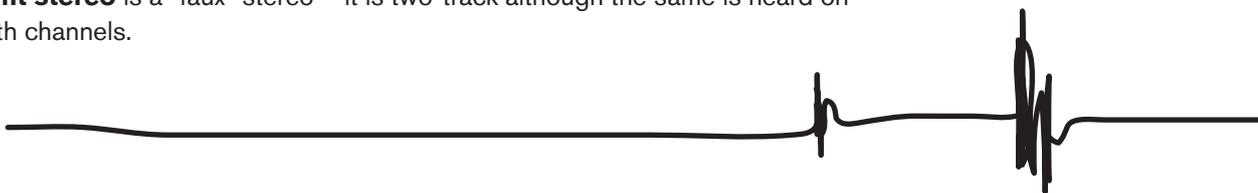
In the digital world, Audios recordings have tracks or channels. **Mono** is recorded to one channel only (single-track), and reproduces the same audio signal through both loudspeakers during playback.



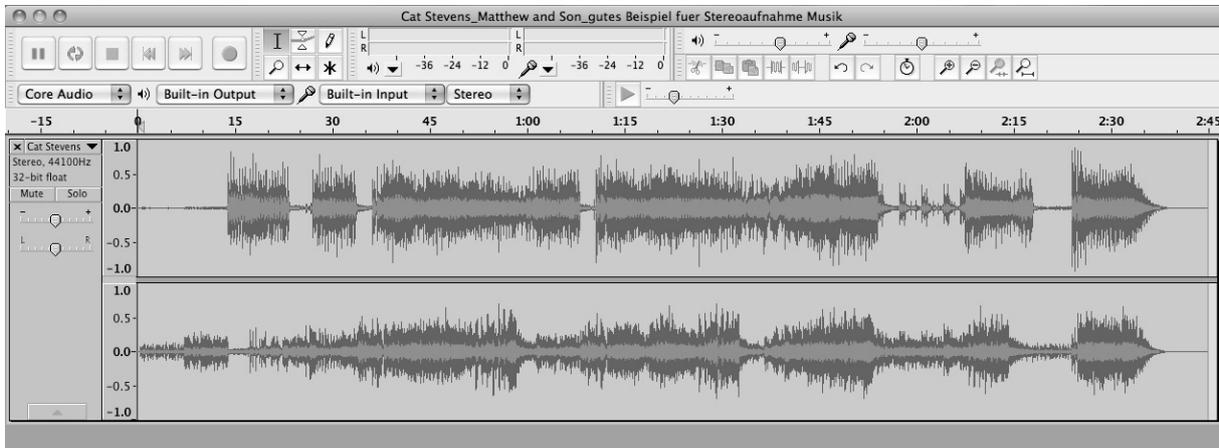
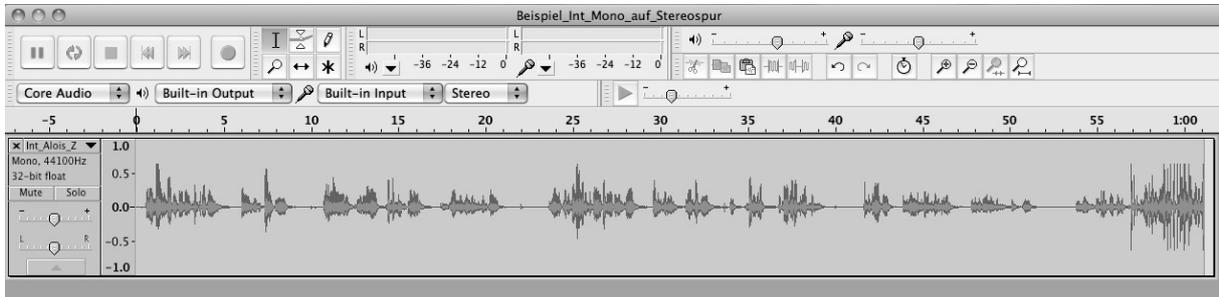
Stereo is recorded with a stereo microphone to two separate channels (two-track), and can reproduce different audio signals through the left and right channel during playback.



Joint stereo is a “faux” stereo – it is two-track although the same is heard on both channels.



Application Stereo is only advisable for atmospheric recordings. For interviews/conversations, mono can be used, as its processing is simpler. Attention: Before broadcasting, make sure that the mono signal is transformed into a joint stereo signal (first **Duplicate**, then **Make Stereo Track**).



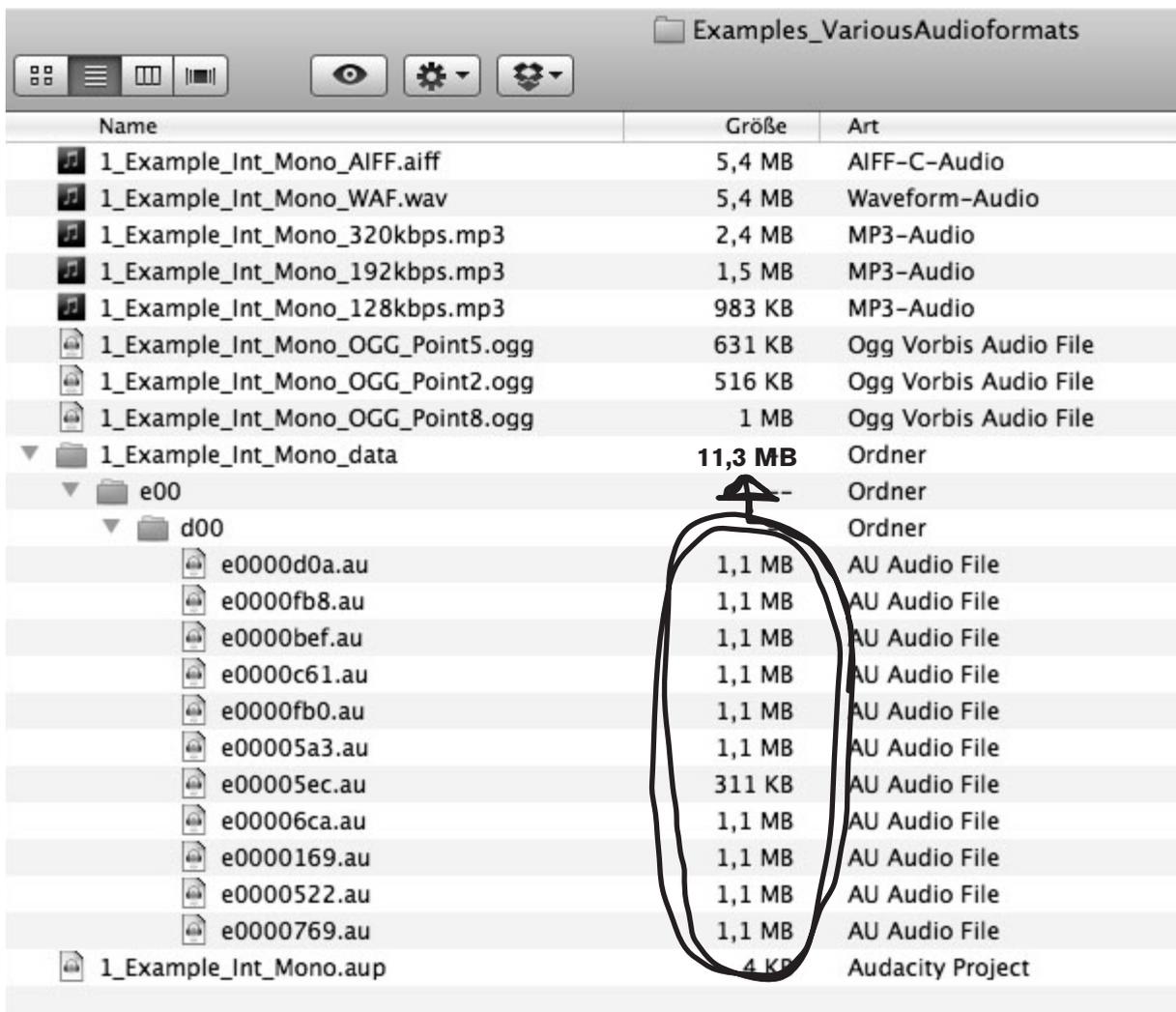
3 STORING SOUND DIGITAL AUDIO FORMATS

Audacity-Projekt Format (AUP)

Audacity saves projects as an aup-file. This format is optimized for reading and writing Audacity projects as fast as possible. To achieve this rapidness, the audio data is separated by Audacity in many small pieces and saved into a _data-folder belonging to the project. The AUP format cannot be read by other sound processing software. If this is desired, the audio data needs to be exported after the processing with Audacity into some other format (uncompressed if possible, e.g. WAV).

Comparison of Audio Formats in Practice

Saving one and the same song in different audio formats results in strongly divergent file sizes.



Name	Größe	Art
1_Example_Int_Mono_AIFF.aiff	5,4 MB	AIFF-C-Audio
1_Example_Int_Mono_WAF.wav	5,4 MB	Waveform-Audio
1_Example_Int_Mono_320kbps.mp3	2,4 MB	MP3-Audio
1_Example_Int_Mono_192kbps.mp3	1,5 MB	MP3-Audio
1_Example_Int_Mono_128kbps.mp3	983 KB	MP3-Audio
1_Example_Int_Mono_OGG_Point5.ogg	631 KB	Ogg Vorbis Audio File
1_Example_Int_Mono_OGG_Point2.ogg	516 KB	Ogg Vorbis Audio File
1_Example_Int_Mono_OGG_Point8.ogg	1 MB	Ogg Vorbis Audio File
1_Example_Int_Mono_data	11,3 MB	Ordner
e00	-	Ordner
d00	-	Ordner
e0000d0a.au	1,1 MB	AU Audio File
e0000fb8.au	1,1 MB	AU Audio File
e0000bef.au	1,1 MB	AU Audio File
e0000c61.au	1,1 MB	AU Audio File
e0000fb0.au	1,1 MB	AU Audio File
e00005a3.au	1,1 MB	AU Audio File
e00005ec.au	311 KB	AU Audio File
e00006ca.au	1,1 MB	AU Audio File
e0000169.au	1,1 MB	AU Audio File
e0000522.au	1,1 MB	AU Audio File
e0000769.au	1,1 MB	AU Audio File
1_Example_Int_Mono.aup	4 KB	Audacity Project

Uncompressed Formats

save sounds losslessly.

AIFF (Audio Interchange File Format)

uncompressed standard Apple audio format. It is not quite as common as the WAV format, but can also be read by most audio processing programmes on other operating systems. Audacity can read and write this format.

WAV (Windows Wave Format)

uncompressed standard Windows audio format. As it is very common, it can also be read by many audio processing programmes on other operating systems. Audacity can read and write this format.

Compressed Formats

save sounds with reduced file size and are therefore lossy.

MP3 (MPEG I, Layer 3)

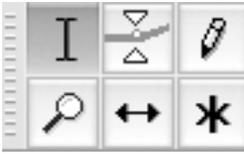
is the most common digital audio format on the Internet. Audacity can read and write MP3 files, however, it requires an external encoder (LAME) for exporting MP3 files. The bit rate of MP3 is given as kbps (kilobit per second), with a range of 96-320 kbps. For comparison: an audio CD has a bit rate of 1.440 kbps. A smaller bit rate results in a reduced amount of data and hence in a loss of sound quality. This loss cannot be made up for later. This means that once the original material is compressed, the initial uncompressed state of the recording cannot be restored. Not even if the finished radio programme is saved as a WAV file – the inferior sound quality nevertheless remains. For radio, a range of 256-320 kbps is recommended when working with MP3, with 192 kbps being the minimal value. When uploading a radio programme to the Radiomaster of ORANGE 94.0, there is no specific required kbps rate, only an upload limit of 250 MB in terms of overall file size per programme.

Ogg Vorbis

is a free alternative to MP3. It is not yet as common as MP3, but free of patent protections and facilitates similar compression at almost the same quality as MP3. Here, there are quality degrees ranging from 1-10; recommended is saving at 5-6. However, this should be tested individually at very quiet passages of songs, where possible unwanted noise caused by compression is most easily detected. A lower or higher degree of quality can be selected accordingly. Audacity can read and write this format.

Application Ideally, the portable audio recorders should be used in WAV mode (displayed as PCM for some recorders). By opening/importing the files in Audacity, they are transformed into AUP files. After processing they are exported as WAV files or, for unfinished montages, saved as AUP. At the end of the production of the programme, save the finished file in AUP format and export it in MP3 format (192-320 kbps) for the upload on Radiomaster resp. in a digital Archive (CBA) or WAV format (44.100 Hz and 16 bit) for the production of audio CDs.

4 CURSOR/MOUSE-FUNCTIONS



Audacity offers the possibility of assigning different functions to the mouse resp. the cursor. For this, the respective symbol needs to be selected in the toolbar. These are:



Selection Tool

Audacity default setting. Serves the selection of audio segments for further processing.



Envelope Tool

For manual volume adjustments, fades (see Chapter Volume Editing).



Draw Tool

To be used only very rarely for editing noise. It requires zooming in deeply into the audio track; only then the individual sample points can be moved.



Zoom Tool

Zooming in combination with clicking the right/left mouse button (zooming in general: see Chapter Editing Audio Tracks).



Time Shift Tool

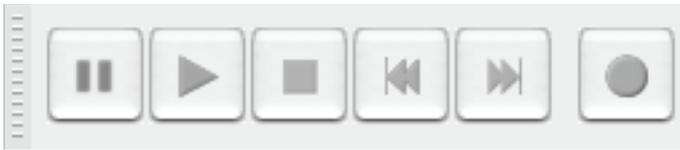
A very important function for the positioning of audio tracks and clips when creating a montage (see Chapter Montage).



Multi-Tool Mode

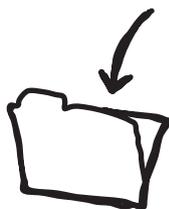
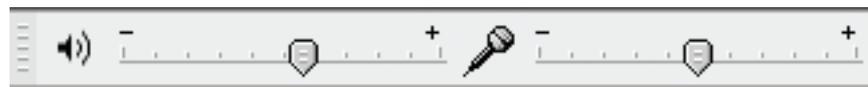
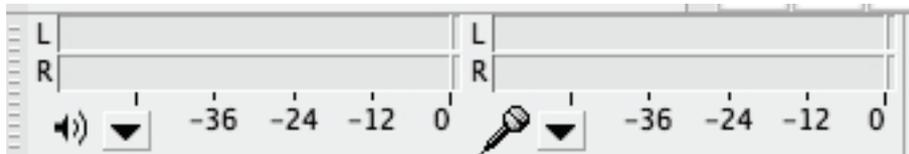
Combination of Selection and Envelope Tool depending on the position of the audio track (see Chapter Volume Editing).

5 RECORDING



By default, Audacity opens with an empty project window. With the red **Record button** in the Transport Toolbar (round circle) one could record directly, as long as there is an internal microphone/an input for an external microphone. This is reasonable only to a limited extent, as the recording quality of the standard built-in sound cards of computers/laptops is not very high. If you want to record without an external recording device, you should use an external audio interface between the computer and the external microphone. The red Record button is also used for directly recording sounds which are internally played through the sound card (e.g., audio files from the Internet). The recording is stopped by the **Stop button** (yellow quadrangle) or paused with the **Pause button** (blue double bar).

The recording volume can be regulated with the **Meter Toolbar** and the **Mixer Toolbar**.



In any case, a new project should, as soon as possible after the recording or the first steps of processing, be saved under a speaking name.

Interview_The_Good_Life.aup

6 SAVING

Basically, there are two possibilities for saving audio files in Audacity:

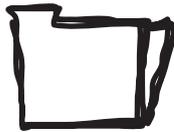
Save Project
(under the menu item: FILE or CTRL + S) resp.
Save Project as



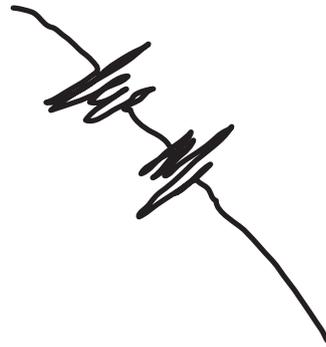
in the Audacity-Format



MyProgramme.aup



MyProgramme_data



Export Audio
(under the menu item: FILE)
in some compressed or uncompressed format
(see Chapter **Storing Sounds – Digital Audio Formats**)



.mp3 .ogg .wav .aiff ...

Caution with Audacity files: These always consist of two parts (a control file with the extension .aup and a folder of the same name augmented by _data) which must not be renamed or altered independently from each other.



something.wav
what_was_that.mp3

Anyway, it is advisable to choose a speaking file name (without punctuation marks, special characters or German Umlauts).



Once the file is saved, it can always be saved again quickly with the key combination CTRL + S.

7 EDITING AUDIO TRACKS

7.1 Open and Import

By using **Open** or **Import**, an already existing audio file can be transferred to Audacity. **Open** can be accomplished via the menu function under the item FILE. Alternatively, an audio file can simply be dragged into an empty project window. By doubleclicking an Audacity control file in File Explorer/Finder, the file is opened in Audacity. In any case, by using **Open** a file is always opened in a new project window. Using **Import** (menu item: FILE), however, an audio file is added to an already existing project in a new audio track at the bottom – this is very handy for montage purposes.

Each audio file is graphically represented in Audacity as an **audio channel/track**. Depending on whether it is a mono or stereo recording, the track has one or two horizontal panels.

On the left-hand-side of the audio track, the **properties of a track** are displayed – it is also here that they can be changed. For this, click on the *black triangle*. The Track Drop-Down Menu for the respective track is then opened.



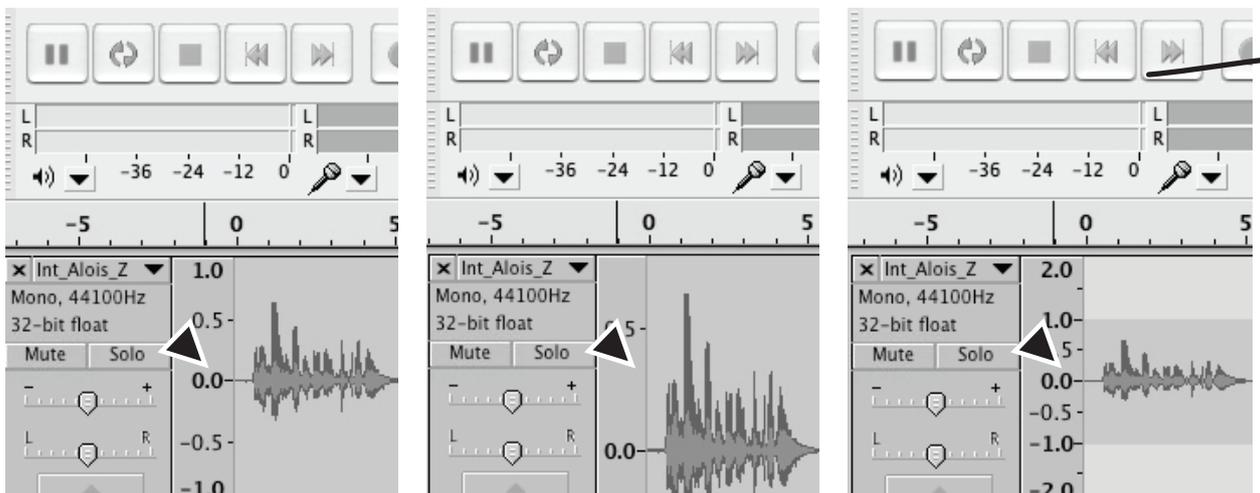
7.2 Preview and Navigation



The buttons **Skip to Start/End** of the Transport Toolbar offer very useful functions for playback and quick navigation, referring to the violet double arrow symbols pointing in opposite directions. They are employed for jumping to the very beginning or end of the entire audio project by a single cursor click. This comes in handy mainly when working on complex montages.



A second function of the **Play button** (usually represented by a *green triangle*) makes playback and listening more convenient: **Loop Play**. Just select the passage you want to listen to and press the **Shift key** [↑] plus the **Space key**. The **Play button** then changes its appearance and now depicts two circular arrows (see the figure above). **Loop Play** is ended by clicking the **Stop button** or the **Space key**.



7.3 Zoom – Horizontal und Vertical



With the toolbar's **Zoom** function, the graphical representation of the audio track can be changed according to current needs. Just click the respective symbol and the view zooms in or out. For instance, to insert sentences, it is necessary to choose a higher resolution, i.e., to zoom with the **+magnifier**. Even faster, these functions can be accessed by holding the *CTRL* key pressed down and turning the *MOUSE'S SCROLL WHEEL* up- or downwards.



For a quick overview of an entire audio project, it is advisable to use the two **special zoom functions**. For the application of the magnifier with a selection within an audio track, the passage which shall be examined more closely must be selected. Then, by a click on this magnifier, it is immediately fitted to the screen area and hence enlarged. If nothing is selected, when clicking the magnifier with the boundaries, the entire audio project is automatically zoomed into the screen area. Alternatively, the key combinations *CTRL + A* and *CTRL + E* can be used for this function.

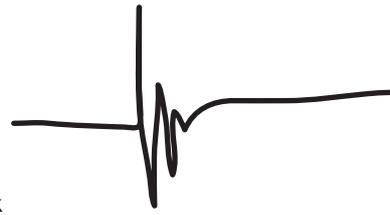
For fitting the entire audio project **vertically** into the screen area, the key combination *CTRL + [↑] + F* is appropriate. From time to time, this makes sense for multitrack montages, as well as for single track editing.

Another **vertical zoom variant** often occurs accidentally and consequently causes confusion. When clicking the scale to the left of the audio track with the left mouse button, the graphical representation of the audio track is altered. The sudden change is sometimes irritating. By a click with the right mouse button, the initial view is restored. In contrast to the vertical zoom variant described above, however, the audio track is not altered within the screen area, the zoom is conducted within the boundaries of the original audio track view.

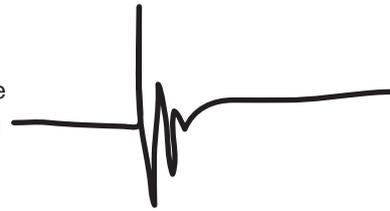


7.4 Preparing/Editing Interviews

In order to get hold of a longer interview and its contents and to prepare it for further processing, it is advisable to utilize a **Label Track**. For this, a new Label Track is selected under the menu item TRACKS. You can then listen to the interview and set **Labels** during playback. Place the cursor at the desired position and press **CTRL + B (OR M)**. A window is created within the Label Track into which a numbering, a catchword, die initials of the interviewee etc. can be inserted. Caution with the choice of characters used: The labels become file names, so do not use special characters/German Umlauts and choose a speaking designation. A simple numbering is not recommendable, as it is difficult to recognize later what is concealed behind. Better are unequivocal catchwords, as for example: introduction, name, school, migration, vote, danger, favourite song, etc.

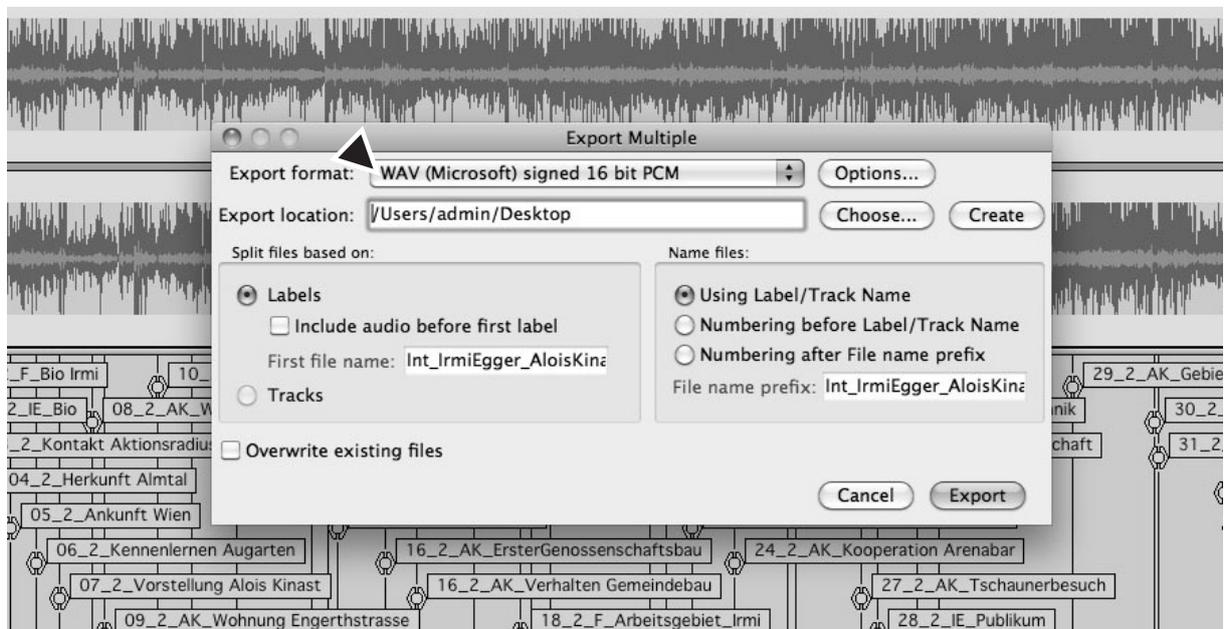
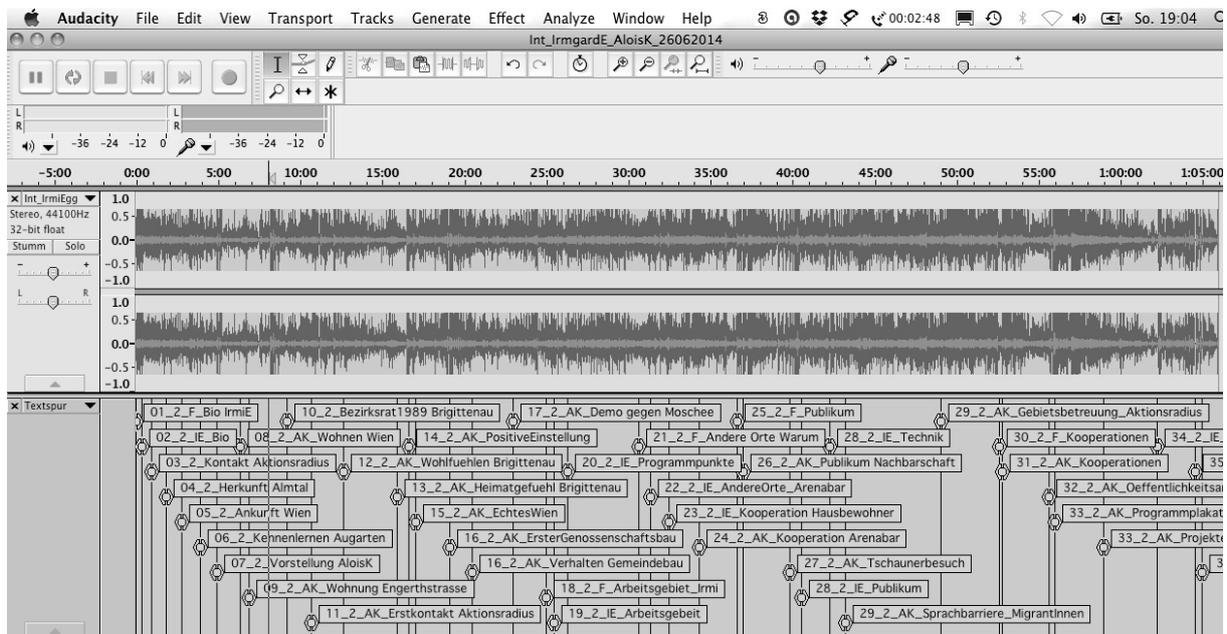


After listening to and labelling the whole interview, the labelled passages can be saved in one working step, using the function **Export Multiple** under the menu item FILE. Make sure to choose a suitable folder for saving and to switch the sound quality to some uncompressed format (e.g. WAV).



The screenshot shows a file explorer window titled "AugartenStadt_20140714". The window displays a list of files with columns for Name, Änderungsdatum, Größe, and Art. The files are listed in chronological order of creation, all dated 13. Juli 2014 17:36. The file types are primarily WAV audio files, with one AUP file at the top.

Name	Änderungsdatum	Größe	Art
Int_IrmiE_AloisK_26062014_Textspur.aup	13. Juli 2014 17:35	217 KB	Audac
01_2_F_Bio IrmiE.wav	13. Juli 2014 17:36	4 MB	Wavef.
02_2_IE_Bio.wav	13. Juli 2014 17:36	6,2 MB	Wavef.
03_2_Kontakt Aktionsradius.wav	13. Juli 2014 17:36	9,9 MB	Wavef.
04_2_Herkunft Almtal.wav	13. Juli 2014 17:36	9,5 MB	Wavef.
05_2_Ankunft Wien.wav	13. Juli 2014 17:36	12,1 MB	Wavef.
06_2_Kennenlernen Augarten.wav	13. Juli 2014 17:36	10,9 MB	Wavef.
07_2_Vorstellung AloisK.wav	13. Juli 2014 17:36	15,1 MB	Wavef.
08_2_AK_Wohnen Wien.wav	13. Juli 2014 17:36	5,7 MB	Wavef.
09_2_AK_Wohnung Engerthstrasse.wav	13. Juli 2014 17:36	24,4 MB	Wavef.
10_2_Bezirksrat1989 Brigittenau.wav	13. Juli 2014 17:36	15,6 MB	Wavef.
11_2_AK_Erstkontakt Aktionsradius.wav	13. Juli 2014 17:36	20,7 MB	Wavef.
12_2_AK_Wohlfuehlen Brigittenau.wav	13. Juli 2014 17:36	34,4 MB	Wavef.
13_2_AK_Heimatgefuehl Brigittenau.wav	13. Juli 2014 17:36	7,7 MB	Wavef.
14_2_AK_PositiveEinstellung.wav	13. Juli 2014 17:36	4,3 MB	Wavef.
15_2_AK_EchtesWien.wav	13. Juli 2014 17:36	22 MB	Wavef.
16_2_AK_ErsterGenossenschaftsbau.wav	13. Juli 2014 17:36	14,4 MB	Wavef.
16_2_AK_Verhalten Gemeindebau.wav	13. Juli 2014 17:36	26,6 MB	Wavef.
17_2_AK_Demo gegen Moschee.wav	13. Juli 2014 17:36	21,3 MB	Wavef.
18_2_F_Arbeitsgebiet_Irmi.wav	13. Juli 2014 17:36	5,2 MB	Wavef.
19_2_IE_Arbeitsgebiet.wav	13. Juli 2014 17:36	8,8 MB	Wavef.
20_2_IE_Programmpunkte.wav	13. Juli 2014 17:36	45,8 MB	Wavef.
21_2_F_Andere Orte Warum.wav	13. Juli 2014 17:36	7,4 MB	Wavef.
22_2_IE_AndereOrte_Arenabar.wav	13. Juli 2014 17:36	11,8 MB	Wavef.
23_2_IE_Kooperation Hausbewohner.wav	13. Juli 2014 17:36	20 MB	Wavef.



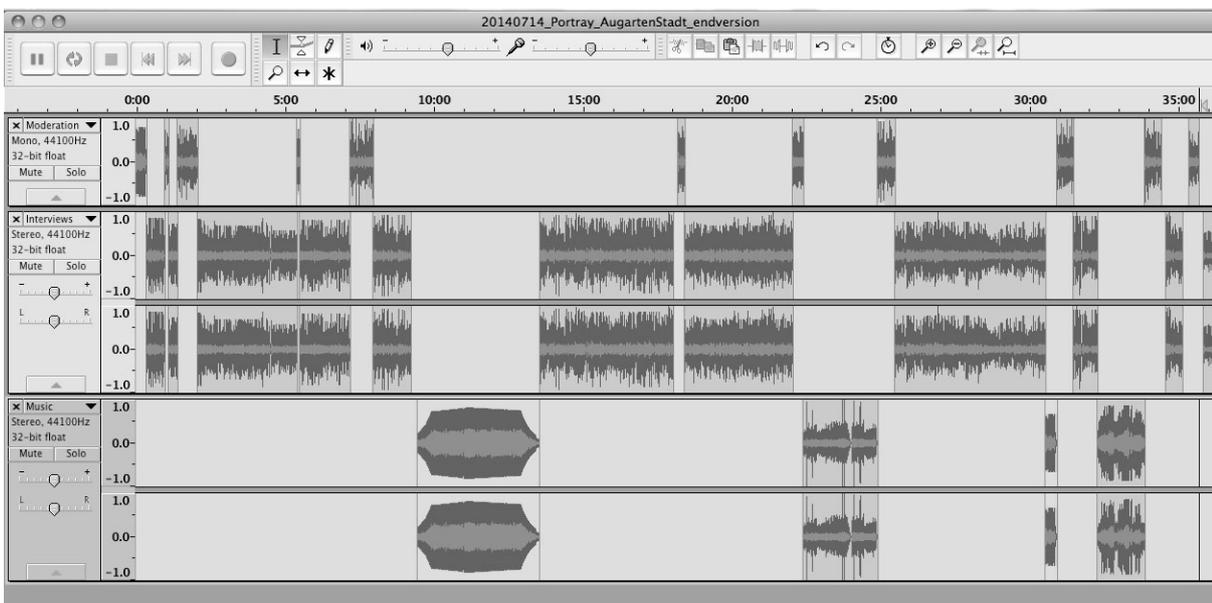
After exporting all the labels, only those passages that are needed for the broadcast are opened and further processed in Audacity. Save the original interview with the Label Track in Audacity – only this way the labels are preserved. If searching for something later, it is easily found thanks to the catchwords. For browsing, click some label and use the tab key to jump to the subsequent one. The Label Track can also be exported on its own (as .txt). It then offers a listing of the exported audio files with durations and names.

8 MONTAGE

8.1 Creating Audio Tracks

If working on a montage, you always create several audio tracks in order to be able to arrange the audio clips (parts of an audio track) in relation to each other and to get a better overview. For this, click **Add New Audio Track** under menu item **TRACKS** or use the key combination *CTRL + [↑] + N* (for mono tracks). If a new track has already been created, further ones can be obtained through **Duplicate**: Press *CTRL + A* to select the entire track (or by clicking the grey track control panel to the left of the track), then press *CTRL + D*.

It is advisable to create one track for moderation/comments, another one for music/signature tunes, one for interview passages and possibly an additional one for noise/atmosphere. Depending on the sound quality, these can be mono (moderation and interviews) or stereo tracks (music, noise, atmosphere). Combinations are possible, however, audio files in mono/stereo quality can only be inserted into the respective mono or stereo track. In other words, it is not possible to insert a mono audio file into a stereo track and vice versa.



8.2 Dividing and Arranging Audio Tracks

After creating the individual audio tracks for a montage, all the different elements of the montage (the previously edited audio files) are imported. Following this, they are moved to the desired position (according to type – into the track for moderation, music, interview passages, noise, etc.). To achieve this, the mouse or cursor is used as the **Time Shift Tool** (a two-headed arrow).



Just click on the clip and drag it to the desired track. However, this works only if the track has the same specifications (stereo/mono, bit rate, sampling frequency – displayed in the grey track control panel to the left of the track) and if there is a suitable free space. It is not possible to insert in such a way that the clips would overlap each other within one track. As soon as the clip has been put to the right position, the empty track can be closed (press x in the upper left corner) and the next audio file is imported.

If clips (parts) of an audio track shall be moved as a whole, the **Shift key** [↑] is pressed down in addition to the Time Shift Tool and the mouse is moved into the desired direction. If several clips shall be moved across several tracks, all elements need to be selected with the Selection Tool and the Shift key [↑] pressed down, and then moved with the Time Shift Tool. Alternatively, you can click the stopwatch sign in the toolbar, select all clips which are to be moved, and then move them to the correct position with the Time Shift Tool. Afterwards, deactivate the stopwatch function.

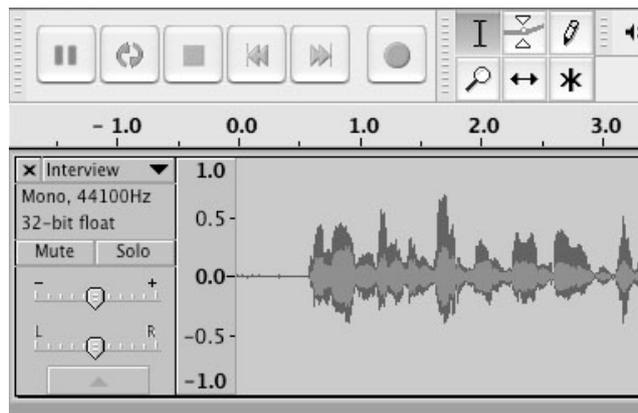
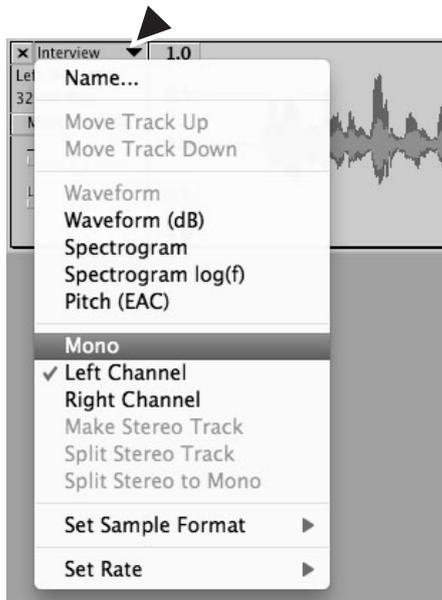
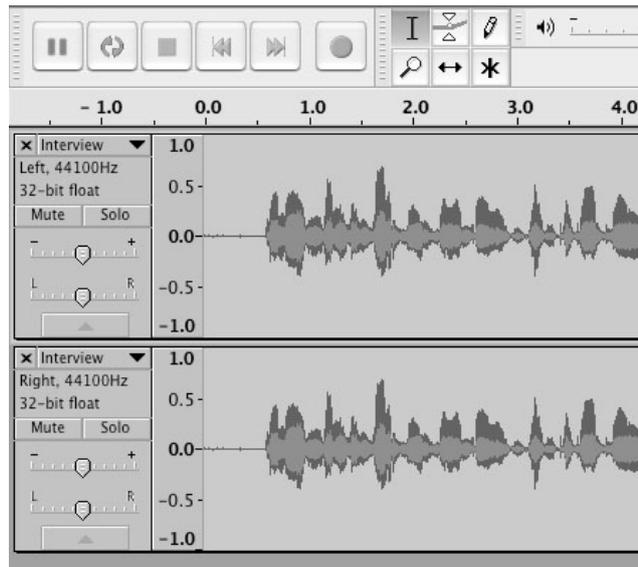
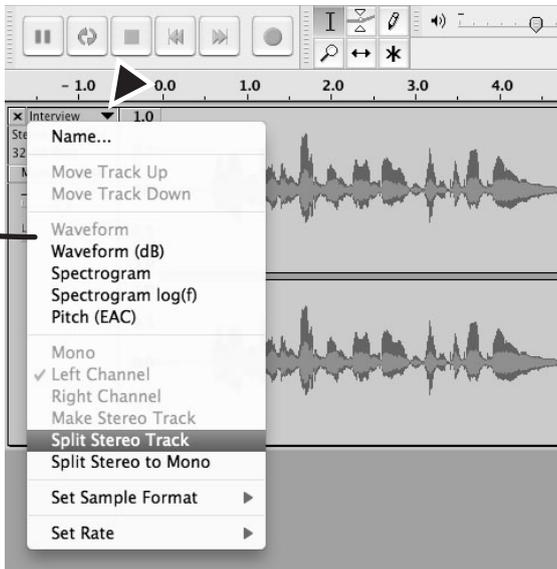
8.3 Splitting/Generating Stereo Tracks

Sometimes it is necessary/reasonable to create a stereo track from two mono tracks (in this case a joint stereo track) or to transform a stereo track into a mono track (e.g., for a montage of interview passages in stereo and mono quality). Click the *black triangle* in the grey track control panel to the left of the track. In the drop-down menu, click the function **Split Stereo Track**. Of the two separated channels, delete the one (by clicking the x in the left upper corner of the track control panel) that contains the recording with the lower volume level (if there is any difference at all), in order to avoid “losing” sound passages. Then, by clicking the *black triangle* again, select the function **Mono** in the drop-down menu. In this way, the split stereo track is switched to a mono track. Otherwise, it would be saved as the left or right channel of a stereo track.



8.4 Dividing/Joining Audio Tracks

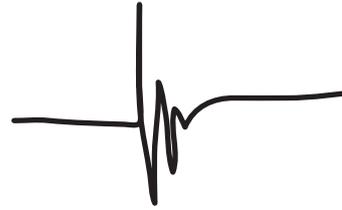
Eventually, it is sometimes necessary during a montage to split a track into two or more parts, e.g., to make possible the shifting of individual parts (clips). Click the intended splitting point and select the function **Clip Boundaries > Split** under the menu item EDIT. The track is then split. If two parts shall be joined, just shift the rear one as far as possible into the direction of the front one, click on the slightly thicker boundary line and the two parts are joined.



9 VOLUME EDITING

9.1 Volume Adjustment – Amplification

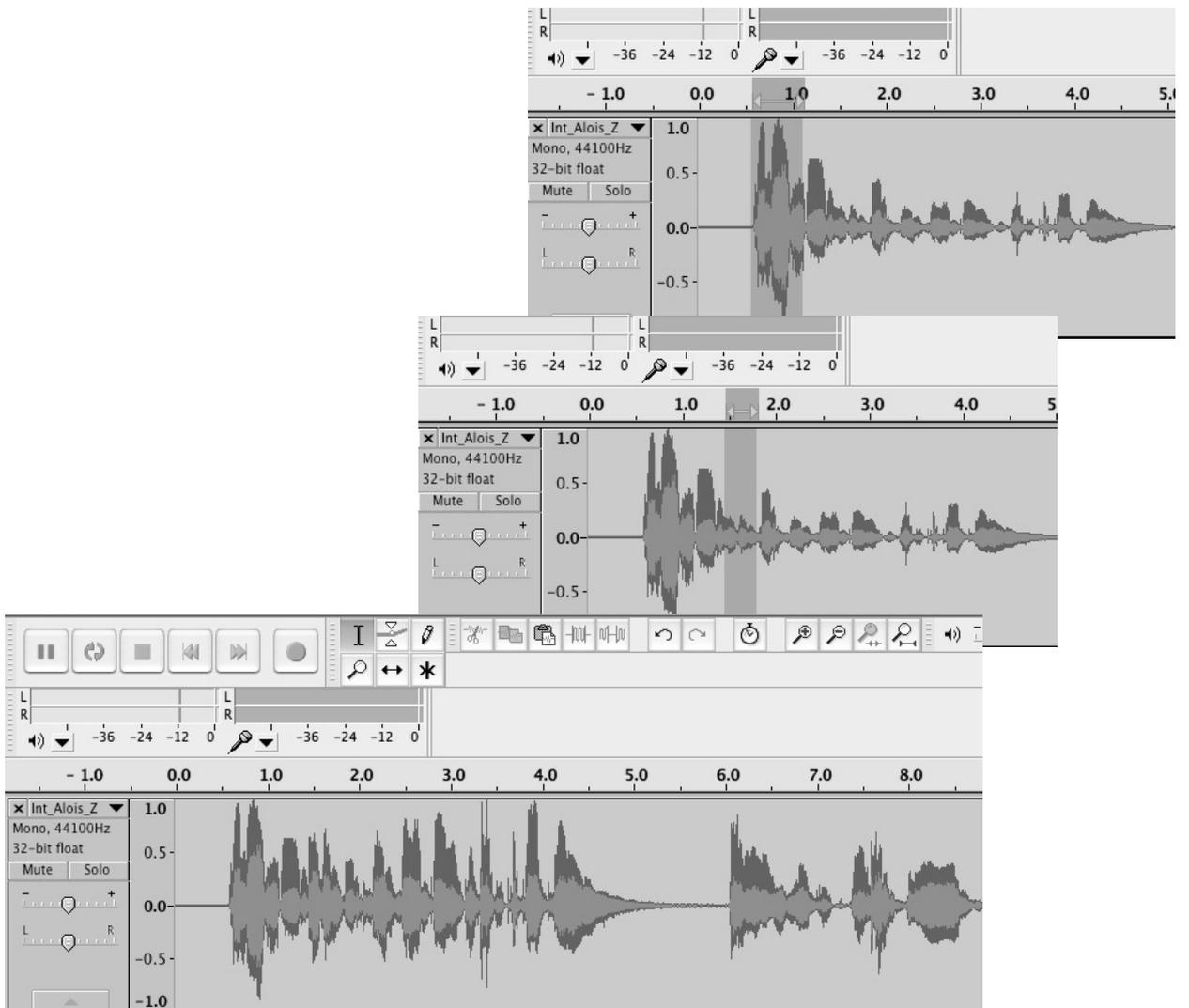
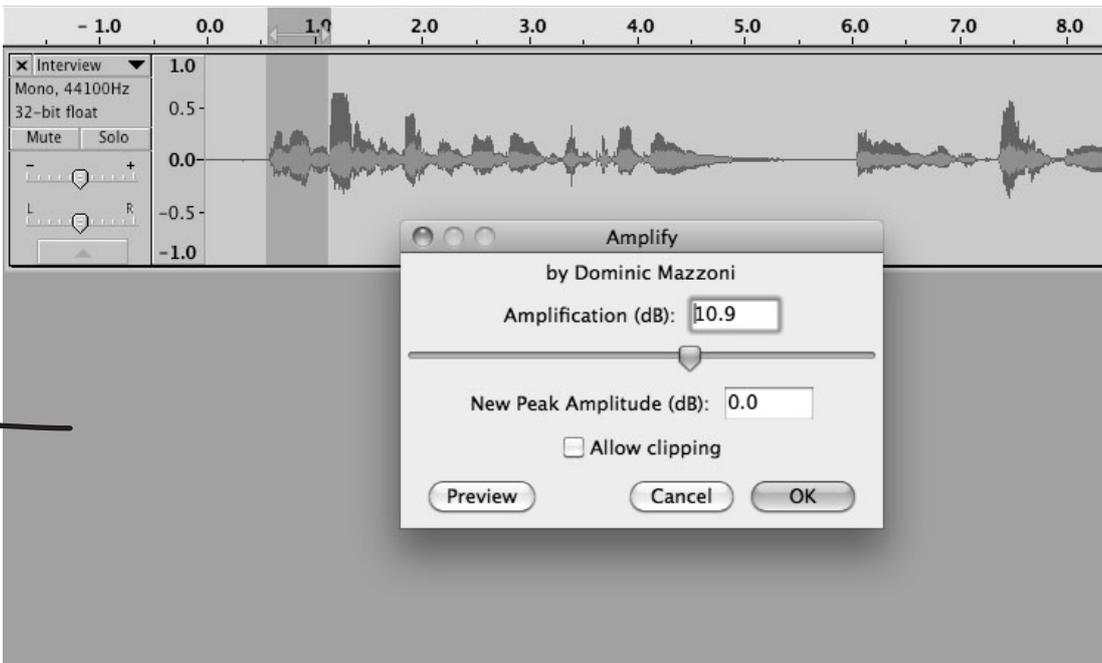
The basic rule is that already during recording the best possible volume should be aimed for by levelling. If, for different reasons, a recording has ended up too loud or quiet, or with volume differences that are too big, this can be fixed by the function **Amplify** under the menu item EFFECT. You should be aware, however, that the processing of problematic recordings in terms of volume levels never leads to an entirely perfect sound quality. The fundamental flaws of a recording can only be made up for up to a certain degree. Recordings which are too loud sound slightly distorted even after processing. Amplifying recordings which are too soft also amplifies unwanted noise and ambience sounds, which reduces the listening pleasure as well.



If, despite these drawbacks, you still have to use the effect Amplify, first select the entire audio track (by pressing *CTRL + A* or by clicking the grey track control panel to the left of the track). Then click the effect **Amplify** and regulate the desired augmentation or reduction. By default, a value is selected such that the new peak amplitude is 0 dB. This means that the loudest passage imposes a boundary to the magnitude of the amplification if the entire clip is selected at once. It is hence advisable to select only the passage which shall be amplified and, if needed, to repeat the procedure for all the other passages of the same volume that need to be changed. For this, applying **Repeat Effect** is of helpful (see below).

9.2 Repeat Effect

The effect which has been applied last at any given moment can be repeated any number of times using the key combination *CTRL + R* or the function Repeat Effect (under the menu item EFFECT). This is mainly helpful when manually adjusting the volume of selected passages of an audio track.



9.3 Volume Adjustment – Envelope Curve

If there are great volume differences within a recording and, e.g., there are some clipping peaks, for these minor **volume adjustments** the Envelope Tool can be utilized. This function is activated by clicking the respective mouse function (see arrow at the very top). As a result, the graphical representation of the audio track is changed. When clicking the blue or the grey outline, a small dot is created. The volume can be amplified or reduced by dragging it up- or downwards. However, the passage that shall be adjusted needs to be selected first by creating dots at the beginning and the end of the passage. Otherwise the volume is changed for the entire recording resp. until the next dot. If a dot has been created accidentally, it can be erased by dragging it out of the audio track.

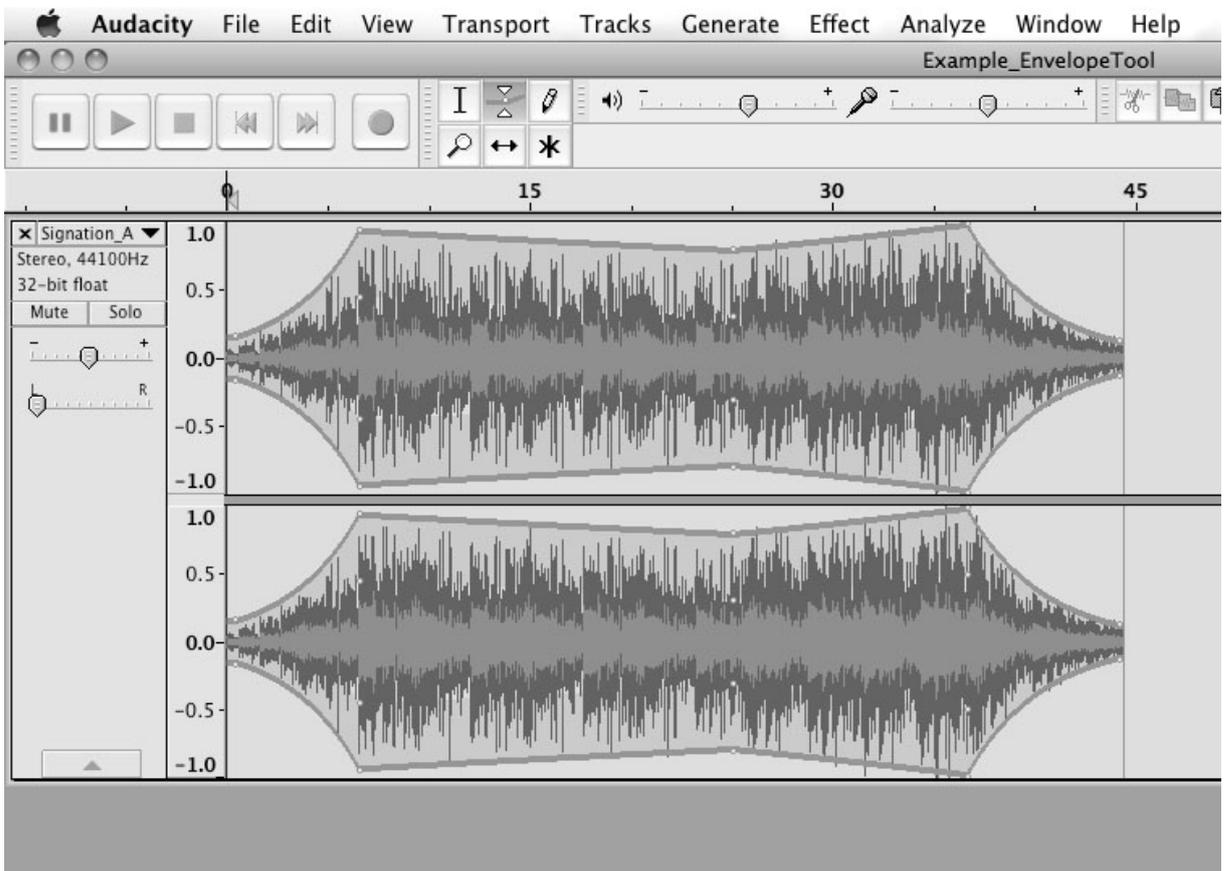
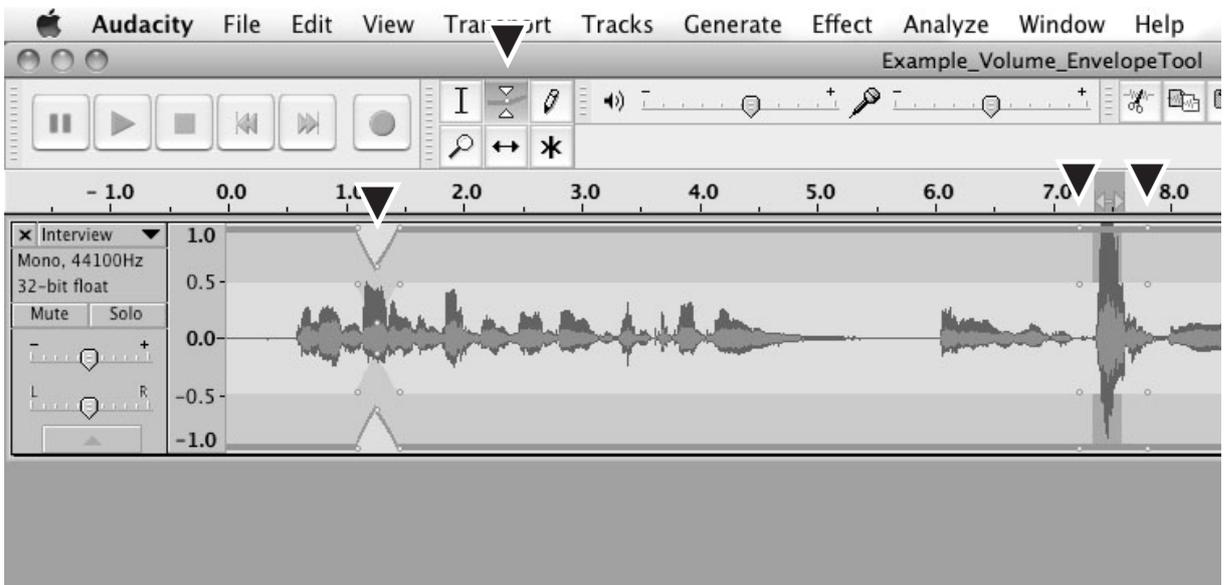
Clipping detection can be activated under the menu item VIEW by **Show Clipping**. By means of this, clipping passages of the audio track are automatically displayed red.



9.4 Fade In/Out

Fading in resp. out music or noise is one of the most commonly used processing steps in the radio sector. For this, under the menu item EFFECT there is the function **Fade In** resp. **Fade Out**. First, the passage that is to be faded in resp. out automatically has to be selected, then the desired effect is clicked. The fade is then implemented from resp. to complete silence. Fading in and out can also be done manually with the Envelope Tool. In this case, the envelope shape can be chosen freely and it does not necessarily have to start or end in silence.





9.5 Volume Adjustment in Combination

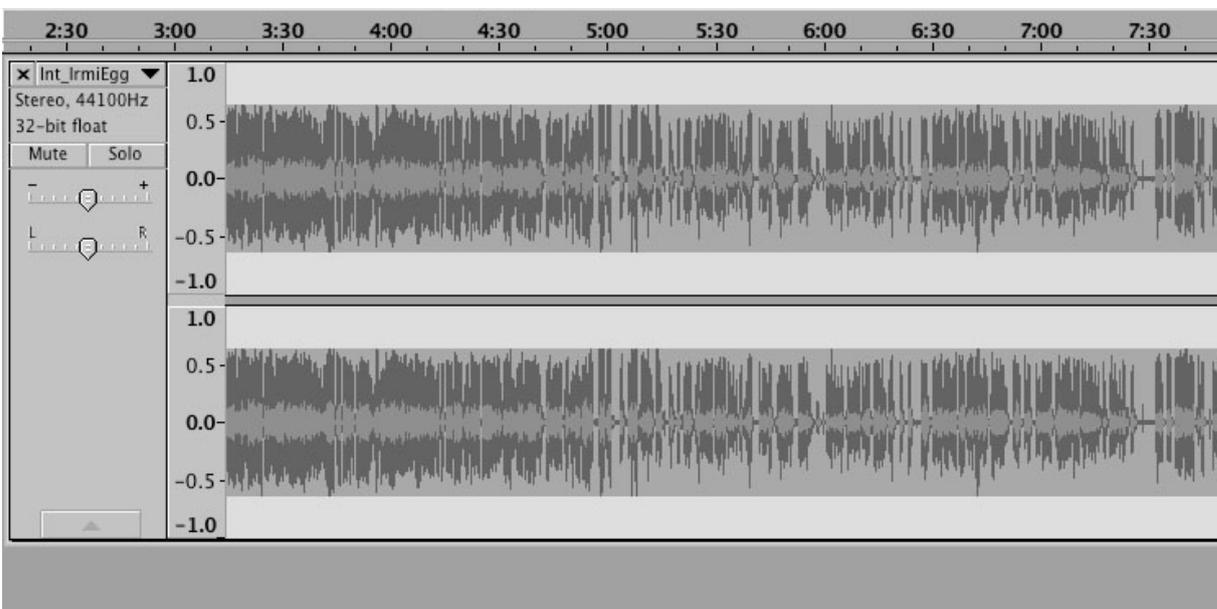
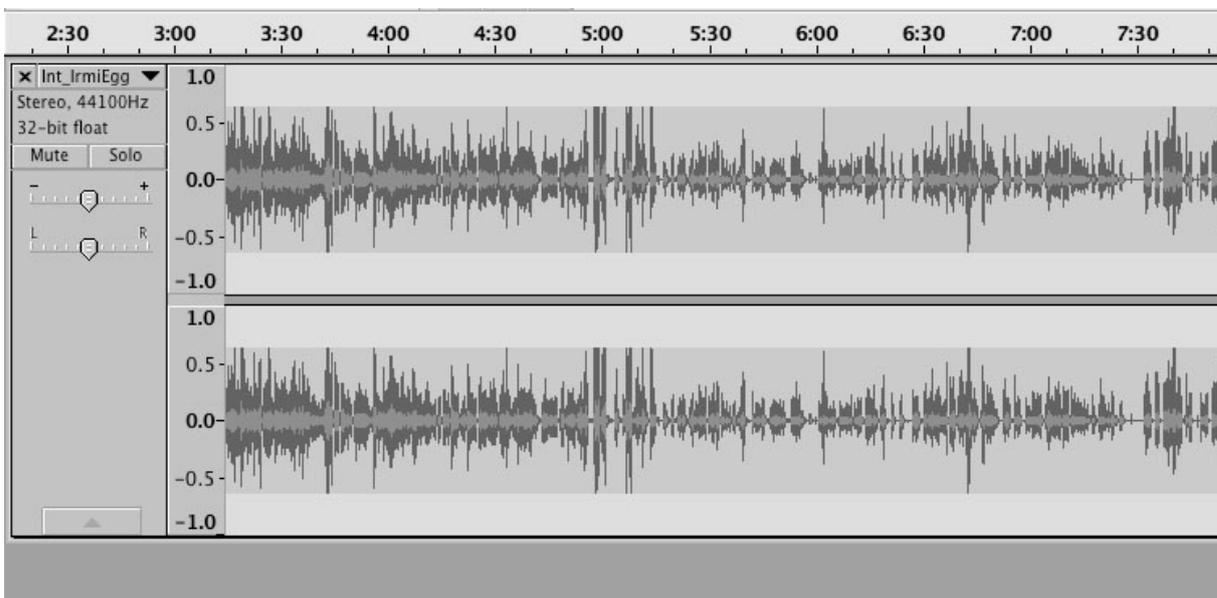
If the last polishing steps in terms of volumes and transitions of a montage are carried out, the mouse or cursor function **Multi-Tool Mode** (star symbol) might be the best choice. In this mode, the audio track can be edited with the *Envelope* or the *Selection Tool*, depending on the current position of the cursor within the clip, and you do not always have to click on the different functions of the mouse. However, this should be used with care, as the transitions happen rapidly and the volume is easily altered by an unintended dot on the envelope curve.



10 OTHER EFFECTS

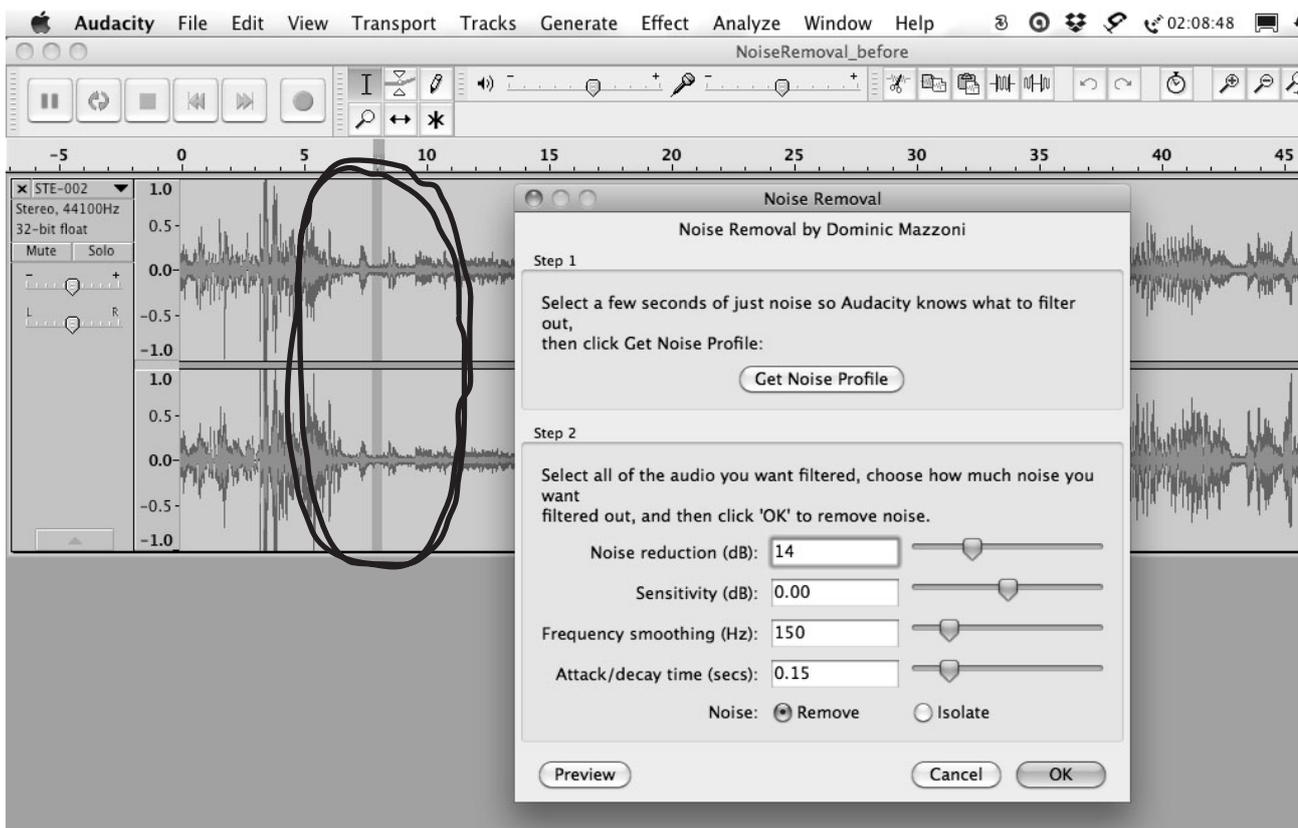
10.1 Compressor

The dynamical differences of a recording (for example caused by varying distance to the microphone) can be made up for through the compressor. Select the respective sound passage and, under the menu item EFFECT, select **Compressor**. A window pops up displaying a curve that can be modified with the faders below it.

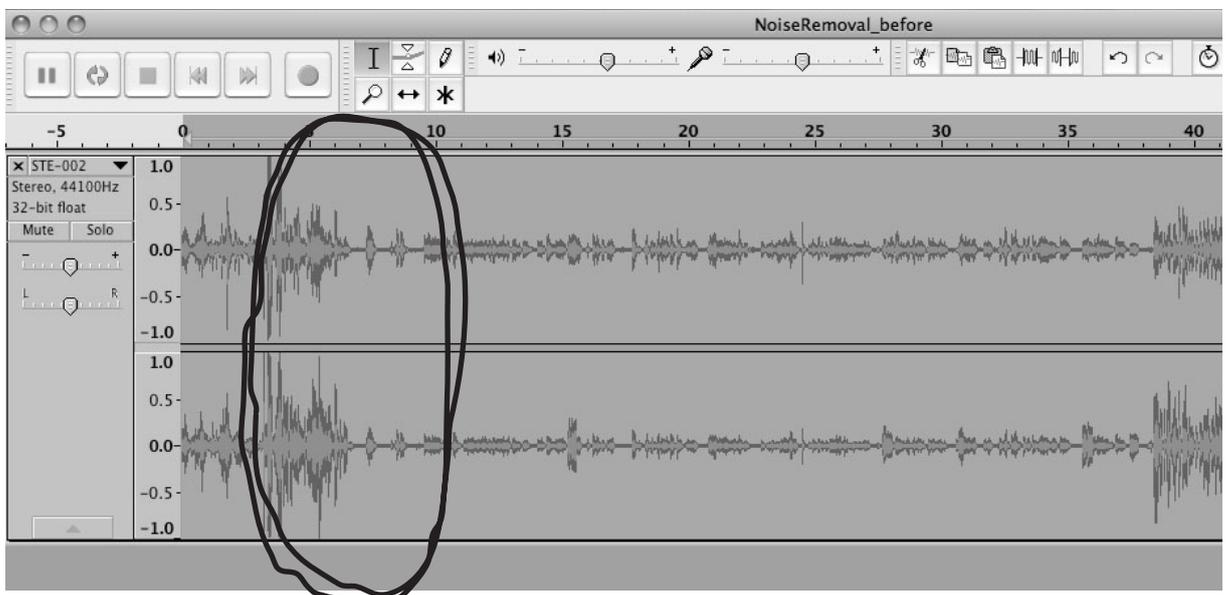
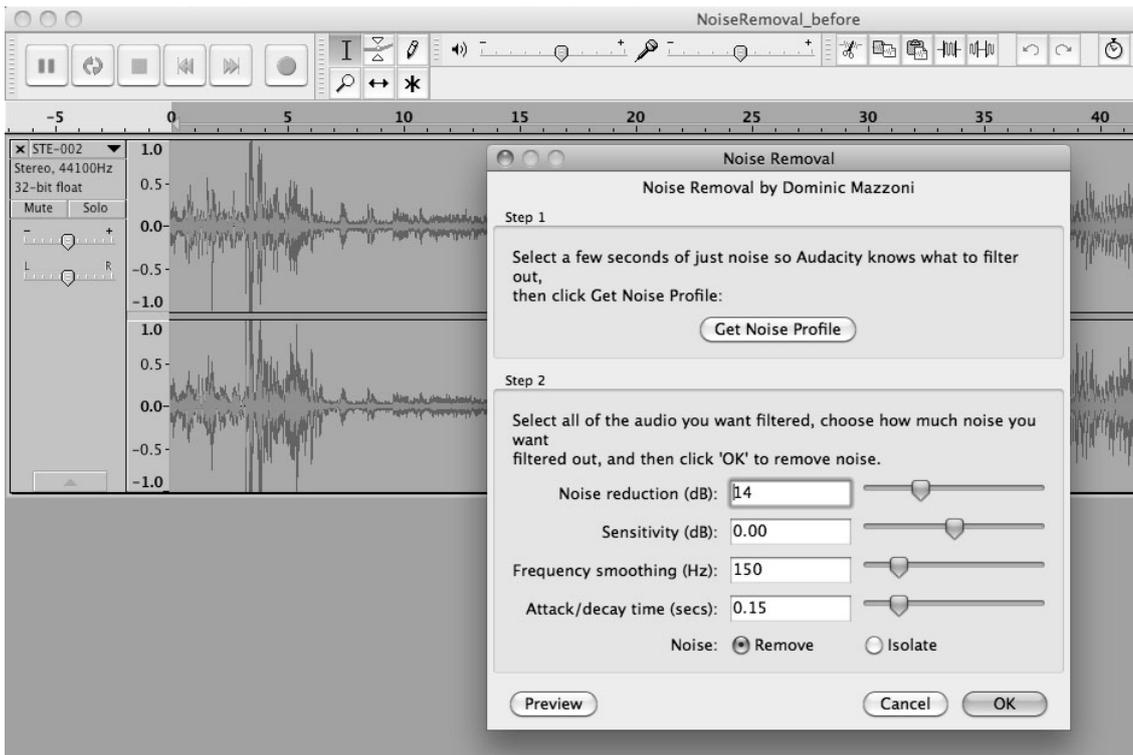


10.2 Noise Removal

If there is some constant background noise on the sound recording (e.g., computer fans, video projectors, etc.), it can be removed by the function Noise Removal. However, this should only be done in case of emergency. It is much more efficient to avoid background noise during the recording. If, despite of this, it is necessary to use the EFFECT **Noise Removal**, open it and select a passage in which only the noise to be removed is audible. Click **Get Noise Profile** and wait. Afterwards, select the passage of the audio track to which Noise Removal shall be applied and press **Preview**. If you like the result, confirm with **OK**. Otherwise, adjustments can be made in the function window using the filter categories in **Step 2**. In any case, previewing is advisable, as voices sometimes sound very “tinny” after the Noise Removal.



Here, the entire audio track is already selected and the function has been opened. The result can now be previewed and possibly be confirmed by **OK**. At the bottom, the finished result can be seen. The lower level of background noise is apparent even visually.



10.3 Remove Distortion/Clipping

With this function, especially high or low frequencies can be filtered. This way, distortion and clicks that arose during the recording can be reduced. But here again: The sound quality will never result as perfect as through good levelling during recording. The function should only be seen as a remedy for emergencies, for diminishing audible distortions a little bit. Select the respective passages of the audio file, under the menu item EFFECT click the function **High Pass Filter/Apple: AUHipass** resp. **Low Pass Filter /Apple: AULowpass**, and try to find the best improvement by modifying the various parameters. There is no preview function – hence use trial and error and the function **Undo**.



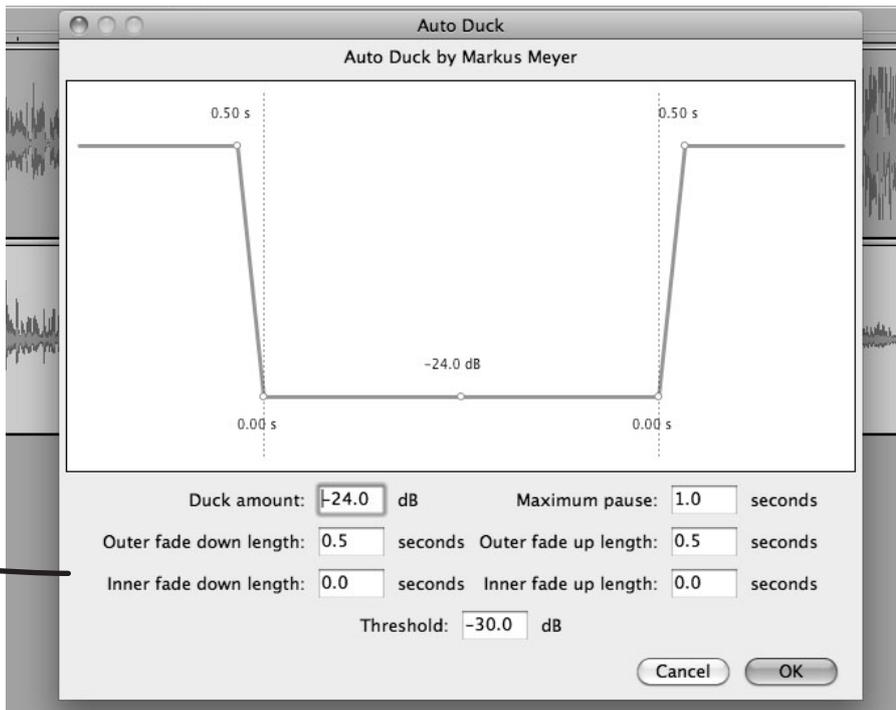
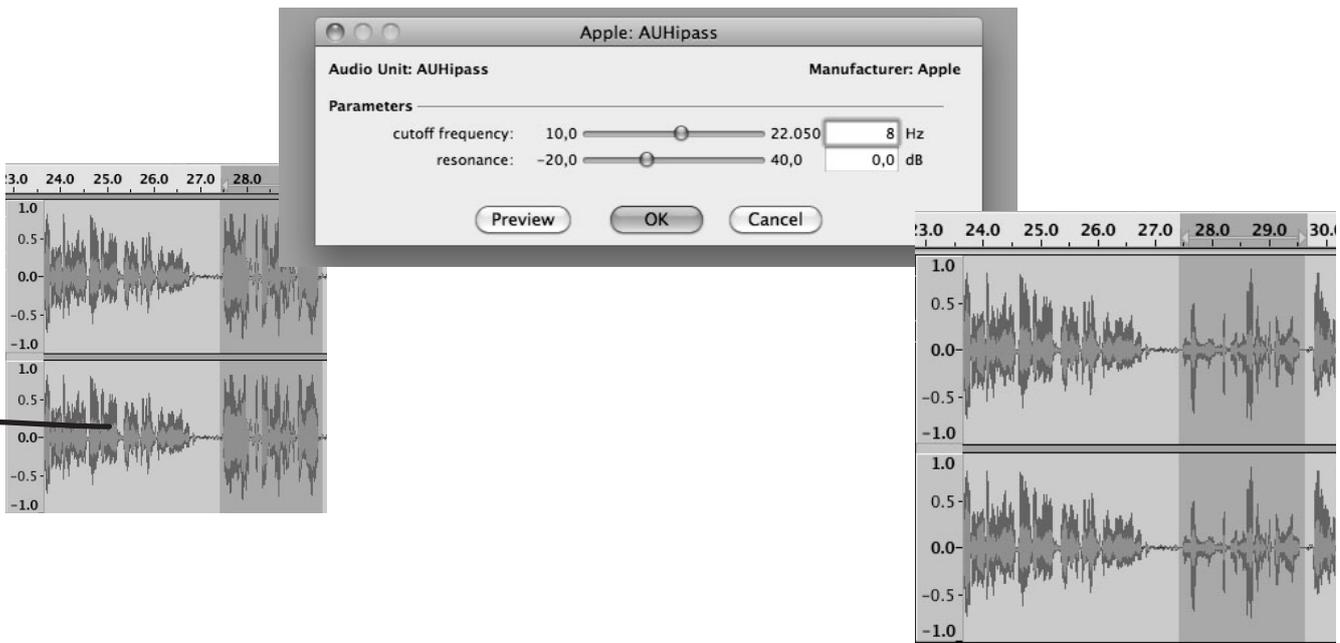
10.4 Equalizer

The equalizer allows for the precise selection of frequency ranges in which something shall be altered. Unwanted frequencies can be lowered, frequencies which are too quiet can be amplified. Select the respective audio track and, under the menu item EFFECT, click **Equalization**. This opens a window displaying a scale in which the alterations are specified through dots and a curve that can be dragged. The outcome can be previewed (click **Preview**) and, if it is satisfying, the function is carried out. If not, the curve needs to be adapted.

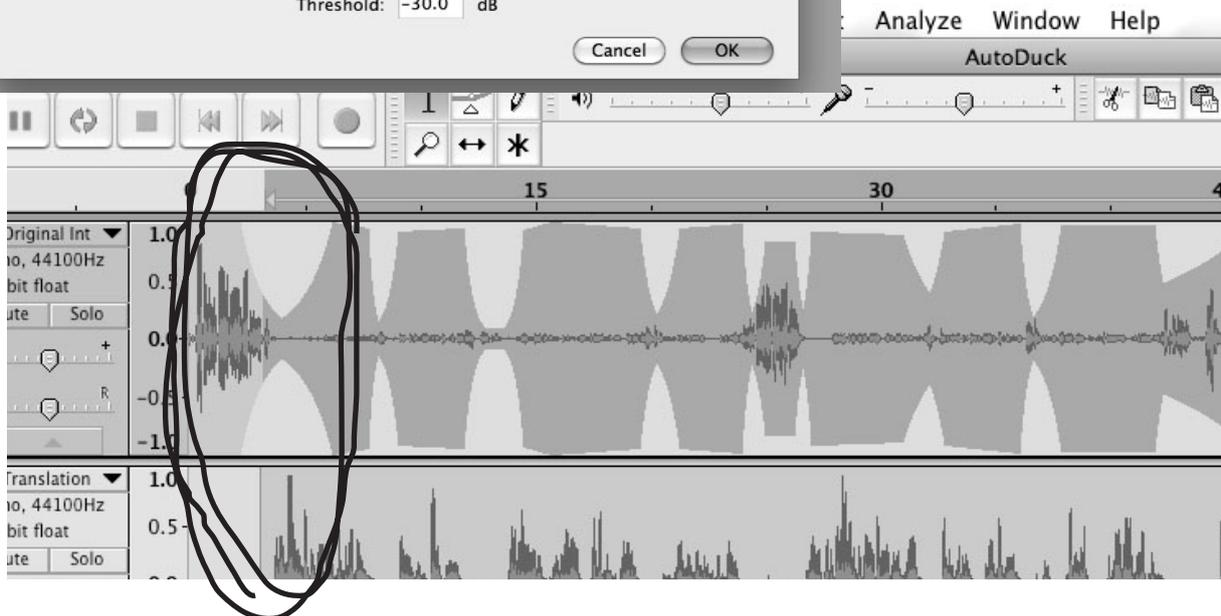
10.5 Auto Duck – Adjusting the volume of two audio tracks relatively to each other

If you want to combine an audio track with another one, e.g. for a voice over when language is translated (the original is heard quietly in the background, the interpreter loud in the foreground), the effect **Auto Duck** can be used. Both audio tracks have to be positioned next to each other in the project – the one of which the volume shall be reduced (e.g., the interview in the original language) above, the clip that shall be heard in full volume (e.g., the interpretation into the target language) below. Select the upper audio track's passage of which the volume shall be reduced and click **Auto Duck** under the menu item EFFECT. Carry out the processing which is then proposed. In case the result is not optimal yet, use **Undo** and then again Auto Duck (with modified parameters) until the volume levels of the two audio tracks fit together well. If needed, the transitions can be edited further manually (with the *Envelope Tool*).





Application of Auto Duck and subsequent editing with the *Envelope Tool*



10.6 Truncate Silence

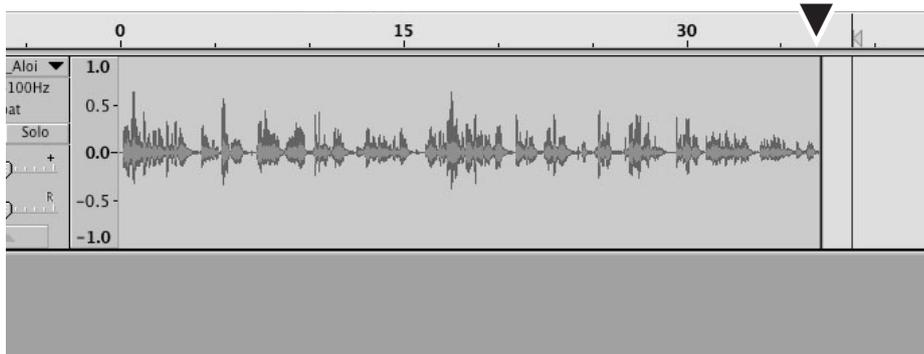
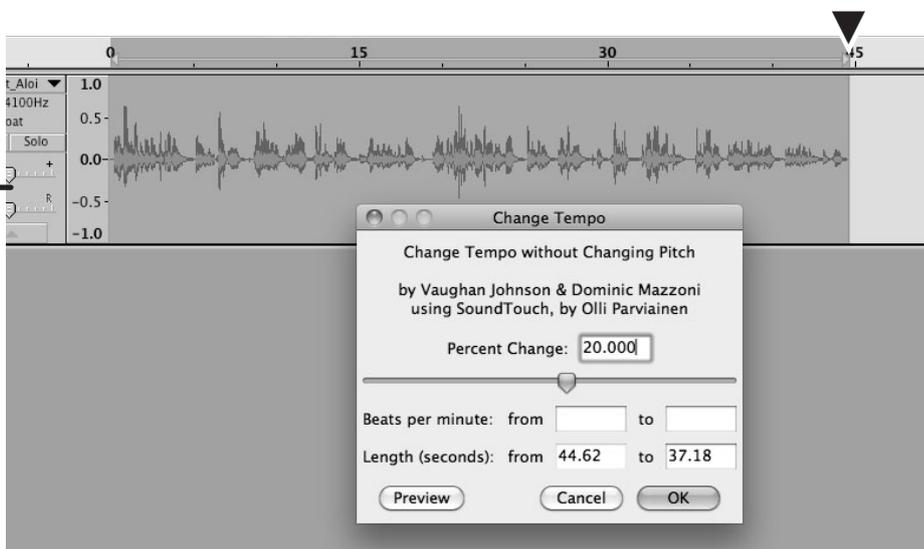
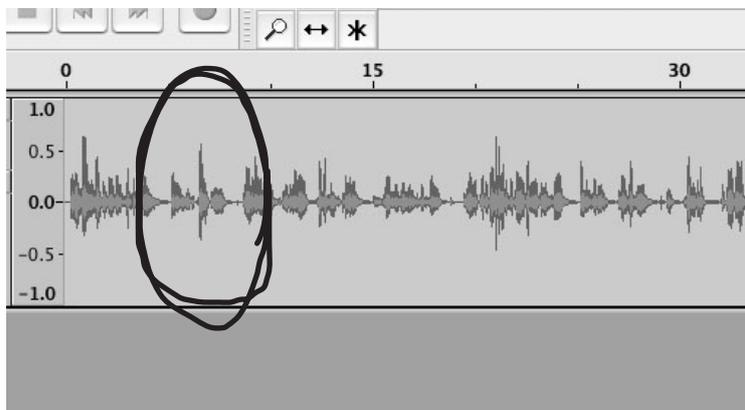
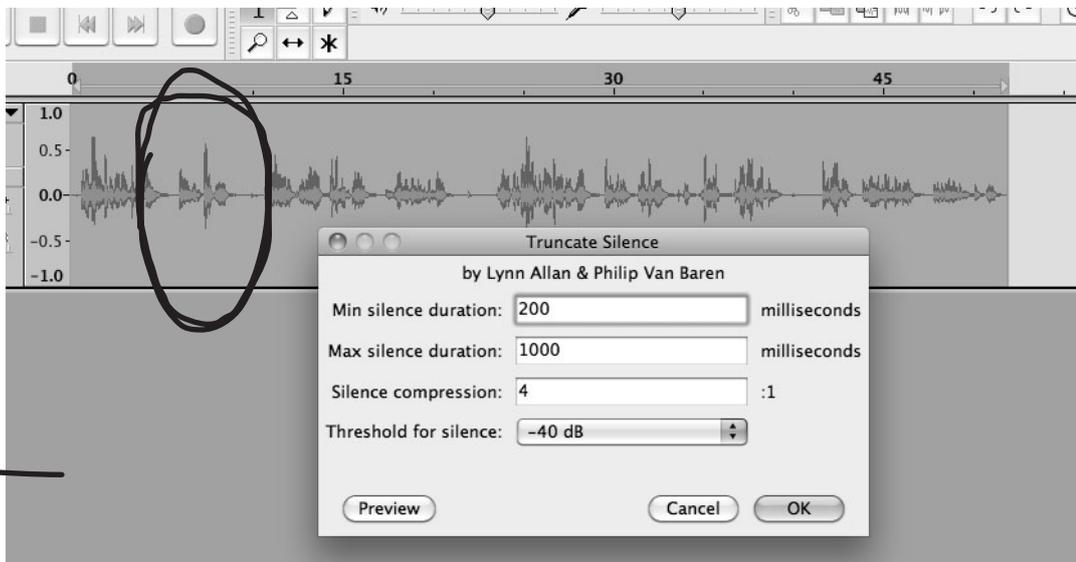
Sometimes, due to various causes (tiredness, thinking pauses, language or talking difficulties) silences arise that unnecessarily prolong a radio programme. In order to remove all these small pauses rapidly, the effect **Truncate Silence** can be applied. First select where pauses shall be removed, then click **Truncate Silence** under the menu item EFFECT. A window with the parameters opens. After previewing, modifications can be made. In the depicted example, the audio file was shortened by seven seconds (from 52 to 45 sec.) by using this effect. However, breathing pauses should not be removed entirely or edited out manually, as the conversation might end up sounding artificially hurried or breathless.



10.7 Change Tempo

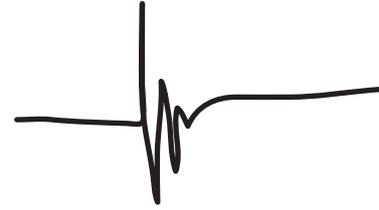
Another possibility to shorten a long audio file without having to omit speech passages is provided under the menu item EFFECT by the function Change Tempo. However, it cannot be used with the default parameter settings. You have to start with a certain percentage for the tempo change and try to gradually approach an optimal result by repeated previewing. In the depicted example, this was achieved at 20 per cent, resulting in a length reduction of 8 seconds without alienating the speech character of the interviewee. The function does not change the pitch of the voice, i.e., the result is not a "Mickey-Mouse"-voice.





10.8 Change Pitch of the Voice

The function **Change Pitch** under the menu item EFFECT facilitates pitch changes of an audio recording, i.e., making it higher/lower sounding, without changing the tempo. This function should only be used for special cases (e.g., radio plays, anonymizing interviewees), as it strongly alienates human voices. The duration of the audio track is slightly effected as well.



10.9 Change Speed and Sliding Time Scale/Pitch Shift

These functions, under the menu item EFFECT, facilitate a more subtle harmonisation of tempo and pitch in relation to each other, but require considerably more time for experimenting and previewing. They are only recommended for editing digitalizations of records (**Change Speed**) and for changes where the length of the track shall not be affected (**Sliding Time Scale/Pitch Shift**).

Change Pitch

Change Pitch without Changing Tempo

by Vaughan Johnson & Dominic Mazzoni
using SoundTouch, by Olli Parviainen

Pitch: From: **F#/Gb** Up Down To: **G**

Semitones (half-steps): **1.02**

Frequency (Hz): from **186.076** to **197.368**

Percent Change: **6.069**

Preview Cancel OK

TonhoeheAendern

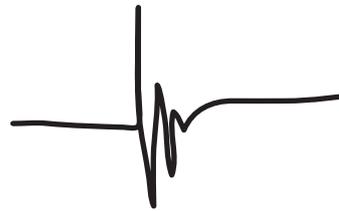
10 15 20 25 30 35

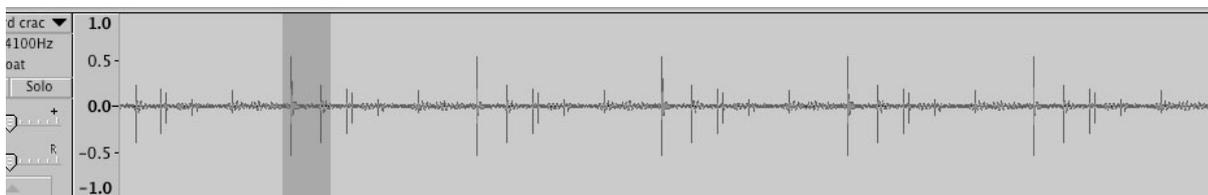
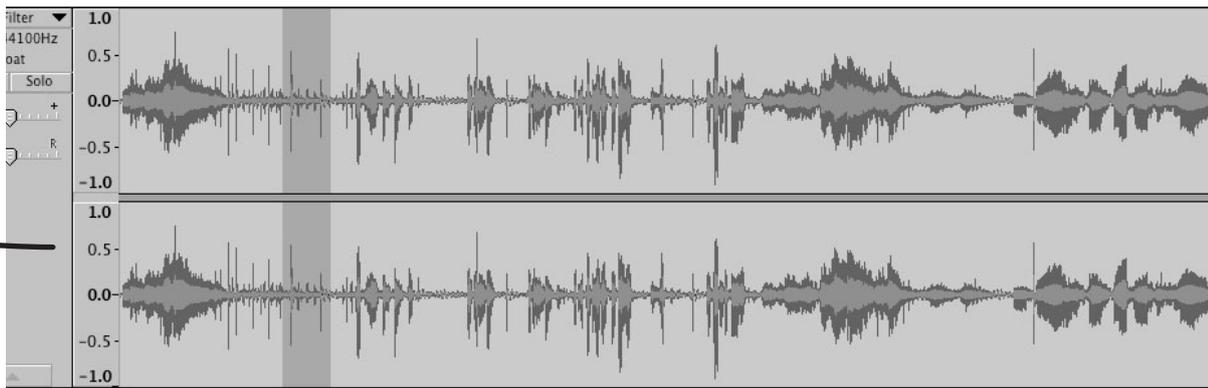
UE_Int_Aloi 1.0
Mono, 44100Hz
32-bit float
Stumm Solo
- 0.5 0.0 -0.5 -1.0

10.10 Click Removal

For the processing of old phono recordings that have been digitalized and on which, caused by a scratching or unclean needle, an unwanted periodic noise is audible, choose the function **Click Removal** under the menu item EFFECT. Select the audio track with the clicking and, by repeated previewing, set the parameters of the click filter in such a way that the periodic clicking noise is filtered out.

The audio track which is to be processed. Below, for comparison, the audio track of "cracking sounds" that were superimposed over a recording. It has a characteristic shape, which can be observed in the unprocessed audio track.



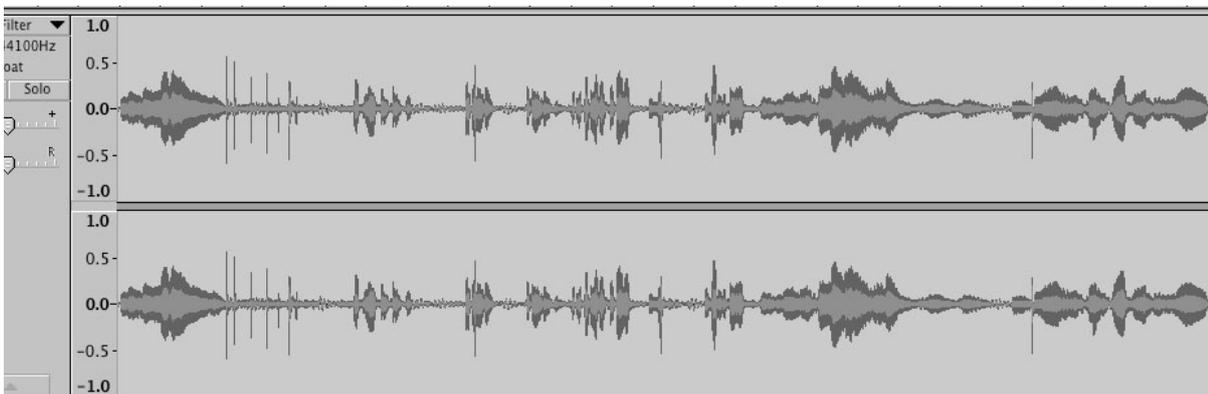


Click Removal
Click and Pop Removal by Craig DeForest

Select threshold (lower is more sensitive): 54

Max spike width (higher is more sensitive): 25

Preview Cancel OK



11 APPENDIX

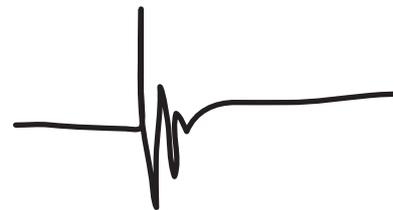
11.1 Sound Enhancement with Auphonic Automatic Audio Post Production Programme

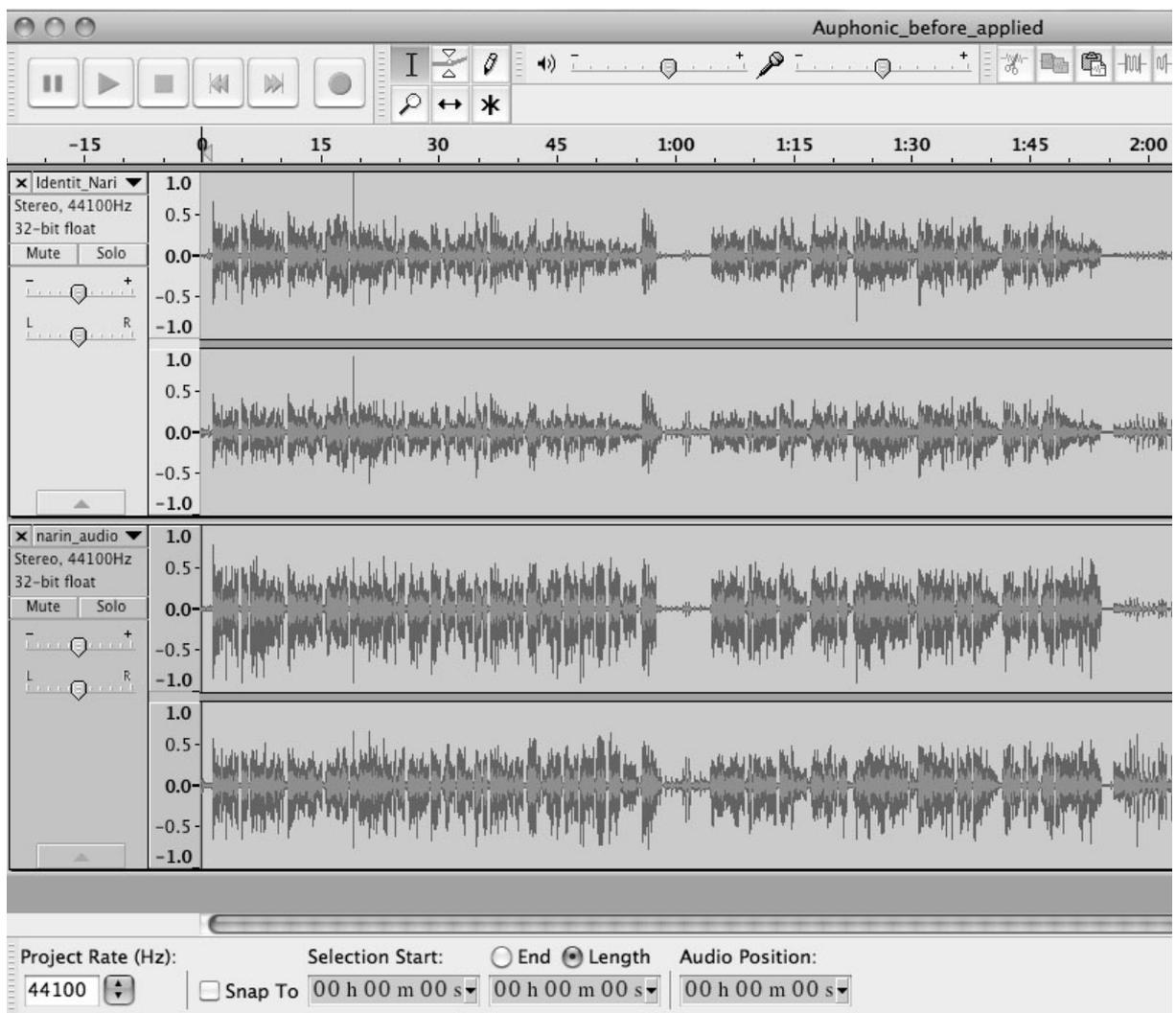
Auphonic is a programme for improving sound quality, aligning volume levels within an audio file, and algorithmic denoising.

Unequal volume levels in a recording can result from body movements during the interview or if passages from interviews with various speakers are composed into a sequence. If, however, a sequence contains unequal volume levels that shall be maintained for reasons of dramaturgy/authenticity/atmosphere/music, etc., Auphonic can NOT be used.

To use Auphonic, e.g., for a montage of interview passages and spoken introductions preceding music, the audio file is uploaded to the website of Auphonic. After the automatic processing through the programme, it is downloaded again. The programme can only be used online. For this, it is necessary to register: on <https://auphonic.com/>. In the upper right corner, you find the possibility to register and log in. Since April 2014, only the processing of up to 120 minutes of audio data per month is free, greater amounts of data have to be paid for. Therefore, Auphonic is advisable mainly for urgent cases (many volume differences within short intervals, or if time is lacking) – all processing performed by Auphonic can also be carried out in Audacity.

Example: At the top the original audio file, at the bottom after processing with Auphonic







11.2 Download Tips

The latest **Audacity** version (currently: 2.1.1 for Windows GNU/Linux and Apple) can always be found on <http://www.audacity.de>.

LAME MP3 Encoder required for saving audio files as MP3s in Audacity. Available from <http://www.audacity.de> > **Nützliche Software** > **Empfehlungen**. Caution: Download the correct Lame Encoder for the installed version of Audacity – usually there are various Lame Encoder versions, which are compatible with different versions of Audacity. Please make sure that you download the right one.

Besides the LAME MP3 Encoder, which should be installed in any case, there are some more plug-ins for Audacity that can be installed optionally (available from **Nützliche Software** on the Audacity website). They expand the effect possibilities, but are not necessary for your everyday digital audio editing needs for ORANGE 94.0 as described in this script.

11.3 Other Useful Programmes

Windows

FreeRip

CD ripping and conversion.
A free CD ripper, which can also convert files.
<http://www.freerip.com/>

GNU/Linux

A multitude of conversion and rip programmes exist. Find tips on the following webpage:
http://wiki.ubuntuusers.de/Audiodateien_umwandeln

Apple

Apple users do not need a CD Ripper, as audio CDs can be imported into iTunes. From there, they can be imported directly into Audacity.

Adapter

File conversion.
<http://www.macroplant.com/adapter/>
(OS X 10.7 or above)

Sources

Audacity Manual – Div. Versionen.
sourceforge.net

audacity-forum.de/download/Audacity-Handbuch-deutsch-23-Jan-2005.pdf

Barbara Huber. Audio im digitalen Bereich:
Theorie und Praxis. Linz: Radio Fro.
(2009)

Andreas Klug. Audacity: Die Effekte.
mediensyndikat.de

Georg Pircher-Verdorfer. Audacity – Skriptum.
Salzburg: Radiofabrik. (2009)

Holger Reibold. Audacity 2.0 kompakt.
Desktop.Edition. (2013)

Martin Schernitsch/Marco Schretter.
Audio-Schnittkurs Audacity.
Graz: Radio Helsinki.

Auphonic: Automatic Audio Post
Production Programme.
auphonic.com

