



University of HUDDERSFIELD

University of Huddersfield Repository

Lee, Hyunkook, Johnson, Dale and Mironovs, Maksims

An Interactive and Intelligent Tool for Microphone Array Design

Original Citation

Lee, Hyunkook, Johnson, Dale and Mironovs, Maksims (2017) An Interactive and Intelligent Tool for Microphone Array Design. In: Audio Engineering Society 143rd international convention, 18-21st October 2017, New York.

This version is available at <http://eprints.hud.ac.uk/id/eprint/33675/>

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

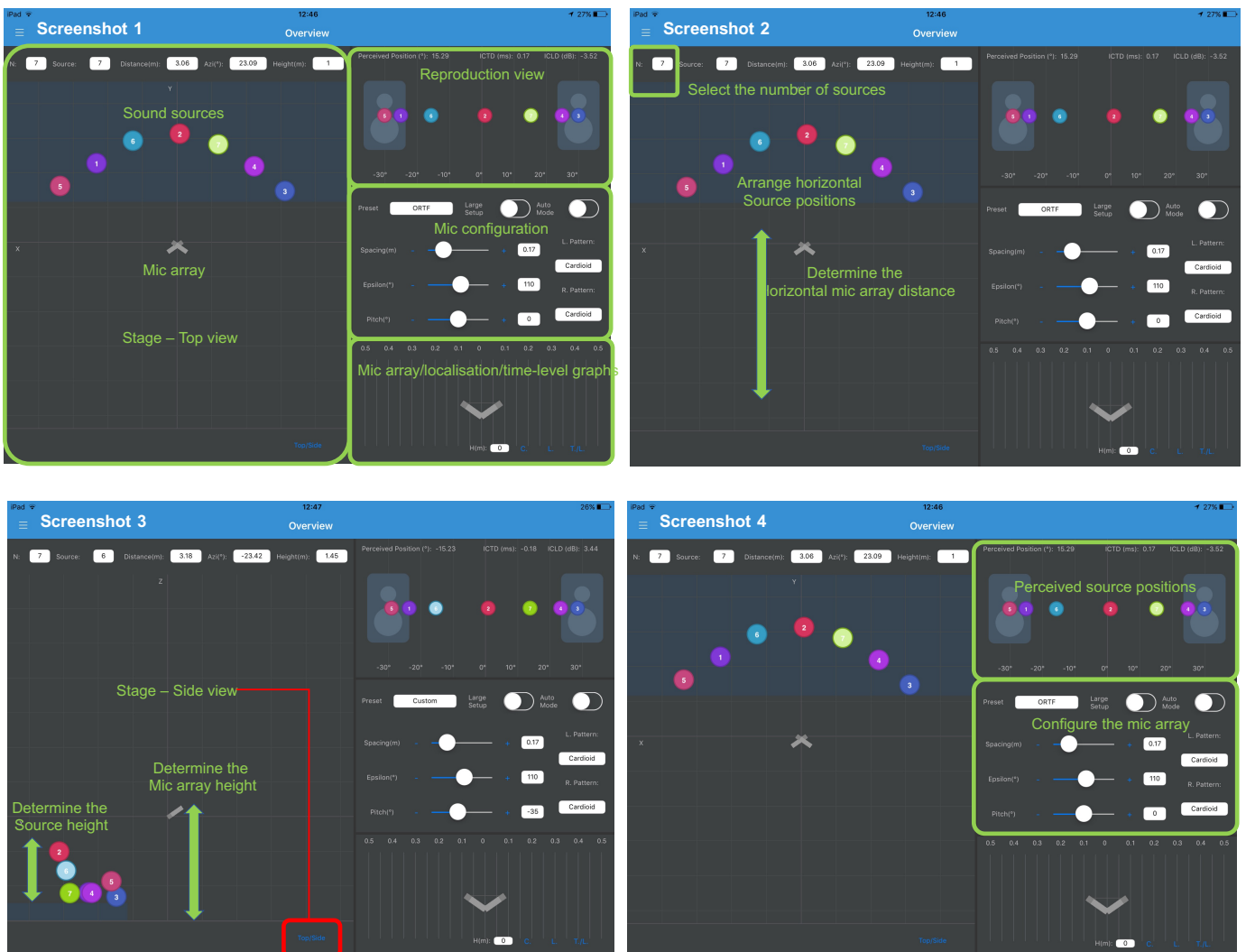
<http://eprints.hud.ac.uk/>

MARRS Quick Start Guide

By

Applied Psychoacoustics Lab (APL), University of Huddersfield

MARRS (Microphone Array Recording and Reproduction Simulator) is an interactive and intelligent tool for stereo microphone technique simulation. It allows the user to predict the perceived positions of multiple sound sources for a given microphone configuration. The tool can also automatically configure suitable microphone arrays for the user's desired spatial scene in reproduction. Furthermore, MARRS overcomes some of the limitations of existing microphone array simulation tools by taking into account microphone height and vertical orientations as well as the target loudspeaker base angle. The app is freely available from both Apple and Google app stores (search "MARRS"). This document provides a quick start guide for MARRS.

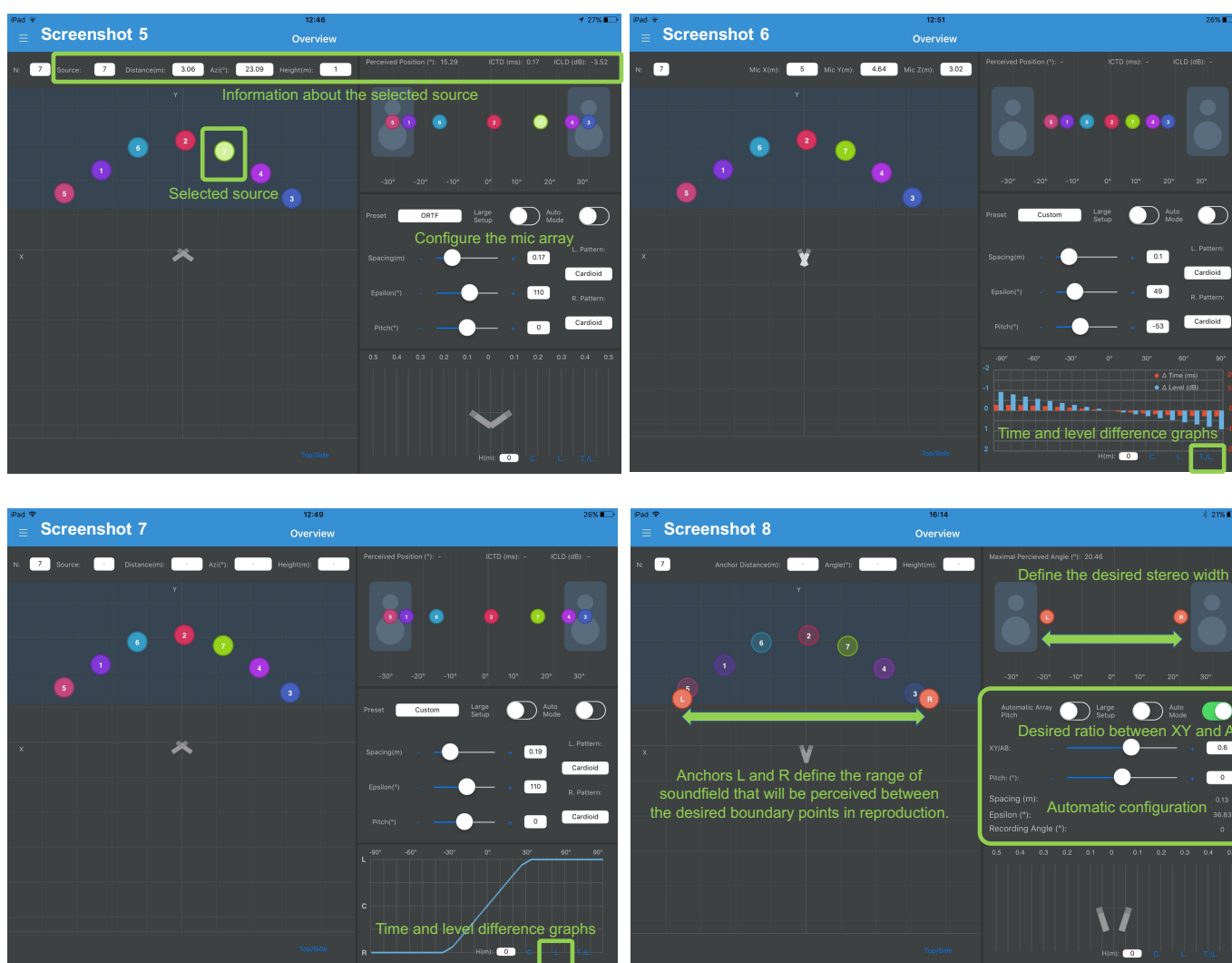


There are 4 sections in the overview mode: Stage view, Reproduction view, Mic configuration view, and mic array/localisation and time-level graph section. The default stage view is set to a top view. You can change this to a side view by pressing the Top/Side icon which is located on the bottom right corner. Each block on the stage represents 1m x 1m size. The reproduction view is currently limited to the conventional 60° loudspeaker base angle. A future version will allow an arbitrary loudspeaker base angle.

The numbered circles on the stage represent sound sources. There is a drop down menu for selecting the number of sources on the top left corner. You can arrange the physical positions of the individual sources by drag and drop. Also the horizontal distance of the microphone array on the stage can be changed by drag and drop. In the side view, the microphone array as well as the individual sources can be raised and the vertical orientation of the microphone array can be changed as desired using the “pitch” control in the mic configuration view.

There are a number of popular preset configurations you can choose in the microphone configuration view, e.g., XY, AB, ORTF, NOS, etc. But you can also customize the spacing and angle of the array as well as the polar pattern and the pitch (vertical orientation of the array).

As you change the microphone configuration, microphone distance/height, and individual source positions, you will see the perceived positions of the sound sources will change in the reproduction view. This is simulated using a psychoacoustic time-level trade-off algorithm by Hyunook Lee (2017). For details of the algorithm, please read this paper (<http://www.aes.org/e-lib/browse.cfm?elib=19338>).



MARRS also displays useful information about each sound source on the top area of the screen when you touch the source on the stage view (Screenshot 5). This includes the perceived horizontal position, interchannel level difference (ICLD) and interchannel time difference (ICTD) of the source, as well as the physical distance, azimuth and height of the source.

By pressing the “T/L” icon at the bottom right corner (Screenshot 6), you can observe the ICLDs and ICTDs between the signals of a given microphone configuration for a range of source positions between -90° and

+90°. The “L” icon (Screenshot 7) shows the localisation curve of the microphone array for a given source-to-microphone distance.

Auto mode: The Auto mode (Screenshot 8) is an intelligent feature of MARRS. The app can recommend you a range of correct microphone configurations for a desired overall stereo width of the ensemble you are recording. This function is enabled by turning on the “Auto Mode: in the configuration view. First, in the reproduction view, place the L and R anchors at the boundary positions of the stereo width you want to create. Then locate the L and R anchors in the stage view at the positions of the sources at the edges of the ensemble that you want to be perceived between the L and R anchors you set in the reproduction view. MARRS will then calculate the correct angle and spacing of a microphone array that you need to apply for the desired stereo width. This is done according to the horizontal and vertical position of the given array. Note that you still have a control over “what type of array” you want it to be. The “XY/AB” section in the configuration view allows you to determine the ratio between 100% coincident (XY) and 100% spaced (AB) depending on the desired spatial characteristics of the stereo image. The more XY you apply, the image will tend to get more localizable but less spacious. The more AB you apply, the image will tend to sound more spacious but less sharp and localizable. Near-coincident techniques such as ORTF and NOS benefit from both localizability and spaciousness. They are popular “preset” techniques with a fixed XY/AB ratio, but you can flexibly choose the ratio, thus designing your own near-coincident technique, depending on your purpose using MARRS.

An example use scenario is as follows. In Screenshot 8, the reproduction anchors are placed at -20° and +20° in the reproduction view, which means the perceived stereo width of the ensemble will be 40° from the listening position (For a fully wide stereo image the anchors should be at -30° and +30°). Now, the L and R anchors on the stage are placed at the edge positions of the ensemble. This means that the edge sources will be localized at -20° and +20° in reproduction and all other sources in between will be localized within the -20° to +20° range, which will be visualized in the reproduction view when you turn off the Auto Mode. You can then change the XY/AB ratio as desired. The microphone configuration will be visualized in the bottom section by choosing the “C” icon.

For any questions or comments regarding the app, please contact Dr Hyunkook Lee h.lee@hud.ac.uk , Maksims Mironovs maksims.mironovs@hud.ac.uk and Dale Johnson dale.johnson@hud.ac.uk .