HULTI-GEN v1.2 User Manual

(Huddersfield Universal Listening Test Interface Generator)

HULTI-GEN v1.2 feature list:

- A free Max-based listening test interface tool for comparing auditory stimuli. - It works without a Max license, remaining adaptable with full functionality.
- Ability to test in multi-comparison and pairwise-comparison formats.
- Multichannel playback, supporting up to 64 audio channels.

- Unlimited number of trials and amount of stimuli tested per trial.
- Option to fully randomise audio samples between and within trials.
- Common testing templates that can be edited to suit a user's needs.
- Total control over the grading scales i.e. maximum/minimum values,

resolution, labelling, markers and the slider's starting position.
- Up to three audible anchors positioned anywhere on the grading scale –

Reference Anchor, High Anchor and Low Anchor.
- Drag-and-drop function to import audio files for easy loading of test stimuli.

Software Requirements

HULTI-GEN is fully compatible with Max 7 from Cycling '74, a runtime/demo of which can be downloaded for free here: https://cycling74.com/downloads/ – purchasing a Max license (or starting the demo) is NOT required to use any part of the tool.

Use of HULTI-GEN with earlier versions of Max is largely untested and it is advised to use the most up-to-date version (Max 7) – work is underway to test and update for backwards compatibility in the future.

Introduction

Before using HULTI-GEN, the user must have a strong idea of their testing format, with consideration toward the number of stimuli in the test, how these stimuli are being split into different trials, and the attributes that are being tested.

It is recommended that a testing plan is documented beforehand, numbering every trial and listing which stimuli are being tested in each, then building the interface around that. This will also help to interpret the results in the latter stages of testing.

IMPORTANT INFORMATION
The settings for all templates and custom test designs are saved in a separate '.json' file, named 'User_Settings.json' as default but can be renamed anything. The user will be asked to save changes to this '.json' file when the tool is closed, which allows the full use of HULTI-

GEN without the need for a Max license. Any stimuli imported can also be saved in separate files to easily import them in again later as well. **Make sure all external files (including audio) are included in the same folder as the patch.**

1. Main Menu

'*Create New Interface*' navigates to the '*Basic Test Details*' page.
'*View, Edit and Load Saved Settings*' navigates to the '*Editing Menu*'.
'*Return to Testing Window*' navigates to the '*Testing Window*' without regenerating the interface or deleting scores/grades from a test that is currently in progress.

2. Basic Test Details

A choice of two testing methods: **Multiple Comparison** or **Pairwise Comparison** **2.1 Multiple Comparison option:**

'*Number of Trials*' = Determines the total number of trials in your test.
'Randomise Trials' =
'*Stimuli per Trial*' = How many auditory stimuli are being compared in each trial (including **hidden** references/anchors, but **NOT** any audible anchors on the scale). There is no limit, although small screens may require the listener to scroll across. ***'Randomise Stimuli'*** =
'Number of Repetitions' = The amount of times all trials are repeated in one sitting.
'Number of Channels' = The total amount of audio channels in use. NB if the stimuli are mono but the test features a stereo loudspeaker pair, then select 2 channels. **'*What will you be testing?*'** = A text box to input the instructions for a listener e.g. "Grade the quality of stimuli against each other and a reference at 100 on the scale." Use the **'*Width*'** slider to adjust the size of the text box, restricting it to 3 lines high.

2.2 Pairwise Comparison option:

'*Number of Comparisons*' = Determines the total number of comparisons in your test. ***'No. of Repetitions', 'No. of Channels'*** and **'*What will you be testing?*'** = As above.

3. Grading Scale and Labelling

This window controls the main design elements of the testing interface. Below are brief descriptions of each different setting, with **some differences between the multiple comparison and pairwise comparison methods**. On the right hand side of the window, an example of how the scale and slider will look is automatically updated as the settings are changed.

3.1 Multiple Comparison Interface:

When creating a multiple comparison interface, **the template can be changed using the drop-down menu at the top**; if a mistake is made on this page, selecting 'Custom' will revert back to the initial settings. Brief summaries for some of the featured templates are given below:

- - ITU-R BS. 1534 – MUSHRA (MUltiple Stimulus with Hidden Reference and Anchor) is a common multiple comparison test with a high reference at 100.
- - ITU-R BS. 1116 – ABC test with Hidden Reference (ABC / HR), where the number of stimuli per trial should be set to two.
- - -50 to 50 Bipolar with Ref – can be conducted as a multiple comparison test similar to MUSHRA, but with the reference at 0 on a bipolar scale.

Scale Settings:

No. of Labels = The number of descriptive or numerical labels on the scale. *No. of Lines* = The number of lines/markers visible on the scale.
Hide Lines = Hides all lines/markers on the scale.
Hide Score = Hides the slider score at the bottom of the scale.

Maximum Scale Value = The maximum slider value on the scale at the top. *Minimum Scale Value* = The minimum slider value on the scale at the bottom. *Scale Resolution* = The step-size of the slider, ranging from 0.1 to 100.
Slider Starting Position = The position the slider is initialised to before testing.

Labelling:

'*Edit Labels*' turns on editing of the labels – select again to turn off. There is also the option to show or hide individual labels by using the toggles on the right hand side. *Hide All Labels* = Hides all labels on the scale.
Label Font Size = Use the slider to adjust the font size between 12 and 24.

Label Length = Adjusts the width of the text box, for controlling the number of lines. *Label Position* = Moves the text box left and right for positioning.

Audible Anchors:

Use the buttons below the '*Ref*', '*High*' and '*Low*' labels to toggle whether these audible anchors are used or not. The sliders below can then be used to adjust the position of the audible anchor, as a percentage of the scale, with 100% at the top.

3.2 Pairwise Comparison Interface:

When *'Pairwise Comparison'* is selected on the *'Basic Test Details'* page, a pairwise comparison between a reference and a single stimulus is generated. The main difference is the ability to randomise between the stimuli and reference; however, the grading is still performed on a vertical slider, as with multiple comparison.

Scale Settings, **Labelling** and **Audible Anchors** as above.

'Randomise Pair' = Randomise between the reference stimulus and the test stimulus.
'Reference Score Type' = If the toggle is 'On', the reference stimulus receives the polar opposite score to the scale i.e. if the slider is set to +1 for the test stimulus, the reference

will receive a score of -1. When the toggle is 'Off', the reference score is fixed to its position on the scale and unchanged by slider movements.

4. Import Auditory Stimuli

Pre-processing and compatibility of auditory stimuli with HULTI-GEN:
- **The audio file formats supported are '.AIFF', '.WAV' and '.AU'.**
- **Multichannel audio files of up to 28 channels can be used with HULTI-GEN.**
- **The channel assignment is not determined inside HULTI-GEN** and should be

specified externally by the user during stimuli creation. Within the audio files, the order of channels is the order of outputs from Max, which should then be routed by the user. For example, if the user is using a 5.1 system, they must specify 6 channels on the *'Basic Test Details'* page to give the required 6 outputs – these outputs then correspond to the stimuli's channels, which in the case of 5.1 might be: output 1 = L, 2 = C, 3 = R, 4 = Ls, 5 = Rs and 6 = LFE.

- If the user requires a direct comparison between very similar stimuli, **all samples (including anchors) must be the same length to loop around in sync**.

- The user might want to consider time/level alignment and normalisation of levels before importing, depending on the loudspeaker setup and test design.

4.1 Stimuli Import for Multiple Comparison:

Follow the instructions in the TOP drag-and-drop box to import the auditory stimuli for each trial, INCLUDING any **hidden** references/anchors.
The order the stimuli are dragged into the box (usually alphabetical) is the order the results will be delivered after testing – all stimuli for a trial can be dragged in at once.

Follow the instructions in the BOTTOM drag-and-drop box to import any audible references or anchors on the scale. This has to be done one at a time and if all three anchors are used, the order to drag them in will be Reference, High and Low.

Use **'*View Stimuli/Anchor Files*'** to check the stimuli imported into the patch before continuing, making sure the filenames are listed in the right order. If there is an issue with the order go back to amend a specific trial (try dragging files in one at a time), or edit the lists directly when viewing the files, then saving any changes made

'*Save Stimuli/Anchor Files*' saves the list of stimuli or anchors to external text files, allowing the user to quickly import them again without having to drag-and-drop. **'*Import Existing Stimuli/Anchor List*'** opens to load the stimuli saved previously.

'*Clear All Stimuli/Anchor Files*' clears any stimuli already imported into the patch. **'*Amend a specific trial:*'** drop-down menu allows you to go back and edit trials – loading a new stimulus or anchor to a trial will clear all others associated with that trial e.g. if you are using high and low anchors, then to import a new high anchor in, you must also drag the low

anchor in again too; likewise with the stimuli drop-box, if you are testing 6 stimuli per trial, you must drag all 6 stimuli into the box again.

'Single-channel mono stimuli' – select when using single-channel mono stimuli in a stereo loudspeaker set-up. If there is a combination of mono and multichannel stimuli, then the two-channel mono samples must be created manually by the user. **'Loop and sync stimuli'** – Playback method of stimuli, and the option to select whether the listener has control. For syncing, all stimuli must be the same length.

4.2 Stimuli Import for Pairwise Comparison:

The window is similar to the importing multiple comparison stimuli process, with many of the same features as detailed above.

There are **two options for importing pairwise stimuli**. The first is to drag every pair into the drag-and-drop box individually, as with the multiple comparison stimuli. The second is to click *'Automatically Match Pairs'*, which opens the following window:

To automatically match the pairs of stimuli, drag the total stimuli into the drag-and- drop box then select *'Match Pairs'*. For example, if you want to compare 5 stimuli against each other once, dragging the 5 stimuli into the box will result in a total of 10 pairs being automatically generated. *'View Stimuli'* to check this has been performed correctly, then click *'Store and Close Window'* to save these pairs as your stimuli.

5. Editing Menu

This page shows a brief overview of the settings stored with the patch; to view the complete settings, the user must navigate to the editing pages as described below. **'*View Stimuli*'** opens windows to display the stimuli/anchors stored with the patch.

'*Save Settings to File*' allows the user to save the current settings as a '.json' file, which can be named anything. The patch will then attempt to load the last saved '.json' file associated with it, however, if it does not you will need to load it manually. **'*Load Settings from File*'** lets the user load saved settings from an existing '.json' file.

'*Generate Interface*' creates a listening test interface from the settings stored with the patch. **This must be pressed after ANY changes are made in the editing pages and when the patch is first loaded.** It generates and initialises all of the sliders with the desired values, ready for testing.

'*Basic Test Details*', **'*Grading Scale and Labelling*'** and **'*Import Auditory Stimuli*'** navigate to the respective editing pages for making changes to the stored settings.

6. Testing Window

If the wrong settings have been loaded in the testing window, click **'*Go to Editing Menu*'** to check the saved settings. If the settings are correct, '*Generate Interface*' again; if they are incorrect, load in the correct '.json' settings file or go back and edit.

'*Audio On/Off*' controls the audio: the audio is on when the speaker is highlighted. The listening test subject then has control over the audio by selecting the different lettered and anchor buttons. Audio is looped around constantly and in sync, provided all audio samples are the same length in each trial – if the samples go slightly out of sync, the subject can click '*Next*' then '*Previous*' to reload the stimuli.

'*Previous*' and **'*Next*'** buttons are used to cycle through the randomised trials.
'Loop' and ***'Sync'*** buttons allow the listener to control how the audio is played back –

these switches can be hidden by navigating to the *'Import Auditory Stimuli'* page.

'*Save Results*' allows the user to save the results in different file formats, such as a text file (.txt) or comma separated values file (.csv) – input the subject details as the filename, followed by a filename extension i.e. 'Subject_A.txt' or 'Subject_B.csv'. The trial order and stimuli order within trials are also saved in the results file (see below). Note: Results can be imported straight into excel from either .txt or .csv files.

'*Clear All and Re-randomise*' deletes all current data and initialises the sliders, ready for a new subject to take part in the test. (Remember to save the results first!)

6.1 Pairwise Comparison Testing Window

Above is an example of a typical pairwise comparison interface in HULTI-GEN. It compares stimulus 'S' against a reference stimulus 'REF', where the listener is asked to grade whether 'S' is 'Better' or 'Worse' than 'REF' for a particular attribute. As described in Section 4.2, the grading scale is fully editable, 'REF' can be given the polar opposite score of 'S', and the stimuli for 'REF' and 'S' can also be randomised.

7. Results

The numbers in the first column are the index values, where the index corresponds with the trial numbers that were decided when importing stimuli. To recall a trial's associated stimuli, click '*View Stimuli*' in the '*Editing Menu*' or '*Save Stimuli/Anchor Files*' on the '*Import Auditory Stimuli*' page to save for future reference. The order the stimuli are listed in these windows is also the order the scores are listed in the results.

In addition, the stimuli randomisation for each user can be determined as follows:

Index 100 = The order the trials were presented to the listener.
Index 10X = The order the stimuli were presented to the listener for Trial X.

8. Contact Information

HULTI-GEN is a Max-based tool that has been developed by Christopher Gribben and Dr Hyunkook Lee, members of the Applied Psychoacoustics Laboratory (APL) at the University of Huddersfield. The development of HULTI-GEN was supported by the University of Huddersfield and the Engineering and Physical Sciences Research Council (EPSRC), UK, Grant Ref. EP/L019906/1.

If you use HULTI-GEN for your research and publish a paper, please reference it as follow:

C. Gribben and H. Lee (2015) Towards the development of a universal listening test interface generator in Max. In proceedings of the 138th Audio Engineering Society AES Convention, 7th-10th May 2015, Warsaw, Poland.

If you have any comments at all regarding the future of HULTI-GEN, have detected any bugs or issues with the tool, or would like to be added to the APL e-mailing list for future updates, please do not hesitate to get in touch with us via e-mail on:

h.lee@hud.ac.uk and christopher.gribben@hud.ac.uk