

The Ghent-Odysseus IRAP (GO-IRAP)

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Welcome to the GO-IRAP. I conceptualised and designed the IRAP on a flight from the USA to Ireland during the summer of 2004, and started writing the first program the day after touching down at Dublin airport. The version you now have is a considerable extension of that first program and I suggest that you study the material below before attempting to proceed any further.

At this point I must emphasise that the current IRAP program is still very much under development, and you use this software entirely at your own risk. Please report any errors in the program, and any inaccuracies in the procedure or data arising there from to me, Professor Dermot Barnes-Holmes, at the Department of Experimental Clinical and Health Psychology, Ghent University, BE-9000, Belgium (Dermot.Barnes-Holmes@ugent.be).

This program must not be used for commercial purposes.

## Starting your Program

To install the program, simply run the Setup\_GO-IRAP.exe file. Click 'yes' when prompted, 'next', and 'I agree'. The program will automatically save an icon onto your desktop. When you double-click on the GO-IRAP icon, the below pictured interface will appear (Figure 1a).

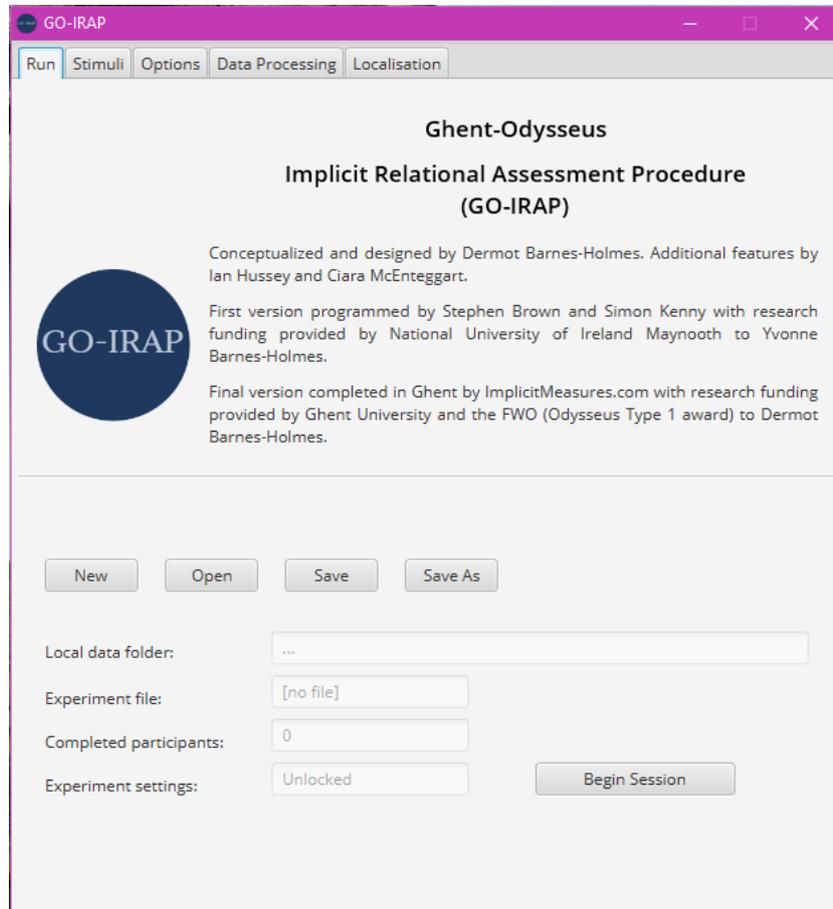


Figure 1a. GO-IRAP program 'Run' screen.

On this Run screen, you can create new experiments with the 'new' button, which you can then 'Save', or copy using 'Save as' a new file. Once your experiment is ready, 'Save' it, and then you can 'Begin Session'.

Experimental settings are 'locked' once the first experimental session is complete. This ensures that all participants within each data file completed an identical procedure. To alter settings, use the 'save as' button to create a copy of the experimental settings. This copy will not contain participant data from the existing experiment.

Once you click 'Begin Session', the following screen will appear (Figure 1b).

Begin Experimental Session

Last participant code: 0

This participant code:

Auto increment participant code

Participant note:

Gender:  Female  Male  Third

Age:

Start experiment

Figure 1b. GO-IRAP program 'Begin Experimental Session' screen.

On this screen, you will need to enter the participant's code manually, or the program will 'auto increment participant code' if selected. The 'Gender' and 'Age' must also be entered. A 'Participant note' is optional. Then you may 'Start experiment'.

### Setting Up Your IRAP Stimuli

Run Stimuli Options Data Processing Localisation

IRAP type  Traditional  Natural language

▼ Label

Format  Text  Images

Label 1 Label 2

Label 1 #1 Label 2 #1

+ -

► Target

Response

Format  Text  Images

Response 1 Response 2

Response 1 #1 Response 2 #1

+ -

Figure 2. GO-IRAP program 'Stimuli' screen.

The GO-IRAP allows you to add multiple text boxes to “Label”, “Target”, and “Response Options” to insert the stimuli you want to use in your experiment (Figure 2). This screen also presents you with a range of choices you can make among various settings for your experiment.

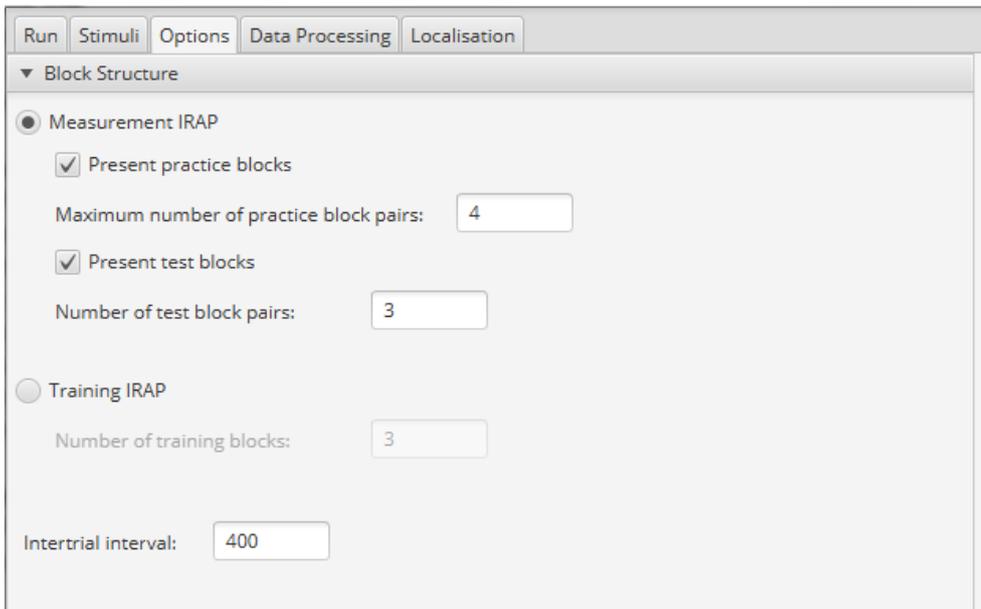
**IRAP Type.** You can present your IRAP in a ‘Traditional IRAP’ format or a ‘Natural Language’ format.

- **Traditional IRAP.** A traditional IRAP pairs Label and Target stimuli to form four “trial-types” (e.g., “me” and “kind” forms a self-positive trial-type).
- **Natural Language IRAP.** A Natural Language IRAP requires the experimenter to preassemble trial-types, which are then delivered as a single sentence (e.g., “I am a kind person”) or a single image to represent this. This allows for greater control over the complexity of the stimuli. However, it increases the demands of the experimenter to design conceptually coherent and meaningful stimuli (see Kavanagh, Hussey, McEntegart, Barnes-Holmes, & Barnes-Holmes, 2016).

**Format.** You can also present images instead of text. All images will be resized to one third proportion of the height of the screen. JPG, PNG and GIF formats can be used. You must place all images in the local data folder.

## Experimental Options

### Block Structure



The screenshot shows the 'Block Structure' configuration window. It features a tabbed interface with 'Options' selected. The 'Measurement IRAP' radio button is active. The 'Present practice blocks' and 'Present test blocks' checkboxes are checked. The 'Maximum number of practice block pairs' is set to 4, and the 'Number of test block pairs' is set to 3. The 'Training IRAP' radio button is inactive. The 'Number of training blocks' is set to 3. The 'Intertrial interval' is set to 400.

Figure 3. GO-IRAP program ‘Block Structure’ screen.

**Measurement IRAP.** The Measurement IRAP is a traditional IRAP which presents practice and test pairs of alternating Rule A and Rule B blocks (see Figure 3). If 'Present Practice Blocks' is selected, participants complete practice blocks until they meet both the accuracy and latency criteria on both blocks within a block-pair. Should a participant not meet these criteria after the set number of block pairs the test blocks will be skipped and the task ends. You can specify how many practice and test block pairs are selected, these are typically set to 4 and 3 respectively.

**Training IRAP.** A Training IRAP can be used to train relational responses by presenting the same block of trials (specified under 'Responding Rules') until the criteria specified are met (specified under 'Mastery Criteria').

One reason for including this option is to allow a researcher to use the IRAP to train new stimulus relations or relational networks, which can then be tested using the standard IRAP. At the time of writing, we were aware of only one published study that had used the training IRAP (Hughes & Barnes-Holmes, 2011).

## Responding Rules

Run Stimuli Options Data Processing Localisation

► Block Structure

▼ Responding Rules

**Measurement IRAP Rule order**

Always present Rule A first

Always present Rule B first

Counterbalance order of presentation of Rule A / B between participants

**Training IRAP Rules**

Always present Rule A

Always present Rule B

Counterbalance training of Rule A / B between participants

Rule A:

Rule B:

Coloured responding rules

Figure 4. GO-IRAP program 'Responding Rules' screen.

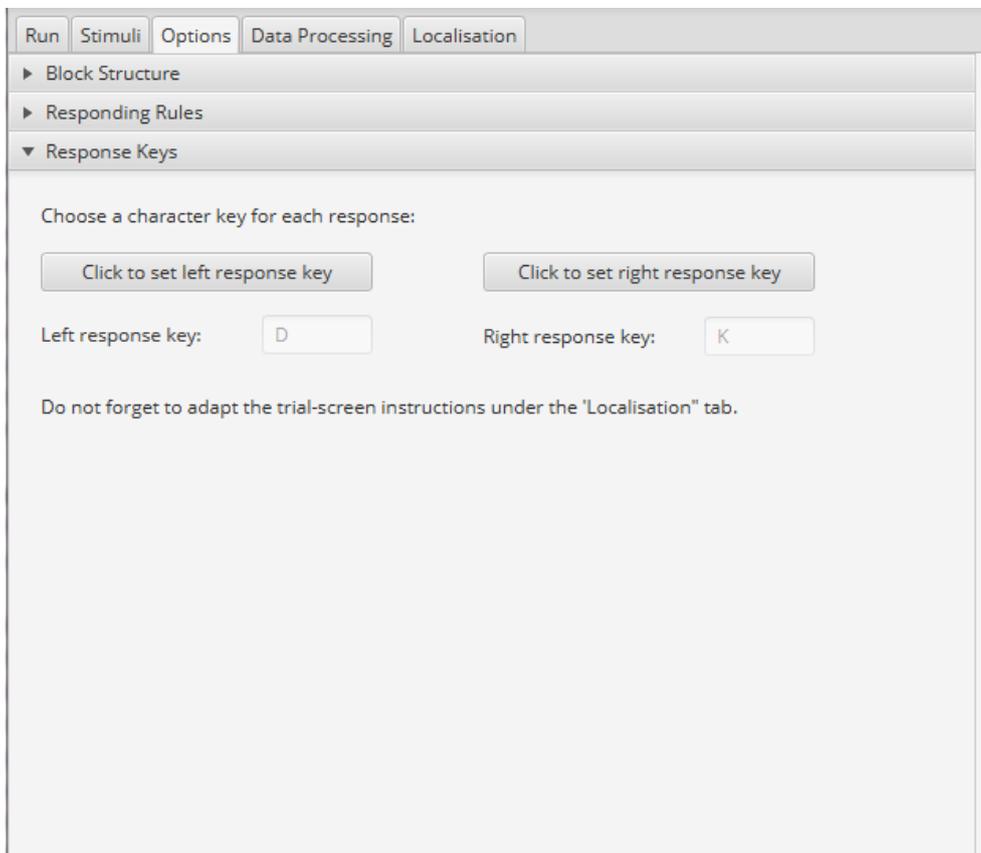
**Measurement IRAP Rule Order.** The order in which participants are exposed to the blocks has been found to influence the results.

- **Rule A first.** This presents consistent blocks first.
- **Rule B first.** This presents inconsistent blocks first.
- **Counterbalancing.** The presentation of Rule A (i.e., consistent) first versus Rule B first (i.e., inconsistent) is therefore typically counterbalanced between participants (Figure 4). If counterbalancing is selected, odd numbered participants will automatically be exposed to Rule A first and even numbered participants will automatically be exposed to Rule B first.

**Training IRAP Rule Order.** For training IRAPs, we typically present the Rule A to participants. However, depending on your experimental design, you can also select to present Rule B blocks, or to counterbalance which block of trials are presented across your participants.

**Text Boxes for Rule A and Rule B.** It is also possible to insert text before each of the blocks of trials. If you do this, do ensure however that the text corresponds to the contingencies within the blocks. If 'coloured responding rules' is selected, this will make the text of Rule A yellow, and the text of Rule B cyan. This pair of colours acts as a cue that the pattern of responding has changed.

## Response Keys



Run Stimuli Options Data Processing Localisation

▶ Block Structure

▶ Responding Rules

▼ Response Keys

Choose a character key for each response:

Click to set left response key      Click to set right response key

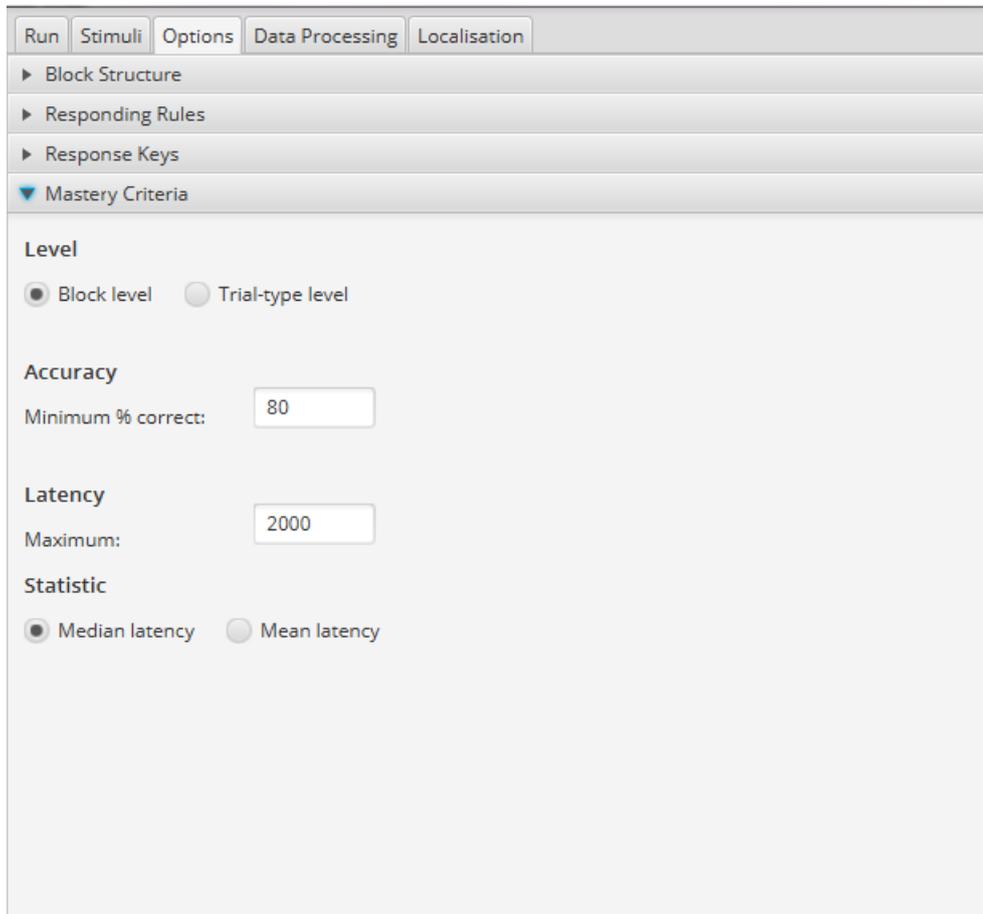
Left response key:       Right response key:

Do not forget to adapt the trial-screen instructions under the 'Localisation' tab.

Figure 5. GO-IRAP program 'Response Keys' screen.

This allows you to set any keys for each response option (Figure 5). This may be desired if a response option begins with the letters 'd' or 'k' for example, which may influence the speed of responding.

## Mastery Criteria



The screenshot displays the 'Mastery Criteria' configuration screen. At the top, there are five tabs: 'Run', 'Stimuli', 'Options', 'Data Processing', and 'Localisation'. Below these are four expandable sections: 'Block Structure', 'Responding Rules', 'Response Keys', and 'Mastery Criteria'. The 'Mastery Criteria' section is expanded and contains the following settings:

- Level:** Two radio buttons are present. 'Block level' is selected (indicated by a filled circle), and 'Trial-type level' is unselected (indicated by an empty circle).
- Accuracy:** A label 'Accuracy' is followed by 'Minimum % correct:' and a text input field containing the value '80'.
- Latency:** A label 'Latency' is followed by 'Maximum:' and a text input field containing the value '2000'.
- Statistic:** Two radio buttons are present. 'Median latency' is selected (indicated by a filled circle), and 'Mean latency' is unselected (indicated by an empty circle).

Figure 6. GO-IRAP program 'Mastery Criteria' screen.

**Level.** If 'Present Practice Blocks' is selected in the 'Blocks Structure' screen, participants are required to practice until they meet mastery criteria. These criteria can be applied at the overall block level or at the trial-type level within the blocks (Figure 6).

- **Block level.** Applying the criteria at the block level averages the scores across the four trial-types within a block.
- **Trial-type level.** Applying the criteria at the trial-type level averages the scores for each of the four trial-types within a block. This ensures that participants are

responding with equally high accuracy and within the response latency specified on each of the four trial-types. Our research has demonstrated that this is important because participants frequently fall below these criteria on one trial-type within a block of trials while still reaching criteria at the block level.

Note: All reaction times >10,000ms are excluded from calculations of scores after each block. In addition to this maximum latency criterion, participants will fail a practice block pair if >10% of reaction times on a block are <300ms.

**Accuracy.** This is where you insert the minimum percentage correct that the participant must achieve on a pair of practice blocks in order to progress to the test blocks (or complete training). We typically use 80%.

**Latency.** This is where you insert the maximum latency that the participant must achieve in each practice block in order to progress (or complete training). Initially, we typically used 2 seconds (2000ms). I would suggest, therefore, using the lowest latency criterion that is feasible, depending of course on the stimuli you are presenting (e.g., single words versus statements) and the type of participants with which you are working (e.g., children or clinical populations versus university undergraduates).

**Statistic.** The above latency can be set as a mean or a median (we typically use median to wash out any outliers).

## Stimuli Presentation

The screenshot shows the 'Stimuli Presentation' settings panel. At the top, there are tabs for 'Run', 'Stimuli', 'Options', 'Data Processing', and 'Localisation'. Below these are expandable sections: 'Block Structure', 'Responding Rules', 'Response Keys', 'Mastery Criteria', and 'Stimuli Presentation' (which is currently expanded). The 'Stimuli Presentation' section contains the following settings:

- Trial-types:** Total trials per block: 4. Radio buttons for 'Present all' (selected), 'Exclude one trial-type', and four options for 'Trial-type 1' through 'Trial-type 4'.
- Block length:** Radio buttons for 'Determine by number of target stimuli' (selected) and 'Use custom number of Target stimuli: 1'.
- Response option location:** Radio buttons for 'Fixed' (selected) and 'Randomised between trials'.
- Stimuli pairing system:** Radio buttons for 'Standard' (selected) and 'Label - Target - Response Locking' (with a note: *Requires equal numbers of stimuli*).
- Maximum number of trial-type repetitions:** Radio buttons for 0 (selected), 1, 2, 3, and Unlimited.

Figure 7. GO-IRAP program 'Stimuli Presentation' screen.

**Trial-types.**

- **Present all.** Typically, all trial-types are presented to participants.
- **Exclude one trial-type.** Occasionally, one trial-type simply doesn't make semantic sense so it may be useful to exclude such trial-types.

**Block Length.**

- **Determine by number of targets.** The number of trials per block will be determined by the number of target stimuli multiplied by the number of trial-types.
- **Use custom number of target stimuli.** This allows a custom number of trials per block while retaining trial-type counterbalancing. The number of trials per block will be determined by this arbitrary number of target stimuli multiplied by the number of trial-types. Target stimuli will be selected from the pool at random in each block. This function should not be used in combination with the Label-Target-Response Option locking function.

**Response Option Location.**

- **Fixed.** Response Option 1 will appear on the left hand side of the screen and Response Option 2 on the right hand side. We would advise using this option if you are collecting EEG data because it serves to reduce excessive head and eye movements.
- **Randomised between trials.** The Response Option pair will alternate randomly between the left and right hand side of the screen.

**Stimuli Pairing System.**

- **Standard.** This will present every Target 1 and Target 2 stimulus twice (assuming the "determine by number of targets" option is selected above), once with a shuffled Label 1 stimulus and once with a shuffled Label 2 stimulus. Response Option stimuli are presented according to the horizontal pairing in which they were entered (e.g., Response Option 1 stimulus #1 with Response Option 2 stimulus #1). Response Option pairs are always shuffled.
- **Label-Target-Response Locking.** This option requires an equal number of Label, Target and Response option stimuli. When selected, it pairs the stimuli non-randomly, so that stimuli row numbers are always presented together. E.g. Label #1 stimuli will always be presented with Target #1 stimuli and Response Options #1 stimuli. This can be useful if you require predictable pairings for the trials to make semantic sense.

**Maximum number of trial-repetitions.** You can select the maximum number of times a particular trial-type may occur across successive trials. We have not investigated the effects of this variable, but we typically set it to between 1 and 3.

## Feedback

Figure 8. GO-IRAP program 'Feedback' screen.

**Latency feedback.** I added this feature to the IRAP program when we found that average response latencies for some participants increased during the test blocks beyond the practice criterion (i.e., these participants completed practice successfully but then appeared to “slow down” during the test). Interestingly, when we removed the data for these participants a non-significant IRAP effect became significant! I thus included an option for the user to provide trial-by-trial latency feedback in order to encourage participants to maintain response speed throughout the test blocks.

- **Not on first pair of practice blocks.** This may be useful because it allows you to train participants on the accuracy criteria first before introducing the latency criteria. In order to facilitate this, this option removes trial-by-trial latency feedback on the first pair of practice blocks.
- **Latency feedback message.** You can also customise the latency feedback message (we typically use '!"). This will of course depend on your population.

**Accuracy feedback.** Accuracy feedback can be customised to text or images.

**Correct response feedback.** Correct response feedback can also be customised to text or images for a specified duration. This can be particularly useful for educational purposes using the Training IRAP (see Figure 3).

## End of Session

Figure 9. GO-IRAP program 'End of Session' screen.

**Display end of session message.** You can customise the text at the end of the session (Figure 9).

**Send to URL.** This opens a browser on a specific page after completing the task. # characters will be replaced with the current participant code. This allows the task to pass the participant code to a webform in order to automatically link a participant's IRAP and questionnaire data.

## Data Processing

Figure 10. GO-IRAP program 'Data Processing' screen.

**D-IRAP scores.** At the moment, the program only offers to automatically calculate the D-score. The D-score is frequently used to quantify the difference between the two

blocks in a block pair in measures such as the IAT and the IRAP. In summary, it is the difference between the mean reaction times of the two blocks divided by the standard deviation of all the RTs in both blocks (see Greenwald, Nosek, & Banaji, 2003). The D-IRAP score is an adaptation of the Greenwald D score for the IRAPs multiple trial-types. D-IRAP scores are also produced for both odd and even trials by order of presentation in order to calculate internal consistency.

## Localisations

Run Stimuli Options Data Processing Localisation

Reset all fields to English default

**Pre-session instructions**

This task will present sets of words or images.

You will be asked to relate the words or images.

If you make a mistake you'll see a red X. Provide the correct response to continue.

Respond as accurately as you can. When you've learned to be accurate you'll naturally speed up too.

**Pre-block rule screen**

Press space to continue

The previously correct and incorrect answers have now been reversed.

**Trial screen**

Press 'd' for

Press 'k' for

**Post-block feedback screen**

Continue responding both as accurately and quickly as you can.

Continue responding as accurately as you can. You'll naturally go quickly when your responses are a

Learn to accurately follow the rule before attempting to respond quickly.

Learn to accurately follow the rule before attempting to respond quickly.

Figure 11. GO-IRAP program 'Localisations' screen.

All user facing text within the IRAP can be customised to the local language and according to the task you are presenting. Non-stimuli text can be customised below. Most character sets are supported, including Japanese, Swedish, Hebrew, Polish etc.

Note to User: During practice blocks, participants are presented with one of the following four instructions on the 'Post-block feedback screen' depending on whether they met the accuracy and/or latency criteria at the block level. The four messages below correspond to:

1. Passed accuracy and passed latency
2. Passed accuracy and failed latency

3. Failed accuracy and passed latency
4. Failed accuracy and failed latency

### **Interpreting IRAP Output**

If you are still planning to use this file with your client, it is best to save a copy of the file when looking at the data, as any changes in the .txt file will make changes to your settings and may cause the IRAP to not work properly. Once this has been done, right click the same experimental file "xxx.txt" and open with excel.

The data is formatted as one line per trial per participant, and all averages are made after the last trial of each participant.

In a Training IRAP, accuracies and latencies for each session/participant are summarised under the column headings "AccuracyTraining1ABlock" and "LatencyTraning1ABlock".

In a Measurement IRAP, mean D-IRAP scores for each trial-type are provided under the relevant columns (e.g., "D\_IRAP\_TrialType\_1\_Test\_mean"). It is always important to check whether the criteria (e.g., responding >80% and <2000ms) were maintained across the test blocks (whether at the trial-type level or block level, depending on what criteria you want to set) -- averaged latencies for each trial type on each block and averaged accuracies for each trial type on each block are provided under the relevant columns.

For interpreting IRAP data, see Hussey, Thompson, McEnteggart, Barnes-Holmes, & Barnes-Holmes (2015).

In closing, we would like to emphasize that the current software is still under development.

## References

- Hughes, S., & Barnes-Holmes, D. (2011). On the formation and persistence of implicit attitudes: New evidence from the Implicit Relational Assessment Procedure (IRAP). *The Psychological Record, 61*(3), 391.
- Hussey, I., Thompson, M., McEnteggart, C., Barnes-Holmes, D., & Barnes-Holmes, Y. (2015). Interpreting and inverting with less cursing: A guide to interpreting IRAP data. *Journal of Contextual Behavioral Science, 4*(3), 157-162.
- Kavanagh, D., Hussey, I., McEnteggart, C., Barnes-Holmes, Y., & Barnes-Holmes, D. (2016). Using the IRAP to explore natural language statements. *Journal of Contextual Behavioral Science, 5*(4), 247-251.
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of personality and social psychology, 85*(2), 197.