Analysis Code for ASTEROID OPO paper

Jenny Read

20/08/2020

## Comparing ASTEROID versions with large vs small dots

This analysis was done in R using the following packages: R [Version 3.6.0; @R-base] and the R-packages *cowplot* [Version 1.0.0; @R-cowplot], *data.table* [Version 1.12.8; @R-data.table], *DescTools* [Version 0.99.30; @R-DescTools], *dplyr* [Version 0.8.3; @R-dplyr], *ggplot2* [Version 3.3.0; @R-ggplot2], *knitr* [Version 1.25; @R-knitr], *lmodel2* [Version 1.7.3; @R-lmodel2], *lubridate* [Version 1.7.4; @R-lubridate], *papaja* [Version 0.1.0.9842; @R-papaja], *readxl* [Version 1.3.1; @R-readxl], *stringr* [Version 1.4.0; @R-stringr], and *tidyr* [Version 1.0.0; @R-tidyr]

##   
## Attaching package: 'data.table'

## The following object is masked from 'package:DescTools':  
##   
## %like%

## The following objects are masked from 'package:dplyr':  
##   
## between, first, last

## The following objects are masked from 'package:lubridate':  
##   
## hour, isoweek, mday, minute, month, quarter, second, wday,  
## week, yday, year

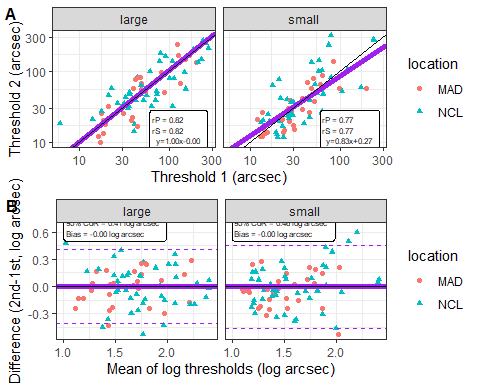
## Test/retest repeatability

## RMA was not requested: it will not be computed.

## No permutation test will be performed

## RMA was not requested: it will not be computed.

## No permutation test will be performed



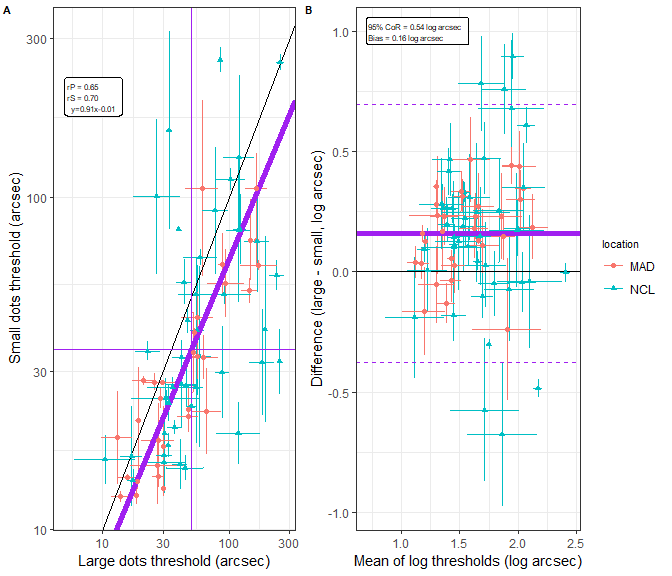
## png   
## 2

In both cases, the test/retest correlation is high (Pearson’s correlation on log arcsec: r = 0.82 , p = 1.9e-19 , for large dots, r= 0.77, p = 9.5e-16 for small), in line with previous findings for the large-dot ASTEROID. There is no evidence for a practice effect: the thresholds on first and second tests did not differ significantly (p=0.8415 for large, 0.8935 for small, paired t-test on log thresholds). The coefficient of repeatability is slightly better for the large dots than the small dots (0.41 log arcsec or a factor of 2.56 for large vs 0.46 log arcsec or a factor of 2.87 for small), but this is not significant (p=0.33, F-test testing whether the variance of the inter-session differences is the same for large vs small dots).

## Comparing thresholds with large vs small dots

## RMA was not requested: it will not be computed.

## No permutation test will be performed



A: Scatterplot, and B: Bland-Altman comparison between thresholds obtained with large vs small dots. The data-points show the geometric mean of all thresholds obtained for a given dot size. The errorbars show +/- 1 SEM. Most participants only took two thresholds with each dot size, but five took 4 and author ZYW took 12.

## png   
## 2

The two versions of ASTEROID are highly correlated (Pearson’s correlation on log arcsec: r = 0.65 , p = 4.2e-10). However, there is a clear tendency for higher thresholds to be obtained with the large dots. Averaging log-thresholds across subjects, the average is 50 arcsec with large dots as against 35 arcsec with small: participants score higher (that is, worse) with large dots by a factor of 1.4. This difference is highly significant (t =5.1, p = 3e-06, paired t-test on log-thresholds; 95% confidence interval on the difference spans to log arcsec). The mean difference (large minus small) across subjects is 0.1599 or a factor of 1.445.

In terms of log arcsec: the population mean is 1.7 logarcsec with SD = 0.33 logarcsec for large dots, and mean is 1.5 logarcsec with SD = 0.32 logarcsec for small.

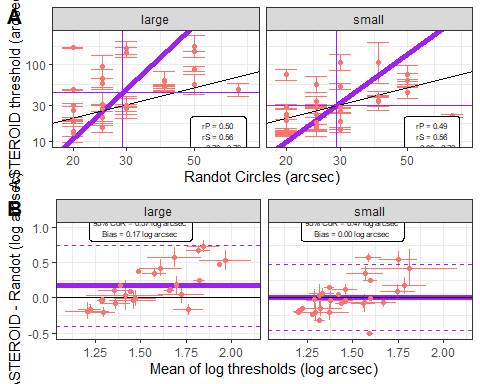
## Comparison with Randot

## RMA was not requested: it will not be computed.

## No permutation test will be performed

## RMA was not requested: it will not be computed.

## No permutation test will be performed



## png   
## 2

Stereoacuity measured with Randot Circles correlates moderately well with that measured on both versions of ASTEROID (Pearson’s correlation on log arcsec for Randot Circles vs large-dot ASTEROID : r = 0.50 , p = 0.00378; for small-dot ASTEROID: r = 0.49 , p = 0.0048).

Consistent with previous results, in our study population of 62 participants, thresholds with large-dot ASTEROID are significantly larger than with Randot Circles (geometric mean on large-dot ASTEROID = 43.37 arcsec, on Randot = 29.16 arcsec; t = 3.29, p = 0.00, paired t-test on log thresholds). However with small-dot ASTEROID, stereo thresholds are not significantly different from with Randot Circles (average on small-dot ASTEROID = 29.46 arcsec, on Randot = 29.16) arcsec; t = 0.10, p = 0.92). The 95% confidence interval on the mean difference between the log threshold spans -0.08 to 0.09 log arcsec. This means that we cannot exclude the possibility that stereo thresholds measured on ASTEROID v1 are actually systematically smaller than thresholds measured with the Randot Circles, by a factor of 0.82, or systematically larger by a factor of 1.24.

For the 62 participants who did all 3 tests, the mean stereothreshold was 1.46 log10 arcsec ( 29.2 arcsec) with Randot Circles and 1.47 log10 arcsec (29.5 arcsec) with small-dot ASTEROID, compared to 1.64 log10 arcsec (43.4 arcsec) with large-dot ASTEROID.

## Methods

There were 88 participants in Newcastle and 62 in Madrid.