Author's response to reviews

Title: A puzzle form of a non-verbal intelligence test gives significantly higher performance measures in children with severe intellectual disability

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Author's response to reviews: see over
**Reply to reviewer’s comments regarding manuscript entitled** A puzzle form of a non-verbal intelligence test gives significantly higher performance measures in children with severe intellectual disability.

**General comments:**
We wish to thank the reviewers for their constructive and helpful comments. In particular we would like to apologize for the unsatisfactory structure of the submitted manuscript. Much of this was due to our misinterpretation of the constraints on manuscript sections, as appeared in the online Instructions to Authors. We believe we have now remedied this in restructuring the manuscript by presenting the two studies separately. In addition, we have taken into consideration the reviewers’ comments and done further analyses regarding completion rates in Study 2. Please find below our responses to each of the two reviewers’ individual comments.

**Reviewer:** John Oates

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<th>Reviewer’s comments</th>
<th>Authors’ response</th>
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<tr>
<td>1. <em>Is the question posed by the authors well defined?</em></td>
<td>Yes</td>
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<td>2. <em>Are the methods appropriate and well described?</em></td>
<td>The methods are reasonable appropriate, however there is a lack of clarity in description in parts. The Method section has been substantially amended and is now presented as two studies.</td>
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<td>3. <em>Are the data sound?</em></td>
<td>As far as can be ascertained from the report, yes.</td>
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<td>4. <em>Does the manuscript adhere to the relevant standards for reporting and data deposition?</em></td>
<td>To improve the structure of the manuscript we have substantially reorganized the information’s. Details of ethics approval for Study 2 (p7, Ln123) and detailed description of the scoring of the test forms have been added (p8, Ln150-154).</td>
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<td>5. <em>Are the discussion and conclusions well balanced and adequately supported by the data?</em></td>
<td>In general the conclusions are supported by the data, apart from the argument that the puzzle form increases attention to the task, thus improving performance. The argument here is not persuasive and this point would be better put as a speculation. We thank the reviewer for his suggestion, and have amended our argument that the puzzle form increases involvement and motivation to the task from an argument to a suggestion, which is then formally addressed as a speculation in the discussed (p14, Ln290-293).</td>
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<td>6. <em>Are limitations of the work clearly stated?</em></td>
<td>There is a lack of clarity in discussing the relations among completion rate, random responding and performance level. This is a crucial point in relation to the argument that the puzzle form gives a more accurate cognition measure. We have endeavored to clarify the point regarding random responding and its relationship with completion rate and performance by expanding our explanation (p14-15, Ln308-312). We also conducted further analyses in Study 2 (p13, Ln251-259) to investigate whether the performance advantage of the puzzle form was still evident when all participants completed the task. By only comparing those who</td>
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completed we aimed to eliminate the advantage the puzzle form may have had in sustaining attention until completion, even if this advantage consists of only random responding. However we are aware that this method does not fully control for random selection but it does provide more evidence for the performance advantage of the puzzle form.

- **Major Compulsory Revisions (which the author must respond to before a decision on publication can be reached)**

10. Restructure paper, reporting each of the two studies separately in order, rather than as a present conflating the two.

The two studies are now presented separately.

11. p.6 Justify and give in detail the hypothesis and predictions in a section before Methods.

We have attempted to justify and detail the hypotheses, see p.6, Ln 101-106. Hypotheses are presented prior to the Methods for both studies in our revised version.

12. p.7 Clarify the procedure used for the puzzle form in Procedure; in Procedure give further details of the scoring and correct the apparent discrepancy between the exclusion of non-completers noted here and the p.13 analysis for all participants; move the description of the interval between tests in to Procedure. Remove repetition of points made here that are repeated under Procedure on p.9. Note that restructuring the paper as noted above will mean reworking this part.

We apologize for the confusion here and have attempted to clarify the Procedure by restructuring the manuscript so that Study 1 and Study 2 are presented separately. We would like to clarify that a specific inclusion criteria set in both studies was that children attempt at least 12 items. Given that all participants in Study 1 completed the RCPM, we did not find it necessary to discuss non-completers here.

13. p.8 Move the hypotheses stated here back to a new section before Methods; clarifying in the penultimate sentence that participants were randomly assigned to ‘book first’ and ‘puzzle first’ and move that into Procedure.

This has been done in statement of hypotheses p6. and in Procedure for Study 1 p8

14. p.9 In the restructure, give the results of Study 1 after Procedure here.

We apologise again for the poor structure of the last version. The results of Study 1 (p9, Ln171) now appear immediately after the Data analysis section of Study 1.

15. p.10 1st and 2nd sentences: these conclusions should be placed as discussion after Results in the Study 1 report. They are unwarranted by the data provided and need more convincing rationales since they are revisited in the final Discussion. Either name the school for the second study or remove the name the school in the first study. Clarify here and also in the text currently on p.11 that participants were randomly assigned to book first or puzzle first and also in reference to and the title of Table 1.

These sentences now appear in the final paragraph of the Results in Study 1 (p 11 Ln202-209). We have also removed the school name in study 1 and replaced it with a description of the type of school and the school’s regional location as this information is more relevant (p6). The text (p6, Ln 118) and the table title (p20) noting that participants were assigned to two groups has been clarified.

16. p.12 2nd para; give p value for the reported r. Why is a Kruskall- Wallis test stated and a Chi-square value given? Correct this.

Thank you for pointing this out. Because of the non normal population distribution we used non-parametric statistics and in particular the Kruskal-Wallis test. The
Chi-square value was incorrectly recorded as the SPSS for a Kruskall-Wallis test output. Our error has now been corrected, p12 Ln229.

17. p.13 report the percentage completion rate values in the text. In the 2nd para, 2nd sentence, clarify that those who did not ‘complete the test’ nevertheless made some attempts (presumably). There is the potential for further analyses of numbers of items completed; this would strengthen the paper.

The text has been expanded to mention that 189 children were recruited (116 children with Autism Spectrum Disorder (ASD), 25 with Down Syndrome (DS) and 48 with Intellectual Disability (ID) of whom 25 (15 children with ASD, 5 DS and 5 ID) were excluded from analyses as they did not meet the inclusion criteria (p8 Ln153-154) of completing at least 12 items (p10 Ln 213-216). Although we have looked further into conducting an item analysis it appears we require a larger sample size. We are now in the process of accumulating more data and will address this issue further in the next publication.

18. p.14 This is where the issue of the confound of completion rate with performance is crucially important and requires detailed analysis.

We thank the reviewer for this important observation. We now done further analyses and presented the data in Study 2 (p12, Ln253-259) showing that the performance advantage of the puzzle form was still evident, although to a lesser extent, when only participants who completed either the book or puzzle form were included in the analyses, thus eliminating the advantage of the puzzle form allowing participants to complete the task.

• Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

19. In Table 1, clarify the title. Presumably it should read ‘…for children who completed the standard book form first and the puzzle form first’

The title has been modified accordingly.

20. Label y axes in charts

All y axes have now been labelled, p21-24.

21. Give details of ethics approval for Study 2

Ethics approval for both studies are detailed in the Method section of Study 1 (p7 Ln123-125)

Reviewer: Eric Emerson

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<td><strong>Minor Essential Revisions</strong></td>
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<tr>
<td>1. For a generic journal it would be useful to include a very brief description of intellectual disability (definition, prevalence) and make a brief case why a general readership should be concerned with this issue.</td>
<td>We thank the examiner for this comment, and have provided a definition of ID and a short explanation for the importance of research regarding ID and measures of intelligence, see p. 3 (Ln 26-36) on the revised version.</td>
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<td>2. Referencing should be reviewed to ensure accuracy. At present, references relating to ASD are used to support assertions relating to severe ID (e.g. 4, 5). This</td>
<td>We recognize the possible ambiguity regarding the references and have endeavored to provide additional references related to severe ID and Down Syndrome</td>
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is misleading. (p3 Ln32-34), although we would like to point out that there is very little in the literature regarding severe ID. We have also attempted to clarify the nature of ID, and how many neurodevelopmental disorders are associated with ID. This is particularly true for ASD, which has been the focus of more research.

3. Table 1. The text on p8 reports that sex is presented in this table. It is not. We apologise for this contradiction and have changed the text. Mention of sex of participants has now been omitted from the description of Table 1 (now on p9) as we have presented this information in text (p6 Ln 114-115).

4. Description of the procedure on p9 repeats information presented on p7 Upon restructuring the manuscript to separately present Study 1 and 2, the repetitive aspects of the procedure has been removed.

5. Results are discussed on p10 prior to their presentation in the results section. This is inappropriate. Again, this has been remedied following the restructuring of the manuscript. The Results of Study 1 are now only discussed following their presentation (p9 and 10).

6. Table 2 is missing RCPM scores (see text on p10) Table 3 (previously Table 2 in submitted version) was not meant to present RCPM scores, as these are already presented in Figure 2. We apologize for this error and have removed reference to RCPM scores in text (p11)

7. p11 the statement that ‘the mean raw performance score for the first attempt was lower than for the second attempt irrespective of the order of completion’ is rather confusing (an order effect that is independent of order?). Maybe ‘irrespective of version’? Thank you for suggesting a correction for this statement. We have altered this statement accordingly (p9, Ln 183-184).

8. p14 (and elsewhere). I fail to see how the authors can argue that the puzzle version gives more ‘accurate’ results and that the standard version ‘underestimates’ performance. The puzzle version certainly gives higher scores for ID children. To make claims of accuracy would require comparison with some gold standard. For example, providing typically developing children with major incentives and encouragement would probably increase their performance. Would it make it more ‘accurate’? The authors accept that more ‘accurate’ is a philosophically difficult position to defend. We have replaced this with terminology such as ‘valid’ and ‘better indicator of potential’. We believe this to be clearer as the findings show better performance in children with ID (p3, Ln 38; p13 Ln 256 and elsewhere).

9. p15. A claim is made in the discussion that the performance advantage is greater than would be expected by random response. The basis on which this claim is made should be described in the results section. Thank you for your comment. We acknowledge that our discussion of random selection was based on our findings without sufficient description in the Results section. We have now limited the discussion to reference of this as a possible variable associated with the performance advantage found for the puzzle form in the current studies, and a suggestion for future(p14)

10. Competing interests. On p5 it sounds as though the authors may be marketing these materials. If true, this Sorry about this misrepresentation. The authors have no commercial interests, and are not marketing the
would constitute a competing interest. materials, hence have no competing interests. The test has been modified accordingly in this revised version.

| 11. Figures. Y axes on figures required labeling | All figures have now been labelled, p21-24. |
| 12. The MS should be shortened. | We attempted to shorten the revised manuscript, but it is now slightly longer than the submitted version due to inclusion of the additional analyses suggested by Reviewer 1. |