Author's response to reviews

Title: The developmental relationship between language and motor performance from 3 to 5 years of age: A prospective longitudinal population study

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Author's response to reviews: see over
Dear editor,

We would like to thank the editor and the reviewers for carefully examining our manuscript, and making helpful and interesting remarks and suggestions. We are grateful for the positive and encouraging feedback. We will try to balance the revision between not changing the manuscript too much (in accordance with reviewer 1), and comply with the changes suggested by the second reviewer.

All changes are marked in red in the manuscript. Following is a point-by-point response to the comments provided by the second reviewer:

General comments:

- The English grammar/typos have been corrected where found.
- The reviewer points out that there is lack of clarity around the primary study. This is an important point and we have done several changes to make clearer that this in fact is follow up study. Further, the reviewer asks for an analysis of the whole time period together. We agree that this would be constructive, but the analyses of all three time points together are however not presented in the current paper. The reason why this was not done in the first paper was that data on 5-year-olds were not available when the first study was conducted. Thus, results on the relationship between communication and motor skills from 1 ½ to 3 years of age now published elsewhere. However, to make clearer the fact that this study builds upon a previous study some changed have been made in the text, including comments about analyses performed to ensure that the relationship was not changed because of earlier skills. Thus, controlling for skills at 1 ½ years of age did not alter the results in a noteworthy manner.
- Another suggestion made by the reviewer was to do separate analyses for gross and fine motor skills. This would certainly improve the value of this study, and all analyses have now been done separately for gross and fine motor skills. We agree that it is important to be aware of the distinction, and have included comments about the distinction several places in the introduction. The analyses part of the methods chapter was also changed, the results section was rewritten, and the discussion chapter was changed to incorporate the new findings.

Abstract:

- Changes was made in the abstract consistent with the comments from the reviewer. The background section now briefly summarize findings from previous literature, in addition to the aim of the present study. The methods section states more precisely what was tested, and the results section has been made clearer. The conclusion was also changed in accordance to our new findings, and to avoid misunderstandings and ambiguous words.

Introduction:

- The first sentence in the introduction was changed to correct the grammatical error made in the original manuscript.
- As the reviewer comments, we state that “most of the research in this field is on clinical populations”. The research on community populations is sparse but as the reviewer points out we cite some population based studies that are relevant for the purpose of the current study, including both Iverson and Alcock’s own research, as well as others. This is a very
important point to make, and we have included small changes throughout the manuscript to make this clearer.

- We agree that it would be helpful to distinguish between gross and fine motor skills, gestural and other motor skills. We have extended our analyses to separate between gross and fine motor skills, but as already mentioned, we regret to say that we do not have the measures to further extend our analyses.

- The reviewer has stimulating comments to the content and good suggestions to improve the introduction / background chapter in the manuscript. We agree that there are several angels to look upon this topic. However, since our measures are limited, we have chosen a broad and general perspective, also in the introduction. We argue that some of the perspectives suggested by the reviewer are not suitable for our data and measures. The reviewer kindly suggests several theoretical perspectives on links between language and motor skills that could be included in the introduction. We fully agree that these theories are relevant for a better understanding of the relationship between language and motor skills. To be able to shed new light upon these theories we would need other measures available, but since our measures are general, and not very specific, this is not the case as it is now. We do not have measures of gestures in our data, but broader measures of gross and fine motor skills. With the data we have now, we argue that, even though gesture production have been found to correlate both with language and motor development, it would in the context of our study be of limited relevance. Further, mirror neurons have been associated to emotion recognition and imitation, as well as language and gestures and is therefore important for social- and language development. However, we argue that this would demand measures that are more precise. Additional, theories concerning working memory are mostly focused on the speech-motor (especially on articulation) links. Thus, we have decided not to include the suggested theories in our manuscript. They are however valuable suggestions that we will remember for our next study.

- Pg 4, para 3; The sentence “non-specific linguistic skills...” has been changed to “non-linguistic skills...”

- Pg 5, Para 2; The sentence “Skills in language and motor performance develop...” has been removed. We agree that this was unclear, and have replaced this phrasing with the two sentences: “Few longitudinal studies have investigated developmental stability of language and motor skills in general populations and results from these are inconsistent. About half of late talkers, and about half of children with motor delay catch up with their peers”

- Pg 5 – The sentence referring to “psychiatric disorders in later life” has been changed to “Symptoms of delayed or deviant language development are related to a variety of different developmental outcomes such as ADHD, emotional and behavioural problems”

- The term “normal” has been replaced with “typical” throughout the manuscript.

- The reviewer also suggests spelling out the hypotheses, and we have now included more detail in our hypotheses, especially on gender, and also including the division between gross and fine motor skills.

Methods

- As both reviewers mention, the main limitation of the current study is measurement limitations. This unfortunately makes comparison between this study and some previous research results problematic. As we have already argued – this is also the main reason why a number of theoretical approaches are not helpful in explaining our data for the current study.
• Reviewer 2 also points out that it would be helpful to know more about the items, and specific types of skills being measured. To answer this we show all the items (including those who were excluded) available for the present study, and their distribution across boys and girls in an appendix. Hopefully this will also be helpful for other issues such as the skewed distribution.

• Unfortunately we do not have the gesture items from the ASQ available for analyses in the current study. Including such measures in addition to measures of language and motor skills would have made it possible to answer a whole range of interesting hypotheses in addition to what was included in this study.

• Pg 8, para 1 – As recommended the sentence “estimates of exposure-outcome associations were not biased due to self-selection in the MoBa” was changed to “estimates of risk exposure and child developmental outcomes were not significantly different when MoBa participants were compared with the entire population of Norwegian mothers” to avoid technical language.

• Pg 8 – The reviewer asks a very reasonable question why the ASQ wasn’t used for motor items at 5 years. MoBa is a large study supporting data to of several sub studies. The two main reasons for changing instruments between these two questionnaires were that more of the items in ASQ only work well if the parents can follow the instruction in the instrument on actual testing/trying out the individual items before responding to the questionnaire. This was considered by the study group to be an unduly demand in the context of a very long questionnaire. The other reason was to include a measure showing a better variability of scores in a group of 5 year olds. The intention was to make possible to study delayed development also in the mild to moderate range and not only severe. It has now been shown that the Ireton CDI items at 5 years have the same skewed distribution across response categories as the ASQ. This supports the argument that the two measures can be compared. We acknowledge that if the two distributions had been very different, such a comparison would have been more ambiguous. Hopefully using two different measures on motor skills have not impacted on our results, but we agree with the reviewer that it is of interest to 1) mention that ASQ is a screening tool (this was included in the text on page 8, para 2), and 2) underline that there is a limitation to use different instruments at the two measurement occasions (included at page 17, para 1).

• To answer the request for more details of the types of skills being measured we have provided all the included items in an appendix. This appendix also answers which items were excluded, and gives insight in the differences in distribution across response categories between boys and girls.

Results

• In accordance with suggestions from the reviewer we have reanalyzed our data separately for gross and fine motor skills. This has had implications for the entire results section (as well as other sections of the manuscript), and we have marked all changes in red writing.

• The reviewer comments that the statistics on gender differences in raw scores are not presented. We regret that this was not included in the original manuscript. This has now been added in the appendix, and a reference to this was included on page 13, para 2.

• We strongly agree with the reviewer, that it would be interesting and informative to make cut-off scores, and investigating the predictive power in children who meet the criteria for motor or language disorder. That would answer to both pervious clinical and population based research in a much better way than what is achieved by the way that was chosen for the current study. We can only regret to say that this was beyond the scope of the present study, but we hope that this will be possible at another time. An ongoing clinical study will give much needed information on language abilities in children from this population when
participating children are at the age of eight. Results from the clinical study will be able to answer the reviewer’s suggestions in a much better way than would have been possible in the current study.

Discussion

- Pg 15, para 3; Clarification concerning the “previous study” has been made in the introduction, and is now also repeated in the discussion.
- Pg 17, para 1: The reviewer makes an interesting point in a comment about the method by which parents are asked to assess children’s language/motor skills at the different ages. We agree that some of the shared variance might be due to verbal instructions being used to get children to perform motor tasks, and has added a sentence in the limitations section of the discussion to cover this aspect.
- To make the distinction between implications for typical and delayed development, a number of changes have been made in the discussion chapter. On page 15, para 3, we specify that we refer to “earlier studies, mainly with clinical samples”
- Conclusions were changed to better incorporate the distinction between gross and fine motor skills. We also restructured parts of the conclusion part to improve the presentation of our main conclusion.

Other changes

- Keywords has been added after the abstract
- Reference [33] repeated on page 6, para 2g
- Page 4, para 3 “motor” replaced with “language”
- Table 3, describing gender differences has been changed. In the addition to separate analyses for gross and fine motor skills, this has now been done by using a multigroup design with wald chi-square tests...

Typos and grammatical corrections

- Page 2, para 1: The sentence “The developmental pathways of both domains have been described in terms of both rapid changes, plateaus, and wide variability” to “The developmental pathways of both domains have been described in terms of rapid changes, plateaus, and wide variability”.
- Page 3, para 2: The word “exist” was replaced with “exists”.