¹ Limited evidence of test-retest reliability in infant-directed speech preference in a large

² pre-registered infant sample

³                                    Abstract

⁴ Test-retest reliability — establishing that measurements remain consistent across multiple

⁵ testing sessions — is critical to measuring, understanding, and predicting individual

⁶ differences in infant language development. However, previous attempts to establish

⁷ measurement reliability in infant speech perception tasks are limited, and reliability of

⁸ frequently-used infant measures is largely unknown. The current study investigated the

⁹ test-retest reliability of infants' preference for infant-directed speech (hereafter, IDS) over

¹⁰ adult-directed speech (hereafter, ADS) in a large sample ($N$=158) in the context of the

¹¹ ManyBabies1 collaborative research project (hereafter, MB1; Frank et al., 2017;

¹² ManyBabies Consortium, 2020). Labs of the original MB1 study were asked to bring in

¹³ participating infants for a second appointment retesting infants on their IDS preference.

¹⁴ This approach allows us to estimate test-retest reliability across three different methods

¹⁵ used to investigate preferential listening in infancy: the head-turn preference procedure,

¹⁶ central fixation, and eye-tracking. Overall, we find no consistent evidence of test-retest

¹⁷ reliability in measures of infants' speech preference (overall $r$ = .09, 95% CI [-.06,.25]).

¹⁸ While increasing the number of trials that infants needed to contribute for inclusion in the

¹⁹ analysis revealed a numeric growth in test-retest reliability, it also considerably reduced the

²⁰ study's effective sample size. Therefore, future research on infant development should take

²¹ into account that not all experimental measures may be appropriate for assessing

²² individual differences between infants.

²³      *Keywords:* language acquisition; speech perception; infant-directed speech;

²⁴ adult-directed speech; test-retest reliability

²⁵      Word count: 3998

<sup>26</sup> Limited evidence of test-retest reliability in infant-directed speech preference in a large

<sup>27</sup> pre-registered infant sample

<sup>28</sup> Obtaining a quantitative measure of infants' cognitive abilities is an extraordinarily

<sup>29</sup> difficult endeavor. The most frequent way to assess what infants know or prefer is to track

<sup>30</sup> overt behavior. However, measuring overt behavior at early ages presents many challenges:

<sup>31</sup> participants' attention span is short, they do not follow instructions, their mood can

<sup>32</sup> change instantly, and their behavior is often inconsistent. Therefore, most measurements

<sup>33</sup> are noisy and the typical sample size of an infant study is small (around 20 infants per

<sup>34</sup> group), resulting in low power (Oakes, 2017). In addition, there is individual and

<sup>35</sup> environmental variation that may add even more noise to the data (e.g., Johnson &

<sup>36</sup> Zamuner, 2010). Despite these demanding conditions, reliable and robust methods for

<sup>37</sup> assessing infants' behavior are critical to understanding development.

<sup>38</sup> In order to address these challenges, the ManyBabies collaborative research

<sup>39</sup> consortium was formed to conduct large-scale, conceptual, consensus-based replications of

<sup>40</sup> seminal findings to identify sources of variability and establish best practices for

<sup>41</sup> experimental studies in infancy (Frank et al., 2017). The first ManyBabies collaborative

<sup>42</sup> research project (hereafter, MB1, ManyBabies Consortium, 2020) explored the

<sup>43</sup> reproducibility of the well-studied phenomenon that infants prefer infant-directed speech

<sup>44</sup> (hereafter, IDS) over adult-directed speech (hereafter, ADS, Cooper & Aslin, 1990). Across

<sup>45</sup> many different cultures, infants are commonly addressed in IDS, which typically is

<sup>46</sup> characterized by higher pitch, greater pitch range, and shorter utterances, compared to the

<sup>47</sup> language used between interacting adults (Fernald et al., 1989). A large body of behavioral

<sup>48</sup> studies finds that infants show increased looking times when hearing IDS compared to ADS

<sup>49</sup> stimuli across ages and methods (Cooper & Aslin, 1990; see Dunst, Gorman, & Hamby,

<sup>50</sup> 2012 for a meta-analysis). This attentional enhancement is also documented in

<sup>51</sup> neurophysiological studies showing increased neural activation during IDS compared to

ADS exposure (Naoi et al., 2012; Zangl & Mills, 2007). IDS has also been identified as facilitating early word learning. In particular, infants' word segmentation abilities (Floccia et al., 2016; Schreiner & Mani, 2017; Singh, Nestor, Parikh, & Yull, 2009; Thiessen, Hill, & Saffran, 2005) and their learning of word-object associations (Graf Estes & Hurley, 2013; Ma, Golinkoff, Houston, & Hirsh-Pasek, 2011) are enhanced in the context of IDS. In sum, several lines of evidence suggest that IDS is beneficial for early language development.

Within MB1, 67 labs contributed data from 2,329 infants showing that babies generally prefer to listen to IDS over ADS. Nevertheless, the overall effect size of $d = 0.35$ was smaller than a previously reported meta-analytic effect size of $d = 0.67$ (Dunst et al., 2012). The results revealed several additional factors that influenced the effect size. First, older infants showed a larger preference of IDS over ADS. Second, the stimulus language was linked to IDS preference, with North American English learning infants showing a larger IDS preference than infants learning other languages. Third, comparing the different methods employed, the head-turn preference procedure yielded the highest effect size, while the central fixation paradigm and eye-tracking methods revealed smaller effects. Finally, exploratory analyses assessed the effect of different inclusion criteria. Across methods, using stricter inclusion criteria led to an increase in effect sizes despite the larger proportion of excluded participants (see also Byers-Heinlein, Bergmann, & Savalei, 2021).

However, there is a difference between a result being reliable in a large sample of infants and the measurement of an individual infant being reliable. In studies tracking individual differences, the measured behavior during an experimental setting is often used to predict a cognitive function or specific skill later in life. Individual differences research of this kind often has substantial implications for theoretical and applied work. For example, research showing that infants' behavior in speech perception tasks can be linked to later language development (see Cristia, Seidl, Junge, Soderstrom, & Hagoort, 2014 for a meta-analysis) has the potential to identify infants at risk for later language delays or disorders. However, a necessary precondition for this link to be observable is that

individual differences between infants can be measured with high reliability at these earlier stages, in order to ensure that measured inter-individual variation mainly reflects differences in children's abilities rather than measurement error. How reliable are the measures used in infancy research?

Previous attempts to address the reliability of measurements have typically been limited to adult populations (Hedge, Powell, & Sumner, 2018), or have been conducted with small sample sizes (e.g., Houston, Horn, Qi, Ting, & Gao, 2007). For example, Colombo, Mitchell, and Horowitz (1988) used a paired-comparison task, in which infants were familiarized with a stimulus and presented with the familiarized and a novel stimulus side-by-side at test. Results indicated that infants' novelty preference was extremely variable from task to task. Assessing infants' performance from one week to another revealed that infants' attention measures were moderately reliable. However, reliability seemed to increase with the number of tasks infants completed in the younger age group, suggesting that reliability is influenced by the number of assessments. In addition, infants' performance from 4 to 7 months was longitudinally stable but somewhat smaller than week-to-week reliability. Cristia, Seidl, Singh, and Houston (2016) also retested infant populations by independently conducting 12 different experiments on infant speech perception at three different labs with different implementations of the individual studies. Hence, it was only after completed data collection that the data was pooled together by the different labs revealing potential confounds. Nevertheless, the results showed that reliability was extremely variable across the different experiments and labs and low overall (meta-analytic $r = .07$).

Against this background, the current study investigates test-retest reliability of infants' performance in a speech preference task. Within MB1, a multi-lab collaboration, we examine whether infants' preferential listening behavior to IDS and ADS is reliable across two different test sessions. We also investigate the influence of various moderators on the reliability of IDS preference (e.g., time between test and retest; infants' language

106   background).

107        Our study was faced with a critical design choice: what stimuli to use to assess

108   test-retest reliability. One constraint on our study was that, since it was a follow-on to

109   MB1, any stimulus we used would always be presented after the MB1 stimuli. One option

110   would be simply to bring back infants and have them hear exactly the same stimulus

111   materials. A weakness of this design would be the potential for stimulus familiarity effects,

112   however, since infants would have heard the materials before. Further complicating

113   matters, infants might show a preference for or against a familiar stimulus depending on

114   their age (Hunter & Ames, 1988). The ideal solution then would be to create a brand new

115   stimulus set with the same characteristics. Unfortunately, because of the process of how

116   MB1 stimuli were created, we did not have enough normed raw recordings available to

117   make brand new stimulus items that conformed to the same standards as the MB1 stimuli.

118   We therefore chose an intermediate path: we reversed the ordering of MB1 stimuli.

119   Average looking times in MB1 were always lower than 9s per trial, even for the youngest

120   children on the earliest trials (the group who looked the longest on average), so most

121   children in MB1 did not hear the second half of most trials. Thus, by reversing the order,

122   we had a perfectly matched stimulus set that was relatively unfamiliar to most infants.

123   The disadvantage of this design was that infants who looked longer might be more likely to

124   hear a familiar clip heard in the previous study. If infants then showed a familiarity

125   preference — an assumption which might not be true — the end result could be to inflate

126   our estimates of test-retest reliability slightly, since longer lookers would on average look

127   longer at retest due to their familiarity preference. We view this risk as relatively low, but

128   do note that it is a limitation of our design.

129        The current study also explores whether there are any differences in test-retest

130   reliability between three widely used methods: central fixation (CF), eye-tracking (ET),

131   and the head-turn preference procedure (HPP). Exploring differences in CF, ET, and HPP,

132   Junge et al. (2020) provide experimental and meta-analytic evidence in favor of using the

HPP in speech segmentation tasks. Similarly, the MB1 project reported an increase in the effect size for HPP compared to CF and ET (ManyBabies Consortium, 2020). HPP requires gross motor movements relative to other methods, such as CF and ET paradigms, for which subtle eye movements towards a monitor located in front of the child are sufficient. One possible explanation for the stronger effects with HPP may be a higher sensitivity to the contingency of the presentation of auditory stimuli and infants' head turns away from the typical forward-facing position. While these findings suggest that HPP may be a more sensitive index of infant preference, they do not necessarily imply higher reliability for individual infants' performance using HPP. For example, Marimon and Höhle (2022) found no evidence for test-retest reliability when testing infants' prosodic preferences using the HPP method. It remains an open question whether the same measures that produce larger effect sizes at the group-level also have higher test-retest reliability for individual infants (Byers-Heinlein, Bergmann, et al., 2021). Therefore, assessing the test-retest reliability of the different preference measures is crucial, so that researchers can make informed decisions about the appropriate methods for their particular research question. Critically, only measures with high test-retest reliability should be used for studies of individual differences.

# Method

## Preregistration

Prior to the start of data collection, we preregistered the current study on the Open Science Framework (https://osf.io/v5f8t; see S1 in the Supplementary Materials for details).

## Data Collection

A call was issued to all labs participating in the original MB1 study on January 24th, 2018 (ManyBabies Consortium, 2020). The collection of retest session data was initially set to end on May 31st, 2018, one month after the end date of the original MB1 project. Due to the fact that the original MB1 project extended the time frame for data collection and the late start of data collection for the MB1 test-retest study, we also allowed participating labs to continue data collection past the scheduled end date.

## Participants

Contributing labs were asked to re-recruit their monolingual participants between the ages of 6 to 12 months who had already participated in the MB1 project. If participating labs had not committed to testing either of these age groups, they were also allowed to re-recruit participants from the youngest age group of 3- to 6-month-olds and/or the oldest age group of 12- to 15-month-olds. Labs were asked to contribute half ($n$=16) or full samples ($n$=32); however, a lab's data was included in the study regardless of the number of included infants. The study was approved by each lab's respective ethics committee and parental consent was obtained for each infant prior to participation in the study.

Our final sample consisted of 158 monolingual infants from 7 different labs (Table 1). In order to be included in the study, infants needed a minimum of 90% first language exposure, to be born full term with no known developmental disorders, and normal hearing and vision. We excluded 11 participants due to session errors and 11 participants who did not have at least one valid trial per condition (IDS and ADS) at their first or second session. The mean age of infants included in the study was 245 days (range: $108 - 373$ days).

## Materials

**Visual stimuli.**    The visual stimuli and instructions were identical to MB1. For the CF paradigm and ET, labs used a multicolored static checkerboard as the fixation stimulus as well as a multicolored moving circle with a ringing sound as an attention-getter between trials. For the HPP method, labs used their standard procedure, as in MB1.

**Speech stimuli.**    We used the identical training stimuli of piano music from MB1. A second set of naturalistic IDS and ADS recordings of mothers either talking to their infant or to an experimenter was created for the retest session by reversing the order of clips within each sequence of the original study. This resulted in eight new sequences of natural IDS and eight new sequences of natural ADS with a length of 18 seconds each.

**Procedure.**    Infants were retested using the identical procedure as during the first testing day: CF, HPP, or ET. Participating labs were asked to schedule test and retest sessions 7 days apart with a minimum number of 1 day and a maximum number of 31 days. However, infants whose time between test and retest exceeded 31 days were still included in the analyses ($n = 3$). The mean number of days between test and retest was 10 (range: 1 - 49).

A total of 18 trials, including two training, eight IDS, and eight ADS trials, were presented in one of four pseudo-randomized orders. Trial length was either infant-controlled or fixed depending on the lab's standard procedure: a trial stopped either if the infant looked away for 2 seconds or after the total trial duration of 18 seconds. The online coding experimenter and the parent listened to music masked with the stimuli of the study via noise-cancelling headphones. If the experimenter was in an adjacent room separate from the testing location, listening to masking music was optional for the experimenter.

**Data exclusion.**    A child was excluded if they had a session error, i.e., an experimenter error (e.g., inaccurate coding, or presentation of retest stimuli on the first test session) or equipment failure (visual stimuli continued to play after the end of a trial).

Table 1

*Statistics of the included labs. n refers to the number of infants included in the final analysis.*

| Lab | Method | Language | Mean age (days) | N |
| --- | --- | --- | --- | --- |
| babylab-potsdam | HPP | German | 227 | 22 |
| babyling-oslo | eye-tracking | Norwegian | 249 | 10 |
| brookes-babylab | central fixation | English | 267 | 18 |
| InfantCog-UBC | central fixation | English | 147 | 7 |
| infantll-madison | HPP | English | 230 | 30 |
| lancslab | eye-tracking | English | 236 | 16 |
| wsi-goettingen | central fixation | German | 280 | 39 |
| wsi-goettingen | HPP | German | 242 | 16 |

204   Trials were excluded if they were marked as trial errors, i.e., if the infant was reported as

205   fussy, an experimental or equipment error occurred, or there was parental interference

206   during the task (e.g., if the parent spoke with the infant during the trial). Trials were also

207   excluded if the minimum looking time of 2 s was not met. If a participant was unable to

208   contribute at least one IDS and one ADS trial for either test or retest, all data of that

209   participant was excluded from the test-retest analyses.

## Results

### IDS preference

212   First, we examined infants' preference for IDS in both sessions. Two-samples t-tests

213   comparing the difference in average looking time between IDS and ADS to zero revealed

214   that infants showed a preference of IDS over ADS in Session 1, $t(157) = 6.47$, $p < .001$, and

Table 2

*Average looking times (in seconds) for each session and condition*

| Trial type | Session 1 Mean | Session 1 $SD$ | Session 2 Mean | Session 2 $SD$ |
|---|---|---|---|---|
| ADS | 7.72 | 2.77 | 6.96 | 2.92 |
| IDS | 8.76 | 2.85 | 7.75 | 2.75 |

215  Session 2, $t(157) = 4.19$, $p < .001$, replicating the main finding from MB1 (Table 2).

216  68.35% of infants in Session 1 and 63.29% of infants in Session 2 showed a preference for

217  IDS. In order to test whether there was a difference in the strength of the preference effect

218  across sessions, we fit a linear mixed-effects model predicting infants' average difference in

219  looking time between IDS and ADS from test session (1 vs. 2), including by-lab and

220  by-participant random intercepts. There was no significant difference in the magnitude of

221  infants' preference between the two sessions, $\beta$=-0.30, $SE$=0.24, $p$=.208.

222  **Reliability**

223       We assessed test-retest reliability in two ways. First, we fit a linear mixed-effects

224  model predicting IDS preference in Session 2 from IDS preference in Session 1, including a

225  by-lab random intercept. The results revealed no significant relationship between IDS

226  preference in Session 1 and 2 (Table 3). Second, we calculated the Pearson correlation

227  coefficient. While a simple correlation coefficient might overestimate the test-retest

228  reliability in our sample because it does not control for the differences between different

229  labs and methods (HPP, CF, and ET), we felt it was important to also conduct a Pearson

230  correlation as it is commonly used to assess reliability. The size of the correlation

231  coefficient was not statistically different from zero and the estimate was small, $r = .09$, 95%

232  CI $[-.06, .25]$, $t(156) = 1.19$, $p = .237$. Moreover, no significant correlations emerged in

233  each sample considered separately (Figure 1; see Supplementary Materials S3 for a

Table 3

*Coefficient estimates from a linear mixed effects model*

*predicting IDS preference in Session 2.*

|  | Estimate | SE | t | p |
|---|---|---|---|---|
| Intercept | 0.87 | 0.46 | 1.92 | 0.10 |
| IDS Preference Session 1 | 0.04 | 0.09 | 0.41 | 0.68 |
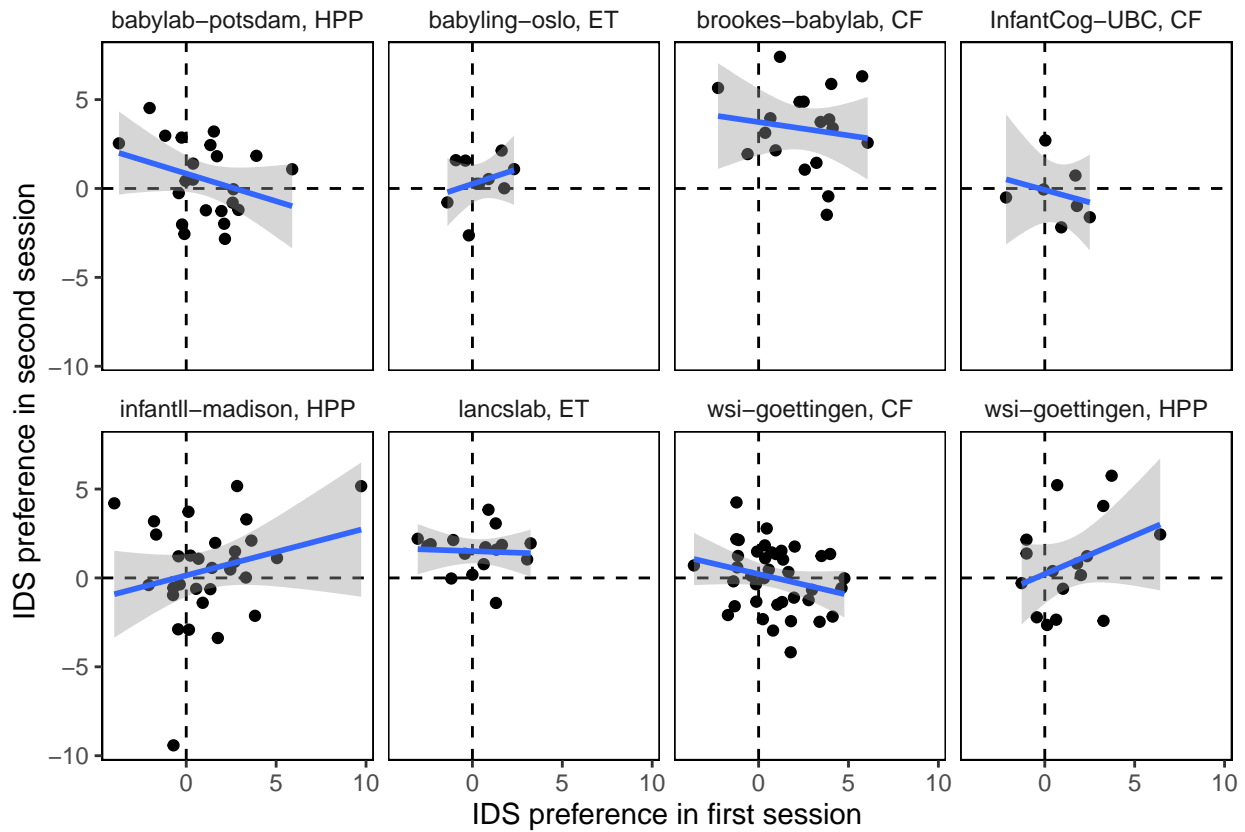


*Figure 1*. Correlation between IDS Preference in Session 1 and Session 2 in each lab and method. Dots indicate individual participants. Error bands represent 95 percent confidence intervals. The dashed line indicates no preference (i.e., a value of zero) for the first and second session, respectively.

Table 4

*Coefficient estimates from a linear mixed effects model predicting IDS preference in Session 2 and Pearson correlation coefficient for each method separately.*

| Method | beta | SE | p | Pearson r |
|--------|------|------|------|-----------|
| HPP | 0.15 | 0.14 | 0.28 | 0.13 |
| ET | 0.03 | 0.16 | 0.84 | 0.02 |
| CF | -0.20 | 0.12 | 0.12 | 0.08 |

meta-analytic approach). 41.77% of the infants reversed their direction of preference for IDS versus ADS from the test to the retest session.

To investigate the test-retest reliability of each specific method, we computed Pearson correlation coefficients and the same mixed-effects model described above for HPP, CF, and ET separately (Table 4). None of the three methods showed evidence of test-retest reliability. Neither the Pearson correlation coefficients nor the coefficients of the multilevel analysis were significant, all $p$-values $> 0.12$. In planned secondary analyses, we found that time between test sessions, participant age, and language background did not moderate the relationship between IDS preference in session 1 and session 2 (see Supplementary Materials S2). Taken together, we find no significant evidence of test-retest reliability across our preregistered analyses.

**Results with different inclusion criteria**

To this point, all analyses were performed using the inclusion criteria from MB1, which required only that infants contribute at least one trial per condition for inclusion (i.e., one IDS and one ADS trial). However, more stringent inclusion criteria yielded larger

effect sizes in MB1. We therefore conducted exploratory analyses assessing test-retest reliability after applying progressively stricter inclusion criteria, requiring two, four, six, and eight valid trials per condition. Applying stricter criteria — and thereby increasing the number of test trials — increased reliability numerically from $r = 0.07$ to $r = 0.34$ (Figure 2). In part due to a decrease in sample size, only one of these correlations was statistically significant (when requiring six trial pairs): two valid trial pairs, $t(152) = 0.90$, $p = .367$; four valid trial pairs, $t(143) = 1.03$, $p = .306$; six valid trial pairs, $t(98) = 2.23$, $p = .028$; eight valid trial pairs — all trials in both sessions — $t(22) = 1.68$, $p = .108$. The analyses provide tentative evidence that stricter inclusion criteria may lead to higher test-retest reliability, but at the cost of substantial decreases in sample size (see Supplementary Materials S5 for additional analyses).

## General Discussion

The current study investigated the test-retest reliability of infants' preference for IDS over ADS. We retested the IDS preference of infants participating in the original MB1 project to assess the extent to which their pattern of preference would remain consistent across multiple testing sessions. While we replicated the original effect of infants' speech preference for IDS over ADS for both the test and retest session on the group-level, we found that infants' speech preference measures showed no evidence of test-retest reliability. In other words, we were unable to detect stable individual differences in infants' preference for IDS. This finding is consistent with past research suggesting low test-retest reliability in other infant paradigms (Cristia et al., 2016). Given that most experimental procedures conducted in infant research are interested in the comparison of groups, individual differences between participants within a specific condition are usually minimized by the experimental procedure while differences between conditions are maximized. Therefore, infant preference measures may be a good approach for capturing group-level phenomena, but may be less appropriate for examining individual differences in development.
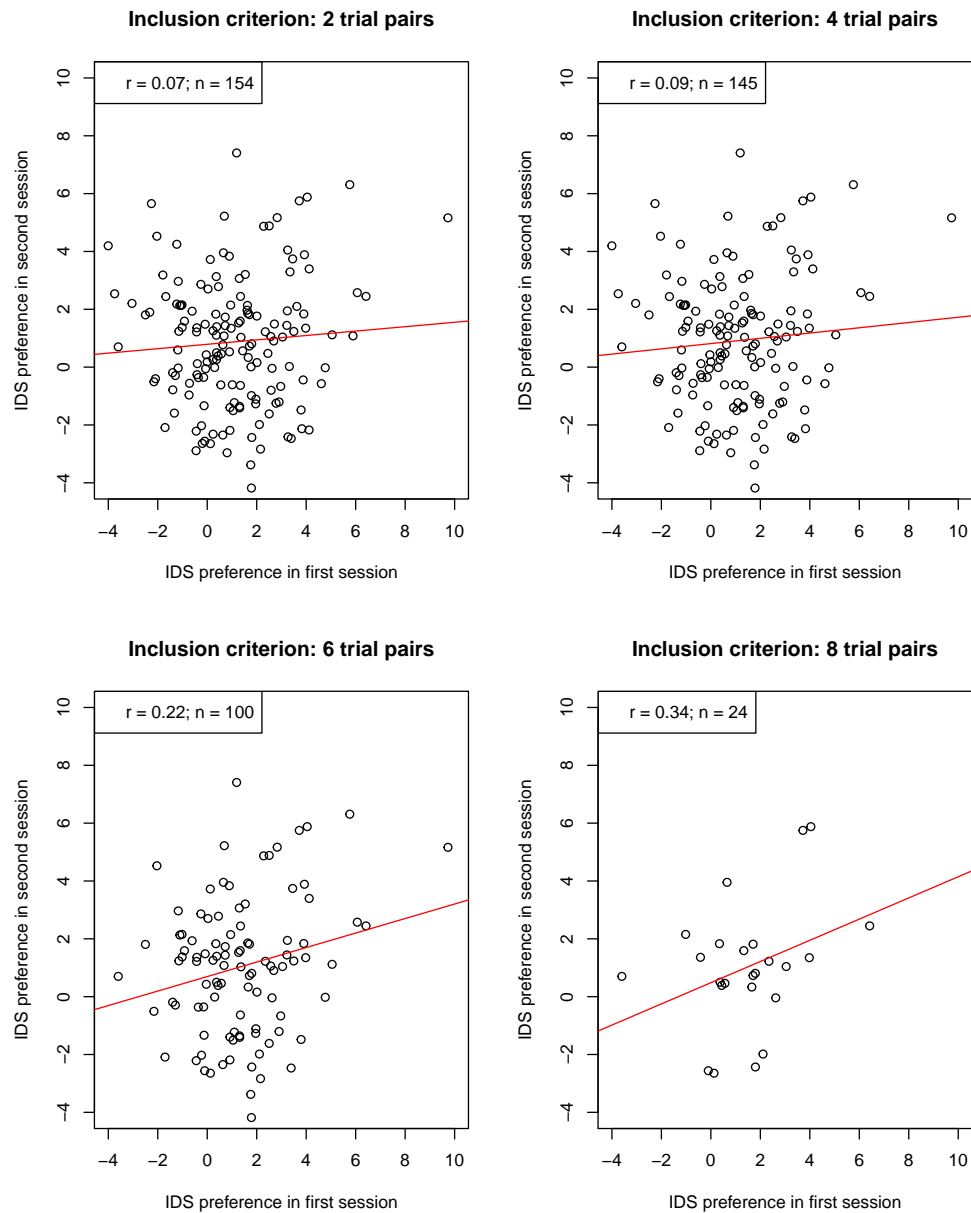
*Figure 2.* IDS preferences of both sessions plotted against each other for each inclusion criterion. $n$ indicates the number of included infants, $r$ is the Pearson correlation coefficient as the indicator for reliability.

275    Consistent with general psychometric theory (e.g., DeBolt, Rhemtulla, & Oakes,
276  2020), stricter inclusion criteria — and consequently a larger number of included test trials
277  per participant — tended to increase the magnitude of the correlation between test
278  sessions. However, this association was based on exploratory analyses and was in part only
279  observed descriptively, and hence should be interpreted with caution. A similar effect on
280  the group-level was found in the MB1 project, where a stricter inclusion criterion led to
281  bigger effect sizes (ManyBabies Consortium, 2020). As in MB1, higher reliability through
282  strict exclusions came at a high cost. In particular, with the strictest criterion, only a small
283  portion of the original sample size (24 out of 158 infants) could be included in the final
284  sample. In other words, applying stricter criteria leads to a higher drop-out rate and can
285  dramatically reduce the sample size. In the case of studies in the field of developmental
286  science, where there are many practical restrictions in collecting large samples of infants
287  (e.g., birth rate in the area, restricted lab capacities, budget restrictions), a strict drop-out
288  criterion may often be difficult to implement. Note that studies in developmental science
289  already have above-average drop-out rates (Miller, 2017). In addition, drop out may not be
290  random, and so having high drop-out rates can further limit the generalizability of a study.
291  In fact, the number of trials individual infants contributed was highly correlated between
292  test sessions in the current study (see Supplementary Materials S6). Particularly in the
293  context of turning individual differences measures into diagnostic tools, high drop-out rates
294  have an additional limitation of not being broadly usable.

295    An alternative approach to increasing the number of valid trials is to increase the
296  number of experimental trials. This approach seeks to increase the likelihood that
297  participants will contribute sufficient trials (after trial-level exclusions) to allow for precise
298  individual-level estimates (DeBolt et al., 2020; see also Silverstein, Feng, Westermann,
299  Parise, & Twomey, 2021). While this approach is promising, it may not always be feasible,
300  because the attention span of a typical infant participant is limited. Therefore, prolonging
301  the experimental procedure to maximize the absolute number of trials is often challenging

in practice. Other avenues for obtaining higher numbers of valid trials may include changes in the procedure (e.g., Egger, Rowland, & Bergmann, 2020) or implementing multi-day test sessions (Fernald & Marchman, 2012).

As our results are only based on the phenomenon of IDS preference (albeit, with three widely used methods: HPP, CF, ET) it is essential to further assess the underlying reliability of preferential looking measures within other areas of speech perception (Marimon & Höhle, 2022). While most infants prefer IDS over ADS (Dunst et al., 2012), patterns of preferential looking in other tasks (e.g., speech segmentation) are often inconsistent and difficult to predict (Bergmann & Cristia, 2016). These inconsistencies in looking behavior are especially important to consider in the context of relating a direction of preference to later language development, and can sometimes lead to seemingly contradictory findings. That is, both familiarity and novelty responses have been suggested to be predictive of infants' later linguistic abilities (DePaolis, Vihman, & Keren-Portnoy, 2014; Newman, Ratner, Jusczyk, Jusczyk, & Dow, 2006; Newman, Rowe, & Ratner, 2016). In light of our findings, researchers conducting longitudinal studies with experimental data from young infants predicting future outcomes should be cautious, as there may be large intra-individual variability affecting preference measurement.

**Limitations**

While we had an above-average sample size for a study in infant research, we were unable to approach the number of participants collected within the original MB1 study. In addition to a delayed call, the extra effort of having to schedule a second lab visit for each participant and the fact that there were already other collaborative studies taking place simultaneously (MB1B, Byers-Heinlein, Tsui, Bergmann, et al., 2021; MB1G, Byers-Heinlein, Tsui, Van Renswoude, et al., 2021), might have contributed to a low participation rate. A higher sample size and a larger number of participating labs from different countries would have enabled us to conduct a more highly-powered test of

328 differences in test-retest reliability across different methods, language backgrounds, and

329 participant age.

330    A further limitation concerns the stimuli. While the order of the audio recording clips

331 presented to infants within a given trial differed between the first and second session, the

332 exact same stimulus material as in MB1 was used in both sessions. In particular, all

333 children heard the exact same voices in Session 1 and in Session 2. From a practical point

334 of view, this was the most straightforward solution for coordinating the experiment within

335 the larger MB1 project. However, familiarity effects might have influenced infants' looking

336 behavior. Infants with longer looking times in their first session might have had more

337 opportunity to recognize familiar audio clips in their second session. For infants with short

338 looking times, familiar audio clips would only occur towards the end of second-session

339 trials, thus offering infants less opportunity to recognize voices from their first session.

340 Therefore, inconsistent familiarity with the stimulus material in the second session across

341 infants might have artificially lowered test-retest reliability.

## Conclusion

343    Following the MB1 protocol, the current study could not detect test-retest reliability

344 in measures of infants' preference for IDS over ADS. Subsequent analyses provided

345 tentative evidence that stricter criteria for the inclusion of participants may enhance

346 test-retest reliability at the cost of high drop-out rates. Developmental studies relying on

347 stable individual differences between their participants need to consider the underlying

348 reliability of their measures, and we recommend a broader assessment of test-retest

349 reliability in infant research.

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