

1 **Supplementary Materials**

2

3 **A. Details visual decision task**

4 Visual decision task items consisted of a single line of constant length (L_1) and two separate line
5 segments (L_2), the individual and combined length of which varied across items. Both the single
6 line and two line segments were straight, vertical lines depicted next to one another. The
7 objective was to indicate which is longer, L_1 or the combined length of L_2 . Responses were given
8 by checking the box corresponding the box.

9 Each item included external information pertaining to the correct response in the form of an
10 answer by a supposed previous participant ‘Robin’, which was correct in 75% of items. If
11 ranking the items from lowest to highest L_2 , the second out of 4 items contained incorrect
12 external information (i.e. incorrect information was given at item 2, item 6, item 10, etc.) This
13 was done so that incorrect information would be spread equally across item difficulty. In the
14 task, the items were presented in a random order, which was the same for all participants.

15 Items were created in R, for $L_1 = 10$, $L_2 = [8.5, 11.5]$, with L_2 increasing in steps of 0.025 (i.e.
16 for item 1 $L_2 = 8.5$, for item 2 $L_2 = 8.525$, for item 3 $L_2 = 8.55$, ..., for item 120 $L_2 = 11.5$).
17 Difficulty varied with the length of L_2 , with items where the difference in length between L_1 and
18 L_2 is smaller being more difficult. L_1 and L_2 were never of the same length.

19 The length of each of the two separate line segments was generated randomly, with a few
20 restrictions. First, the line segment lengths would sum up to equal the L_2 length of that item.
21 Second, the two segments of L_2 were constrained to have a difference in length of at least 1.
22 Also, the line segments were displayed so that the shortest segment would always be closest to
23 the single line (L_1). This was done as varying which segment of L_2 was shown closest to L_1
24 might affect item difficulty, which was intended to depend solely on the length of L_2 .

25 Items were exported from R at a 240×240 mm format, with a resolution of 144, resulting in the
26 single line (L_1) having a length of 75mm, and the total length of the two separate line segments
27 (L_2) varying between 63.75mm and 86.25mm in steps of 0.1875.

28 Information on ‘Robin’ (e.g. age, gender, whether getting 75% of items correct was good
29 performance) was purposefully withheld (the name ‘Robin’ is unisex in Dutch and gender-
30 specific pronouns were avoided). This was supposedly due to privacy regulations, but actually
31 done to prevent such factors from influencing decision strategy use—which would be likely to
32 happen (Lourenc et al., 2015).

33 The task consisted of 120 items, a reduced number as compared to the auditory decision task
34 from the pilot. A small pilot with the visual task indicated that it took longer to complete than the
35 auditory task, potentially because checking boxes takes longer than pressing buttons, or because

36 participants rather than the computer determined the pace. Simulations showed that 120 items
37 were sufficient to discriminate between different strategy models, and children indicated this
38 length to be feasible.

39 The full R-code used in item creation is available on the Open Science Framework (OSF;
40 https://osf.io/pe8jw/?view_only=4c3e221a699f475280b28f361206bcd5), under the name ‘A.
41 Line task (Study 2).R’.

42

43 **B. Data analysis**

44 Strategy model assignment and strategy parameter estimation are achieved through Bayesian
45 hierarchical mixture modeling. Below the details of the model are explained. The codes are
46 available on the OSF as: ‘Analyses Study1.R’ (pilot study) and ‘Analyses Study2.R’ (main
47 study).

48

49 *B1. Strategy Model Assignment*

50 The model assigned to an individual is the one with the highest posterior probability. The
51 posterior probability of each strategy model, per individual, can be calculated according to the
52 Monte Carlo estimator, see Equation B1:

53

$$54 \quad p(M_k|D) = \frac{\text{Number of occurrences of } M_k \text{ in } strat_i}{\text{Total number of iterations in } strat_i} \quad (\text{Eq. B1})$$

55

56 This utilizes model index parameter $strat_i$, a vector containing strategy model M assignment
57 $k = \{1, 2, \dots, K\}$ for individual $i = \{1, 2, \dots, N\}$, across samples.

58 Evidence for assignment of model k over the other models is then quantified in terms of the
59 Bayes factor, as calculated using the product space method (Lodewyckx et al., 2011;
60 Steingroever, Pachur, Šmíra, & Lee, 2018), see Equation B2:

61

$$62 \quad BF_{k,\neq k} = \frac{p(M_k|D) / p(M_{\neq k}|D)}{p(M_k) / p(M_{\neq k})} \quad (\text{Eq. B2})$$

63

64 In this equation, the numerator is the ratio of the posterior probability of model k and the
65 summated posterior probabilities of all other models. The denominator is the ratio of prior
66 probabilities of these same models. A BF is computed per individual for every model. The
67 individual is assigned the model with the highest BF.

68

69 *B2. Strategy Parameters*

70 Strategy parameters refer to all parameters that inform behavior within all strategy models. In
71 our hierarchical Bayesian model, we distinguish between group-level parameters and individual-
72 level parameters (Boehm, Marsman, Matzke, & Wagenmakers, 2018; Lee & Wagenmakers,
73 2013). Group-level parameters inform the group-distributions from which individual-level
74 parameters are drawn.

75 Our model utilizes shared group parameters, meaning that individual parameters shared by
76 multiple models are drawn from a common group-distribution. Parameter b_{int} is shared by the
77 internal, sequential, and integrative model, and parameter b_{ext} the external, sequential, and
78 integrative model. Inclusion of shared group parameters improves model switching in $strat_i$ and
79 is allowed as the parameters have the same interpretation across models, as is the case here
80 (Carlin & Chib, 1995; Tenen et al., 2014).

81

82 *B2.1. Strategy Parameter Priors*

83 Individual-level parameters were drawn from Gaussian distributions with group mean μ and
84 group precision λ . As b_{int} and b_{ext} were expected to be positive, their group means were given a
85 uniform prior between 0 and 10. The group mean of parameter z of the sequential model was
86 distributed uniformly, with a range of 0 to 1.73 (i.e. the range of S_{Δ} after standardization).
87 Finally, as parameters of the guessing and bias models are probabilities, these are drawn from
88 uniform distributions ranging from 0 to 1.

89 Instead of group precisions, we estimated group standard deviations (which are easier to
90 interpret) for each distribution, and converted these to precisions ($\lambda = 1/\sigma^2$). The group
91 standard deviation of each parameter was given by a uniform distribution ranging from 0.1 to 5
92 for all parameters. The lower bound was chosen to prevent what Lee and Wagenmakers (2013)
93 refer to as the ‘zero variance trap’, an problem common to complex hierarchical Bayesian
94 models wherein the variance parameter gets stuck at zero. This phenomenon was observed in
95 earlier runs, obstructing parameter convergence.

96

97

98 *B2.2. Strategy Parameter Constraints*

99 An overview of individual strategy parameter constraints is given in Table B.1.

100

101 **Table B1**

102 Constraints of individual strategy parameter estimates.

Parameter	Constraint	Reason
b_{int}	$> -\ln(1/.6 - 1)$	to reflect that responding $L_2 > L_1$ increases as L_2 increases. Exact value chosen to be equal to the constraint on b_{ext} , so as not to unfairly (dis-)advantage
b_{ext}	$> -\ln(1/.6 - 1)$	to implement a $\geq .6$ probability of responding according to the external information in the external/sequential strategy model, thus distinguishing reliance on only external information from guessing
z	$> .1$	to prevent exchangeability of the sequential and internal strategy model (if $z = 0$)
	< 1.63	to prevent exchangeability of the sequential and external strategy model (if $z = 1.73^*$)
P_{guess}	$> .45$	to reflect a probability close to .5 of ever responding
	$< .55$	$L_2 > L_1$
P_{L1}	$< .1$	to reflect a probability close to zero of responding $L_2 > L_1$
P_{L2}	$> .9$	to reflect a probability close to 1 of responding $L_2 > L_1$

103 * parameter z is expressed in terms of $L_\Delta (= L_2 - L_1)$ in standardized absolute values, thus ranging from 0 to 1.73 in both studies.

104

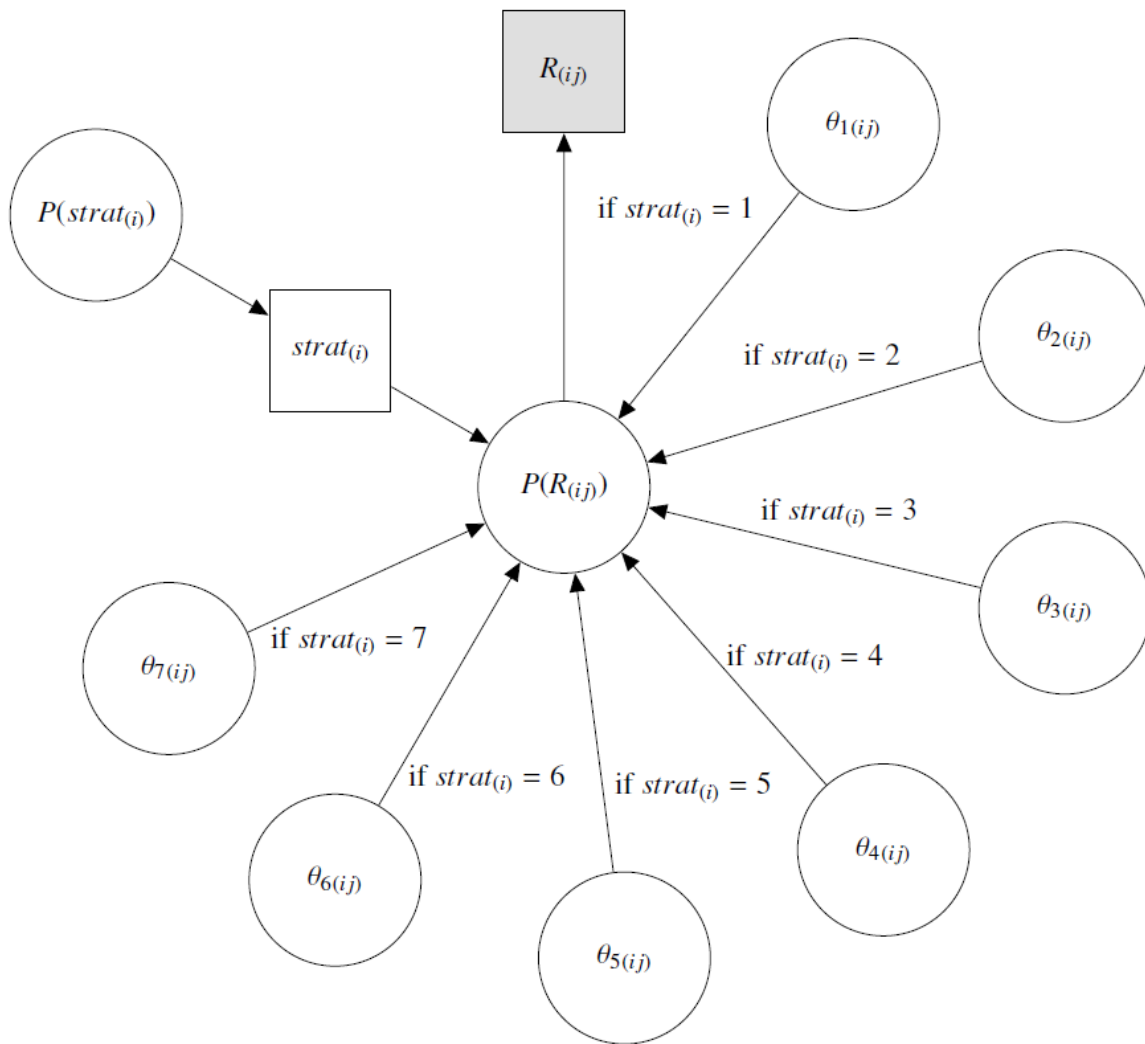
105 *B3. Graphical Representation*

106 Below is depicted a graphical representation of the hierarchical Bayesian model, see Fig. B.1.

107 Due to the size of the model, the model has been split into the part of strategy model assignment
 108 (top) and strategy parameter estimation (bottom).

109

110 **Fig. B1**
 111 The graphical representation of the strategy models.



Response Prediction

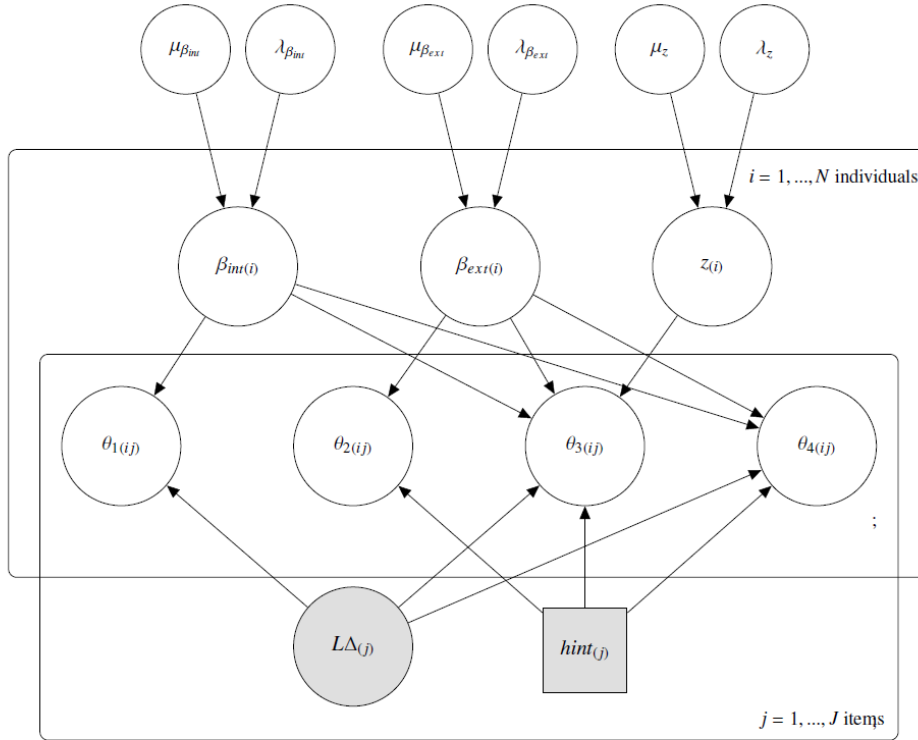
$$R_{(ij)} \sim \text{Bernoulli}(P(R_{(ij)}))$$

$$P(R_{ij}) \leftarrow \begin{cases} \theta_{1(ij)} & \text{if } strat_{(i)} = 1 \\ \theta_{2(ij)} & \text{if } strat_{(i)} = 2 \\ \theta_{3(ij)} & \text{if } strat_{(i)} = 3 \\ \theta_{4(ij)} & \text{if } strat_{(i)} = 4 \\ \theta_{5(ij)} & \text{if } strat_{(i)} = 5 \\ \theta_{6(ij)} & \text{if } strat_{(i)} = 6 \\ \theta_{7(ij)} & \text{if } strat_{(i)} = 7 \end{cases}$$

Model prediction

$$strat_{(i)} \sim \text{Categorical}(P(strat_{(i)}))$$

$$P(strat_{(i)}) \leftarrow 1/n_{strat}$$



Models

$$\theta_{1(ij)} \leftarrow \frac{1}{1 + e^{-(b_{int(i)} \times L_{\Delta(j)})}}$$

$$\theta_{2(ij)} \leftarrow \frac{1}{1 + e^{-(b_{ext(i)} \times hint_{(j)})}}$$

$$\theta_{3(ij)} \leftarrow \begin{cases} \frac{1}{(1 + e^{-(b_{int(i)} \times L_{\Delta(j)})})} & \text{for } -z_{(i)} \leq L_{\Delta(j)} \leq z_{(i)} \\ \frac{1}{(1 + e^{-(b_{ext(i)} \times hint_{(j)})})} & \text{for elsewhere} \end{cases}$$

$$\theta_{4(ij)} \leftarrow \frac{1}{1 + e^{-(b_{int(i)} \times L_{\Delta(j)} + b_{ext(i)} \times hint_{(j)})}}$$

$$\theta_{5(ij)} \leftarrow P_{guess(i)}$$

$$\theta_{6(ij)} \leftarrow P_{L1(i)}$$

$$\theta_{7(ij)} \leftarrow P_{L2(i)}$$

Parameters

$$\beta_{int(i)} \sim \text{Gaussian}(\mu_{\beta_{int}}, \lambda_{\beta_{int}})T(-\ln(1/.6 - 1),)$$

$$\mu_{\beta_{int}} \sim \text{Uniform}(0,10)$$

$$\lambda_{\beta_{int}} \leftarrow 1/(\sigma_{\beta_{int}})^2$$

$$\sigma_{\beta_{int}} \sim \text{Uniform}(.1, 5)$$

$$z_{(i)} \sim \text{Gaussian}(\mu_z, \lambda_z)T(.1, 1.63)$$

$$\mu_z \sim \text{Uniform}(0, 1.73)$$

$$\lambda_z \leftarrow 1/(\sigma_z)^2$$

$$\sigma_z \sim \text{Uniform}(.1, 5)$$

$$\beta_{ext(i)} \sim \text{Gaussian}(\mu_{\beta_{ext}}, \lambda_{\beta_{ext}})T(-\ln(1/.6 - 1),)$$

$$\mu_{\beta_{ext}} \sim \text{Uniform}(0, 10)$$

$$\lambda_{\beta_{ext}} \leftarrow 1/(\sigma_{\beta_{ext}})^2$$

$$\sigma_{\beta_{ext}} \sim \text{Uniform}(.1, 5)$$

$$P_{guess(i)} \sim \text{Gaussian}(\mu_{guess}, \lambda_{guess})T(.45, .55)$$

$$\mu_{guess} \sim \text{Uniform}(0, 1)$$

$$\lambda_{guess} \leftarrow 1/(\sigma_{guess})^2$$

$$\sigma_{guess} \sim \text{Uniform}(.1, 5)$$

$$P_{L1(i)} \sim \text{Gaussian}(\mu_{L1}, \lambda_{L1})T(0, .1)$$

$$\mu_{L1} \sim \text{Uniform}(0, 1)$$

$$\lambda_{L1} \leftarrow 1/(\sigma_{L1})^2$$

$$\sigma_{L1} \sim \text{Uniform}(.1, 5)$$

$$P_{L2(i)} \sim \text{Gaussian}(\mu_{L2}, \lambda_{L2})T(.9, 1)$$

$$\mu_{L2} \sim \text{Uniform}(0, 1)$$

$$\lambda_{L2} \leftarrow 1/(\sigma_{L2})^2$$

$$\sigma_{L2} \sim \text{Uniform}(.1, 5)$$

- 114 The graphical representation of all seven models predicting responses of individual $i = \{1, 2, \dots, N\}$, across items $j = \{1, 2, \dots, J\}$.
 115 The nodes represent variables/strategy parameters, wherein round nodes are continuous and square nodes categorical, white
 116 nodes are unobserved and colored nodes are observed. θ_{ij} is the probability of giving response 1 (i.e. " $L_2 > L_1$ ") instead of 0 (i.e.
 117 " $L_2 < L_1$ ") by individual i on item j ; $P(R_{ij})$ is the probability of individual i giving response 1 instead of 0 on item j depending

118 on which of the five models individual i was assigned to. Model assignment is captured in index parameter $strat_i$, which is
119 determined prior probability to be assigned to individual i , $P(strat_i)$, and the probability of item responses as predicted by each
120 of the different model. Top: the seven models combined, predicting the probability of a response, $P(R_{ij})$, using the model
121 corresponding to the assigned strategy, $strat_i$. Bottom: prediction of θ_{ij} according to the internal (θ_{1ij}), the external (θ_{2ij}), the
122 sequential (θ_{3ij}), the integrative strategy model (θ_{4ij}) as informed by their strategy parameters ($b_{int(i)}$, $b_{ext(i)}$, $z_{(i)}$) and variables
123 describing item characteristics ($L_{\Delta(j)}$, $hint_{(j)}$). The guessing strategy (θ_{5ij}), and the two bias strategies, (θ_{6ij} and θ_{7ij}) are not
124 shown for simplicity.

125

126 C. Trace plots strategy assignment analysis

127 This supplement contains visual representation of the chains of both individual and group
128 parameters, see file: ‘C. Parameters Traceplots Study 2.pdf’ on OSF. Note that the L_1 bias model
129 is referred to as ‘bias1’ and the L_2 bias model as ‘bias2’. Individual parameters are named
130 according to the format: parameter_name[participant_number] (e.g. ‘b1[23]’ indicates parameter
131 b1 of participant 23). Per individual we only inspected parameters of the assigned model to that
132 individual (i.e. the model with the highest BF).

133

134 D. Strategy assignment and Bayes factors

135 Table D1

136 Strategy assignment and Bayes factors (per participant).

137 [Table D1 omitted due to size. See file: “D1. Strategy Assignment and Bayes Factors (Per
138 Participant, Study 2).csv” on the OSF]

139 Individual strategy assignment, including Bayes factors (BF), for the analysis of the main study. Rows represent individuals. The
140 column ‘strat’ indicates the model assigned to each individual, based on the product space method (see Supplement A1). Each
141 column under ‘BF’ indicates the BF expressing evidence for the model indicated by ‘strat’ as compared to all, or one of the other
142 models. Specifically, the column ‘total’ shows the BF of the assigned model (see ‘strat’) compared to all six other models. The
143 subsequent columns contain the BF of the assigned model (see ‘strat’) compared to the model named in the column title
144 (intern=internal model; extern=external model; sequen=sequential model; integr=integrative model; guess=guessing model;
145 bias1=bias L_1 model, bias2 =bias L_2 model). Note that the best model compared to itself will always produce a BF of 1. If
146 BF=‘Inf’, this indicates no evidence in favor of the column model.

147

148 For BF interpretation we adhere to guidelines provided by Jeffrys (1961), as described in Lee
149 and Wagenmakers (2013). Accordingly, evidence in favor of individual model assignments
150 ranged from moderate to extreme.

151 Within-group model assignment was assessed using the product space method. The posterior
152 probability of each model is calculated similarly to individual model assignment, except now the
153 calculations happen across all participants within an age group rather than per participant, see
154 Equation D1:

155

$$p(M_k|D) = \frac{\text{Number of occurrences of } M_k \text{ in group } m}{\text{Total number of iterations group } m}. \quad (\text{Eq. D1})$$

157

158 Herein, $group_m$ is a vector containing strategy model assignment ($k = 1, 2, \dots, K$) across
 159 participants in age group m ($m = 1, 2, \dots, M$), across samples. Evidence for model k over the
 160 other models given the data is calculated identically to Equation B1, but the resulting BF now
 161 applies to a group, rather than an individual.

162

163 **Table D2**

164 BF values of strategy assignment per age group of main study.

Age group	intern	extern	sequen	integr	guess	bias1	bias2
9 y.o. (N=34)	4.2	≤.001	2.3	2.7	≤.001	≤.001	≤.001
10 y.o. (N=54)	4.2	≤.001	2.9	2.0	≤.001	≤.001	≤.001
11 y.o. (N=47)	3.8	≤.001	2.9	2.3	≤.001	≤.001	≤.001
12 y.o. (N=64)	3.5	≤.001	2.2	2.7	≤.001	≤.001	≤.001
13 y.o. (N=74)	3.7	≤.001	3.2	2.2	≤.001	≤.001	≤.001
14 y.o. (N=32)	3.1	≤.001	1.8	4.5	≤.001	≤.001	≤.001

165 BF values of the respective model (see column name; intern=internal model; extern=external model; sequen=sequential model;
 166 integrate=integr model; guess=guessing model; bias1=bias L_1 model, bias2=bias L_2 model) versus all other models per age group
 167 of the main Study (N=305).

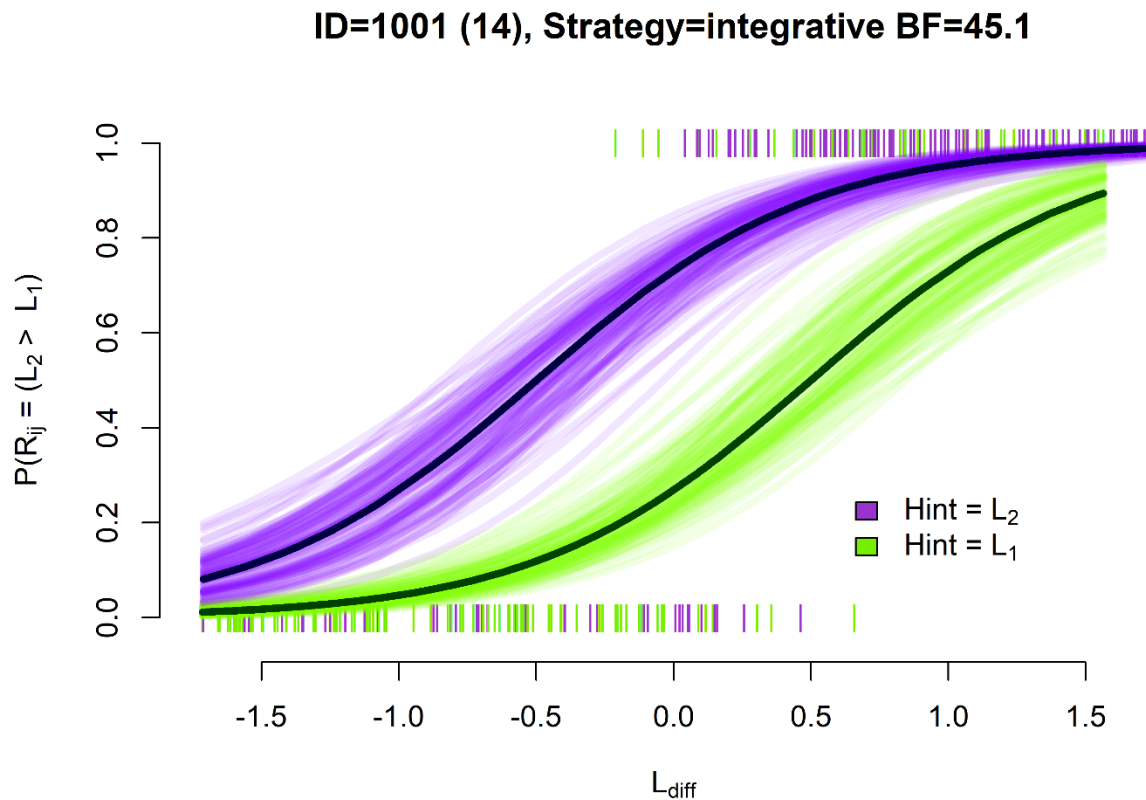
168

169 **E. Graphical representation of individually assigned strategy models**

170 This supplement consists of a graphical representation of the assigned strategy model for each
 171 participant alongside observed responses. When computing individual strategy parameter
 172 estimates, we only considered samples wherein a model containing this strategy parameter was
 173 assigned. In other samples those strategy parameters are free-floating (i.e. randomly drawn from
 174 the prior-imposed range of values), rendering corresponding estimates uninformative. An
 175 example individual model is given in Fig. E.1.

176

177



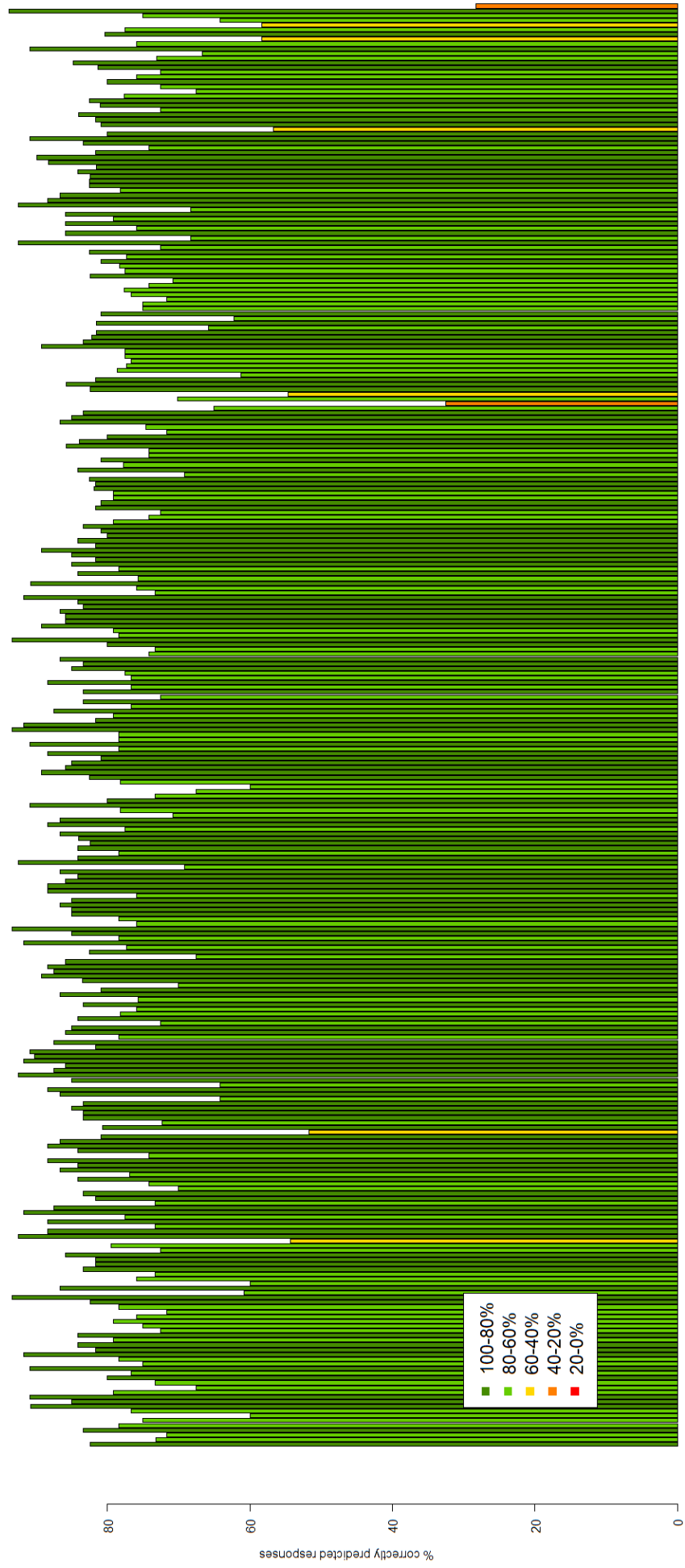
181 Graph of the assigned model for a fake participant (participant ID: 1001, age: 14 years old, assigned mode: the integrative
 182 strategy, Bayes factor: 45.1. The x-axis represents all possible values of the discrimination attribute for the varying stimulus
 183 (L_2). The y-axis represents the probability of responding " $L_2 > L_1$ ". The solid black lines represent the model as defined by the
 184 median of strategy parameter estimates across samples. The transparent lines represent the strategy parameter estimates of 100
 185 randomly chosen samples. The vertical dashes (top and bottom) represent participant responses. Dash/line color denotes the
 186 nature of the hint on these item.

187

188 Fake participant 1001 was thus assigned the integrative strategy, with evidence 45.1 times in
 189 favor of the integrative as opposed to all other models. The black lines are spaced apart,
 190 indicating that external information had a pronounced effect on participant responses. This is
 191 consistent with the dashes on the top of the screen being predominantly purple, representing
 192 responses when the hint pointed towards L_2 , and those on the bottom of the screen being
 193 predominantly green, representing responses when the hint pointed towards L_1 . The transparent
 194 lines approximate the black lines, suggesting little variability in strategy parameter estimation
 195 across samples.

196

correctly predicted responses per participant



Participants (N=305)

198 Graphical representation of individually assigned strategy model are found in: ‘E. Visual
199 Representation of Individually Assigned Models – Study 2.pdf’ for all models on OSF.

200 The proportion of correctly predicted responses by the assigned model, per participant, are given
201 in Figure E2 above, as well as Table E.1 on OSF.

202

203 **F. Pilot study**

204 The aim of this pilot study is to test whether the current task format elicited the use of
205 internal and external information, and get a preliminary view of individual differences and age
206 effects in strategy use.

207

208 ***F.1 Methods***

209 *F.1.1 Participants*

210 A total of 67 individuals (12 children, 30 adolescents, 25 adults) participated.¹ Besides age group
211 (children: ages 7-11; adolescents: ages 12-17; adults; ages 18-65), no demographic information
212 was acquired.

213 Participants were recruited by contacting primary and secondary schools, after-school care
214 centers, and direct and indirect acquaintances of the researchers. Only individuals between 7 and
215 65 years of age were approached, as children younger than this were expected to lack the reading
216 skills required for the task, or have difficulty understanding the task and operating the computer.
217 Individuals over 65, in turn, were more likely to suffer from reduced vision or hearing abilities,
218 hindering them in the task. Relatedly, vision and hearing disabilities were exclusion criteria, as
219 was epilepsy, which could potentially be triggered by screen changes of the computerized task.

220 Participants were sent an information letter explaining the research, and an informed consent
221 form to sign upon agreement to participate. Participants over 16 years of age signed the form
222 themselves, while younger participants required a signature from a parent or caretaker. Older
223 participants were contacted about this directly, for younger participants schools and after-school
224 care centers were asked to forward the letter and form to its destination. Participants were
225 screened for exclusion criteria prior to participation. The study was approved by the UvA ethics
226 committee. Participation was not compensated.

227 Participants were omitted from data analyses if they failed to respond to >10% of items, as too
228 many missing data points could hinder accurate distinction between models (Bennett, 2001).

¹ Children: 7-12 years of age; adolescents 12-17 years of age, adults 18-64 years of age.

229 This study was approved by the University of Amsterdam ethics committee.

230

231 *F.1.2 Materials*

232 The auditory discrimination task consisted of 250 binary choice items wherein two tones
233 differing in pitch frequency were presented, with the objective to indicate whether the second
234 tone was higher or lower in pitch than the first. In concurrence with the main study, in this
235 auditory task the first (i.e., constant) tone is referred to as L_1 and the second (i.e., varying) tone
236 equals L_2). The computerized task was administered on two Dell Latitude E5510s laptops,
237 programmed and administered in Presentation version 17.0.0.1 (Version 17.0.0.1,
238 Neurobehavioral Systems, Inc., Berkeley, CA, www.neurobs.com). Details on item generation
239 can be found on OSF as supplement 'F1. pitchtask.sce'.

240 Pitch frequency of the first tone was constant at 440Hz, while that of the second tone varied
241 between 425Hz and 455Hz. Participants indicated whether the second tone was 'lower' or
242 'higher' than the first by pressing the left or right shift-button, respectively. The response buttons
243 on the laptops were marked with blank white stickers.

244 The first tone sounded for 500ms, followed by 500ms of silence, followed by 500ms of the
245 second tone. External information appeared between 50 and 250ms after the second tone, in the
246 form of a visually displayed hint, namely the word 'higher' or 'lower' appearing on-screen, see
247 Fig. F1.

248 Participants were told that the hint was correct in 75% of items before starting the task. This
249 correctness percentage struck a balance between guessing (50% correct, in which case there
250 would be no logical reason to consider external information) and perfect discrimination (100%
251 correct, in which case there would be no reason to consider internal information). The hint
252 remained displayed until the participant had responded, after which the next item automatically
253 started. There was no response time limit. Responses given before the hint were not registered.
254 The tones were played at normal speaking volume (± 60 dB). No feedback was provided.

255 Prior to the task there was a practice round consisting of 3 items identical to the real items,
256 including instructions, except hints were absent. The practice round and task took up
257 approximately 5 and 15 minutes, respectively. Both the task and instructions were in Dutch.

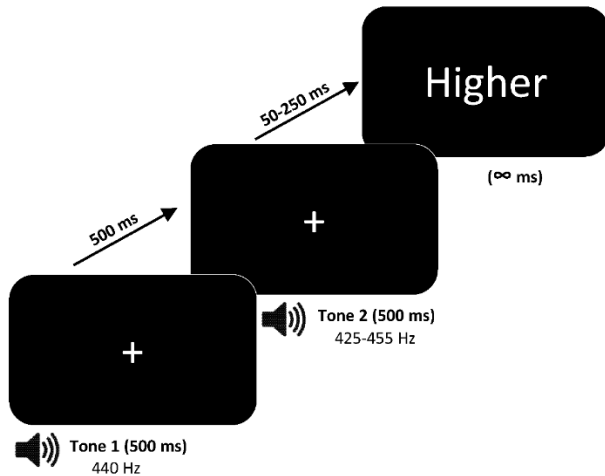
258

259 *F.1.3 Procedure*

260 Test administration happened either in a classroom of the school or after-school center, or at the
261 residence of the participant. The task was performed individually on a laptop provided by the
262 researchers.

263 **Fig. F1**
264 The auditory discrimination task.

265



267 Two 500ms tones were played, intermitted by 500ms of silence. During this participants were shown a black screen with a white
268 fixation cross. Between 50 and 250ms of silence after the second tone a word would be displayed in white letters on the screen
269 until a response was given. In items containing hints the word would be either 'higher' or 'lower'. In this example item, the hint
270 indicated that the second tone (L_2) was higher than the first tone (L_1). In practice items, the word displayed was always 'respond'.

271

272 The task without hints was administered first, the task with hints second. Both versions of the
273 task started with instructions presented on screen, followed by a practice round, followed by the
274 actual task. A researcher remained present for questions and to check if the task was understood.
275 The participant was allowed to ask questions or refuse (further) participation at all times. The
276 research included no deception.

277

278 *F.1.4. Statistical analyses*

279 The same Bayesian hierarchical mixture model analysis was used to assign strategies to
280 individuals as in the main study. To test for age differences in strategy use, age groups were
281 compared (i.e., child/adolescent/adult) on the posterior probability of both sequential and
282 integrative strategy assignment versus other strategy assignment via Bayesian logistic regression
283 (Kruschke, 2014). To test for age effects on strategy parameters we compared age groups on
284 individual strategy parameters b_{int} , b_{ext} , and z using linear regression. To test for age effects on
285 strategy parameters we compared age groups on individual strategy parameters b_{int} , b_{ext} , and z ,
286 using linear regression. Age effects are interpreted via their median and 95% CI.

287

288 **F.2 Results**

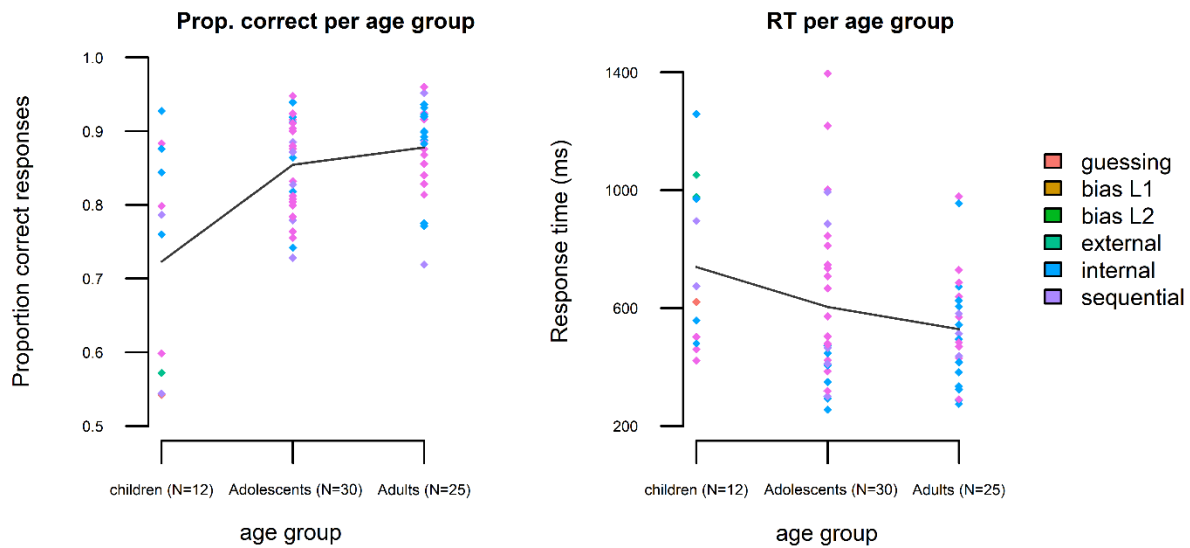
289 **F.2.1 Descriptive statistics**

290 No participants were excluded for missing/early responses, leaving $N = 67$. First, we examined if
291 accuracy and response time differed across age groups, see Fig. F2.

292

293 **Fig. F2**

294 Observed decision accuracy and response times per age group.



298

299 The proportion of correct responses of all age groups well exceeded guessing levels, indicating
300 that (the majority of) participants understood the task and put effort into completing it.

301 A Bayesian linear regression indicated that adolescents had a higher proportion of correct than
302 children, $b_{adoles-child} = .113$, 95% $CI[.056; .166]$. The same was observed for adults,
303 $b_{adult-child} = .135$, 95% $CI[.079; .190]$. adults did not differ in proportion of correct responses,
304 $b_{adult-adoles} = .022$, 95% $CI[-.024; .067]$.

305 Adolescents had shorter mean response times than children, $b_{child-adoles} = -3.748$,
306 95% $CI[-22.692; 16.004]$, as did adults $b_{adult-child} = -3.103$, 95% $CI[-22.356; 16.773]$.
307 Adults had longer mean response times than adolescents, $b_{adult-adoles} = .633$, 95%,
308 $CI[-27.334; 27.889]$.

309 Secondly, after strategies were assigned, we examined if strategy use affected accuracy and
310 response time. To disentangle these effects from the aforementioned age effects, strategies were
311 compared per age group. Linear regressions showed only one effect, namely that accuracy was
312 higher for the internal versus the external strategy model in the child group, $b_{internal-external} =$
313 $.294, 95\% CI[.092; .481]$. That is, within age groups strategy use differences did generally not
314 relate to differences in accuracy or response time.

315

316 *F.2.2 Main results*

317 In the strategy assignment analysis, as based on the \hat{R} , 100% of group and individual parameters
318 converged successfully. Visual inspection of trace plots supported this (see OSF, supplement
319 ‘F2. Parameters Traceplots Study 1.pdf’).

320 Visual representations of individual models provided an intuitive overview of individual
321 differences in both decision strategies and strategy parameters (see OSF, supplement ‘F3. Visual
322 Representation of Individually Assigned Models – Study 1.pdf’). Individual posterior
323 probabilities of strategy assignment, as well as resulting strategy model assignment overall and
324 per age group, are shown in Fig. F3.

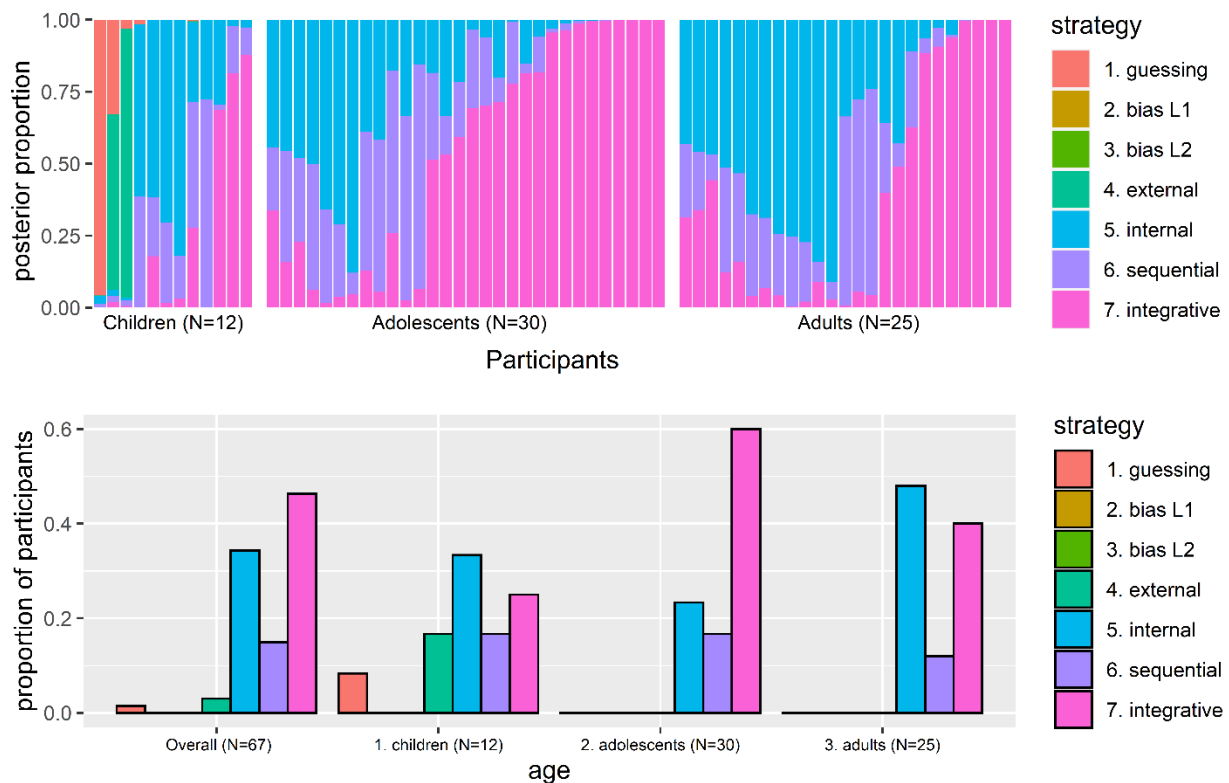
325 Bayes factors of individual strategy assignment ranged from moderate to extreme (see OSF,
326 supplement ‘F4. Strategy Assignment and Bayes factors (Per Participant, Study 1).csv’). In the
327 children and adults group, the internal and the integrative strategy were equally common ($BF =$
328 1.3 and $BF = 1.0$). In the adolescents group, anecdotal evidence supported assignment of the
329 integrative over the internal strategy ($BF = 2.4$), while moderate evidence supported assignment
330 of the integrative over all other strategy models ($BF = 7.3$). A full overview of strategy model
331 comparisons is given below.

332 A Bayesian logistic regression tested the effect of age group (categorical) on the posterior
333 probability of integrative strategy assignment as compared to assignment of all other strategies.
334 Adolescents had a higher probability of being assigned the integrative strategy model than
335 children, $b_{adoles-child} = 1.562, 95\% CI[.021; 4.196]$. This was not the case for adults,
336 $b_{adult-child} = .916, 95\% CI[-.701; 3.546]$. Adults and adolescents did not differ in probability
337 of integrative strategy assignment, $b_{adult-adoles} = -.639, 95\% CI[-1.555; .272]$.

338

339

340 **Fig. F3**
 341 Strategy assignment.



349

350 The same analysis was performed for the sequential versus all other strategy model assignments.
 351 The sequential strategy model did not have a higher posterior probability of assignment in
 352 adolescents compared to children, $b_{adoles-child} = .138$, 95% $CI[-.968; 1.519]$, adults
 353 compared to children, $b_{adult-child} = .075$, 95% $CI[-1.046; 1.543]$, or adults compared to
 354 adolescents, $b_{adult-adoles} = -.059$, 95% $CI[-.851; .693]$.

355 Finally, three linear regressions were performed to see if age group affected strategy parameters
 356 $b_{int(i)}$, $b_{ext(i)}$, and $z(i)$. Included were only participants assigned to a model containing the
 357 corresponding parameter ($N_{b_{int}} = 64$, $N_{b_{ext}} = 43$, $N_z = 10$). The only observed effect was that
 358 b_{int} was higher in adults than in adolescents, $b_{adult-adoles} = .880$, 95% $CI[.044; 1.715]$,
 359 indicative of adults more accurately deciding given internal information than adolescents.

360 *F.3 Discussion*

361 In this pilot study we investigated whether the task format elicited internal and external
362 information utilization. Use of all four strategies of interest indicated that both internal and
363 external information were used in the decision making process. We are thus confident in this
364 operationalization of external information as hints with a correctness-percentage of 75% in its
365 potential to influence decision making. Furthermore, all age groups performed above chance-
366 levels indicated that effort was put into the task despite a lack of performance-dependent
367 incentive. We conclude that the task format is suitable for investigating decision strategy use in
368 our main study.

369 We observed an increase in integrative strategy use in adolescents relative to children.
370 The sequential strategy was present but equally prevalent across age groups. The effect of
371 internal information on decision making was higher in adults than adolescents. Accuracy and
372 reaction time increased with age. Good parameter convergence, observed individual differences
373 in strategy use and strategy parameters, as well as the observation of age effects in strategy use,
374 suggested the model suitable for the study thereof.

375 Four limitations of this pilot study warrant mentioning. Firstly, the modest number of
376 participants, especially children ($N=12$), may have led to misrepresentation of strategy
377 prevalence and age differences therein. As such, we switch to a pen-and-paper task in the main
378 study as to allow for simultaneous testing of large groups, thus boosting the sample size. Note
379 that this format doesn't allow for sequential presentation of internal and external information,
380 requiring simultaneous presentation instead. However, presentation order, given that only two
381 pieces of information are presented, and responses are prompted after *all* information is
382 presented, should not influence decision making (Morgan et al., 2012; Tubbs, Messier, &
383 Knechel, 1990).

384 Secondly, the presence of guessing in children suggested that the task was hard to understand for
385 younger participants. To ease comprehension, in the main study we present external information
386 as answers from a supposed other person, rather than being computer-generated. Previous
387 research suggests that both forms of external information influence decision making, with the
388 effect of a human source matching or exceeding the influence of a computer source (Hertz &
389 Wiese, 2016, 2018). This form of external information also aligns better with the pen-and-paper
390 format, and may improve ecological validity for real-life social decision situations.

391 Thirdly, the large age variation within age groups disallows specificity concerning the age at
392 which effects occur, and whether such effects are sudden or gradual. We will therefore use more
393 fine-grained age groups in the main study. In the main study, as opposed to the pilot, other
394 demographic variables (i.e., sex and school level) are also collected to check for confounding
395 effects.

396 Fourthly, we used the 95% CI of parameters to infer whether the differences/age effects they
397 represented deviated from zero. However, this approach has since been criticized for being
398 statistically incoherent (Wagenmakers, Lee, Rouder, & Morey, 2020) and alternatives such as the
399 Savage-Dickey density ratio test (Wagenmakers, Lodewyckx, Kuriyal, & Grasman, 2010) have
400 been advised instead. As both the pilot-study and the main study had already been (mostly)
401 concluded at this point, we address this matter by providing a complete overview of findings
402 using the Savage-Dickey method for both studies in Supplement H. The majority of analyses
403 provide inconclusive results.

404 In summary, the pilot suggests that the current task is suitable for investigating individual
405 differences and age effects in use of decision strategies of utilizing internal and external
406 information. The most interesting age range herein appears to be the transition between
407 childhood and adolescence, wherein an increase in integrative strategy use was observed—a
408 potential explanation for the heightened susceptibility to peer pressure frequently observed in
409 adolescents (Bednar & Fisher, 2003; Blakemore & Robbins, 2012; Dekkers et al., 2018; Gardner
410 & Steinberg, 2005; Steinberg, 2005, 2008; Zwane, Mngadi, & Nxumalo, 2004). This
411 developmental period will be the focus of the main study.

412

413 **G. Comparison of task difficulty between the pilot study and main study**

414 To examine potential differences in difficulty between the auditory decision task from pilot study
415 and the visual decision task from the main study, we performed a Bayesian t-test (Kruschke,
416 2013) on response accuracy.

417 As the main study did not include adults and the pilot study indicated age-related differences in
418 accuracy, adults were excluded from the pilot study sample. As in the main analyses, only
419 participants with $\leq 10\%$ missing responses were included ($N_{\text{auditory}} = 42$, $N_{\text{visual}} = 305$).
420 Strong evidence indicated that accuracy did not differ between the auditory task and the visual
421 task, $BF_{\mu_{\text{hint}}(\text{auditory-visual})=0} = 32.0$ $\mu_{\text{hint}}(\text{auditory-visual}) = -.002$, 95% $CI[-.029; .032]$.

422 We conclude that any differences in findings between the pilot-study and the main study are not
423 attributable to differences in decision task difficulty.

424

425 **H. Findings using the Savage-Dickey density ration test**

426 This section pertains to the findings of age effects in the pilot study (section H1-2) and the main
427 study (section H3-4) using the Savage-Dickey density ratio test of hypothesis testing. Details on
428 the interpretation of these Bayes factors are found in footnote 2 of the main paper.

429 Each analysis is run using two different sets of priors to examine potential differences in
 430 findings. As the wider priors showed similar or improved posterior predictive ability, these
 431 findings were reported in the main paper.

432

433 *H.1. Overview pilot-study*

434 **Table H1**

435 Overview of findings using the Savage-Dickey method of hypothesis testing for two sets of
 436 priors.

Effect	Narrow prior	Wide prior	Findings narrow prior	Findings wide prior
Prop correct changes with age?	Mu = 0	Mu = 0	Adolescent > child	Adolescent > child
	Sd = .1	Sd = .5	Adult > child	Adult > child
			Adult ? adolescent	Adult = adolescent
Response time changes with age?	Mu = 0	Mu = 0	Adolescent ? child	Adolescent ? child
	Sd = 10	Sd = 60	Adult < child	Adult < child
			Adult ? adolescent	Adult ? adolescent
Integrative strategy use changes with age?	Mu = 0	Mu = 0	Adolescent ? child	Adolescent ? child
	Sd = .5	Sd = 1	Adult ? child	Adult ? child
			Adult ? adolescent	Adult ? adolescent
Sequential strategy use changes with age?	Mu = 0	Mu = 0	Adolescent ? child	Adolescent ? child
	Sd = .5	Sd = 1	Adult ? child	Adult ? child
			Adult ? adolescent	Adult ? adolescent
Effect internal information increases with age?	Mu = 0	Mu = 0	Adolescent ? child	Adolescent ? child
	Sd = .1	Sd = .5	Adult ? child	Adult > child
			Adult ? adolescent	Adult ? adolescent
Effect external information increases with age?	Mu = 0	Mu = 0	Adolescent ? child	Adolescent ? child
	Sd = .1	Sd = .5	Adult ? child	Adult ? child
			Adult ? adolescent	Adult = adolescent
Switch internal / external information increases with age?	Mu = 0	Mu = 0	Adolescent = child	Adolescent = child
	Sd = .1	Sd = .5	Adult = child	Adult = child
			Adult = adolescent	Adult = adolescent

437 A “?” indicates that the comparison yielded insufficient evidence to support a claim concerning the presence of
 438 absence of differences between age groups.

439

440

441

442 **H.2. Details pilot-study**

443 **H.2.1. The effect of age on proportion of correct responses**

444

445 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .1)$*

446

447 **Table H2**

448 Bayes factors and parameter estimate of the age effect corresponding to prior 1.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	.002	.112	[.058; .167]
Adult - child	< .001	.135	[.080; .191]
Adult - adolescent	2.7	.022	[-.023; .069]

449

450 A linear regression with a narrow prior (i.e., prior 1) indicated extreme evidence that adolescents
451 had a higher proportion of correct responses than children, see Table H2. The same was observed
452 for adults relative to children. The comparison of adolescents and adults produced anecdotal
453 evidence only ($1/3 < BF < 3$; Lee & Wagenmakers, 2013), which was deemed insufficient to
454 support or refute the presence of differences between these age groups.

455

456 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .25)$*

457

458 **Table H3**

459 Bayes factors and parameter estimate of the age effect corresponding to prior 2.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	.001	.113	[.072; .187]
Adult - child	< .001	.151	[.093; .211]
Adult - adolescent	6.5	.023	[-.023; .070]

460

461 A Bayesian linear regression with a wider prior (i.e., prior 2) indicated extreme evidence that
462 adolescents had a higher proportion of correct than children, see Table H3. The same was
463 observed for adults. Moderate evidence supported that adults and adolescents did not differ in
464 proportion of correct responses.

465 We conclude that adults and adolescents made more accurate decisions than children while
466 adults and adolescents did not differ in decision accuracy.

467

468 **H.2.2. The effect of age on response times**

469

470 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = 60)$*

471

472 **Table H4**

473 Bayes factors and parameter estimate of the age effect corresponding to prior 1.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	.699	-87.5	[-206.4; 31.1]
Adult - child	.118	-148.6	[-276.2; -28.6]
Adult - adolescent	1.2	-61.0	[-190.8; 64.3]

474

475 A linear regression assessed potential differences in response time between age groups with a
476 narrow prior, see Table H4. Moderate evidence supported adults to have shorter response times
477 than children. Other group comparisons provided insufficient (i.e., anecdotal) evidence to draw
478 conclusions concerning response time differences.

479

480 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = 240)$*

481

482 **Table H5**

483 Bayes factors and parameter estimate of the age effect corresponding to prior 2.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	.600	-132.1	[-271.7; 5.1]
Adult - child	.065	-202.6	[-343.6; -59.6]
Adult - adolescent	2.0	-71.0	[-205.1; 60.3]

484

485 The analysis was redone with a wider prior, see Table H5. Strong evidence indicated adults to
486 have shorter response times than children. Other group comparisons were inconclusive as before.
487 We conclude that adults made faster decisions than children.

488

489 **H.2.3. The effect of strategy on accuracy, per age**

490

491 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .1)$*

492

493

494 **Table H6**

495 Bayes factors expressing evidence in favor of the accuracy of two strategies being equal
 496 corresponding to prior 1.

	Children	Adolescents	Adults
guess.vs.extern	1.7	-	-
guess.vs.intern	.7	-	-
guess.vs.seq	1.0	-	-
guess.vs.integ	.7	-	-
extern.vs.intern	.4	-	-
extern.vs.seq	.9	-	-
extern.vs.integ	.3	-	-
intern.vs.seq	.8	1.4	.5
intern.vs.integ	1.0	2.8	1.0
seq.vs.integ	1.2	1.8	2.0

497 intern=internal model; extern=external model; seq=sequential model; integ=integrative model; guess=guessing
 498 model; bias1=bias L_1 model, bias2 =bias L_2 model. A “-” indicates that one or both of the strategies were never
 499 assigned in this age group.

500

501 Pairwise comparison of strategy models on decision accuracy per age produced inconclusive
 502 findings, see Table H6. For corresponding parameter estimates, see supplementary Table H.1 on
 503 the OSF.

504

505 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .25)$*

506

507 **Table H7**

508 Bayes factors expressing in favor of the accuracy of two strategies being equal corresponding to
 509 prior 2.

	Children	Adolescents	Adults
guess.vs.extern	3.7	-	-
guess.vs.intern	.2	-	-
guess.vs.seq	1.1	-	-
guess.vs.integ	0.5	-	-
extern.vs.intern	.1	-	-
extern.vs.seq	1.2	-	-
extern.vs.integ	.2	-	-

intern.vs.seq	1.1	3.2	1.5
intern.vs.integ	2.1	6.6	2.6
seq.vs.integ	1.6	3.7	4.1

510 intern=internal model; extern=external model; seq=sequential model; integ=integrative model; guess=guessing
511 model; bias1=bias L_1 model, bias2 =bias L_2 model. A “-” indicates that one or both of the strategies were never
512 assigned in this age group.

513
514 BFs for the pairwise comparison of strategy models on decision accuracy per age are found in
515 Table H7. For children, the guessing and external strategy were characterized by less accurate
516 decision making than the internal and integrative strategy. For adolescents, moderate evidence
517 indicated no accuracy differences between strategies. For adults, moderate evidence supported
518 the sequential and integrative strategy being equal in decision accuracy. Other comparisons were
519 inconclusive. For corresponding parameter estimates, see supplementary Table H.2 on the OSF.

520

521 *H.2.4. The effect of strategy on response time, per age*

522

523 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = 10)$*

524

525 **Table H8**

526 Bayes factors expressing evidence in favor of response times of two strategies being equal
527 corresponding to prior 1.

	Children	Adolescents	Adults
guess.vs.extern	1.0	-	-
guess.vs.intern	1.0	-	-
guess.vs.seq	1.0	-	-
guess.vs.integ	1.0	-	-
extern.vs.intern	1.0	-	-
extern.vs.seq	1.0	-	-
extern.vs.integ	1.0	-	-
intern.vs.seq	1.0	1.0	1.0
seq.vs.integ	1.0	1.0	1.0
seq.vs.integ	1.0	1.0	1.0

528 intern=internal model; extern=external model; seq=sequential model; integ=integrative model; guess=guessing
529 model; bias1=bias L_1 model, bias2 =bias L_2 model. A “-” indicates that one or both of the strategies were never
530 assigned in this age group.

531

532 Pairwise comparison of strategy models on response time per age indicated inconclusive results
 533 concerning response time differences between strategies, see Table H8.

534

535 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = 60)$*

536

537 **Table H9**

538 Bayes factors expressing evidence in favor of response times of two strategies being equal
 539 corresponding to prior 2.

	Children	Adolescents	Adults
guess.vs.extern	1.0	-	-
guess.vs.intern	1.0	-	-
guess.vs.seq	1.0	-	-
guess.vs.integ	1.0	-	-
extern.vs.intern	.9	-	-
extern.vs.seq	1.0	-	-
extern.vs.integ	1.0	-	-
intern.vs.seq	1.0	.6	.3
intern.vs.integ	1.0	.8	.4
seq.vs.integ	1.0	1.1	.9

540 intern=internal model; extern=external model; seq=sequential model; integ=integrative model; guess=guessing
 541 model; bias1=bias L_1 model, bias2 =bias L_2 model. A “-” indicates that one or both of the strategies were never
 542 assigned in this age group.

543

544 Pairwise comparison with a wider prior indicated moderate evidence for the internal strategy
 545 having shorter response times than the sequential strategy in adults, see Table H9. Other
 546 comparisons were inconclusive. For parameter estimates, see Table H.2 on the OSF.

547

548 ***H.2.5. The effect of age on strategy use***

549

550 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .5)$*

551

552 **Table H10**

553 Bayes factors and parameter estimate of the age effect on integrative strategy use corresponding
 554 to prior 1.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
------------	------------------	------------	--------

Adolescent - child	1.2	-.075	[-.866; .705]
Adult - child	1.1	-.224	[-1.162; .864]
Adult - adolescent	.934	-.146	[-1.097; .839]

555

556 A logistic regression tested the effect of age group (categorical) on the posterior probability of
557 integrative strategy assignment as compared to assignment of all other strategies, see Table H10.
558 Findings concerning age-related changes in integrative strategy use were inconclusive.

559

560 **Table H11**

561 Bayes factors and parameter estimate of the age effect on sequential strategy use corresponding
562 to prior 1.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	.821	-.075	[-.866; .705]
Adult - child	.950	-.224	[-1.062; .550]
Adult - adolescent	.362	-.146	[-1.162; .864]

563

564 The same analysis was performed for the sequential versus all other strategy model assignments,
565 see Table H11. Findings concerning age-related changes in sequential strategy use were
566 inconclusive.

567

568

569 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = 1)$*

570

571 **Table H12**

572 Bayes factors and parameter estimate of the age effect on integrative strategy use corresponding
573 to prior 2.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	1.6	-.245	[-1.362; .941]
Adult - child	1.1	-.523	[-1.760; .692]
Adult - adolescent	1.4	-.288	[-1.648; 1.043]

574

575 Repetition of the previous analyses with a wider prior again provided inconclusive evidence
576 concerning the presence or absence of age-related changes in integrative strategy use and
577 sequential strategy use, see Table H13 and Table H12, respectively.

578

579 **Table H13**580 Bayes factors and parameter estimate of the age effect on integrative strategy use sequential to
581 prior 2.

Comparison	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	1.1	-.560	[-1.654; .447]
Adult - child	1.4	.411	[-.648; 1.443]
Adult - adolescent	.366	.966	[-.092; 2.046]

582

583

584 **H.2.6. The effect of age on strategy parameters**

585

586 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .1)$*

587

588 **Table H14**

589 Bayes factors and parameter estimate of the age effect corresponding to prior 1.

Comparison b_{int}	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	1.0	-.004	[-.190; .190]
Adult - child	.841	.062	[-.131; .248]
Adult - adolescent	.657	.067	[-.194; .329]

590

Comparison b_{ext}	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	.909	.062	[-.039; .156]
Adult - child	1.051	.057	[-.049; .160]
Adult - adolescent	2.1	-.004	[-.102; .090]

591

Comparison z	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	7.9	-.006	[-.030; .019]
Adult - child	7.1	.004	[-.027; .033]
Adult - adolescent	5.9	.004	[-.019; .038]

592

593 Finally, three linear regressions were performed to see if age group affected strategy parameters
594 $b_{int(i)}$, $b_{ext(i)}$, and $z(i)$. Included were only participants assigned to a model containing the
595 corresponding parameter ($N_{b_{int}} = 64$, $N_{b_{ext}} = 43$, $N_z = 10$). Evidence concerning age-related

596 differences in b_{int} and b_{ext} was inconclusive, see Table H14. Moderate evidence indicated that
 597 parameter z did not differ between age groups.

598 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .5)$*

599

600 **Table H15**

601 Bayes factors and parameter estimate of the age effect corresponding to prior 2.

Comparison b_{int}	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	1.1	.253	[−.409; .907]
Adult - child	.122	.773	[.087; 1.438]
Adult - adolescent	.476	.520	[−.187; 1.230]

602

Comparison b_{ext}	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	2.3	.097	[−.026; .212]
Adult - child	2.6	.095	[−.037; .223]
Adult - adolescent	10.0	−.001	[−.105; .099]

603

604

Comparison z	$BF_{b_{age}=0}$	Param. Est	95% CI
Adolescent - child	39.2	−.006	[−.032; .019]
Adult - child	36.1	.003	[−.027; .036]
Adult - adolescent	29.0	.009	[−.019; .039]

605

606 With a wider prior, moderate evidence indicated that effect b_{int} had a stronger positive effect in
 607 adults than children, see Table H15. This suggests that internal information influenced the
 608 decisions of adults more than those of children. Moderate evidence supported that the b_{ext} did
 609 not differ between adults and adolescents. Strong evidence indicated that parameter z did not
 610 differ between age groups. Other comparisons were inconclusive.

611

612

613 **H.3. Overview main study**

614

615 **Table H16**

616 Overview of findings using the Savage-Dickey method of hypothesis testing for two sets of
 617 priors.

Effect	Narrow prior	Wide prior	Findings narrow prior	Findings wide prior
Prop correct changes with age?	Mu = 0 Sd = .1	Mu = 0 Sd = .5	inconclusive	inconclusive
Integrative strategy use changes with age?	Mu = 0 Sd = .5	Mu = 0 Sd = 1	no age-related change	no age-related change
Sequential strategy use changes with age?	Mu = 0 Sd = .5	Mu = 0 Sd = 1	no age-related change	no age-related change
Effect internal information increases with age?	Mu = 0 Sd = .1	Mu = 0 Sd = .5	inconclusive	inconclusive
Effect external information increases with age?	Mu = 0 Sd = .1	Mu = 0 Sd = .5	no age-related change	no age-related change
Switch internal / external information increases with age?	Mu = 0 Sd = .1	Mu = 0 Sd = .5	no age-related change	no age-related change

618 “inconclusive” indicates that the analysis yielded insufficient evidence to support a claim concerning the presence of
 619 absence of an age-related change

620

621

622 **H.4. Details main study**

623 **H.4.1. The effect of age on proportion of correct responses**

624

625 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .1)$*

626

627 A linear regression ($N = 305$) using a narrow prior (i.e., prior 1) provided inconclusive (i.e.,
 628 anecdotal) evidence concerning age-related changes in decision accuracy, $BF_{b_{age}=0} = .899$
 629 ($b_{age} = .008$, 95% CI[.002; .014]).

630

631 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .25)$*

632

633 Repetition of this analysis with a wider prior (i.e., prior 2) rendered similar results, $BF_{b_{age}=0} =$
634 $2.2 (b_{age}=.008, 95\% \text{ CI} [.002; .014])$.

635 Based on these data, we cannot draw definitive conclusions concerning age-related changes in
636 decision accuracy.

637

638 *H.4.2. The effect of strategy on accuracy, per age*

639

640 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .1)$*

641

642 **Table H17**

643 Bayes factors expressing evidence for accuracy of two strategies being equal corresponding to
644 prior 1.

	9y.o.	10y.o.	11y.o.	12y.o.	13y.o.	14y.o.
guess.vs.biasL1	-	-	-	1.5	-	-
guess.vs.biasL2	-	-	-	-	-	-
guess.vs.extern	-	-	-	-	-	-
guess.vs.intern	-	<0.05	-	<.01	.6	-
guess.vs.seq	-	.3	-	.2	.3	-
guess.vs.integ	-	.1	-	<.01	<0.5	-
biasL1.vs.biasL2	-	-	-	-	-	-
biasL1.vs.extern	-	-	-	-	-	-
biasL1.vs.intern	-	-	-	<.05	-	-
biasL1.vs.seq	-	-	-	.5	-	-
biasL1.vs.integ	-	-	-	<.05	-	-
biasL2.vs.extern	-	-	-	-	-	-
biasL2.vs.intern	-	-	-	-	-	-
biasL2.vs.seq	-	-	-	-	-	-
biasL2.vs.integ	-	-	-	-	-	-
ext.vs.intern	-	-	-	-	-	-
ext.vs.seq	-	-	-	-	-	-
ext.vs.integ	-	-	-	-	-	-
intern.vs.seq	1.4	3.4	3.7	1.7	4.3	3.3

intern.vs.integ	2.4	4.1	2.7	1.6	2.6	3.5
seq.vs.integ	1.9	3.1	1.7	.3	3.4	3.2

645 intern=internal model; extern=external model; seq=sequential model; integ=integrative model; guess=guessing
646 model; bias1=bias L_1 model, bias2 =bias L_2 model. A “-” indicates that one or both of the strategies were never
647 assigned in this age group.

648

649 Pairwise comparison of strategy models on decision accuracy per age indicated, firstly, that the
650 guessing and bias strategies were characterized by less accurate decision making than the
651 internal, sequential, and integrative strategies in 10-, 12-, and 13-year-olds, see Table H17.

652 Moderate evidence indicated that the internal, sequential, and integrative strategy did not differ
653 in accuracy for ages 10, 11, 13, and 14. Results of age 9 and 12 were inconclusive. For parameter
654 estimates, see Table H.3 on the OSF).

655

656 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .25)$*

657

658 **Table H18**

659 Bayes factors expressing evidence for accuracy of two strategies being equal corresponding to
660 prior 2.

	9y.o.	10y.o.	11y.o.	12y.o.	13y.o.	14y.o.
guess.vs.biasL1	-	-	-	2.5	-	-
guess.vs.biasL2	-	-	-	-	-	-
guess.vs.extern	-	-	-	-	-	-
guess.vs.intern	-	<.05	-	<.001	.6	-
guess.vs.seq	-	.1	-	.1	.3	-
guess.vs.integ	-	<.01	-	<.001	<.05	-
biasL1.vs.biasL2	-	-	-	-	-	-
biasL1.vs.extern	-	-	-	-	-	-
biasL1.vs.intern	-	-	-	<.05	-	-
biasL1.vs.seq	-	-	-	.4	-	-
biasL1.vs.integ	-	-	-	<.01	-	-
biasL2.vs.extern	-	-	-	-	-	-
biasL2.vs.intern	-	-	-	-	-	-
biasL2.vs.seq	-	-	-	-	-	-
biasL2.vs.integ	-	-	-	-	-	-
ext.vs.intern	-	-	-	-	-	-

ext.vs.seq	-	-	-	-	-	-
ext.vs.integ	-	-	-	-	-	-
intern.vs.seq	2.8	8.5	8.9	3.9	10.5	7.9
intern.vs.integ	5.6	9.5	6.5	3.8	6.3	8.9
seq.vs.integ	4.1	7.6	4.0	.7	8.1	7.7

661 intern=internal model; extern=external model; seq=sequential model; integ=integrative model; guess=guessing
662 model; bias1=bias L_1 model, bias2 =bias L_2 model. A “-” indicates that one or both of the strategies were never
663 assigned in this age group.

664

665 With a wider prior, moderate to strong evidence indicates the absence of accuracy differences
666 between strategies of interest across the entire age range. Accuracy differences between the
667 guessing/bias strategies and the strategies of interest were more pronounced. For parameter
668 estimates, see Table H.4 on the OSF).

669 We tentatively conclude that there were no differences in accuracy between the strategies of
670 interest. However, the strategies of interest were related to more accurate decision making than
671 the guessing or bias strategies.

672

673 ***H.4.3. The effect of age on proportion of strategy use***

674

675 *Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .5)$*

676

677 A logistic regression using the narrow prior provided moderate evidence that age did not predict
678 the probability of integrative versus other strategy assignment, $BF_{b_{age}=0} = 7.6$ ($b_{age} = -.022$, 95%
679 CI[-.140; .098]), nor the probability of sequential versus other strategy assignment, $BF_{b_{age}=0} =$
680 7.7 ($b_{age} = -.011$, 95% CI[-.115; .139]), or the probability of combined integrative and sequential
681 strategy use versus other strategy assignment, $BF_{b_{age}=0} = 8.0$ ($b_{age} = .027$, 95% CI[-.081; .014]).

682

683 *Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = 1)$*

684

685 Repetition of these analyses with a wider prior provided strong evidence that age did not predict
686 the probability of integrative versus other strategy assignment, $BF_{b_{age}=0} = 15.7$ ($b_{age} = -.022$,
687 95% CI[-.143; .093]), nor the probability of sequential versus other strategy assignment,
688 $BF_{b_{age}=0} = 15.2$ ($b_{age} = .010$, 95% CI[-.119; .137]), or the probability of combined integrative
689 and sequential strategy use versus other strategy assignment, $BF_{b_{age}=0} = 15.8$ ($b_{age} = -.027$, 95%
690 CI[-.082; .138]).

691 We conclude that sequential and integrative strategy use did not change with age.

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H.4.4. The effect of age on proportion of parameter estimates

Prior 1: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .1)$

Three linear regressions using a narrow prior were performed to see if age predicted strategy parameters $b_{int(i)}$, $b_{ext(i)}$, and $z(i)$, including only participants assigned a model containing the corresponding parameter ($N_{b_{int}} = 300$, $N_{b_{ext}} = 158$, $N_z = 64$). The data provided inconclusive evidence for age-related changes in b_{int} , $BF_{b_{age_int}=0} = .678$ ($b_{age_int}=.046$, 95% CI[-.002; .095]). Moderate to extreme evidence supported that b_{ext} and z estimates did not increase with age, $BF_{b_{age_ext}=0} = 3.2$ ($b_{age_ext}=.011$, 95% CI[-.001; .023]); $BF_{b_{age_z}=0} = 168.0$ ($b_{age_z}=.000$, 95% CI[-.001; .001]).

Prior 2: $b_{age} \sim \text{Gaussian}(\mu = 0, \sigma = .5)$

Re-analysis with a wider prior again provided moderate to extreme evidence that b_{ext} and z estimates did not increase with age, $BF_{b_{age_ext}=0} = 15.5$ ($b_{age_ext}=.011$, 95% CI[-.001; .023]); $BF_{b_{age_z}=0} = 848.9$ ($b_{age_z}=.000$, 95% CI[-.001; .001]). Findings concerning age-related changes in b_{int} remained inconclusive, $BF_{b_{age_int}=0} = 2.7$ ($b_{age_int}=.050$, 95% CI[-.001; .100]).

We conclude that neither the effect of external information on decision making or the switching point between internal and external information use in the sequential strategy changed with age. Based on these data, we cannot draw definitive conclusions concerning the effect of internal information on decision making changing with age.

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