Sex differences in the use of social information emerge under conditions of risk

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Social learning provides an effective route to gaining up-to-date information, particularly when information is costly to obtain asocially. Theoretical work predicts that the willingness to switch between using asocial and social sources of information will vary between individuals according to their risk tolerance. We tested the prediction that, where there are sex differences in risk tolerance, altering the variance of the payoffs of using asocial and social information differentially influences the probability of social information use by sex. In a computer-based task that involved building a virtual spaceship, men and women (N=88) were given the option of using either asocial or social sources of information to improve their performance. When the asocial option was risky (i.e., the participant's score could markedly increase or decrease) and the social option was safe (i.e., their score could slightly increase or remain the same), women, but not men, were more likely to use the social option than the asocial option. In all other conditions, both women and men preferentially used the asocial option to a similar degree. We therefore found both a sex difference in risk aversion and a sex difference in the preference for social information when relying on asocial information was risky, consistent with the hypothesis that levels of risk-aversion influence the use of social information.

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24 **Abstract**

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26 information is costly to obtain asocially. Theoretical work predicts that the willingness to switch

27 between using asocial and social sources of information will vary between individuals according

28 to their risk tolerance. We tested the prediction that, where there are sex differences in risk

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36 conditions, both women and men preferentially used the asocial option to a similar degree. We

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38 social information when relying on asocial information was risky, consistent with the hypothesis

39 that levels of risk-aversion influence the use of social information.

40

41 **Introduction**

42 Individuals can acquire information either directly through their own asocial learning experiences

43 or by copying other individuals [1]. Asocial learning allows individuals to gain first-hand

44 knowledge about the immediate environment, but reliance on this type of learning can be costly,

45 for instance, in terms of time and energy [2]. In contrast, social learning can provide a cost-

46 effective route to gaining up-to-date information, particularly when the environment is changing

47 and information is costly to obtain asocially [2, 3]. Theoretical models support the hypothesis

48 that an increased reliance on social learning is adaptive when the environment becomes more

49 variable (although not when variability is very high) and when the returns from asocial learning

50 become more unreliable [3-6]. Therefore, individuals are predicted to be sensitive to the

51 reliability of the available sources of information and to use these reliability estimates when

52 choosing whether to learn asocially or socially [2].

53   Reliability can include the predictability of the source of information (e.g., the likelihood

54 that a food reward is associated with a particular cue) and the variability in the expected payoff

55 derived from different sources (e.g., the variability in the amounts of food obtained from different

56 foraging patches). Empirical research on non-human animals and humans has shown that

57 individuals are likely to use social learning when personal experience reveals that the

58 environment is unpredictable or the variability in payoffs of available options is high (e.g., [7-

59 10]). For example, a study of nine-spined sticklebacks (*Pungitius pungitius*) showed that

60 reducing the predictability of personally experienced cues in a foraging context increased

61 reliance on social learning [10]. Similarly, when faced with the option of taking a risky decision in

62 an experimental paradigm, human participants were found to delay their decision and observe

63 the choices made by others [7]. These findings support the broader hypothesis that social

64 learning is used strategically [11].

65   Individual differences in the use of social information are predicted to reflect individual

66   differences in risk tolerance [12]. Risk-averse individuals are expected to switch to using social

67   sources sooner than risk-prone individuals when faced with unreliable personal experience. In

68   real-world scenarios, the predictability and riskiness of sources of information are likely to co-

69   vary; for example, food items with high nutritional value are likely to be both rarer in the

70   environment, and more difficult to obtain, than low value food items [4, 13]. By switching to

71   social sources of information when faced with risky options, individuals are thus potentially

72   better able to exploit high-value resources. In both non-human animals and humans, individuals

73   vary in their sensitivity to experiencing gains and losses [14, 15], and a small number of studies

74   of non-human animals have revealed that 'shy' individuals are more likely than 'bold' individuals

75   to copy the decisions of others (e.g., [16-19]). However, the link between risk-proneness and

76   social information use has yet to be evaluated in humans.

77   One variable that is commonly related to risk aversion in humans is an individual's sex,

78   with women showing lower average scores than men on a range of measures of risky behaviour

79   (e.g., [20-22]). While the degree of overlap between the sexes on risk-aversion measures is

80   often considerable [23], and not all risk-aversion measures show sex differences [24], women

81   perceive the benefits gained from taking risks as being lower than do men [24, 25]. Women also

82   rate both the likelihood of a negative outcome and the perceived severity of the costs higher

83   than do men [24, 25], and report being less likely than men to engage in novel activities that

84   involve risk [22]. Similarly, data from personality measures indicate that, on average, women are

85   more sensitive than men to the potential negative outcomes of decisions [26]. The probability of

86   using asocial versus social sources of information when faced with a risky decision is therefore

87   likely to differ on average between women and men.

88   The aim of this study was to examine whether altering the riskiness of using asocial and

89   social sources of information would differentially influence the probability that men and women

90   used these sources. Here, we are defining riskiness in terms of variation in expected score [27].

91   We predicted that, when one of these sources of information appeared to be risky (i.e., high

92   variation in expected score), women would be more likely than men to use the alternative

93   source, safe (i.e., low variation in expected score) of information. In the control condition, no sex

94   difference in the use of asocial and social sources was predicted. We designed a novel

95   computer-based task that involved constructing a virtual spaceship. After building the first

96   spaceship, participants were given the option of using asocial or social sources of information to

97   improve their ranked score. Participants were assigned to one of three conditions, in which

98   either i) the asocial option was risky and the social option was safe, ii) the asocial option was

99   safe and the social option was risky, or iii) both the asocial and social options were safe.

100 Because scores were randomly allocated to spaceships, participants could not learn about the

101 usefulness of different design features. The outcome measure of principal interest was the

102 participant's choice of information source. Participants also completed a risky impulsivity

103 measure [28], in order to confirm that the predicted sex difference in average score was found in

104 our set of participants.

105

106 **Methods**

107 *Participants*

108 Eighty-eight participants (50 women and 38 men) were recruited through the School of

109 Psychology & Neuroscience's online participant recruitment system. All participants were aged

110 17 or over, with the majority (91%) falling into the 18-25 age range. Participants gave consent

111 before taking part in the experiment and were debriefed afterwards. All participants were

112 reimbursed £3 for attending the session – which lasted approximately 20 minutes – and could

113 obtain an additional £2 depending on performance criteria (see 'Procedure' below). Participants

114   were randomly assigned to one of the three conditions (see 'Asocial and social information') and

115   were tested in groups (range = 4-9 individuals). Participants gave consent via a button click at

116   the start f the experiment. This was approved, as were all other procedures used in this study,

117   by the Ethics Committee of the School of Psychology & Neuroscience on behalf of the

118   University of St Andrews (approval code PS11481).

119

120   *Procedure*

121   Participants stated their gender ('female', 'male', 'other' or 'prefer not to say') and age bracket

122   before beginning the experiment. They then played a computer game, programmed using web-

123   based JavaScript, in which they built virtual spaceships. Participants were instructed that the

124   aim was to construct spaceships with the highest scores, and that the participant with the

125   highest score at the end of the session would receive a bonus payment. Spaceship construction

126   proceeded in three rounds, each with two building phases. In Phase 1, participants constructed

127   their first spaceship by selecting tiles from a grid of thirty available items that were arranged into

128   themes (crew, cargo, engines, shields and lasers) (see **Figure 1a**). Players had two minutes to

129   view these items and choose ten to place on a spaceship template. The only constraint was that

130   they had to use at least one crew member and one engine. After finishing Phase 1, each

131   player's ship was given a numerical score and a rank in a league table (1st to 5th, highest to

132   lowest) (see **Figure 1b**). Players were given no information on how a good score might be

133   achieved, and, in reality, scores were randomly assigned to the participants' spaceship (with a

134   range of 8,000 to 25,000), along with a false 'rank' that was always either 1st, 3rd or 5th.

135   Participants then chose between using asocial and social sources of information (see

136   'Asocial and social options') before building a second spaceship (Phase 2). Participants were

137   not given a score or rank for their second spaceship at the end of Phase 2, meaning that they

138   received no feedback on whether the choice to use asocial or social source of information

139 improved the outcome. Furthermore, because scores were randomly generated, no rules for

140 building high-scoring spaceships were available for participants to learn.

141   Phases 1 and 2 were then repeated a further two times (i.e., three Rounds of building

142 spaceships), with scores and ranks shown at the end of each Phase 1. Each participants'

143 spaceships were ranked randomly, once at 1st, 3rd or 5th on the league table. At the end of

144 each Round, participants were informed that their score had been saved and that their best

145 score out of the three Rounds would be used at the end of the experiment to allocate the bonus.

146 Because the scores given to spaceships were random, bonuses were awarded at the end of the

147 experiment to more than one participant according to a lottery in which participants had a higher

148 probability of a reward when choosing the safe rather than the risky option in the final Round.

149   After completing all three Rounds, participants completed the 12-item risky impulsivity

150 measure [28] on-screen. This measure assesses willingness to take risks without prior thought

151 in everyday life and is reported to have high internal consistency [28]. The bonus payments

152 were awarded when all participants had completed the final on-screen material, including the

153 questionnaire.

154

155 *Asocial and social options*

156 The asocial option consisted of viewing up to ten previously unseen items in the scrapheap, of

157 which up to three items could be kept for use in the next building Phase. The social option

158 consisted of viewing three completed spaceships, ostensibly built by 'other participants', along

159 with the associated 'scores'. These spaceship designs had actually been generated by the

160 experimenter prior to the study using randomly selected tiles, and three out of twelve completed

161 spaceships were presented at random as social sources. The scores for these spaceships were

162 also randomly assigned. Participants could choose up to three items from one of the three

163 ships, and these items were automatically added to the participant's spaceship template in the

164   next Phase and could not be removed. Because each participant was assigned to a single

165   condition, the description of the asocial and social options (see below) remained the same for

166   participants across Rounds, in order to avoid potential confusion among participants and reduce

167   the chance that participants failed to attend to the subtle differences in the descriptive material.

168   In the Asocial Risky (AR) condition (N=28; 18 female, 10 male), participants were

169   informed that their score could markedly increase or decrease if they visited the scrapheap, in a

170   short paragraph that included the following wording: "some of these items may be broken and

171   useless, but some may greatly increase your ship's score… your score could go up or down".

172   Conversely, the social option was safe; participants were informed their score could slightly

173   increase or would remain the same ("the ships will have the same score as your ship, or slightly

174   higher… you will be guaranteed at least the same score as your current ship"). In the Social

175   Risky (SR) condition (N=32; 17 female, 15 male), the asocial option was safe ("all of these items

176   will help your ship to fly, and some of them can slightly increase your ship's score… you will be

177   guaranteed at least the same score as your current ship"), and the social option was risky ("the

178   ships may have a much worse or much better score that your current ship's score… your score

179   could go up or down"). In the Control (C) condition (N=28; 15 female, 13 male), both the asocial

180   and social options were safe: the wording was identical to that used in the safe options in the

181   other conditions. This wording reflects the Bounded Risk Distribution model, in which individuals

182   are expected to maximize their probability of reaching a goal while minimizing their probability of

183   falling below a certain threshold [27]. In our experiment, participants are trying to achieve the

184   goal of a top score and want to minimize their chance of falling below this threshold, in order to

185   achieve a bonus payment. Therefore, although the safe options have a slightly higher average

186   expected score, these safe options preclude a large increase in score. The risky option is

187   therefore a rational choice where participants believe that they need to greatly improve their

188   score in order to move up in the rankings and win a monetary bonus. .

189

Statistical analyses

We modelled the participants' decision to use asocial or social options using Bayesian binomial multi-level logistic regression in R with the *map2stan* function from the *Rethinking* package [29]. The full model included an effect for sex, an effect for condition, a sex*condition interaction, an effect for the rank given to the participant's spaceship after Phase 1, and a random effect for individual. The C condition was represented as the baseline in the model, so that any effects of the AR or SR conditions were in relation to C. Because men were coded as 0 and women as 1, the baseline represents men's behaviour in the control condition, and the effect of sex represents how women's behaviour differed from men's in the C condition. Model predictions were calculated by averaging across all candidate models weighted according to the WAIC (Watanabe-Akaike Information Criteria). The model with the lowest WAIC value, and the highest Akaike weight, is the model that is most likely to make accurate predictions on new data, conditional on the set of models considered. Posterior predictions were calculated based on the population mean of the participants and thus represent predictions for a 'new', previously unobserved, average participant. These predictions are presented in Figure 2. Candidate models were chosen based on *a priori* hypotheses formulated before data collection (**Table 1**).

In order to examine whether the choice of using risky or safe options varied with the rank assigned to the spaceship, or sex of participant, and whether men and women responded differently to their rank assignments, we ran an additional model with risky/safe choice rather than social/asocial choice as the outcome variable. This model excluded data from the C condition, because both options in this condition were safe and therefore no risky choice could be made. The risky/safe choice was modelled using a Bayesian binomial multi-level logistic regression with rank, sex and a sex*rank interaction as predictors.

Finally, we also modelled participants' risky impulsivity scores using a Bayesian linear model, with sex as a predictor variable, to check whether our sample displayed the expected

215   sex difference in risky impulsivity.

216   All model estimates are reported with 89% credible intervals (CIs), which are the default in

217   the *Rethinking* package [28]. The CIs provide an upper and lower estimate around the mean of

218   the parameter estimate and encompass 89% of the posterior distribution. This method contrasts

219   with the traditional use of 95% confidence intervals in null hypothesis testing. Using 95%

220   intervals would not change the interpretation of our results, because we are using a model

221   comparison approach, and the size of the credible intervals does not affect which models best fit

222   the data. All error bars are 89% credible intervals and can be interpreted as the region within

223   which the model expects to find 89% of responses, given the data and the assumptions in the

224   model.

225

226   **Results**

227   *Asocial versus social options model*

228   When modelling the probability of choosing asocial or social options, the best-fitting model (i.e.,

229   the model with the lowest WAIC value) included an effect for sex and an effect for the sex and

230   AR condition interaction (**Table 1**). This interaction can be seen in detail in **Figure 3**. In the C

231   condition, both women and men preferentially chose to use the asocial source information

232   rather than the social source (women: β= -0.72, CI [-1.36, -0.05]; men: β= -0.41, CI [-0.72, -

233   0.10]; **Figure 3**). As shown by the model estimates (**Figures 4 & 5**), there was not strong

234   evidence for an interaction effect between sex and SR condition (β= 0.62, CI [-0.09, 1.40]),

235   meaning that women's choices in the SR condition did not differ strongly from women's choices

236   in the C condition. Thus, as can be seen in the model predictions (**Figure 3**), both women and

237   men preferentially chose the asocial source in the SR condition also. In contrast, the interaction

238   between sex and the AR condition had a strong effect in the model (β= 1.76, CI [1.03, 2.51];

239 **Figure 4**). As can be seen in **Figure 4**, women in the AR condition preferentially chose the

240 social option, whereas men's choice did not differ compared to men's choices in the control

241 condition. Thus, women in the AR condition chose the social source of information more than

242 women in the C condition, while men in the AR condition did not differ from men in the C

243 condition with regard to their choice. According to the full model (**Figure 5**), rank did not predict

244 the choice to use asocial or social options (β= 0.05, CI [-0.22, 0.29]).

245

246 *Risky versus safe model*

247 The risky versus safe model indicated that participants of both sexes preferred to use the safe

248 option overall (β= -2.38, CI [-4.20, -0.56]; **Figure 6**). The intercept estimates the preferences of

249 men in both conditions, showing that they had an overall preference for the safe choice, and the

250 effect of sex included zero (β= 1.12, CI [-0.71, 3.13]), indicating that women did not choose

251 differently from men. However, the effect of rank (β= 1.14, CI [0.22, 1.95]) shows that both men

252 and women were more likely to choose risky than safe options after receiving a lower rank than

253 a higher rank. There was no evidence for an interaction between rank and sex in the model (β=

254 -0.77, CI [-1.98, 0.19]), indicating that men and women were responding similarly to their rank

255 assignments.

256 *Risky impulsivity measure*

257 Women scored lower than men on the risky impulsivity measure, as expected (women = 23.41 ±

258 6.97; men = 27.24 ± 7.59; means and SEMs) (β = -0.06, CI [-0.09, -0.04]; **Figure 7**). Men

259 scored half a standard deviation higher than women on average (Cohen's d = 0.52). The scale

260 had an acceptable level of internal consistency (Cronbach's alpha = 0.78). Individual scores did

261 not predict the use of risky versus safe options (β= 0.13, CI [-1.75, 1.90]).

262

Discussion

264   In our experimental study, we found a sex difference in the use of social sources of information

265   that only emerged when using the asocial option was a risky (i.e. the payoffs varied widely).

266   Women, but not men, preferentially chose to use the social source of information when the

267   asocial option was risky. In contrast, women and men did not differ from each other in their

268   responses to risky social options; both women and men preferentially used the asocial option in

269   the 'Social Risky' condition, as well as in the control condition. Male and female participants

270   were more likely to choose the risky option when the spaceship was given a low rank than a

271   high rank, while rank did not predict whether participants chose asocial or social information.

272   Women had lower average scores than men on the risky impulsivity measure, as reported in

273   previous research (e.g., [28, 30]). Our main finding, which was that individuals of the more risk-

274   averse sex (i.e. women) used the social option when the asocial one was risky, is consistent

275   with the hypothesis that levels of risk-aversion influence social learning strategies [4]. This result

276   has potentially broad implications for understanding the dynamics of social information

277   transmission.

278   While previous research has suggested that women are more likely than men to

279   conform to the decisions of others (e.g., [31]), our findings contribute further evidence that social

280   sources of information are used strategically, irrespective of gender. We found that the sex

281   difference in the use of social sources of information depended upon the type of decision being

282   made. Women were not more likely than men to use social options across all conditions, nor

283   were women less likely than men to choose the risky option in general. The sex difference in the

284   use of the social sources of information when the asocial source was risky could potentially

285   have reflected lower confidence in one's own performance in women compared to men.

286   Previous research has shown that both female and male participants copy others when lacking

287   confidence in their personal information (e.g [31]), and that this relationship is likely to influence

288   patterns of conformity in cases where men's and women's confidence differs [32]. However, the

289   absence of a sex difference in the control condition suggests that both sexes were equally

290   confident in solving the task alone.

291   The psychological mechanisms underpinning the sex difference in response to risky

292   asocial sources remain to be determined. While a sex difference in competitiveness has been

293   identified in previous literature [33], this sex difference is unlikely to explain our results because

294   men and women responded similarly to their Phase 1 ranks. One possible explanation is that

295   women were more sensitive on average than men to the potential loss in score associated with

296   the risky asocial option and were thereby minimizing their probability of a loss. However, women

297   and men did not differ in their probability of selecting a risky social option, possibly because they

298   had a preference for the asocial option irrespective of risk. Neither female nor male participants

299   avoided the social option completely, even when it was risky. Participants might have been

300   sampling the social sources in order to compare their own decisions with those of others or to

301   check for particularly high-scoring solutions. This sampling strategy might have prevented

302   participants from relying solely on the asocial option in the social risky condition, which might

303   have resulted in a ceiling effect. Altering the experimental design to make the social option more

304   appealing (in terms of perceived benefits gained from viewing social sources) might have

305   reduced overall reliance on asocial sources when this social information became risky

306   .Our results showed that both men and women used asocial, rather than social, sources

307   of information when both sources were safe, consistent with previous experiments showing the

308   preferential use of asocial learning in laboratory settings (e.g., [32, 34]). While theoretical

309   models have suggested that social learning should initially be prioritised over asocial learning

310   [35], our empirical research suggests that participants prefer to try to solve tasks for themselves,

311   before relying on help from others. The asocial version of our task, which involved viewing new

312   tiles in a scrapheap, could have been more appealing than the social condition, in terms of

313   providing opportunities to innovate or for other reasons related to the characteristics of the

314 stimuli. Although the probability that men chose the social option did not vary across conditions,

315 the level of risk could potentially influence use of social sources of information by men under

316 different experimental conditions. For instance, further increasing the riskiness of the asocial

317 option could potentially result in men switching to using the social option. The idea that men and

318 women could differ in the cut-off point at which the risk is deemed sufficiently high to change

319 strategy could be investigated experimentally by varying the level of risk along a continuum.

320   Our results confirmed that participants of both sexes were more likely to choose the risky

321 option when the spaceship was given a low rank than a high rank. Previous experiments using

322 economic game protocols have also shown that participants are more likely to take a risk when

323 performing poorly in relation to other participants (e.g., [37]). Given that our definition of

324 riskiness focused on the variation in expected score, rather than the absolute size of the

325 expected score, future studies could manipulate both average scores and variance in scores of

326 different options to examine the influence of these on the strategic use of social information in

327 men and women. In the current study, the average score for the safe option was slightly higher

328 than for the risky option, given that scores in the safe option could either increase slightly or

329 remain stable, while scores in the risky option could either increase or decrease markedly. The

330 effects of manipulating level of risk and differences in average payoffs could be further

331 investigated experimentally in both human beings and non-human animals, using available

332 protocols (e.g., [7, 10, 19]).

333   Individual scores on the risky impulsivity measure did not correlate with the likelihood of

334 choosing the risky versus safe option. While this correlation was not the main focus of the study,

335 one suggestion for future research might be to examine measures of sensitivity to 'actuarial'

336 risk, although these measures are less likely to show sex differences than measures of

337 sensitivity to physical risk [20]. Indeed, we chose risky impulsivity because we were looking for a

338 trait that differs by sex. A second possibility is as follows. In our task, choosing the 'risky' option

339 is rational when a large increase in score is needed, but it brings with it the possibility of a large

340   'loss' in score. We could consider a decrease in score when selecting the rational option as a

341   form of unrepresentative negative feedback [38, see also 26], to which women appear to be

342   more sensitive than men. We might therefore expect sensitivity to negative feedback in, for

343   example, a gambling task to correlate with a shift in strategy in our spaceship-building task.

344   **Conclusion**

345   Our results indicated that individuals of the more risk-averse sex preferentially used a

346   social option when the asocial option was risky, supporting theoretical evidence that levels of

347   risk-aversion are linked to the implementation of social learning strategies [4]. Whether the

348   psychological mechanisms underpinning the decision to use social sources of information

349   involved greater sensitivity to punishment or lower confidence in one's own performance was

350   not investigated. However, regardless of the mechanism, switching to social learning can

351   potentially provide individuals with the opportunity to avoid costly mistakes and learn from the

352   successes of others. Understanding how sex differences in risk-aversion relate to the use of

353   social information deserves further investigation in non-human animals, as well as humans, and

354   would add to the growing evidence that individual traits influence a broad range of social

355   processes [12, 40]. Between-individual differences in risk-aversion are likely to influence the

356   dynamics of social learning and the spread of socially transmitted information through

357   populations, with potential broad-scale implications for the characteristics of local traditions and

358   the evolution of cultural traits.

359

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366

367   **Supplementary information**

368   The full dataset supporting this paper is available at https://risweb.st-

369   andrews.ac.uk/admin/workspace.xhtml?uid=5

370

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478 **Figure Legends**
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Candidate models and their WAIC weights

List of candidate models that were included in the asocial/social information analysis, the a priori hypotheses and the included parameters, with model values (WAIC ± SE) and weights (Akaike weight). Bold type indicates the best fitting model

2 **Table 1** List of candidate models that were included in the asocial/social information analysis,

3 the a priori hypotheses and the included parameters, with model values (WAIC ± SE) and

4 weights (Akaike weight). Bold type indicates the best fitting model.

Model	Hypothesis	Parameters included	WAIC (±SE)	Akaike weight
1	Null	Intercept	360.3 (5.10)	0.00
2	Full	Intercept + sex + AR + SR + sex*AR + sex*SR + rank + personality	357.1 (10.36)	0.01
3	Sex and condition interactions predict choice	Intercept + sex*AR + sex*SR	351.1 (9.11)	0.25
4	**Sex, and sex and condition interactions, predict choice**	**Intercept + sex + sex*AR + sex*SR**	**349.6 (9.77)**	**0.52**
5	Sex and condition predict choice	Intercept + sex + AR + SR	354 (8.92)	0.06
6	Only condition predicts choice	Intercept + AR + SR	352 (8.77)	0.16
7	Only sex predicts choice	Intercept + sex	362.3 (5.32)	0.00

Figure 1

Screenshot of Phase1

Example screenshot from the online experiment showing shipbuilding in Phase 1.
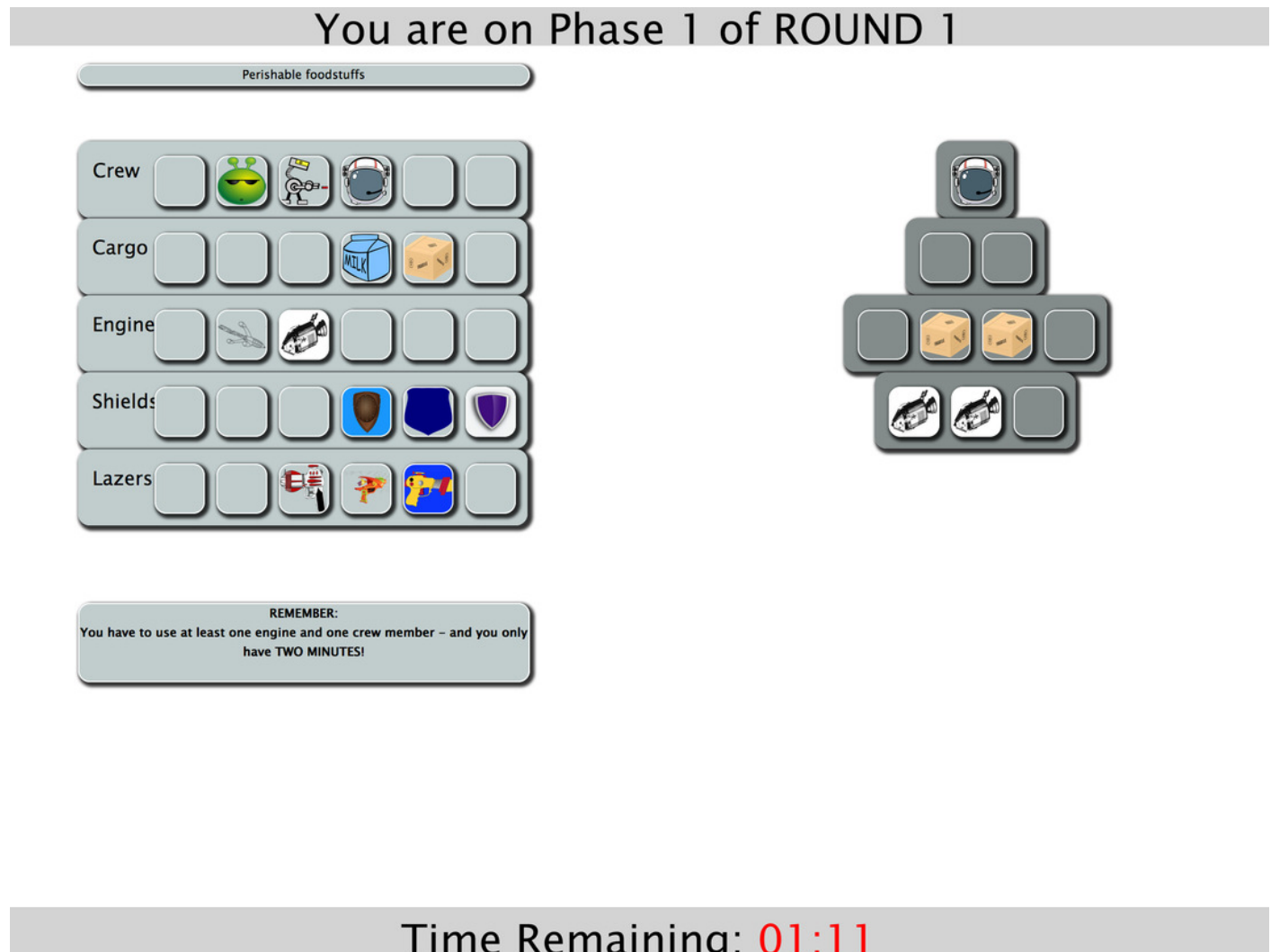
Figure 2

Screenshot of Phase1.

Example screenshot of the generated score presented to participants at the end of Phase 1.

You have completed Phase1

Well done! Your ship's score is 25,000. Here is a list of the high scores:

Name	Score
Rank 1	25,000
Rank 2	21,050
Rank 3	16,850
Rank 4	10,500
Rank 5	8,780

Click continue to find out how you can improve your score!

Continue

Figure 3

Model predictions

Model predictions of the mean proportion of individuals that chose social information plotted according to condition and sex. Predictions were averaged across all models and weighted according to WAIC weight. Error bars show 89% CIs. Raw means are also plotted, represented by a cross symbol
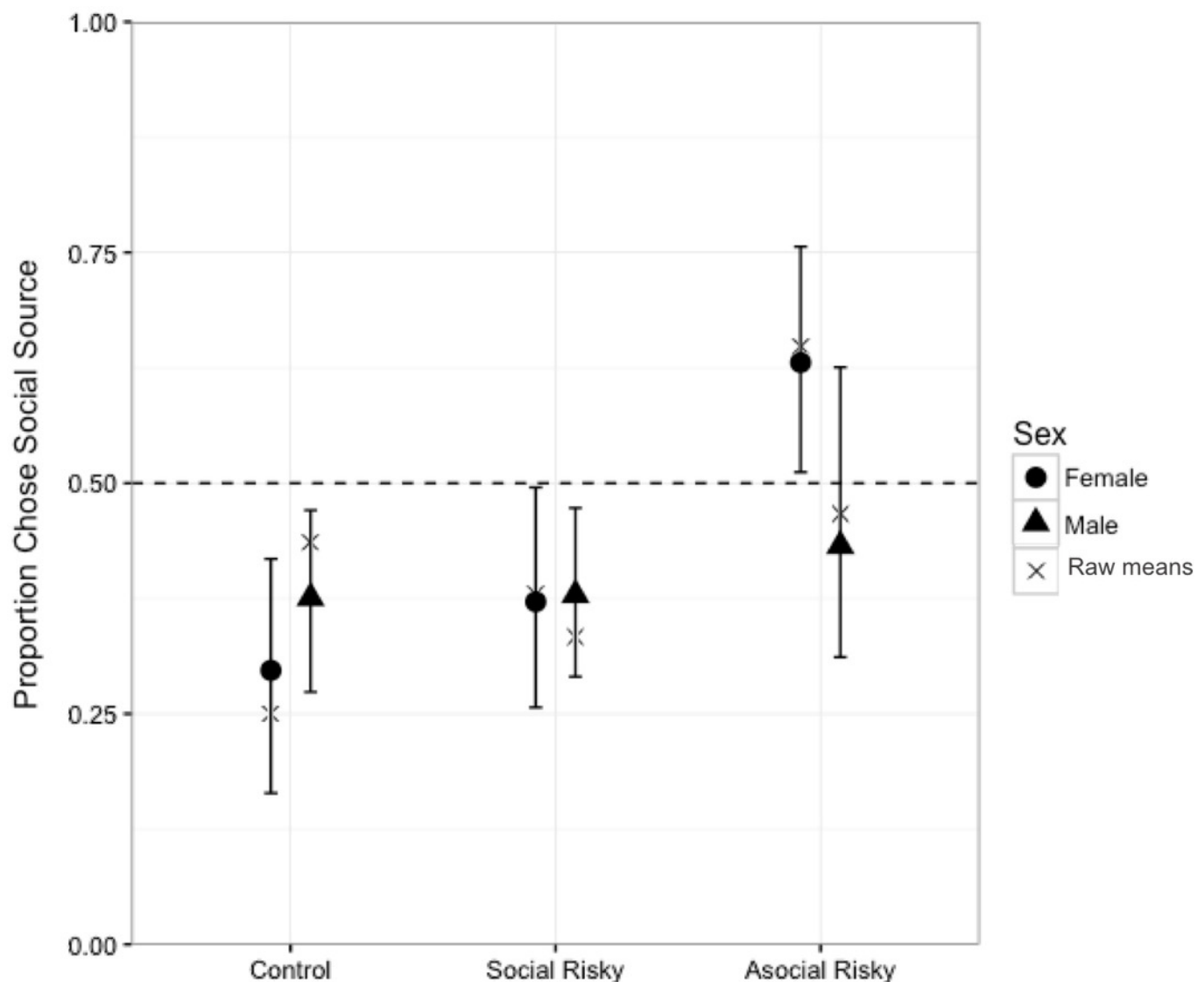
Figure 4

Plot of parameter estimates of best fitting model (lowest WAIC)

Plot displaying parameter estimates for the probability of choosing the social option, taken from the model with the lowest WAIC value and plotted with 89% CIs. A positive estimate indicates a greater likelihood of choosing social, rather than asocial, information. Where the 89% CIs of parameter estimates include zero, there is no clear evidence of an effect of that parameter on the likelihood of choosing the social or asocial option. The intercept (baseline) represents males in the control condition
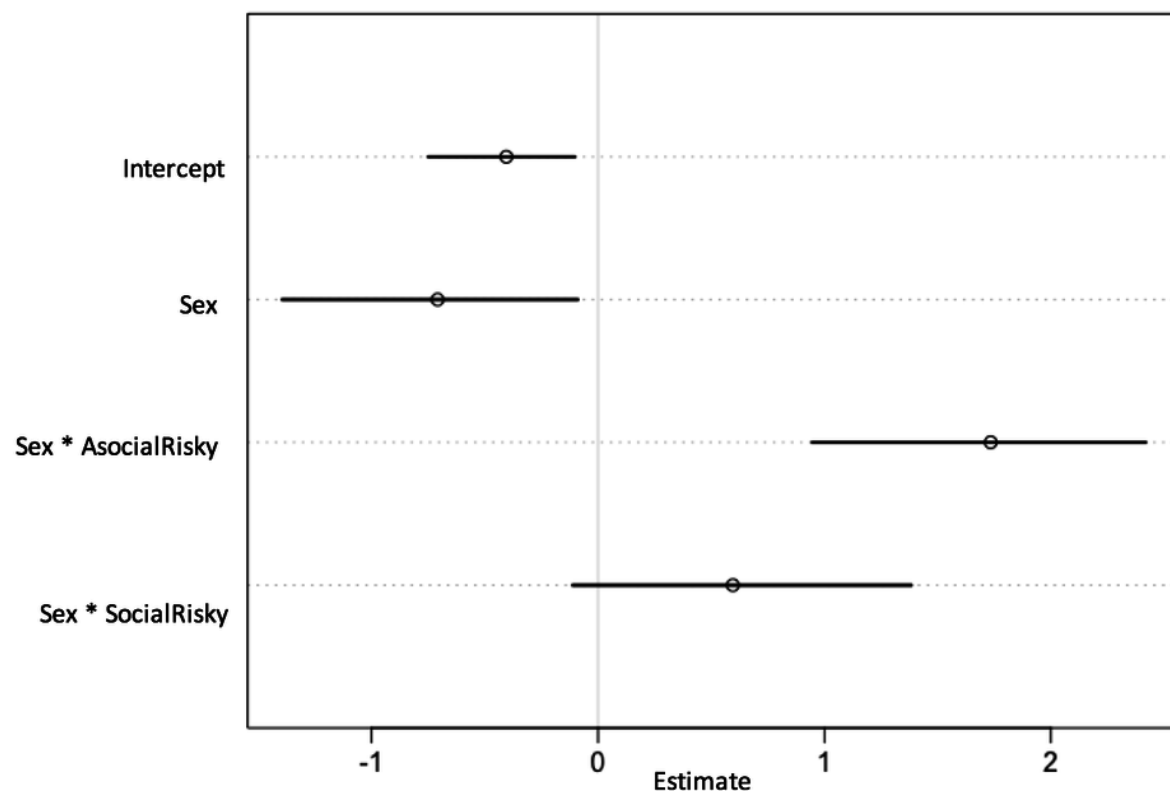
Figure 5

Plot of parameter estimates from Full Model.

Plot displaying parameter estimates for the probability of choosing the social option, taken from the full model and plotted with 89% CIs.
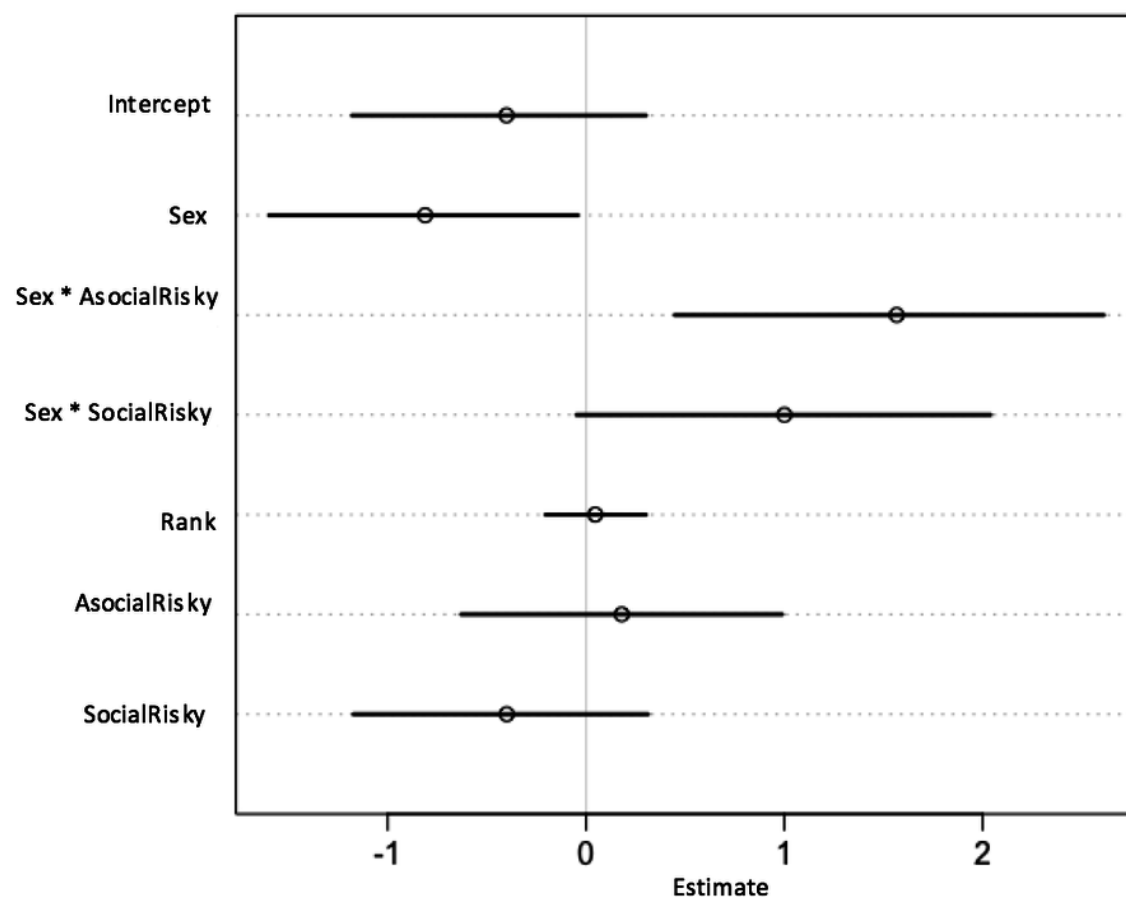
Figure 6

Plot of parameter estimates from the second model.

Plot displaying parameter estimates for the likelihood of choosing the risky option, plotted with 89% CIs. A positive estimate indicates a greater likelihood of choosing the risky, rather than the safe, option. Where estimates include zero, there is no clear evidence of that parameter affecting the likelihood of choosing the risky or safe option
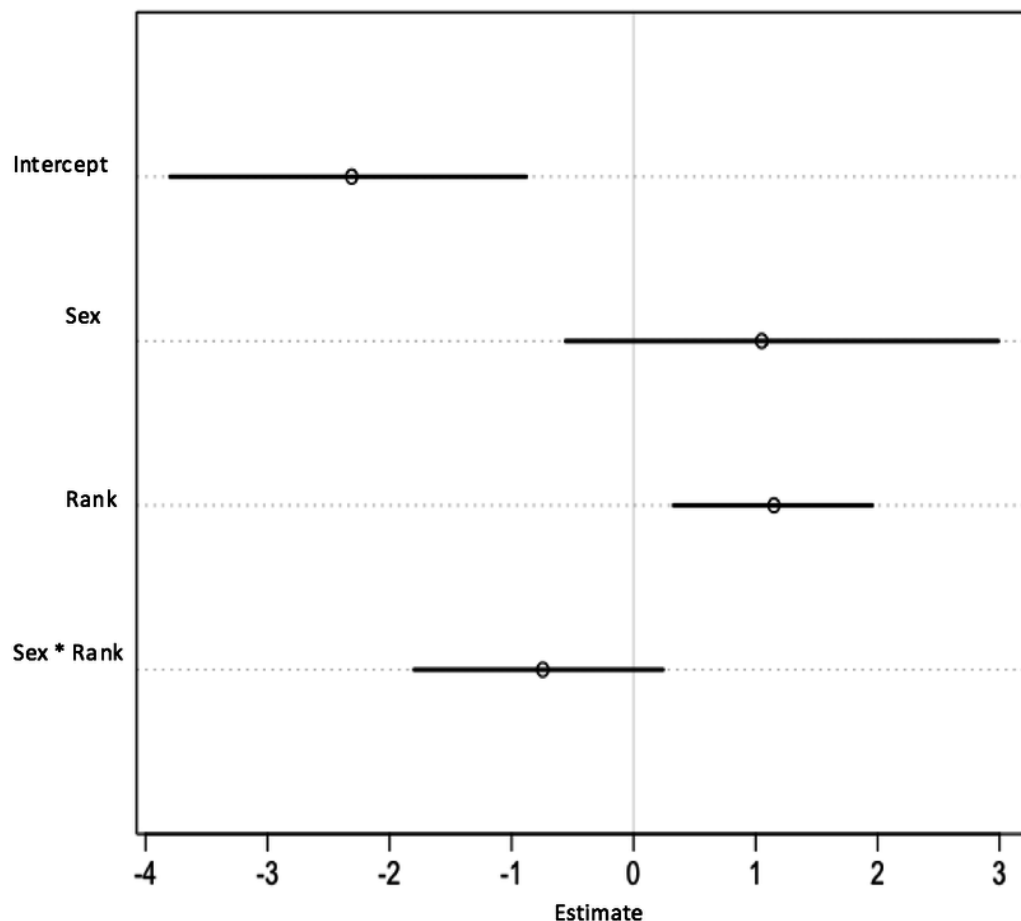
Figure 7

Density plot of sex difference in risk-taking measure

Density plot showing men and women's risky impulsivity scores