Tinder for orang-utans: comparing sexually selective cognition among Bornean orang-utans (Pongo pygmaeus) and humans (Homo sapiens)

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Appendices

Appendix A: Supplementary Material for Chapter 2

Supplementary Table 1 – Overview of studies on sexually selective cognition in primates.

Study	Method	Species	Main finding
Waitt et al., 2003	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	Females showed an attentional bias towards red male faces compared to more pale faces.
Cooper & Hosey, 2003	Preferential looking (sequential)	Common brown lemur (*Eulemur vulvus*) & controls that do not experience sexual dichromatism (*Lemuridae)*	Common brown lemur females showed an attentional bias towards more brightly coloured male pelage, while this was not the case for the control individuals, suggesting that sexual dichromatism plays a role in mate choice.
Deaner et al., 2005	Preference task	Rhesus macaque (*Macaca mulatta*)	Male macaques could choose to see an empty screen or a picture, with each choice receiving different kinds of rewards. Results showed that macaques were willing to give up reward to see pictures of high-status faces and perinea.
Waitt & Little, 2006	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	Macaques showed an attentional bias towards symmetrized faces. However, this effect was especially driven by female observers.
Waitt et al., 2006	Preferential looking (sequential)	Rhesus macaque (*Macaca mulatta*)	Males show more attention to pictures of reddened female hindquarters compared to less red hindquarters. This effect was not found for female faces.
Gerald et al., 2007	Preferential looking (sequential)	Rhesus macaque (*Macaca mulatta*)	Females show more attention to pictures of reddened female faces and hindquarters compared with more pale versions of the same picture.
Lacreuse et al., 2007	Effort	Rhesus macaque (*Macaca mulatta*)	Ovulating females, but not non-ovulating female, pressed longer when they would see a male face than a female face. However, they only showed this effect for same-species stimuli.
Higham et al., 2011	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	Males looked longer at faces of ovulating females when paired with faces of non-ovulating females. This effect was especially pronounced when males were shown pictures of familiar females.
Watson et al., 2012	Preference test	Rhesus macaque (*Macaca mulatta*)	In a preference task, female macaques could choose to either see a picture or an empty screen. They picked the picture-option most frequently when they knew the picture would be of either a perineum or of a high-status face.
Pflüger et al., 2014	Preferential looking (simultaneous)	Japanese macaque (*Macaca fuscata*)	Males looked longer at faces of intensely coloured female faces.

Supplementary Table 1 – continued

Study	Method	Species	Main finding
Dubuc et al., 2016	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	Both males and females look longer at dark red male faces. However, when considering the proportion of subjects that looked longer at dark red faces regardless of preference strength, only females showed a significant dark red bias.
Paukner et al., 2017	Preferential looking (simultaneous)	Capuchin monkey (*Sapajus apella*)	Males showed an attentional bias for symmetrical male faces when paired with asymmetrical male faces, but not symmetrical female faces that were paired with asymmetrical female faces. Females, on the other hand, did not show an attentional bias in either condition.
Damon et al., 2017	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	3-month-old macaques show an attentional bias towards "average" macaque faces, similar to human infants.
Tomeo et al., 2017	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	Macaques showed an attentional bias towards individuals faces instead of composite faces, suggesting that they do not prefer averageness.
Lonsdorf et al., 2018	Preferential looking (simultaneous)	Capuchin monkey (*Sapajus apella*)	Females showed a same-sex attentional bias, while males showed no significant bias.
Acikalin et al., 2018	Preference test	Rhesus macaque (*Macaca mulatta*)	Macaques preferred brand logos that they associated with pictures of high-status faces or perinea.
Damon et al., 2019	Preferential looking (sequential)	Rhesus macaque (*Macaca mulatta*)	Macaques show a species-specific bias for attractive faces, just like humans.
Rosenfield et al., 2019	Preferential looking (simultaneous)	Rhesus macaque (*Macaca mulatta*)	Female macaques show an attentional bias towards masculine male faces that were paired with more feminine male faces. However, this was only the case when the difference in masculinity between the faces was most pronounced.

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Appendix B: Supplementary Material for Chapter 3

Supplementary Table 1 - Model table for the logistic regressions predicting propensity to date again from post-date attractiveness and long-term partner suitability ratings.

	Propensity to date again			
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Intercept	0.21	0.12 – 0.34	0.39	0.23 – 0.64
rater sex [M]	1.31	0.74 – 2.35	1.47	0.82 – 2.60
post-date attractiveness	5.68	4.00 – 8.41		
rater sex [M]:post-date attractiveness	1.88	1.18 – 3.04		
post-date long-term rating			5.59	3.98 – 8.16
rater sex [M]:post-date long-term rating			1.69	1.07 – 2.71
Random effects	Estimate	CI (89%)	Estimate	CI (89%)
sd [Intercept] participant	1.10	0.65 – 1.58	1.41	0.94 – 1.94
sd [post-date attractiveness] participant	0.38	0.05 – 0.77		
sd [post-date long-term rating] participant			0.38	0.06 – 0.76
sd [Intercept] partner	1.08	0.62 – 1.57	0.95	0.39 – 1.50
N	67_{pp}		67_{pp}	
	67_{partner}		67_{partner}	
Observations	554		554	

Supplementary Table 2 – Effect sizes for the logistic regressions predicting propensity to date again from post-date attractiveness and long-term partner suitability ratings.'

Predictor	*Rater sex*	*Median OR*	*CrI 89%*	*pd*	*d*	*N*
attractiveness	female	5.68 [1.30]	4.00; 8.41	1.00	0.96 [0.13]	554
attractiveness	male	10.61 [3.06]	6.92; 17.92	1.00	1.30 [0.16]	
long-term	female	5.59 [1.24]	3.98; 8.16	1.00	0.95 [0.12]	
long-term	male	9.37 [2.61]	6.14; 15.53	1.00	1.23 [0.16]	

Supplementary Table 3 – Model table for the ordinal regressions between visual attractiveness rating and long-term rating. Dependent variables are in bold

	Visual attractiveness rating		**Visual long-term rating**	
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Threshold.1.	0.00	0.00 – 0.00	0.00	0.00 – 0.00
Threshold.2.	0.03	0.01 – 0.04	0.07	0.04 – 0.13
Threshold.3.	0.25	0.15 – 0.40	0.70	0.42 – 1.18
Threshold.4.	3.69	2.25 – 6.16	9.33	5.36 – 16.67
Threshold.5.	47.45	26.09 – 89.41	105.74	53.54 – 221.66
Threshold.6.	1108.79	436.90 – 3190.56	4769.71	1535.19 – 16746.93
long-term rating	8.14	6.33 – 10.61		
rater sex [M]	1.16	0.70 – 1.96	1.19	0.68 – 2.04
long-term rating:rater sex [M]	0.97	0.75 – 1.26		
attractiveness rating			7.11	5.27 – 9.68
attractiveness rating:rater sex [M]			1.97	1.39 – 2.83
Random effects	Estimate	CI (89%)	Estimate	CI (89%)
sd [Intercept] participant	1.03	0.74 – 1.35	1.46	1.15 – 1.80
sd [attractiveness rating] participant			0.72	0.51 – 0.96
sd [long-term rating] participant	0.29	0.08 – 0.49		
sd [Intercept] partner	0.79	0.53 – 1.06	0.46	0.13 – 0.75
N	$58_{\text{participant}}$		$58_{\text{participant}}$	
	59_{partner}		59_{partner}	
Observations	482		482	

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Supplementary Table 4 – Model table for the ordinal regressions between auditory attractiveness rating and long-term rating. Dependent variables are in bold.

Predictors	**Auditory attractiveness rating**		**Auditory long-term rating**	
	Odds Ratios	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Threshold.1.	0.00	0.00 – 0.00	0.00	0.00 – 0.00
Threshold.2.	0.00	0.00 – 0.01	0.04	0.02 – 0.07
Threshold.3.	0.12	0.07 – 0.18	0.48	0.29 – 0.79
Threshold.4.	1.93	1.24 – 3.00	10.15	6.07 – 17.42
Threshold.5.	42.24	24.84 – 75.27	162.56	88.26 – 316.36
Threshold.6.	1291.53	598.32 – 3142.25	7094.86	2793.92 – 19513.68
long-term rating	11.82	9.08 – 15.63		
rater sex [M]	0.92	0.58 – 1.47	1.24	0.73 – 2.08
long-term rating:rater sex [M]	1.07	0.84 – 1.41		
attractiveness rating			12.20	9.47 – 15.87
attractiveness rating:rater sex [M]			1.38	1.08 – 1.81
Random effects	***Estimate***	***CI (89%)***	***Estimate***	***CI (89%)***
sd [Intercept] participant	0.98	0.72 – 1.26	1.42	1.12 – 1.75
sd [attractiveness rating] participant			0.22	0.03 – 0.46
sd [long-term rating] participant	0.28	0.05 – 0.49		
sd [Intercept] partner	0.57	0.27 – 0.84	0.22	0.02 – 0.49
N	$59_{\text{participant}}$ 58_{partner}		$59_{\text{participant}}$ 58_{partner}	
Observations	481		481	

Supplementary Table 5 – Model table for the ordinal regressions between olfactory attractiveness rating and long-term rating. Dependent variables are in bold.

	Olfactory attractiveness rating		**Olfactory long-term rating**	
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Threshold.1.	0.00	0.00 – 0.00	0.00	0.00 – 0.00
Threshold.2.	0.02	0.02 – 0.04	0.04	0.02 – 0.06
Threshold.3.	0.26	0.18 – 0.39	0.36	0.23 – 0.55
Threshold.4.	2.60	1.79 – 3.76	4.93	3.20 – 7.70
Threshold.5.	31.57	20.24 – 50.33	96.52	55.14 – 175.00
Threshold.6.	534.49	288.02 – 1027.61	5005.33	2012.81 – 13620.72
long-term rating	9.96	8.02 – 12.52		
rater sex [M]	1.20	0.79 – 1.81	1.11	0.70 – 1.78
long-term rating:rater sex [M]	0.90	0.72 – 1.12		
attractiveness rating			10.20	7.86 – 13.41
attractiveness rating:rater sex [M]			1.21	0.88 – 1.69
Random effects	*Estimate*	*CI (89%)*	*Estimate*	*CI (89%)*
sd [Intercept] participant	0.93	0.71 – 0.18	1.22	0.96 – 1.52
sd [attractiveness rating] participant			0.71	0.54 – 0.90
sd [long-term rating] participant	0.26	0.08 – 0.44		
sd [Intercept] partner	0.27	0.04 – 0.54	0.23	0.02 – 0.49
N	$66_{participant}$ $67_{partner}$		$66_{participant}$ $67_{partner}$	
Observations	523		523	

Supplementary Table 6 – Effect sizes for the ordinal regressions between attractiveness rating and long-term rating per modality.

Modality	*Dependent*	*Predictor*	*Rater sex*	*Median OR*	*CrI 89%*	*pd*	*d*	*N*
visual	attractiveness	long-term	female	8.14 [1.30]	6.33; 10.61	1	1.16 [0.09]	482
visual	attractiveness	long-term	male	7.86 [1.18]	6.23; 10.11	1	1.14 [0.08]	
visual	long-term	attractiveness	female	7.11 [1.31]	5.27; 9.68	1	1.08 [0.10]	
visual	long-term	attractiveness	male	14.04 [2.85]	10.22; 19.60	1	1.46 [0.11]	
auditory	attractiveness	long-term	female	11.82 [1.99]	9.08; 15.63	1	1.36 [0.09]	481
auditory	attractiveness	long-term	male	12.75 [2.08]	9.88; 16.89	1	1.40 [0.09]	
auditory	long-term	attractiveness	female	12.20 [1.94]	9.47; 15.87	1	1.38 [0.09]	
auditory	long-term	attractiveness	male	16.95 [2.99]	12.89; 22.66	1	1.56 [0.10]	
olfactory	attractiveness	long-term	female	9.96 [1.38]	8.02; 12.52	1	1.27 [0.08]	523
olfactory	attractiveness	long-term	male	8.93 [1.30]	7.15; 11.47	1	1.21 [0.08]	
olfactory	long-term	attractiveness	female	10.2 [1.70]	7.86; 13.41	1	1.28 [0.09]	
olfactory	long-term	attractiveness	male	12.36 [2.40]	9.12; 17.03	1	1.39 [0.11]	

Supplementary Table 7 – Model table for the independent logistic regressions, separately testing the effect of attractiveness in each modality on propensity to date again.

	Propensity to date again					
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Intercept	0.63	0.39 – 1.04	0.39	0.22 – 0.69	0.27	0.16 – 0.46
rater sex [M]	1.63	0.92 – 2.81	1.44	0.77 – 2.64	1.81	0.99 – 3.27
visual attractiveness	2.01	1.59 – 2.61				
rater sex [M]:visual attractiveness	1.45	1.04 – 2.05				
auditory attractiveness			1.26	0.98 – 1.65		
rater sex [M]:auditory attractiveness			1.03	0.74 – 1.44		
olfactory attractiveness					0.82	0.66 – 0.99
rater sex [M]:olfactory attractiveness					1.33	1.01 – 1.76
Random effects	*Estimate*	*CI (89%)*	*Estimate*	*CI (89%)*	*Estimate*	*CI (89%)*
sd [Intercept] participant	0.98	0.60 – 1.40	1.24	0.85 – 1.68	1.28	0.92 – 1.69
sd [attractiveness rating] participant	0.23	0.02 – 0.53	0.36	0.07 – 0.65	0.14	0.01 – 0.34
sd [Intercept] partner	1.10	0.74 – 1.51	1.55	1.14 – 2.02	1.51	1.14 – 1.95
N	$58_{\text{participant}}$ 59_{partner}		$59_{\text{participant}}$ 58_{partner}		$67_{\text{participant}}$ 67_{partner}	
Observations	482		481		533	

Supplementary Table 8 - Model table for the ordinal regressions between auditory and visual attractiveness ratings. Dependent variables are in bold.

	Auditory attractiveness		**Visual attractiveness**	
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Threshold.1.	0.01	0.01 – 0.03	0.03	0.02 – 0.06
Threshold.2.	0.10	0.06 – 0.16	0.38	0.21 – 0.66
Threshold.3.	0.44	0.27 – 0.71	1.47	0.84 – 2.58
Threshold.4.	1.62	1.01 – 2.62	7.58	4.24 – 13.63
Threshold.5.	7.15	4.40 – 11.87	40.18	21.27 – 77.12
Threshold.6.	53.99	29.92 – 100.41	360.35	158.86 – 896.16
visual attractiveness	1.30	1.09 – 1.56		
rater sex [M]	1.30	0.77 – 2.21	1.29	0.71 – 2.31
visual attractiveness:rater sex [M]	1.06	0.83 – 1.36		
auditory attractiveness			1.25	1.04 – 1.52
auditory attractiveness:rater sex [M]			1.02	0.80 – 1.29
Random effects	*Estimate*	*CI (89%)*	*Estimate*	*CI (89%)*
sd [Intercept] participant	1.16	0.84 – 1.54	0.70	0.35 – 1.07
sd [visual attractiveness] participant			0.17	0.01 – 0.39
sd [auditory attractiveness] participant	0.10	0.00 – 0.28		
sd [Intercept] partner	1.60	1.25 – 2.03	1.25	0.94 – 1.63
N	58 $_{participant}$ 58 $_{partner}$		58 $_{participant}$ 58 $_{partner}$	
Observations	473		473	

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Supplementary Table 9 - Model table for the ordinal regressions between olfactory and visual attractiveness ratings. Dependent variables are in bold.

	Olfactory attractiveness		**Visual attractiveness**	
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Threshold.1.	0.04	0.02 – 0.06	0.04	0.02 – 0.07
Threshold.2.	0.19	0.12 – 0.32	0.38	0.21 – 0.65
Threshold.3.	0.65	0.40 – 1.06	1.42	0.81 – 2.47
Threshold.4.	1.97	1.21 – 3.19	6.66	3.77 – 11.87
Threshold.5.	8.52	5.16 – 14.27	36.02	19.30 – 68.75
Threshold.6.	49.60	27.83 – 92.77	332.24	145.70 – 823.36
visual attractiveness	1.24	1.04 – 1.47		
rater sex [M]	1.52	0.89 – 2.59	1.25	0.69 – 2.23
visual attractiveness:rater sex [M]	0.99	0.79 – 1.26		
olfactory attractiveness			1.21	1.03 – 1.42
olfactory attractiveness:rater sex [M]			0.99	0.79 – 1.23
Random effects	**Estimate**	**CI (89%)**	**Estimate**	**CI (89%)**
sd [Intercept] participant	0.93	0.63 – 1.29	1.15	0.84 – 1.51
sd [visual attractiveness] participant	0.12	0.00 – 0.32		
sd [olfactory attractiveness] participant			0.10	0.00 – 0.29
sd [Intercept] partner	1.18	0.87 – 1.54	1.56	1.22 – 1.98
N	$58_{\text{participant}}$ 59_{partner}		$58_{\text{participant}}$ 59_{partner}	
Observations	465		465	

Supplementary Table 10 - Model table for the ordinal regressions between olfactory and auditory attractiveness ratings. Dependent variables are in bold.

	Olfactory attractiveness		**Auditory attractiveness**	
Predictors	*Odds Ratios*	*CI (89%)*	*Odds Ratios*	*CI (89%)*
Threshold.1.	0.04	0.02 – 0.07	0.02	0.01 – 0.03
Threshold.2.	0.23	0.14 – 0.36	0.12	0.07 – 0.19
Threshold.3.	0.76	0.48 – 1.19	0.53	0.34 – 0.83
Threshold.4.	2.18	1.37 – 3.46	1.92	1.23 – 3.02
Threshold.5.	8.99	5.57 – 14.69	8.46	5.30 – 13.72
Threshold.6.	52.94	29.91 – 95.91	60.81	33.64 – 112.95
auditory attractiveness	1.20	1.00 – 1.44		
rater sex [M]	1.56	0.93 – 2.58	1.27	0.77 – 2.11
auditory attractiveness:rater sex [M]	0.93	0.74 – 1.18		
olfactory attractiveness			1.15	0.98 – 1.34
olfactory attractiveness:rater sex [M]			0.98	0.79 – 1.21
Random effects	*Estimate*	*CI (89%)*	*Estimate*	*CI (89%)*
sd [Intercept] participant	0.92	0.67 – 1.18	0.76	0.52 – 1.02
sd [olfactory attractiveness] participant			0.10	0.01 – 0.25
sd [auditory attractiveness] participant	0.11	0.01 – 0.27		
sd [Intercept] partner	1.10	0.86 – 1.37	1.17	0.92 – 1.45
N	59 $_{participant}$ 58 $_{partner}$		59 $_{participant}$ 58 $_{partner}$	
Observations	465		465	

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Supplementary Table 11 – Model table for the partial logistic regression model, testing the effect of attractiveness in each modality on propensity to date again.

	Propensity to date again	
Predictors	*Odds Ratios*	*CI (89%)*
Intercept	0.59	0.35 – 1.00
rater sex [M]	1.62	0.90 – 2.89
visual attractiveness	2.25	1.71 – 3.06
olfactory attractiveness	0.73	0.57 – 0.92
auditory attractiveness	1.17	0.89 – 1.55
rater sex [M]:visual attractiveness	1.38	0.96 – 2.03
rater sex [M]:olfactory attractiveness	1.27	0.93 – 1.75
rater sex [M]:auditory attractiveness	1.12	0.78 – 1.61
Random effects	*Estimate*	*CI (89%)*
sd [Intercept] participant	1.12	0.50 – 1.79
sd [visual attractiveness] participant	0.30	0.01 – 0.77
sd [auditory attractiveness] participant	0.41	0.03 – 0.87
sd [olfactory attractiveness] participant	0.21	0.01 – 0.56
sd [Intercept] partner	1.12	0.58 – 1.76
N	$58_{participant}$ $58_{partner}$	
Observations	457	

Appendix C: Supplementary Material for Chapter 5

Supplementary Table 1 - Model table for the Bayesian mixed model that predicts RT from Pre-date attractiveness rating and Gender.

	RT	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.52	-1.18 – 2.22
Gender[Female]	0.34	-1.37 – 2.05
AttractivenessDistractor	1.44	0.18 – 2.69
AttractivenessProbe	-1.09	-2.51 – 0.29
Gender[Female]: AttractivenessDistractor	-0.41	-1.68 – 0.86
Gender[Female]: AttractivenessProbe	1.40	-0.02 – 2.82
Random Effects		
σ^2	2588.90	
$\tau_{00\ Subject}$	0.97	
$\tau_{11\ Subject:AttractivenessDistractor}$	7.60	
$\tau_{11\ Subject:AttractivenessProbe}$	13.47	
$N_{Subject}$	57	
Observations	4831	

Notes: Gender was sum-coded, while Pre-date attractiveness ratings were centered around 4 (the middle option).

Supplementary Table 2 - Model table for the Bayesian mixed model that predicts RT from Post-date attractiveness ratings and Gender.

	RT	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.36	-1.42 – 2.14
Gender[Female]	-0.24	-2.06 – 1.64
AttractivenessDistractor	1.89	0.66 – 3.11
AttractivenessProbe	-0.89	-2.44 – 0.63
Gender[Female]: AttractivenessDistractor	0.34	-0.89 – 1.59
Gender[Female]: AttractivenessProbe	1.16	-0.41 – 2.71
Random Effects		
σ^2	2580.38	
$\tau_{00\ Subject}$	1.29	
$\tau_{11\ Subject:AttractivenessDistractor}$	1.92	
$\tau_{11\ Subject:AttractivenessProbe}$	13.50	
$N_{Subject}$	56	
Observations	3251	

Notes: Gender was sum-coded, while Post-date attractiveness ratings were centered around 4 (the middle option).

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Table S3 - Model table for the Bayesian mixed model that predicts RT from Date outcome and Gender.

	RT	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.82	-1.14 – 2.82
Gender[Female]	0.97	-1.08 – 2.99
DateAgainProbe[yes]	-0.81	-3.16 – 1.45
DateAgainDistractor[yes]	2.20	0.22 – 4.24
Gender[Female]:DateAgainProbe[yes]	2.31	0.00 – 4.66
Gender[Female]:DateAgainDistractor[yes]	0.62	-1.42 – 2.67
Random Effects		
σ^2	2588.97	
$\tau_{00\ Subject}$	1.60	
$\tau_{11\ Subject:DateAgainProbe[yes]}$	26.92	
$\tau_{11\ Subject:DateAgainDistractor[yes]}$	4.71	
$N_{Subject}$	56	
Observations	3251	

Notes: All predictors were sum-coded.

Supplementary Table 4 - Model table for the Bayesian zero-one inflated beta regression predicting Looking time proportion to the left picture from Pre-date attractiveness rating and Gender.

	Left bias	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.97	0.91 – 1.04
phi_Intercept	5.44	4.52 – 6.56
zoi_Intercept	0.02	0.01 – 0.06
coi_Intercept	0.86	0.43 – 1.69
AttractivenessLeft	1.39	1.34 – 1.44
Gender[Female]	1.00	0.94 – 1.06
AttractivenessRight	0.69	0.67 – 0.71
AttractivenessLeft:Gender[Female]	0.98	0.95 – 1.02
Gender[Female]:AttractivenessRight	1.01	0.98 – 1.05
phi_AttractivenessLeft	0.96	0.90 – 1.02
phi_Gender[Female]	0.97	0.80 – 1.17
phi_AttractivenessRight	0.97	0.91 – 1.03
phi_AttractivenessLeft:Gender[Female]	1.02	0.95 – 1.09
phi_Gender[Female]:AttractivenessRight	1.02	0.96 – 1.09
zoi_AttractivenessLeft	1.19	1.00 – 1.43
zoi_Gender[Female]	1.10	0.55 – 2.21
zoi_AttractivenessRight	1.58	1.32 – 1.92
zoi_AttractivenessLeft:Gender[Female]	0.98	0.83 – 1.17
zoi_Gender[Female]:AttractivenessRight	0.93	0.77 – 1.12
coi_AttractivenessLeft	1.93	1.43 – 2.67
coi_Gender[Female]	0.85	0.48 – 1.52
coi_ AttractivenessRight	0.42	0.28 – 0.61
coi_AttractivenessLeft:Gender[Female]	0.86	0.63 – 1.17
coi_Gender[Female]:AttractivenessRight	1.40	0.96 – 2.12
Random Effects		
σ^2	0.01	
$\tau_{00\ Subject}$	0.06	
$N_{Subject}$	35	
Observations	1569	

Notes: Gender was sum-coded, while Pre-date attractiveness ratings were centered around 4 (the middle option). Estimates for the predictors were exponentiated, so that they represent Odds Ratios for the beta, coi and zoi parameters.

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Supplementary Table 5 – Slope estimates at different levels of Pre-date attractiveness rating (both left and right picture).

Pre-date attractiveness rating left picture	Median estimate [MAD]	89% CrI	Probability of direction
-3	0.068 [.0028]	0.063, 0.072	1.00
-2	0.077 [.0039]	0.071, 0.083	1.00
-1	0.084 [.0048]	0.077, 0.092	1.00
0	0.087 [.0050]	0.079, 0.095	1.00
1	0.083 [.0044]	0.076, 0.090	1.00
2	0.074 [.0032]	0.069, 0.079	1.00
3	0.063 [.0020]	0.059, 0.066	1.00
Pre-date attractiveness rating right picture	**Median estimate [MAD]**	**89% CrI**	**Probability of direction**
-3	-0.078 [.0025]	-0.081, -0.073	1.00
-2	-0.088 [.0038]	-0.094, -0.082	1.00
-1	-0.096 [.0046]	-0.103, -0.088	1.00
0	-0.098 [.0048]	-0.106, -0.091	1.00
1	-0.091 [.0041]	-0.098, -0.085	1.00
2	-0.077 [.0028]	-0.082, -0.073	1.00
3	-0.061 [.0019]	-0.064, -0.058	1.00

Table S6 – Difference in slope between women and men at different levels of Pre-date attractiveness rating (both left and right picture).

Pre-date attractiveness rating left picture	Median estimate [MAD]	89% CrI	Probability of direction
-3	-.0052 [.0055]	-0.014, 0.004	0.83
-2	-.0075 [.0076]	-0.021, 0.004	0.84
-1	-.0094 [.0094]	-0.025, 0.006	0.84
0	-.0097 [.0100]	-0.026, 0.007	0.83
1	-.0075 [.0088]	-0.021, 0.007	0.81
2	-.0043 [.0064]	-0.015, 0.006	0.75
3	-.0013 [.0040]	-0.008, 0.005	0.64
Pre-date attractiveness rating right picture	**Median estimate [MAD]**	**89% CrI**	**Probability of direction**
-3	.000 [.005]	-0.009, 0.010	0.50
-2	.001 [.008]	-0.014, 0.015	0.54
-1	.005 [.009]	-0.014, 0.022	0.70
0	.012 [.010]	-0.006, 0.032	0.91
1	.013 [.008]	-0.002, 0.030	0.95
2	.008 [.006]	-0.003, 0.020	0.94
3	.003 [.004]	-0.004, 0.011	0.82

Supplementary Table 7 - Model table for the Bayesian zero-one inflated beta regression predicting Looking time proportion to the left picture from Post-date attractiveness rating and Gender.

	Left bias	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.93	0.85 – 1.01
phi_Intercept	4.49	3.62 – 5.53
zoi_Intercept	0.01	0.00 – 0.04
coi_Intercept	0.70	0.18 – 2.21
AttractivenessLeft	1.21	1.15 – 1.26
Gender[Female]	1.01	0.93 – 1.09
AttractivenessRight	0.79	0.75 – 0.82
AttractivenessLeft:Gender[Female]	0.98	0.94 – 1.02
Gender[Female]:AttractivenessRight	1.07	1.02 – 1.11
phi_AttractivenessLeft	0.90	0.84 – 0.97
phi_Gender[Female]	0.94	0.76 – 1.16
phi_AttractivenessRight	1.02	0.95 – 1.10
phi_AttractivenessLeft:Gender[Female]	1.03	0.95 – 1.10
phi_Gender[Female]:AttractivenessRight	1.00	0.93 – 1.07
zoi_AttractivenessLeft	1.26	0.99 – 1.63
zoi_Gender[Female]	1.09	0.51 – 2.31
zoi_AttractivenessRight	1.60	1.26 – 2.08
zoi_AttractivenessLeft:Gender[Female]	1.07	0.84 – 1.36
zoi_Gender[Female]:AttractivenessRight	0.79	0.61 – 1.00
coi_AttractivenessLeft	1.84	1.19 – 2.95
coi_Gender[Female]	0.98	0.46 – 2.23
coi_ AttractivenessRight	0.57	0.36 – 0.87
coi_AttractivenessLeft:Gender[Female]	0.88	0.56 – 1.45
coi_Gender[Female]:AttractivenessRight	1.14	0.73 – 1.80
Random Effects		
σ^2	0.01	
$\tau_{00\ Subject}$	0.06	
$N_{Subject}$	35	
Observations	1009	

Notes: Gender was sum-coded, while Post-date attractiveness ratings were centered around 4 (the middle option). Estimates for the predictors were exponentiated, so that they represent Odds Ratios for the beta, coi and zoi parameters.

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Supplementary Table 8 - Model table for the Bayesian zero-one inflated beta regression predicting Looking time proportion to the left picture from Date outcome and Gender.

	Left bias	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.87	0.80 – 0.96
phi_Intercept	4.18	3.38 – 5.21
zoi_Intercept	0.02	0.00 – 0.05
coi_Intercept	0.58	0.19 – 1.50
DateAgainLeft[Yes]	0.79	0.73 – 0.84
Gender[Female]	1.03	0.93 – 1.13
DateAgainRight[Yes]	1.32	1.24 – 1.41
DateAgainLeft[Yes]:Gender[Female]	1.03	0.96 – 1.11
Gender[Female]:DateAgainRight[Yes]	0.98	0.91 – 1.04
phi_DateAgainLeft[Yes]	1.16	1.05 – 1.29
phi_Gender[Female]	1.03	0.84 – 1.27
phi_DateAgainRight[Yes]	0.92	0.83 – 1.03
phi_DateAgainLeft[Yes]:Gender[Female]	0.98	0.88 – 1.08
phi_Gender[Female]:DateAgainRight[Yes]	0.88	0.79 – 0.97
zoi_DateAgainLeft[Yes]	0.73	0.52 – 1.03
zoi_Gender[Female]	1.03	0.49 – 2.15
zoi_DateAgainRight[Yes]	0.49	0.34 – 0.69
zoi_DateAgainLeft[Yes]:Gender[Female]	0.81	0.57 – 1.13
zoi_Gender[Female]:DateAgainRight[Yes]	1.27	0.89 – 1.79
coi_DateAgainLeft[Yes]	0.43	0.23 – 0.83
coi_Gender[Female]	0.85	0.42 – 1.89
coi_DateAgainRight[Yes]	3.18	1.67 – 6.18
coi_DateAgainLeft[Yes]:Gender[Female]	1.62	0.86 – 3.08
coi_Gender[Female]:DateAgainRight[Yes]	1.38	0.73 – 2.75
Random Effects		
σ^2	0.01	
$\tau_{00\ Subject}$	0.06	
$N_{Subject}$	35	
Observations	1009	

Notes: All predictors were sum-coded. Estimates for the predictors were exponentiated, so that they represent Odds Ratios for the beta, coi and zoi parameters.

Supplementary Table 9 - Model table for the Bayesian mixed model that predicts RT from Pre-date attractiveness ratings and Gender. This analysis was performed on the complete cases-dataset.

	RT	
Predictors	**Estimates**	**CI (95%)**
Intercept	1.19	-0.93 – 3.34
Gender[Female]	0.74	-1.49 – 2.92
AttractivenessDistractor	2.06	0.61 – 3.48
AttractivenessProbe	-1.11	-2.83 – 0.65
Gender[Female]: AttractivenessDistractor	-0.10	-1.52 – 1.28
Gender[Female]: AttractivenessProbe	2.06	0.28 – 3.79
Random Effects		
σ^2	2580.38	
$\tau_{00\ Subject}$	2.29	
$\tau_{11\ Subject:AttractivenessDistractor}$	5.24	
$\tau_{11\ Subject:AttractivenessProbe}$	19.83	
$N_{Subject}$	55	
Observations	3198	

Notes: Gender was sum-coded, while Pre-date attractiveness ratings were centered around 4 (the middle option).

Supplementary Table 10 - Model table for the Bayesian mixed model that predicts RT from Post-date attractiveness ratings and Gender. This analysis was performed on the complete cases-dataset.

	RT	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.38	-1.38 – 2.19
Gender[Female]	-0.27	-2.19 – 1.63
AttractivenessDistractor	1.78	0.55 – 3.01
AttractivenessProbe	-0.91	-2.48 – 0.64
Gender[Female]: AttractivenessDistractor	0.46	-0.77 – 1.68
Gender[Female]: AttractivenessProbe	1.19	-0.38 – 2.75
Random Effects		
σ^2	2581.06	
$\tau_{00\ Subject}$	1.30	
$\tau_{11\ Subject:AttractivenessDistractor}$	1.73	
$\tau_{11\ Subject:AttractivenessProbe}$	13.89	
$N_{Subject}$	55	
Observations	3198	

Notes: Gender was sum-coded, while Post-date attractiveness ratings were centered around 4 (the middle option).

Supplementary Table 11 - Model table for the Bayesian mixed model that predicts RT from Date outcome and Gender. This analysis was performed on the complete cases-dataset.

	RT	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.80	-1.19 – 2.77
Gender[Female]	1.01	-1.04 – 3.05
DateAgainProbe[yes]	-0.93	-3.31 – 1.35
DateAgainDistractor[yes]	1.97	0.01 – 3.97
Gender[Female]:DateAgainProbe[yes]	2.39	0.04 – 4.70
Gender[Female]:DateAgainDistractor[yes]	0.87	-1.14 – 2.86
Random Effects		
σ^2	2590.00	
$\tau_{00\ Subject}$	1.62	
$\tau_{11\ Subject:DateAgainProbe[yes]}$	26.86	
$\tau_{11\ Subject:DateAgainDistractor[yes]}$	4.46	
$N_{Subject}$	55	
Observations	3198	

Notes: All predictors were sum-coded.

Supplementary Table 12 - Model table for the Bayesian zero-one inflated beta regression predicting Looking time proportion to the left picture from Pre-date attractiveness rating and Gender. This analysis was performed on the complete cases-dataset.

	Left bias	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.95	0.88 – 1.03
phi_Intercept	5.64	4.55 – 7.03
zoi_Intercept	0.02	0.01 – 0.06
coi_Intercept	0.83	0.30 – 2.13
AttractivenessLeft	1.38	1.32 – 1.45
Gender[Female]	0.99	0.92 – 1.08
AttractivenessRight	0.70	0.67 – 0.72
AttractivenessLeft:Gender[Female]	1.00	0.95 – 1.04
Gender[Female]:AttractivenessRight	1.01	0.97 – 1.05
phi_AttractivenessLeft	0.95	0.87 – 1.04
phi_Gender[Female]	1.02	0.82 – 1.26
phi_AttractivenessRight	0.98	0.91 – 1.06
phi_AttractivenessLeft:Gender[Female]	0.98	0.90 – 1.07
phi_Gender[Female]:AttractivenessRight	1.07	1.00 – 1.16
zoi_AttractivenessLeft	1.13	0.89 – 1.44
zoi_Gender[Female]	1.04	0.51 – 2.11
zoi_AttractivenessRight	1.56	1.25 – 1.98
zoi_AttractivenessLeft:Gender[Female]	0.97	0.77 – 1.23
zoi_Gender[Female]:AttractivenessRight	0.83	0.65 – 1.04
coi_AttractivenessLeft	1.61	1.07 – 2.45
coi_Gender[Female]	0.83	0.42 – 1.77
coi_ AttractivenessRight	0.48	0.30 – 0.76
coi_AttractivenessLeft:Gender[Female]	0.84	0.56 – 1.32
coi_Gender[Female]:AttractivenessRight	1.22	0.77 – 2.00
Random Effects		
σ^2	0.01	
$\tau_{00\ Subject}$	0.06	
$N_{Subject}$	35	
Observations	1009	

Notes: Gender was sum-coded, while Pre-date attractiveness ratings were centered around 4 (the middle option). Estimates for the predictors were exponentiated, so that they represent Odds Ratios for the beta, coi and zoi parameters.

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Supplementary Table 13 - Model table for the Bayesian zero-one inflated beta regression predicting Looking time proportion to the left picture from Post-date attractiveness rating and Gender. This analysis was performed on the complete cases-dataset.

	Left bias	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.93	0.85 – 1.01
phi_Intercept	4.49	3.62 – 5.53
zoi_Intercept	0.01	0.00 – 0.04
coi_Intercept	0.70	0.18 – 2.21
AttractivenessLeft	1.21	1.15 – 1.26
Gender[Female]	1.01	0.93 – 1.09
AttractivenessRight	0.79	0.75 – 0.82
AttractivenessLeft:Gender[Female]	0.98	0.94 – 1.02
Gender[Female]:AttractivenessRight	1.07	1.02 – 1.11
phi_AttractivenessLeft	0.90	0.84 – 0.97
phi_Gender[Female]	0.94	0.76 – 1.16
phi_AttractivenessRight	1.02	0.95 – 1.10
phi_AttractivenessLeft:Gender[Female]	1.03	0.95 – 1.10
phi_Gender[Female]:AttractivenessRight	1.00	0.93 – 1.07
zoi_AttractivenessLeft	1.26	0.99 – 1.63
zoi_Gender[Female]	1.09	0.51 – 2.31
zoi_AttractivenessRight	1.60	1.26 – 2.08
zoi_AttractivenessLeft:Gender[Female]	1.07	0.84 – 1.36
zoi_Gender[Female]:AttractivenessRight	0.79	0.61 – 1.00
coi_AttractivenessLeft	1.84	1.19 – 2.95
coi_Gender[Female]	0.98	0.46 – 2.23
coi_ AttractivenessRight	0.57	0.36 – 0.87
coi_AttractivenessLeft:Gender[Female]	0.88	0.56 – 1.45
coi_Gender[Female]:AttractivenessRight	1.14	0.73 – 1.80
Random Effects		
σ^2	0.01	
$\tau_{00\ Subject}$	0.06	
$N_{Subject}$	35	
Observations	1009	

Notes: Gender was sum-coded, while Post-date attractiveness ratings were centered around 4 (the middle option). Estimates for the predictors were exponentiated, so that they represent Odds Ratios for the beta, coi and zoi parameters.

Supplementary Table 14 - Model table for the Bayesian zero-one inflated beta regression predicting Looking time proportion to the left picture from Date outcome rating and Gender. This analysis was performed on the complete cases-dataset.

	Left bias	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.87	0.80 – 0.96
phi_Intercept	4.19	3.37 – 5.21
zoi_Intercept	0.02	0.00 – 0.06
coi_Intercept	0.58	0.19 – 1.52
DateAgainLeft[Yes]	1.27	1.19 – 1.36
Gender[Female]	1.03	0.94 – 1.13
DateAgainRight[Yes]	0.76	0.71 – 0.81
DateAgainLeft[Yes]:Gender[Female]	0.97	0.90 – 1.04
Gender[Female]:DateAgainRight[Yes]	1.03	0.96 – 1.09
phi_DateAgainLeft[Yes]	0.86	0.78 – 0.95
phi_Gender[Female]	1.03	0.83 – 1.28
phi_DateAgainRight[Yes]	1.08	0.98 – 1.21
phi_DateAgainLeft[Yes]:Gender[Female]	1.03	0.92 – 1.14
phi_Gender[Female]:DateAgainRight[Yes]	1.14	1.03 – 1.27
zoi_DateAgainLeft[Yes]	1.37	0.97 – 1.94
zoi_Gender[Female]	1.04	0.49 – 2.16
zoi_DateAgainRight[Yes]	2.04	1.45 – 2.96
zoi_DateAgainLeft[Yes]:Gender[Female]	1.24	0.88 – 1.76
zoi_Gender[Female]:DateAgainRight[Yes]	0.80	0.56 – 1.13
coi_DateAgainLeft[Yes]	2.34	1.22 – 4.46
coi_Gender[Female]	0.84	0.42 – 1.93
coi_DateAgainRight[Yes]	0.31	0.16 – 0.59
coi_DateAgainLeft[Yes]:Gender[Female]	0.62	0.32 – 1.16
coi_Gender[Female]:DateAgainRight[Yes]	0.72	0.37 – 1.35
Random Effects		
σ^2	0.01	
$\tau_{00\ Subject}$	0.06	
$N_{Subject}$	35	
Observations	1009	

Notes: All predictors were sum-coded. Estimates for the predictors were exponentiated, so that they represent Odds Ratios for the beta, coi and zoi parameters.

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Appendix D: Supplementary Material for Chapter 6

Supplementary Table 1 - Model outputs for the Flange Size dot-probe.

	Kawan		Samboja		Sandy	
Predictors	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*
Intercept	-0.23	-9.95 – 9.36	-0.95	-10.69 – 8.64	-0.14	-9.80 – 9.68
Congruence [LargeFlanges]	-3.28	-19.79 – 13.37	3.90	-14.35 – 22.15	2.08	-15.99 – 19.99
ProbeLocation[Left]	5.08	-11.74 – 21.90	-6.61	-25.43 – 12.14	7.58	-10.45 – 25.68
Random Effects						
σ^2	178.89		301.29		258.61	
$\tau_{00\ Session}$	960.64		1735.80		2012.05	
Observations	133		131		140	

Note: all categorical independent variables were sum-to-zero coded.

Supplementary Table 2 - Model outputs for the Symmetry dot-probe.

	Kawan		Samboja		Sandy	
Predictors	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*
Intercept	-0.67	-10.29 – 8.90	-0.13	-9.87 – 9.54	-0.50	-10.16 – 9.31
Congruence [Symmetrical]	-2.10	-18.13 – 13.99	-3.82	-22.22 – 14.26	0.81	-17.21 – 18.90
ProbeLocation[Left]	12.09	-4.24 – 28.09	-7.11	-24.98 – 10.94	-1.11	-19.08 – 16.78
Random Effects						
σ^2	169.60		276.77		264.60	
$\tau_{00\ Session}$	2962.89		3146.86		4452.39	
Observations	152		142		154	

Note: all categorical independent variables were sum-to-zero coded.

Supplementary Table 3 - Model output for the Flange Size preference test.

	Preference	
Predictors	*Odds Ratios*	*CI (95%)*
Intercept	1.00	0.73 – 1.38
Color Flanged[Green]	0.67	0.52 – 0.91
Order[FlangedRedFirst]	0.88	0.67 – 1.18
Random Effects		
$\tau_{00\ Subject}$	0.11	
$\tau_{00\ Subject:Session}$	0.01	
$\tau_{11\ Subject:Color\ Flanged}$	0.09	
$N_{SubjectName}$	6	
Observations	570	

Note: all categorical independent variables were sum-to-zero coded.

Supplementary Table 4 - Model output for the Flange Size preference test, including vertical location.

	Preference	
Predictors	*Odds Ratios*	*CI (95%)*
Intercept	1.00	0.74 – 1.35
Color Flanged[Green]	0.65	0.49 – 0.90
Order[FlangedRedFirst]	0.86	0.65 – 1.15
Vertical_Location	16.97	9.35 – 30.66
Random Effects		
$\tau_{00\ Subject}$	0.27	
$\tau_{00\ Subject:Session}$	0.13	
$\tau_{11\ Subject:Color\ Flanged}$	0.26	
$N_{SubjectName}$	6	
Observations	570	

Note: all categorical independent variables were sum-to-zero coded. Continuous independent variable Vertical_Location was centralized around 0.5.

Appendix E: Supplementary Material for Chapter 7

Supplementary Table 1 – Model tables for the binary logistic regressions that predict first fixation on flanged males for Experiment 1 and 2.

	Experiment 1		Experiment 2	
Predictors	First Fixation Flanged		First Fixation Flanged	
	Odds Ratios	*CI (95%)*	*Odds Ratios*	*CI (95%)*
Intercept	1.54	0.63 – 3.30	1.40	0.77 – 2.41
FlangedLocation[Left]	2.14	1.57 – 2.99	1.51	1.11 – 2.07
Random Effects				
$Intercept_{Participant}$	0.74		0.38	
$Intercept_{Participant:Session}$	0.24		0.51	
$N_{Session}$	45		70	
$N_{Participant}$	4		4	
Observations	195		186	

Note: Predictors were sum-coded.

Supplementary Table 2 – Model tables for the zero-one inflated beta regressions that predict looking time bias to flanged males for Experiment 1 and 2.

	Experiment 1		Experiment 2	
	Looking time bias		Looking time bias	
Predictors	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*
Intercept	1.09	0.72 – 1.59	1.29	0.89 – 1.83
phi_Intercept	4.07	1.78 – 8.18	4.36	2.44 – 7.43
zoi_Intercept	0.31	0.13 – 0.94	0.39	0.11 – 1.74
coi_Intercept	2.82	0.57 – 11.36	2.91	0.83 – 12.12
FlangedLocation[Left]	0.99	0.84 – 1.17	0.93	0.79 – 1.10
phi_FlangedLocation[Left]	0.96	0.74 – 1.24	1.25	0.96 – 1.62
zoi_FlangedLocation[Left]	1.23	0.88 – 1.73	0.88	0.60 – 1.26
coi_FlangedLocation[Left]	1.31	0.64 – 2.72	1.39	0.69 – 2.85
Random Effects				
$Intercept_{Participant}$	0.26		0.24	
$phi\_Intercept_{Participant}$	0.55		0.36	
$zoi\_Intercept_{Participant}$	0.73		1.35	
$coi\_Intercept_{Participant}$	1.25		0.79	
$Intercept_{Participant:Session}$	0.21		0.19	
$phi\_Intercept_{Participant:Session}$	0.27		0.30	
$zoi\_Intercept_{Participant:Session}$	0.53		0.87	
$coi\_Intercept_{Participant:Session}$	0.55		1.44	
$N_{Session}$	44		70	
$N_{Participant}$	4		4	
Observations	195			

Note: Predictors were sum-coded.

Supplementary Table 3 – Model table for the binary logistic regression that predicts first fixation to the left as a function of male morph on the left and right side of the screen.

	First Fixation Left	
Predictors	*Odds Ratios*	*CI (95%)*
Intercept	1.46	0.35 – 5.29
Morph Left [Flanged]	1.19	0.88 – 1.61
Morph Right [Flanged]	0.74	0.54 – 1.01
Morph Left [Flanged]: Morph Right [Flanged]	1.01	0.74 – 1.38
Random Effects		
$Intercept_{Participant}$	1.89	
$Intercept_{Participant:Session}$	0.43	
$N_{Session}$	71	
$N_{Participant}$	4	
Observations	274	

Note: Predictors were sum-coded.

Supplementary Table 4 - Model table for the zero-one inflated beta regression that predicts total attention to the left as a function of male morph on the left and right side of the screen.

	Looking time bias left	
Predictors	*Estimates*	*CI (95%)*
Intercept	0.93	0.45 – 1.93
phi_Intercept	5.07	3.07 – 7.95
zoi_Intercept	0.42	0.13 – 1.77
coi_Intercept	1.81	0.17 – 19.01
Morph Left [Flanged]	1.15	1.00 – 1.31
Morph Right [Flanged]	0.84	0.73 – 0.96
Morph Left [Flanged]: Morph Right [Flanged]	1.00	0.87 – 1.15
phi_Morph Left [Flanged]	1.09	0.86 – 1.37
phi_Morph Right [Flanged]	0.87	0.69 – 1.08
phi_Morph Left [Flanged]: Morph Right [Flanged]	0.97	0.76 – 1.26
zoi_Morph Left [Flanged]	0.97	0.72 – 1.30
zoi_Morph Right [Flanged]	1.08	0.80 – 1.45
zoi_Morph Left [Flanged]: Morph Right [Flanged]	1.02	0.75 – 1.36
coi_Morph Left [Flanged]	2.74	1.21 – 6.94
coi_Morph Right [Flanged]	0.75	0.33 – 1.66
coi_Morph Left [Flanged]: Morph Right [Flanged]	1.12	0.49 – 2.61
Random Effects		
$Intercept_{Participant}$	0.69	
$phi\_Intercept_{Participant}$	0.27	
$zoi\_Intercept_{Participant}$	1.30	
$coi\_Intercept_{Participant}$	3.37	
$Intercept_{Participant:Session}$	0.26	
$phi\_Intercept_{Participant:Session}$	0.27	
$zoi\_Intercept_{Participant:Session}$	0.32	
$coi\_Intercept_{Participant:Session}$	1.29	
$N_{Session}$	71	
$N_{Participant}$	4	
Observations	274	

Note: Predictors were sum-coded.

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Supplementary Table 5 – Pairwise contrasts for each combination of stimuli for (I) the binary logistic regression that predicts first fixation to the left and (II) the zero-one inflated beta regression that predicts total attention to the left as a function of male morph on the left and right side of the screen.

Contrast		First fixation (binary logistic regression)			Total attention (zero-one inflated beta regression)		
		Median estimate	89% credible interval	Probability of direction	Median estimate	89% credible interval	Probability of direction
FM-FM	FM-UFM	-0.064	-0.140; 0.012	0.908	-0.064	-0.140; 0.012	0.908
FM-FM	UFM-FM	0.101	0.027; 0.179	0.988	0.101	0.027; 0.179	0.988
FM-FM	UFM-UFM	0.023	-0.060; 0.111	0.675	0.023	-0.060; 0.111	0.675
FM-UFM	UFM-UFM	0.088	0.013; 0.164	0.970	0.088	0.013; 0.164	0.970
UFM-FM	FM-UFM	-0.165	-0.227; -0.104	1.000	-0.165	-0.227; -0.104	1.000
UFM-FM	UFM-UFM	-0.077	-0.151; -0.005	0.958	-0.077	-0.151; -0.005	0.958

Supplementary Table 6 - Model tables for the zero-one inflated beta regressions that predict total attention to specific male individuals per female participant.

	Samboja		Sandy		Wattana	
Predictors	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*	*Estimates*	*CI (95%)*
Intercept	1.00	0.84 – 1.19	1.00	0.83 – 1.21	1.00	0.81 – 1.23
phi_Intercept	4.45	3.19 – 6.45	4.87	2.83 – 8.52	4.75	3.29 – 6.94
zoi_Intercept	0.20	0.08 – 0.38	0.91	0.43 – 1.93	0.84	0.44 – 1.64
coi_Intercept	1.00	0.39 – 2.60	1.00	0.57 – 1.76	1.00	0.56 – 1.79
focus[Bako]	1.14	0.83 – 1.54	1.27	0.92 – 1.75	1.39	0.97 – 1.95
focus[Jingga]	0.83	0.62 – 1.11	1.04	0.77 – 1.44	0.98	0.67 – 1.44
focus[Sibu]	1.14	0.85 – 1.53	0.78	0.54 – 1.15	0.93	0.66 – 1.32
distractor[Bako]	0.88	0.65 – 1.20	0.79	0.58 – 1.08	0.72	0.51 – 1.01
distractor[Jingga]	1.21	0.90 – 1.62	0.95	0.70 – 1.29	1.02	0.69 – 1.49
distractor[Sibu]	0.87	0.66 – 1.18	1.28	0.87 – 1.85	1.07	0.76 – 1.50
phi_focus[Bako]	0.72	0.44 – 1.15	1.00	0.54 – 1.83	1.39	0.77 – 2.46
phi_focus[Jingga]	0.76	0.46 – 1.28	1.94	0.97 – 3.81	0.59	0.34 – 1.01
phi_focus[Sibu]	0.88	0.54 – 1.43	0.62	0.34 – 1.15	1.44	0.82 – 2.47
phi_distractor[Bako]	0.71	0.43 – 1.16	1.00	0.53 – 1.85	1.40	0.77 – 2.46
phi_distractor[Jingga]	0.77	0.46 – 1.30	1.95	0.97 – 3.77	0.59	0.34 – 1.01
phi_distractor[Sibu]	0.88	0.55 – 1.43	0.62	0.33 – 1.14	1.44	0.82 – 2.45
zoi_focus[Bako]	0.72	0.31 – 1.58	1.16	0.60 – 2.30	1.36	0.72 – 2.63
zoi_focus[Jingga]	1.39	0.63 – 2.99	1.61	0.81 – 3.30	1.02	0.52 – 1.97
zoi_focus[Sibu]	1.09	0.48 – 2.38	1.16	0.58 – 2.31	0.94	0.48 – 1.84
zoi_distractor[Bako]	0.72	0.31 – 1.55	1.17	0.59 – 2.27	1.37	0.71 – 2.67
zoi_distractor[Jingga]	1.38	0.62 – 2.98	1.61	0.82 – 3.22	1.02	0.52 – 1.96
zoi_distractor[Sibu]	1.08	0.48 – 2.38	1.16	0.58 – 2.30	0.94	0.48 – 1.80
coi_focus[Bako]	0.81	0.22 – 2.91	1.74	0.76 – 4.14	1.21	0.50 – 2.91
coi_focus[Jingga]	0.53	0.15 – 1.78	0.73	0.31 – 1.70	1.26	0.53 – 3.10
coi_focus[Sibu]	2.44	0.72 – 8.90	1.52	0.66 – 3.64	1.36	0.56 – 3.30
coi_distractor[Bako]	1.23	0.35 – 4.46	0.57	0.24 – 1.31	0.83	0.35 – 1.98
coi_distractor[Jingga]	1.87	0.56 – 6.41	1.36	0.59 – 3.23	0.79	0.32 – 1.90
coi_distractor[Sibu]	0.42	0.11 – 1.38	0.66	0.27 – 1.53	0.74	0.30 – 1.79
Random Effects						
$\text{Intercept}_{\text{Session}}$	0.07		0.09		0.09	
$\text{phi\_Intercept}_{\text{Session}}$	0.39		0.81		0.26	
$\text{zoi\_Intercept}_{\text{Session}}$	1.05		1.34		1.05	
$\text{coi\_Intercept}_{\text{Session}}$	0.46		0.26		0.27	
N_{Session}	20		17		18	
Observations	134		142		134	

Note: Predictors were sum-coded.

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Supplementary Table 7 – Pairwise contrasts for the zero-one inflated beta regressions that predict total attention to specific male individuals per female participant. Pd = probability of direction.

Contrast		Samboja			Sandy			Wattana		
		Median estimate	89% credible interval	*pd*	Median estimate	89% credible interval	*pd*	Median estimate	89% credible interval	*pd*
Bako	Jingga	0.084	-0.019; 0.186	0.905	0.123	-0.008; 0.254	0.931	0.038	-0.097; 0.177	0.668
Bako	Sibu	-0.043	-0.147; 0.057	0.749	0.073	-0.055; 0.209	0.806	0.038	-0.095; 0.174	0.672
Bako	Wousan	0.034	-0.073; 0.142	0.696	0.142	0.0148; 0.265	0.964	0.156	0.011; 0.294	0.960
Jingga	Sibu	-0.127	-0.228; -0.024	0.976	-0.051	-0.185; 0.092	0.715	0.001	-0.137; 0.131	0.502
Jingga	Wousan	-0.050	-0.160; 0.057	0.772	0.018	-0.112; 0.152	0.586	0.121	-0.013; 0.261	0.916
Sibu	Wousan	0.077	-0.029; 0.182	0.879	0.068	-0.054; 0.200	0.808	0.119	-0.009; 0.254	0.925

Appendix F: Supplementary Material for Chapter 8

Supplementary Table 1 – Orang-utans housed at Allwetter Zoo during the study periods.

Name	Sex	Date of Birth
Temmy	*F*	*07-12-1981*
Sari	F	26-07-1970
Mandi	F	19-12-1999
Niah	F	08-05-2013
Mr. Miyagi	M	05-05-2014
Ramon (only 2nd study period)	M	20-11-1998

Appendix G: model stability checks

In this appendix, I strive to provide extra information about the model checks that I performed across the empirical chapters in order to assess model stability. First, I will give some context with regard to the WAMBS-checklist (Depaoli & van der Schoot, 2017) that was used to test for model convergence issues throughout the thesis, posterior predictive checks based on the posterior distribution and cross-validation, and Pareto smoothed importance sampling for identification of influential cases (Vehtari et al., 2017). Second, I will provide posterior predictive checks and diagnostics about influential observations for each empirical chapter.

Model convergence

While relatively simple Bayesian models can rely on methods like grid approximation to estimate the posterior distribution, such methods quickly become computationally costly in the context of multidimensional models that require the approximation of joint posterior distributions (Kruschke, 2014; Johnson et al., 2022). One solution that has gained traction is the use of algorithms such as MCMC (Markov chain Monte Carlo) sampling. Such algorithms provide a useful tool to approximate complex multidimensional posterior distributions rather efficiently by generating values from the posterior distribution via randomly 'walking' through the parameter space combined with simple decision rules (Kruschke, 2014). Johnsen et al. (2022) provide an excellent explanation of and tutorial on MCMC sampling.

Although MCMC algorithms have provided most useful for Bayesian inference, their usefulness depends strongly on the accuracy and stability of the process. Therefore, it is essential to throughly examine the posterior samples and the stochastics of the algorithm. The WAMBS checklist (Depaoli & van der Schoot, 2017) provides some useful criteria to evaluate these sources of information. First, one can check whether the models converged properly by visually evaluating the trace plots for all four chains for all parameters in the model. By visually inspecting the plots, it is possible to identify divergent transitions, slow mixing within a chain, or chains getting stuck on one particular value. All these issues can result in poor approximation of the posterior distribution (Johnsen et al., 2022). Second, one can visually check the autocorrelation between consecutive iterations within a chain. Although consecutive iterations are by definition autocorrelated to some extent, extreme degrees of autocorrelation can indicate estimation problems within the model (Depaoli & van der Schoot, 2017). Third, one can visually check the histograms of the posterior distributions for each parameter for gaps or other abnormalities. In most cases, the posterior distributions are expected to be smooth and follow a Gaussian distribution, with one exception being variance parameters that are zero-bounded. Fourth, to investigate the similarity between separate chains, one can examine the Gelman-Rubin statistic (Gelman & Rubin, 1992). This statistic compares the within-chain variability to the between-chain variability. If between-chain variance is relatively small compared to within-chain variance -which is indicative of a well-converged model- the Gelman-Rubin diagnostic for a parameter should be close to 1, and at least not larger than 1.1 (Gelman & Rubin, 1992). The *brms*-package incorporates an adapted version of the Gelman-Rubin diagnostic, that is reported as the Rhat (Vehtari et al., 2021).

For all Bayesian regression models reported in this thesis, the above-mentioned steps were taken to ensure correct convergence of the models. I identified no convergence issues in any of the models reported. Therefore, in the remainder of this appendix, I will not report the specific diagnostics per model.

Posterior predictive checks

Next to convergence, there are other aspects of Bayesian regression models that are important to check, such as the predictive validity of the model. If a model fits well to the data, it should be able to predict new data from this model that are relatively similar to our original data (Johnsen et al., 2022; Kruschke, 2014). It is important to note that this is a different question from model convergence: a well-converged model can have a poor fit to the underlying data. For example, one can easily fit a converging Gaussian regression model to extremely zero-inflated data, and -despite the convergence- predictions based on the model will deviate strongly from the underlying data, indicating model misspecification.

One way to test whether the model fits the original data well is performing visual checks of the posterior predictive distribution. This can be done by creating graphs that plot the distribution of the original data on top of the distributions based on multiple simulated datasets randomly drawn from the posterior predictive distribution (Gabry et al., 2019). If the model fits the original data well, we expect the distribution of the original data to overlap with the distributions of simulated datasets. However, if this is not the case, the model is potentially misspecified, either because important predictors are missing or because the error distribution of the model does not fit the data well (Johnsen et al., 2022). Therefore, I will report posterior predictive checks for the main models reported in the empirical chapters.

Pareto smoothed importance sampling (PSIS)

One important aspect of checking model stability is to investigate whether there are multivariate outliers that strongly influence the posterior distribution. If many of such observations are present, this might indicate that the model is biased. In Bayesian regression models, such influential cases can be identified using Pareto smoothed importance sampling combined with LOO cross-validation (Vehtari et al., 2017). With this approach, for every removed observation, a Pareto distribution is fitted to the 20% largest importance ratios. Based on this process, a k-value (the shape parameter of the Pareto distibution) can be calculated, which indicates whether an observation is influential. In general, k-values up to 0.7 suggest that the observation is not overly influential, while estimates above 1 are indicative of strongly influential observations. If multiple observations have k-values > 0.7, but especially > 1, this might indicate issues with the model fit. It is important to note, though, that no threshold exists for how many high k-values are acceptable: a small number of high k-values is not problematic per se. I will report whether there were any influential observations found for the main models reported in the empirical chapters.

Chapter 3

Posterior predictive check

Posterior predictive checks based on the posterior predictive distribution indicated good model fit (Figure 1)

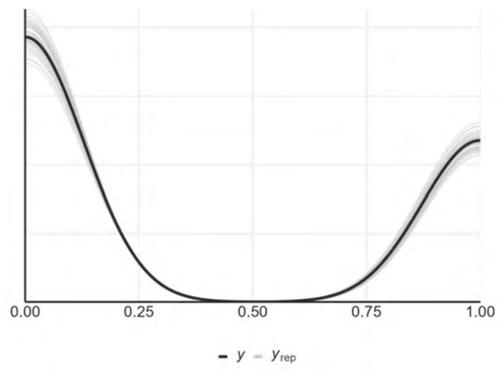

Figure 1 – Predictive posterior distribution of 50 simulated datasets based on the model (in grey) with the distribution of the original data plotted on top (in black).

PSIS

Only one out of 457 observations had a k-value just over 0.7, indicating that this observation had relatively large effect on the posterior distribution. However, because it concerned only one observation, it is unlikely to heavily influence model stability.

Chapter 4

Posterior predictive check

Posterior predictive checks based on the posterior predictive distribution indicated good model fit for all three experiments (Figure 2).

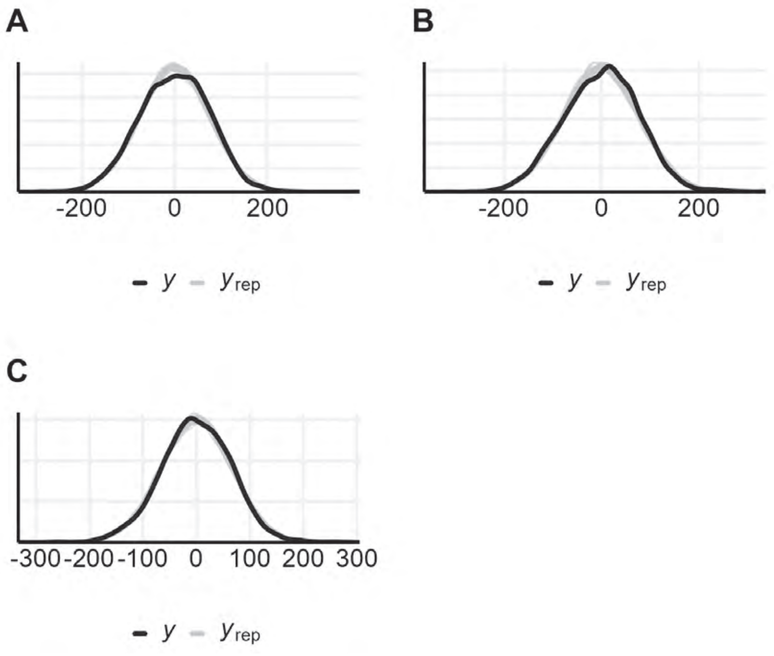

Figure 2 – Predictive posterior distribution of 50 simulated datasets based on the model (in grey) with the distribution of the original data plotted on top (in black) for (A) Experiment 1, (B) Experiment 2, and (C) Experiment 3.

PSIS

For the three main models, all k-values were < 0.5, indicating that no extremely influential observations were found.

Chapter 5

Dot-probe

Posterior predictive check

For both dot-probe models the posterior predictive distribution indicated that the models were able to predict the data accurately, although the original data distribution appears slightly more narrow than the simlated distributions (Figure 3).

For both models eye-tracking models, the posterior predictive distributions slightly deviate from the original data distribution. This is very likely caused by the beta distribution that does not fit well to multimodal distributions, such as the distribution of the original data. However, solving this issue would entail specifying a custom distribution that covers both the zero-one inflation part as well as the multimodal beta distribution. Currently, no such distribution is available. This, combined with the absence of further issues related to convergence with the models, has led me to retain the models as they are (Figure 3).

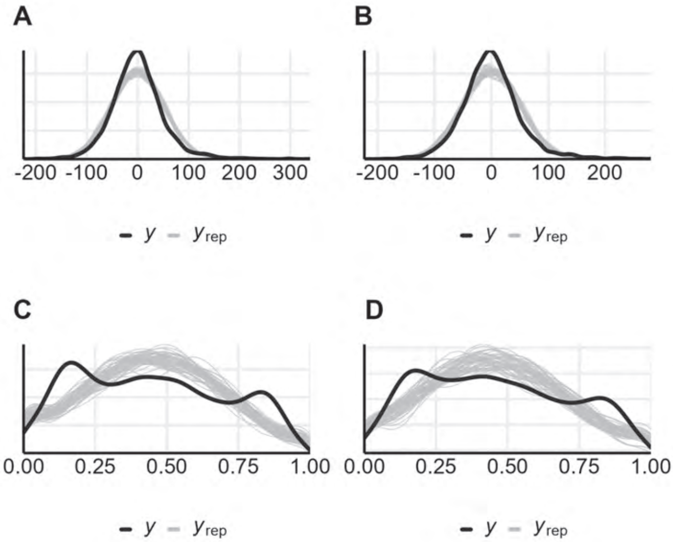

Figure 3 – Predictive posterior distribution of 50 simulated datasets based on the model (in grey) with the distribution of the original data plotted on top (in black) for (A) dot-probe with attractiveness ratings, (B) dot-probe with date outcome 2, (C) eye-tracking with attractiveness ratings, and (D) eye-tracking with date outcome.

PSIS

For both dot-probe models, all k-values were < 0.5, indicating that no extremely influential observations were found. For the attractiveness rating model, only one out of 1569 observations had a k-value just over 0.7, indicating that this observation had relatively large effect on the posterior distribution. However, because it concerned only one observation, it is unlikely to heavily influence model stability. For the date response model, four out of 1009 observations yielded k-values > 0.7. To ensure model stability, I ran the model without these four observations included, which resulted in the same quantitative results as the original model.

Chapter 6

Posterior predictive check

For all models, both the individual dot-probe models (Figure 4) and the preference test model (Figure 5), posterior predictive checks showed no indication of model misspecification.

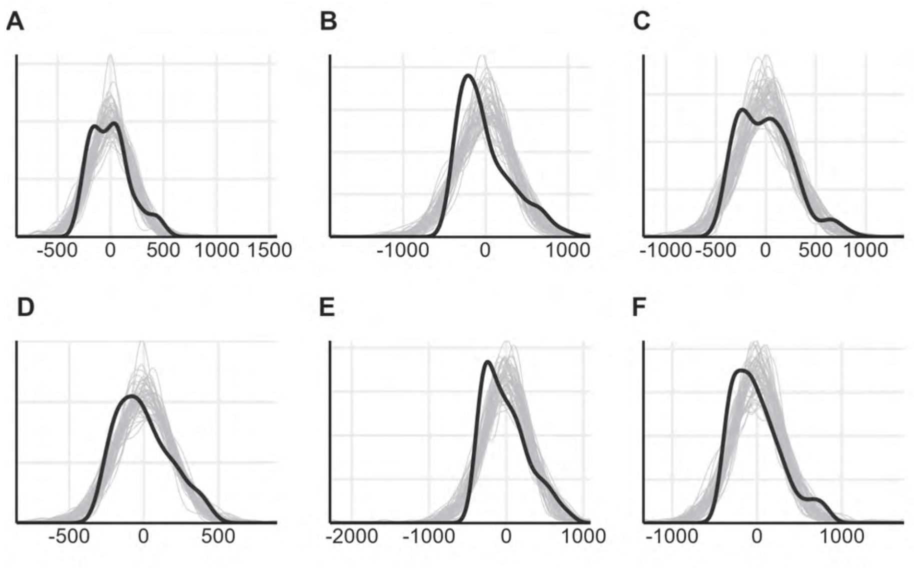

Figure 4 – Predictive posterior distribution of 50 simulated datasets based on the model (in grey) with the distribution of the original data plotted on top (in black) for the flange size dot-probe separately for (A) Kawan, (B) Samboja, and (C) Sandy; for the symmetry dot-probe separately for (D) Kawan, (E) Samboja, and (F) Sandy.

A

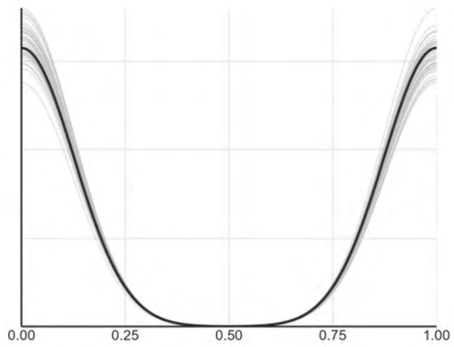

Figure 5 – Predictive posterior distribution of 50 simulated datasets based on the model (in grey) with the distribution of the original data plotted on top (in black) for the preference test model.

PSIS

For all dot-probe models and the preference test model, all k-values were < 0.5, indicating that no extremely influential observations were found.

Chapter 7

Experiment 1

Posterior predictive check

For experiment 1, posterior predictive checks showed no indication of model misspecification for both the first fixation- and the total fixation duration-model. For experiment 2, posterior predictive checks showed no indiviation of model misspecifications for the first fixation- and the total fixation duration-models (Figure 6).

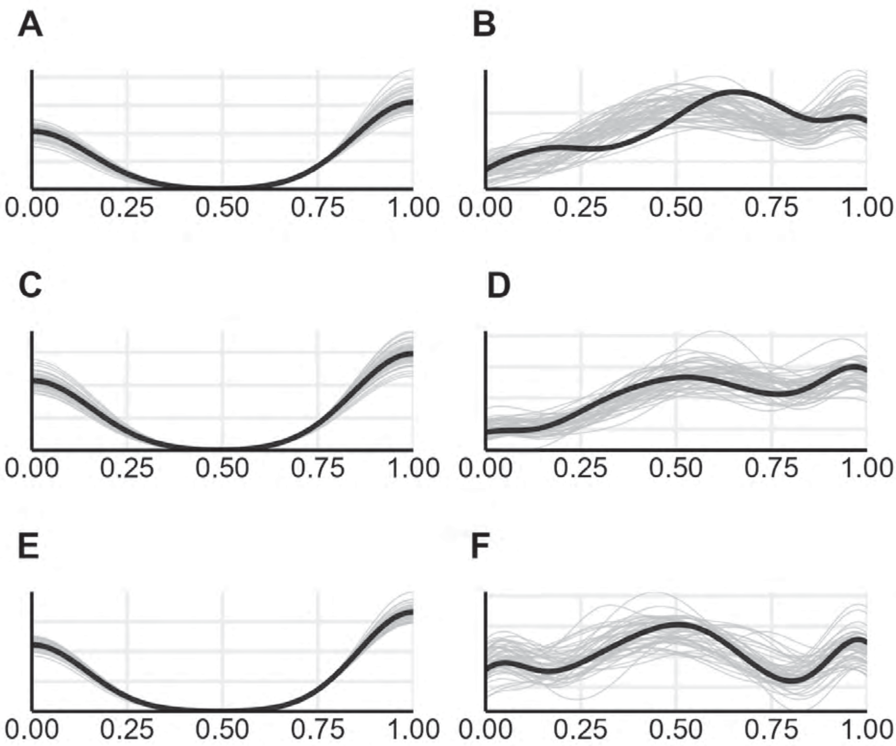

Figure 6 – Predictive posterior distribution of 50 simulated datasets based on the model (in grey) with the distribution of the original data plotted on top (in black) for experiment 1: (A) first fixation model, (B) total fixation duration model; experiment 2: (C) first fixation model replicating exp. 1, (D) total fixation duration model replicating exp. 1, (E) second first fixation duration model, and (F) second total fixation duration model.

PSIS

For experiment 1, all k-values were < 0.7 for the first fixation-model. For the total fixation duration-model, three of 195 observations had a k > 0.7, indicating that they had a strong influence on the posterior. However, after refitting the model without these observations, the main result remained the same.

For experiment 2, all k-values were < 0.7 for the first fixation-model that replicated experiment 1. For the total fixation duration-model that replicated experiment 1, six of 186 observations had a k > 0.7, indicating that they had a strong influence on the posterior. However, after refitting the model without these observations, the main result remained the same. For the second first fixation-model, all k-values were < 0.7. For the second total fixation duration-model that replicated experiment 1, five of 274 observations had a k > 0.7, indicating that they had a strong influence on the posterior. However, after refitting the model without these observations, the main result remained the same.

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