Mapping the Perception-space of Facial Expressions (Moebius vs Online Participants)

Supplementary Materials

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1 General approach

The Geneva Emotion Wheel [GEW; Scherer (2005)] allows having an intuitive and informative way to collect participants' responses in a facial expression perception task. Specifically, in a single measurement is possible to have information about the facial expression *category* (i.e., the response angle around the circle) and *intensity* (i.e., the distance from the center).

1.1 Facial expression category

In order to measure the response angle for each trial we transformed Cartesian coordinates ((x_i, y_i)) into polar coordinates ((r_i, θ_i)) as in Equation (1).

$$\theta_{ij} = tan^{-1}(\frac{y_{ij}}{x_{ij}}) \tag{1}$$

In this way we have the *pressed angle* for each trial. Given that each emotion has an absolute location on the GEW, we calculated a *position-free* index of performance computing the difference between the *pressed angle* and the *ideal angle* (i.e., the GEW location of the presented emotion).

Then we calculated the *ideal* angle for each presented emotion, in the middle of each wheel circle. To obtain a measure comparable between emotion, we calculated the angular difference between the *ideal* and the pressed angle using the Equation (2)

$$Bias = ((ideal - pressed) + 180) \mod 360 - 180 \tag{2}$$

This new measure (*bias*) has several advantages. Despite each emotion have a different location within the wheel, each response is now expressed in a position-free metric. The *bias* is centered on 0 if there is no response tendency away from the *ideal* value. Otherwise, a systematic shift would move the circular mean away from 0, clockwise (positive values) or anticlockwise (negative values). Other than the circular mean, also the spread on the circle (i.e., *uncertainty*) is an important performance measure. The *bias* and the *uncertainty* are can be considered independent measures.

Given the periodicity of circular data, we cannot use standard statistical modeling tools (Cremers, Mulder, and Klugkist 2018; Cremers and Klugkist 2018). There are different ways to model circular data (see Cremers, Mulder, and Klugkist 2018 for an overview). We decided to use a generalized linear mixed-effect model using the *von Mises* likelihood function. The *von Mises* distribution is an alternative to the Gaussian distribution for circular data, bounded in the range $[-\pi, \pi]$. The two parameters of the von Mises distribution, μ and k[1] representing our *bias* and *uncertainty* parameters. To facilitate the interpretation of models' parameters, we transformed k into the circular variance using Equation (3).

$$\sigma^2 = 1 - \frac{I_1(k)}{I_0(k)} \tag{3}$$

The circular variance ranges between 0 (no *uncertainty*) to 1 (maximum *uncertainty*). The transformation is computed using the modified Bessel function $I_i(k)$ of order i (Evans, Hastings, and Peacock 2011).

1.2 Perceived Intensity

The emotion *intensity* is expressed as the difference from the center of the GEW. Values close or far from the center represent respectively neutral and high facial expression intensity. We calculated the *intensity* for

[1] In fact, k is a concentration parameter that can be conceptually considered as the inverse of the standard deviation. When the concentration is 0 the distribution is *uniform*

each trial as the *euclidean distance* between the *center* and the *pressed location*. Given that the GEW has been centered (i.e., the center has coordinates $x = 0, y = 0$), the distance from the center is calculated as Equation (4).

$$I_{ij} = \sqrt{x^2 + y^2} \tag{4}$$

1.3 Statistical models

For the response angle (i.e., *bias* and *uncertainty*) we decided to use a *scale-location* mixed-effect model (Bürkner 2018; Rigby and Stasinopoulos 2005). Under this framework, all parameters of a distribution can be predicted. In particular, we are predicting the *circular mean* (i.e., *bias*) and the *concentration* (i.e., *uncertainty*) Von Mises parameters as a function of Intensity (full and subtle) and Emotion (anger, happiness, disgust, fear, surprise and sadness). For the perceived intensity, we used a regular general linear mixed-effect model.

We estimated both models under a Bayesian framework the R software (R Core Team 2021) using the Brms package (Bürkner 2017) based on the STAN probabilistic programming language (Carpenter et al. 2017). The Bayesian statistics consist in combining information from prior knowledge (i.e. *priors*) and the data (i.e., *likelihood*) to obtain the *posterior* distribution (Kruschke and Liddell 2018).

In terms of contrast coding, for categorical predictors, we used `sum contrasts` using the `contr.sum()` function.

1.3.1 `brms`

We fitted our models using the `brms` package. According to different models the `brm` setup could be different in terms of `backend`, number of `iterations` and `chains` and the parallelization approach. The general approach for `bias/uncertainty` models is the following:

```
# the scale-location specification
form <- bf(theta_cen ~ ... + (1|id),
           kappa ~ ... + (1|id))

brm(formula, # model formula
    data = data,
    prior = priors,
    family = von_mises(link = "tan_half", link_kappa = "log"),
    chains = 15,
    cores = 15,
    iter = 4000,
    sample_prior = "yes",
    save_pars = save_pars(all = TRUE),
    seed = 2022)
```

For the `perceived intensity`

```
brm(int ~ ... + (1|id),
    data = data,
    prior = priors,
    family = gaussian(),
    chains = 15,
    cores = 15,
```

```
    iter = 4000,
    save_pars = save_pars(all = TRUE),
    sample_prior = "yes",
    seed = 2022)
```

When fitting models with uninformative or flat priors, we used a different chains/iteration approach to improve model fitting (especially for the Von Mises model). In particular we used the *within-chains* parallelization (https://cran.r-project.org/web/packages/brms/vignettes/brms_threading.html) for `bias/uncertainty` models:

```
# the scale-location specification
form <- bf(theta_cen ~ ... + (1|id),
           kappa ~ ... + (1|id))

brm(form,
    data = data,
    family = von_mises(link = "tan_half", link_kappa = "log"),
    chains = 4,
    prior = priors, # uninformative or flat
    cores = 4,
    iter = 10000,
    sample_prior = "yes",
    threads = threading(6),  # within-chains parallellization
    save_pars = save_pars(all = TRUE),
    seed = seed)
```

For the `perceived intensity` models we use the same approach as the main models given the simpler fitting process.

1.4 Raw data

The figure S2 represents all participants' responses for each experimental condition, directly plotted on the GEW. The figure S1 represents the GEW legend and the responses to the neutral condition.

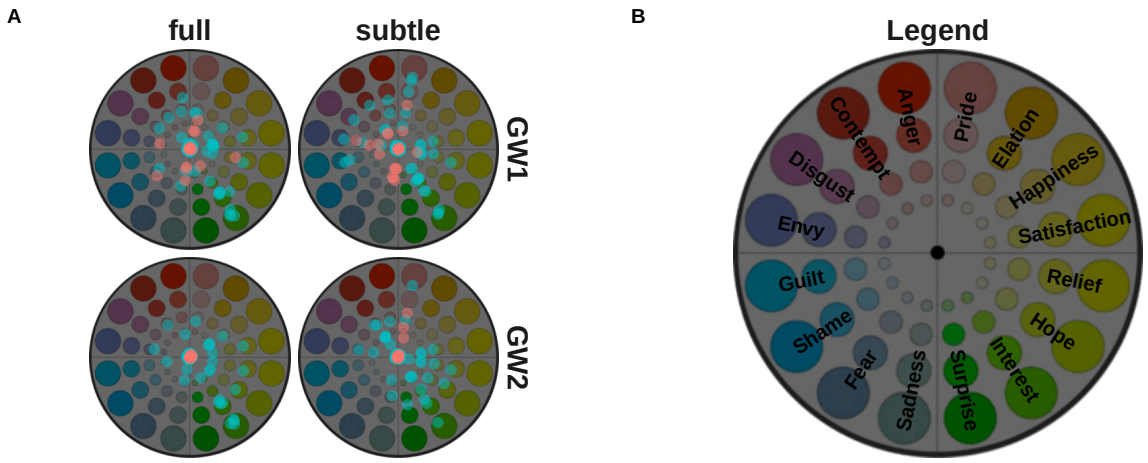

Figure S1: GEW legend (B) and responses to neutral facial expressions as a function of the Intensity and Mapping Wheel 1 and 2 (A)

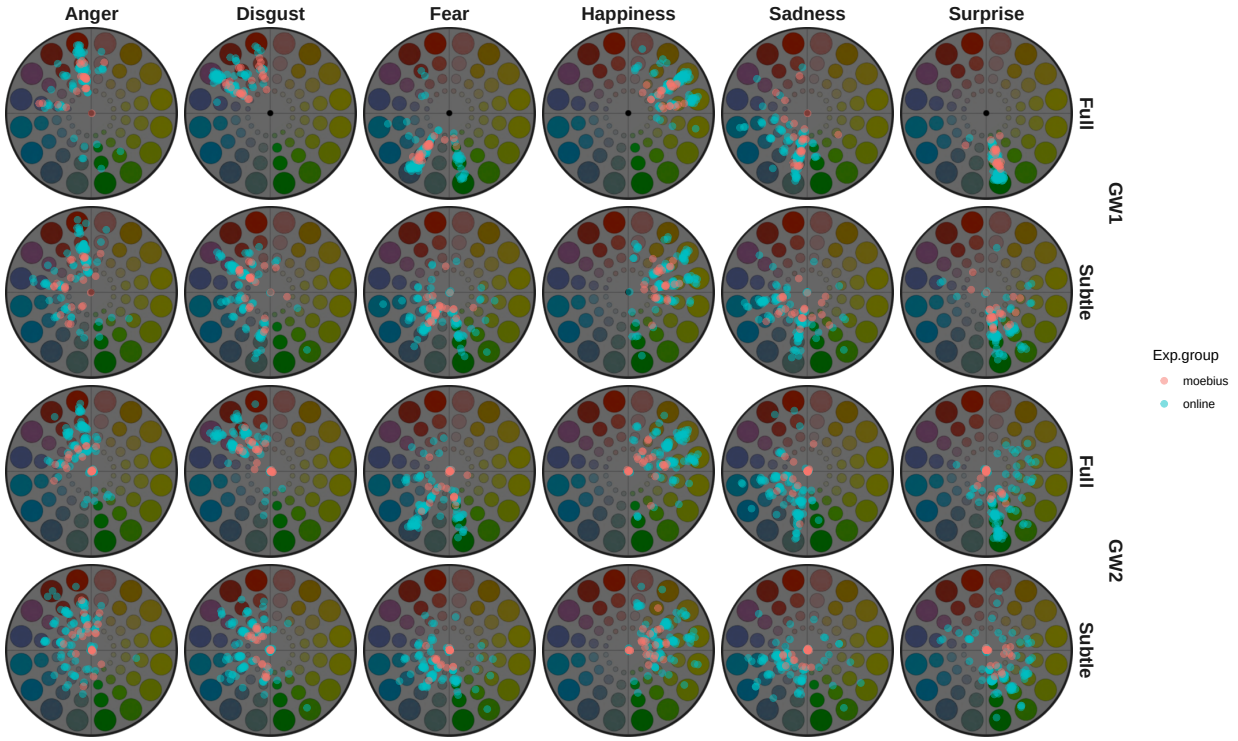

Figure S2: GEW responses as a function of displayed Emotion, Intensity and Mapping Wheel 1 and 2.

2 Fitted Models

Table S1 depicts all fitted models with main parameters. To read the table:

- `fit_ri_int`: the random-intercept two-way interaction model for *bias/uncertainty* and *perceived intensity*
- `fit_ri_no2int`: the random-intercept model without the two-way interaction *bias/uncertainty* and *perceived intensity*
- `fit_*un/flat`: models with completely uninformative or flat priors

Table S1: Table with model formulas, names and fitting parameters

model	name	chains	iter	warmup	samples
diff_theta ~ emotion * group * intensity + (1 | id) kappa ~ emotion * group * intensity + (1 | id)	fit_ri_int	15	4,000	2,000	30,000
theta_cen ~ 0 + Intercept + group_e + (1 | id) kappa ~ 0 + Intercept + group_e + (1 | id)	fit_ri_neu	15	4,000	2,000	30,000
diff_theta ~ emotion + group + intensity + emotion:group + emotion:intensity + group:intensity + (1 | id) kappa ~ emotion + group + intensity + emotion:group + emotion:intensity + group:intensity + (1 | id)	fit_ri_no3int	15	4,000	2,000	30,000
int ~ 0 + Intercept + emotion * group * intensity + (1 | id)	fit_ri_int	15	4,000	2,000	30,000
int ~ 0 + Intercept + group + (1 | id)	fit_ri_neu	4	10,000	5,000	20,000
int ~ 0 + Intercept + emotion + group + intensity + emotion:group + emotion:intensity + group:intensity + (1 | id)	fit_ri_no3int	15	4,000	2,000	30,000

In the next section we presented all fitted models using the same approach:

- the model name (the same name as the R object)
- prior distributions for each parameter
- model output

For the prior tables:

- `prior`: is the prior distribution with parameters. All parameters without a proper prior (i.e., different from a flat prior) are not reported in the table.
- `class`: is the type of parameter (`b` is for β and `sd` for a standard deviation parameter e.g., by-subject intercept or residual σ)
- `coef`: is the specific model parameters. If a prior is defined only for a *class*, then all parameters of that class will have the same prior
- `dpar`: is for *distributional parameters*. In the case of the von Mises model refers to k coefficients

For the model tables:

- `param`: is the model parameter name
- `estimate`: is the mean of the posterior distribution
- `Est.Error`: is the standard error of the posterior distribution
- `95% CI`: is the 95% credible interval
- `Rhat`: is the Gelman and Rubin (Gelman and Rubin 1992) convergence index. When is below 1.1 the parameters has converged.
- `Bulk/Tail Effective Sample Size`: can be considered as the amount of information used for estimating a parameter. In general higher is better (see https://mc-stan.org/docs/2_18/reference-manual/effective-sample-size-section.html). Is calculated from the number of iterations and chains of the models.

2.1 Bias/Uncertainty

2.1.1 fit_ri_int

2.1.1.1 Priors

Table S2:

prior	class	coef	dpar
normal(0, 2)	b		
normal(0, 2)	b		kappa
student_t(3, 0, 2.5)	Intercept		
normal(5.0, 0.8)	Intercept		kappa
student_t(3, 0, 2.5)	sd		
student_t(3, 0, 2.5)	sd		kappa

2.1.1.2 Model

Table S3:

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
emotion1	-0.26803	0.06629	-0.40021	-0.14083	1.00057	13,845.87398	12,471.21063
emotion1:grouponline	0.15287	0.07094	0.01896	0.29642	1.00074	14,098.60327	12,949.01246
emotion1:grouponline:intensity1	-0.12141	0.07104	-0.26777	0.01077	1.00067	14,168.65907	12,387.80204
emotion1:intensity1	0.16352	0.06664	0.03923	0.30114	1.00068	13,807.77923	12,051.27197
emotion2	0.08410	0.04887	-0.01634	0.17754	1.00038	17,062.23805	18,893.29647
emotion2:grouponline	-0.17037	0.05321	-0.27420	-0.06392	1.00040	17,201.35204	19,372.51755
emotion2:grouponline:intensity1	0.05579	0.05402	-0.05192	0.16170	1.00017	17,259.31370	19,121.33917
emotion2:intensity1	0.06823	0.04972	-0.03155	0.16570	1.00029	17,381.36425	18,231.18225
emotion3	-0.00810	0.03654	-0.07962	0.06498	1.00029	17,921.46045	20,857.25317
emotion3:grouponline	-0.04051	0.04231	-0.12435	0.04189	1.00052	19,214.48600	21,744.52906
emotion3:grouponline:intensity1	0.03996	0.04220	-0.04124	0.12469	1.00042	19,014.92200	21,562.40872
emotion3:intensity1	-0.05723	0.03666	-0.12982	0.01381	1.00054	18,030.53307	20,867.30279
emotion4	0.11073	0.02972	0.05439	0.17041	1.00053	18,288.55840	20,422.61333
emotion4:grouponline	-0.02308	0.03359	-0.08925	0.04176	1.00024	19,286.90034	21,669.61394
emotion4:grouponline:intensity1	0.04418	0.03295	-0.01830	0.11140	1.00029	17,666.19141	20,513.56815
emotion4:intensity1	-0.11401	0.02908	-0.17004	-0.05562	1.00048	16,844.28648	18,751.02397
emotion5	0.11626	0.05822	0.00397	0.23397	1.00074	19,934.45981	20,648.99746
emotion5:grouponline	0.08483	0.06237	-0.04122	0.20518	1.00059	19,847.15210	20,459.71342

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
emotion5:grouponline:intensity1	-0.04033	0.06197	-0.15969	0.08518	1.00025	20,766.47685	20,506.69725
emotion5:intensity1	-0.06582	0.05793	-0.18105	0.04716	1.00031	20,400.83545	19,811.71802
grouponline	0.02639	0.02368	-0.01857	0.07394	1.00032	18,439.97963	18,849.61754
grouponline:intensity1	-0.03414	0.02313	-0.07951	0.01164	1.00060	16,486.65079	19,427.80153
intensity1	0.04800	0.02127	0.00640	0.08997	1.00068	15,770.47767	19,407.86905
Intercept	-0.02557	0.02178	-0.06959	0.01606	1.00031	17,192.34648	17,562.97026
kappa_emotion1	-0.64457	0.19946	-1.06643	-0.28996	1.00043	24,809.46062	17,557.78635
kappa_emotion1:grouponline	-0.23636	0.21871	-0.66194	0.19046	1.00039	25,536.58489	17,918.24379
kappa_emotion1:grouponline:intensity1	-0.46051	0.21709	-0.89676	-0.05114	1.00101	23,647.04445	18,060.89889
kappa_emotion1:intensity1	-0.09176	0.19800	-0.46933	0.29970	1.00071	22,838.86200	17,689.36213
kappa_emotion2	-0.33628	0.18917	-0.71675	0.02161	1.00039	24,658.77290	18,829.45155
kappa_emotion2:grouponline	0.35086	0.20867	-0.04357	0.76844	1.00037	25,381.91884	18,902.21000
kappa_emotion2:grouponline:intensity1	0.27889	0.21037	-0.13704	0.68640	1.00008	24,802.56188	20,349.13585
kappa_emotion2:intensity1	0.03080	0.19141	-0.32986	0.42299	1.00007	23,794.32527	20,053.64886
kappa_emotion3	0.31525	0.18724	-0.05519	0.67578	1.00018	26,246.46487	21,179.72874
kappa_emotion3:grouponline	-0.90774	0.20598	-1.30260	-0.49706	1.00015	26,153.16872	21,447.18140
kappa_emotion3:grouponline:intensity1	-0.56162	0.20662	-0.97478	-0.16673	1.00010	26,187.42239	23,338.11392
kappa_emotion3:intensity1	0.14182	0.18728	-0.22312	0.51234	1.00023	25,946.62996	23,395.68101
kappa_emotion4	0.80402	0.18836	0.43885	1.17625	1.00014	25,757.89773	22,108.06013
kappa_emotion4:grouponline	-0.66490	0.20870	-1.07722	-0.25957	1.00008	26,269.70402	22,836.38909
kappa_emotion4:grouponline:intensity1	-0.10263	0.20599	-0.51082	0.29495	1.00013	26,543.30894	23,708.00799
kappa_emotion4:intensity1	-0.22120	0.18649	-0.58945	0.14022	1.00020	25,940.59096	22,894.70161
kappa_emotion5	-0.94647	0.19125	-1.32492	-0.57439	1.00052	23,339.55615	16,875.24843
kappa_emotion5:grouponline	0.35537	0.21075	-0.04799	0.77656	1.00042	24,214.44657	16,372.81505
kappa_emotion5:grouponline:intensity1	0.14230	0.22266	-0.30680	0.56797	1.00054	22,164.76369	18,851.85919
kappa_emotion5:intensity1	-0.55335	0.20358	-0.95425	-0.16051	1.00062	22,038.97032	19,299.95791
kappa_grouponline	0.09110	0.44702	-0.75192	1.02427	1.00026	13,882.41570	17,651.52818
kappa_grouponline:intensity1	0.14751	0.09468	-0.03434	0.33866	1.00032	28,231.96020	21,287.25887
kappa_intensity1	0.68095	0.08538	0.51024	0.84688	1.00023	27,511.93910	21,365.53636
kappa_Intercept	1.68439	0.41424	0.91036	2.55875	1.00074	14,490.40472	16,419.49711
sd(Intercept)	0.00477	0.00436	0.00000	0.01390	1.00187	9,527.11057	14,693.08249
sd(kappa_Intercept)	0.64621	0.18631	0.37676	1.04597	1.00182	8,289.76330	13,455.41571

2.1.2 fit_ri_neu

2.1.2.1 Priors

Table S4:

prior	class	coef	dpar
uniform(-3.141593, 3.141593)	b		
normal(0, 2)	b		kappa
student_t(3, 0, 2.5)	sd		
student_t(3, 0, 2.5)	sd		kappa

2.1.2.2 Model

Table S5:

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
group_e1	-1.51231	0.90416	-3.13687	0.14591	1.00079	9,638.98062	12,378.68516
Intercept	-1.54810	0.49422	-2.55111	-0.58146	1.00129	8,693.78716	9,613.74839
kappa_group_e1	0.42445	0.83704	-1.23324	2.08411	1.00105	10,596.97262	14,575.95614
kappa_Intercept	-0.07454	0.44114	-0.94829	0.79674	1.00113	9,525.35395	15,002.56155
sd(Intercept)	1.31046	0.38084	0.74298	2.13790	1.00123	10,470.45204	15,972.42280
sd(kappa_Intercept)	1.29538	0.36991	0.75713	2.09912	1.00130	10,550.46722	16,272.48921

2.1.3 fit_ri_no3int

2.1.3.1 Priors

Table S6:

prior	class	coef	dpar
normal(0, 2)	b		
normal(0, 2)	b		kappa
student_t(3, 0, 2.5)	Intercept		
normal(5.0, 0.8)	Intercept		kappa
student_t(3, 0, 2.5)	sd		
student_t(3, 0, 2.5)	sd		kappa

2.1.3.2 Model

Table S7:

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
emotion1	-0.21745	0.04838	-0.31532	-0.12493	1.00044	23,436.51245	21,478.98935
emotion1:grouponline	0.08970	0.05261	-0.01288	0.19321	1.00043	23,656.62265	22,311.15394
emotion1:intensity1	0.06507	0.02310	0.02014	0.11082	1.00038	47,658.02623	22,172.22695
emotion2	0.05642	0.03647	-0.01516	0.12834	1.00023	26,579.43632	22,381.37276
emotion2:grouponline	-0.13853	0.03579	-0.20920	-0.06956	1.00052	29,393.35915	22,929.24700
emotion2:intensity1	0.11668	0.01930	0.07841	0.15433	1.00107	47,992.73192	24,064.64285
emotion3	-0.01895	0.03050	-0.07987	0.03980	1.00027	27,635.15929	23,439.51206
emotion3:grouponline	-0.02515	0.03415	-0.09108	0.04249	1.00041	29,440.36594	23,110.55389
emotion3:intensity1	-0.02662	0.01799	-0.06233	0.00863	1.00021	50,862.87848	22,778.60190
emotion4	0.09570	0.02565	0.04473	0.14560	1.00065	23,511.49365	23,138.46410
emotion4:grouponline	-0.00336	0.02797	-0.05779	0.05199	1.00022	25,702.34540	23,237.67284
emotion4:intensity1	-0.07909	0.01367	-0.10616	-0.05240	1.00042	47,692.84228	23,022.48244
emotion5	0.12406	0.05334	0.02075	0.23086	1.00026	21,193.99479	20,879.31878
emotion5:grouponline	0.07341	0.05620	-0.03627	0.18340	1.00028	21,455.90977	21,017.22791
emotion5:intensity1	-0.10010	0.02070	-0.14046	-0.05965	1.00037	56,651.75150	23,343.77259
grouponline	0.01792	0.02136	-0.02412	0.05970	1.00016	23,675.68666	23,239.51947
grouponline:intensity1	-0.00963	0.01830	-0.04626	0.02562	1.00010	28,291.31291	23,637.33318
intensity1	0.02715	0.01684	-0.00604	0.05971	1.00015	26,525.84627	22,438.39474
Intercept	-0.01856	0.01943	-0.05571	0.02043	1.00040	21,844.70754	23,118.61254

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
kappa_emotion1	-0.66554	0.18413	-1.03454	-0.31270	1.00059	27,430.93061	21,565.49869
kappa_emotion1:grouponline	-0.21362	0.20713	-0.62303	0.19150	1.00028	27,632.41107	20,628.53145
kappa_emotion1:intensity1	-0.45023	0.08240	-0.61152	-0.28945	1.00021	51,019.15660	23,910.85378
kappa_emotion2	-0.31705	0.19499	-0.71839	0.04009	1.00039	27,498.39552	22,149.20810
kappa_emotion2:grouponline	0.33510	0.21523	-0.06724	0.77681	1.00021	27,815.21234	22,216.33127
kappa_emotion2:intensity1	0.26318	0.08209	0.10073	0.42328	1.00070	53,141.96760	22,688.12614
kappa_emotion3	0.24217	0.19014	-0.13632	0.60535	1.00031	26,827.31674	23,625.29806
kappa_emotion3:grouponline	-0.81848	0.20982	-1.23004	-0.40873	1.00038	27,220.64392	23,436.87656
kappa_emotion3:intensity1	-0.31293	0.08199	-0.47123	-0.14823	1.00062	50,754.96227	23,836.48135
kappa_emotion4	0.85187	0.18559	0.48602	1.21075	0.99993	27,039.10712	23,245.57601
kappa_emotion4:grouponline	-0.69674	0.20668	-1.09819	-0.28983	0.99998	26,983.58258	22,964.84357
kappa_emotion4:intensity1	-0.29852	0.08042	-0.45566	-0.14057	1.00049	53,451.90680	23,415.85534
kappa_emotion5	-0.90326	0.18591	-1.27952	-0.55521	1.00045	28,133.44435	20,582.37668
kappa_emotion5:grouponline	0.32598	0.20603	-0.06563	0.74320	1.00050	28,828.70138	20,246.78043
kappa_emotion5:intensity1	-0.42931	0.08032	-0.58649	-0.27341	1.00033	54,507.76147	22,046.07977
kappa_grouponline	0.13616	0.41068	-0.68723	0.94143	1.00077	13,918.97875	17,096.25279
kappa_grouponline:intensity1	0.13639	0.09818	-0.05922	0.32507	1.00086	26,554.24665	23,086.85075
kappa_intensity1	0.68092	0.08900	0.51230	0.86266	1.00050	26,287.03006	21,263.90675
kappa_Intercept	1.62338	0.37654	0.90024	2.40338	1.00065	15,931.24166	16,379.33502
sd(Intercept)	0.00498	0.00444	0.00000	0.01424	1.00131	10,127.74020	15,008.15040
sd(kappa_Intercept)	0.59576	0.16529	0.34781	0.95227	1.00073	8,171.75659	13,509.19497

2.2 Perceived intensity

2.2.1 fit_ri_int

2.2.1.1 Priors

Table S8:

prior	class	coef	dpar
normal(0, 50)	b		
normal(150, 100)	b	Intercept	
student_t(3, 0, 67.4)	sd		
student_t(3, 0, 67.4)	sigma		

2.2.1.2 Model

Table S9:

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
emotion1	-4.47628	5.59224	-15.45809	6.19566	1.00085	33,036.19845	22,946.98835
emotion1:grouponline	-4.67427	6.23992	-16.90726	7.48660	1.00036	32,477.63982	24,040.85461
emotion1:grouponline:intensity1	-0.12645	6.31260	-12.66670	12.04812	1.00034	33,314.73982	22,757.87970
emotion1:intensity1	-9.58321	5.66052	-20.73418	1.32155	1.00031	33,825.57722	23,895.73844
emotion2	0.53550	5.64597	-10.32272	11.65878	1.00044	34,239.26252	23,386.53222
emotion2:grouponline	3.71742	6.26129	-8.44247	16.00081	1.00026	34,404.76137	23,599.10852
emotion2:grouponline:intensity1	5.58223	6.24681	-7.00801	17.56260	1.00018	34,538.08193	22,724.62640
emotion2:intensity1	1.93352	5.58670	-9.04160	12.74684	1.00054	34,022.43895	22,360.59396
emotion3	-4.73003	5.61780	-15.78672	6.16551	1.00024	32,187.91011	24,217.66929
emotion3:grouponline	-1.69496	6.26451	-14.13262	10.37377	1.00021	32,348.50175	23,354.43727
emotion3:grouponline:intensity1	-4.61394	6.32083	-17.38605	7.30736	1.00007	33,443.71165	21,815.68244
emotion3:intensity1	15.10584	5.67123	4.13798	26.27637	1.00022	32,968.96160	22,910.17684
emotion4	20.53978	5.68343	9.38455	31.66669	1.00044	33,062.85900	22,493.10099
emotion4:grouponline	2.86310	6.32841	-9.26573	15.52922	1.00023	32,893.78452	23,670.76520
emotion4:grouponline:intensity1	9.49147	6.33689	-2.92404	21.97542	1.00014	34,622.62909	24,184.98919
emotion4:intensity1	-12.54845	5.67390	-23.68710	-1.40775	1.00009	34,312.27052	24,409.70217
emotion5	-15.95616	5.67497	-27.07651	-4.88487	1.00078	33,677.58946	23,664.35012
emotion5:grouponline	-1.82506	6.32782	-14.24355	10.58849	1.00046	33,779.55282	24,038.89984
emotion5:grouponline:intensity1	-6.15980	6.35514	-18.26283	6.56273	1.00018	34,395.42035	23,683.12345
emotion5:intensity1	-5.93937	5.68902	-16.54405	5.63668	1.00015	34,544.09587	22,753.11893

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
grouponline	40.52680	11.69674	16.99323	63.32662	1.00057	16,804.28828	17,082.41889
grouponline:intensity1	-4.14776	2.85068	-9.73088	1.46262	1.00079	37,200.00078	22,109.47175
intensity1	23.94116	2.56052	18.94780	28.93217	1.00080	37,744.33821	22,268.19867
Intercept	135.08187	10.57514	114.92316	156.94042	1.00071	17,977.82886	16,692.78202
sd(Intercept)	17.26028	4.01608	10.95083	25.76310	1.00057	9,739.97219	17,029.57329

2.2.2 fit_ri_neu

2.2.2.1 Priors

Table S10:

prior	class	coef	dpar
normal(0, 50)	b		
normal(150, 100)	b	Intercept	
student_t(3, 0, 7.1)	sd		
student_t(3, 0, 7.1)	sigma		

2.2.2.2 Model

Table S11:

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
grouponline	6.71334	24.08608	-40.70518	53.71500	1.00072	4,143.20586	5,829.38404
Intercept	35.00746	22.21136	-8.59797	79.69964	1.00100	4,655.26485	6,077.58473
sd(Intercept)	42.08315	8.05981	28.93743	59.19758	1.00047	3,998.39974	6,874.97366

2.2.3 fit_ri_no3int

2.2.3.1 Priors

Table S12:

prior	class	coef	dpar
normal(0, 50)	b		
normal(150, 100)	b	Intercept	
student_t(3, 0, 67.4)	sd		
student_t(3, 0, 67.4)	sigma		

2.2.3.2 Model

Table S13:

param	median	se	lower	upper	Rhat	Bulk_ESS	Tail_ESS
emotion1	-4.49455	5.60492	-15.19672	6.74953	1.00059	26,638.21459	22,283.27476
emotion1:grouponline	-4.64646	6.24996	-16.87394	7.47455	1.00045	26,620.93656	21,742.33701
emotion1:intensity1	-9.68170	2.55009	-14.70345	-4.76390	1.00023	44,932.70562	22,783.17486
emotion2	0.54985	5.63855	-10.52681	11.60242	1.00019	26,953.19839	23,589.54819
emotion2:grouponline	3.65934	6.28817	-8.52463	16.08661	1.00022	27,192.90751	22,958.79144
emotion2:intensity1	6.41124	2.54537	1.38168	11.41569	1.00030	45,253.60517	21,962.96241
emotion3	-4.68222	5.58755	-15.47074	6.37478	1.00085	26,957.56406	23,364.20220
emotion3:grouponline	-1.72485	6.21592	-14.16868	10.24502	1.00078	27,624.38495	23,011.08170
emotion3:intensity1	11.43491	2.51075	6.45087	16.25210	1.00079	43,963.17157	22,378.84247
emotion4	20.45000	5.61258	9.43884	31.26480	1.00039	27,155.90903	22,926.18460
emotion4:grouponline	2.95003	6.28550	-9.42024	15.15926	1.00031	27,211.70942	23,257.92088
emotion4:intensity1	-4.89471	2.50939	-9.79928	0.00026	1.00057	45,966.67747	22,670.04272
emotion5	-15.99716	5.58645	-26.94928	-5.03571	1.00058	26,814.57639	23,411.33523
emotion5:grouponline	-1.82454	6.25908	-13.94064	10.50872	1.00056	26,575.14139	21,192.32606
emotion5:intensity1	-10.84663	2.53689	-15.87698	-5.86638	1.00063	45,404.53643	21,863.58006
grouponline	40.76649	11.63686	17.08608	63.68439	1.00068	11,995.89734	15,002.20152
grouponline:intensity1	-4.13883	2.82478	-9.82211	1.25761	1.00027	30,764.91930	22,648.95299
intensity1	23.95367	2.53542	18.92112	28.89478	1.00044	30,708.79311	22,323.72565
Intercept	134.94000	10.48731	114.71306	156.63313	1.00083	13,251.81927	15,800.49334
sd(Intercept)	17.28259	4.02054	10.91384	25.87963	1.00104	9,195.57199	16,329.30220

3 Suggestions for meta-analysis

In this section, there are some suggestions for including these results into a meta-analysis. Firstly, if the presented results are not sufficient, the online OSF repository (https://osf.io/e2kcw/) contains raw data to compute all relevant measures. In general, for Bayesian models, each parameter or posterior contrast has a full posterior probability. This makes the computation of new measures (e.g., standardized effect sizes) and standard errors relatively easy. The only difference from standard calculations is that each new measure will have a full posterior distribution. These new distributions can be summarized (e.g., using the median) and used for the meta-analytic model.

3.1 Bias

To our knowledge, for the *bias*, there is no straightforward standardized effect size measure to compute, especially for a meta-analytic model. A possibility is using a general index of overlap between two posterior distributions (e.g., for a specific post-hoc contrast) as proposed by Pastore and Calcagnì (2019). However, the meta-analytic comparison with standard effect sizes index is not straightforward.

3.2 Uncertainty

For the *uncertainty* it is possible to use directly the values from the posterior contrasts. The *uncertainty* (i.e., *circular variance*) is expressed on a scale from 0 to 1 (similar to a probability). All posterior contrasts can be interpreted as probability ratios and odds ratios. Also, the standard error can be calculated as the standard deviation of the posterior distribution. Furthermore, it is also possible to convert from odds ratio (or similar measures) to other effect size indexes (e.g., Cohen's d, see https://easystats.github.io/effectsize/reference/d_to_r.html).

3.3 Perceived Intensity

For the perceived intensity it is possible to use a standard Cohen's d measure. The only general caveat about calculating a Cohen's d with multilevel models concerns which standard deviation(s) to use (Brysbaert and Stevens 2018; Westfall, Kenny, and Judd 2014)

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