# Supplementary Material

**Table S1**

*List of the featured individuals from the Radboud Faces Database (RAFD; Langner et al., 2010), Karolinska Directed Emotional Faces database (KDEF; Lundqvist, et al., 1998), and the Warsaw Set of Emotional Facial Expression Pictures (WSEFEP; Olszanowski et al., 2015) in each emotion condition.*

 **Featured individuals**

**Prime emotion**

**Happiness**

 *RAFD* F04, F18, M03, M10, M38

 *KDEF* F04,F11, F26, F34, M23, M25, M29

 *WSEFEP* MB\_0048*,* MR1\_0132,HW\_0068, KA\_0043

**Anger**

 *RAFD* F01, F14, M07, M23, M24

 *KDEF* F23, F25, F29, F31, M09, M10, M24

 *WSEFEP* JS\_2296, SO\_0071, DC\_1317, AG\_1314

**Fear**

 *RAFD* F19, F22, F61, M25, M49

 *KDEF* F14, F16, F22, M11, M14, M17, M22

 *WSEFEP* KP\_1148, KS\_0624, KM\_1980, RA\_3483

**Sadness**

 *RAFD* F16, F31, F56, M46, M71

 *KDEF* F02, F13, F32, M05, M03, M16, M35

 *WSEFEP* MJ\_0484, MK1\_1982, MG\_0754, MR2\_2086

**Disgust**

 *RAFD* F08, F27, M05, M28, M33

 *KDEF* F09, F17, F12, F27, M02, M12, M31

 *WSEFEP* AD\_8268, SS\_0084, PA\_1701, PB\_0442

**Table S2**

Excluded trials (as % of all trials), including those containing severe EMG artifacts and statistical outliers (far-out values according Tukey, 1977) by muscle and prime emotion in the intentional categorization task of Study 1.

**Study 1:** Intentional categorization of visible emotional expressions

 **Prime emotion**

 happiness anger fear sadness disgust

*Zygomaticus major*

 EMG artifacts 4.6 5.7 4.9 6.6 6.1

 statistical outliers 10.3 10.1 5.4 5.2 5.9

*Corrugator supercilii*

 EMG artifacts 4.6 5.7 4.9 6.6 6.1

 statistical outliers 1.5 1.4 1.2 0.8 1.5

*Frontalis lateralis*

 EMG artifacts 4.6 5.7 4.9 6.6 6.1

 statistical outliers 1.5 1.5 2.0 1.0 1.2

*Depressor anguli oris*

 EMG artifacts 4.6 5.7 4.9 6.6 6.1

 statistical outliers 6.1 7.8 4.1 7.6 7.1

*Levator labii*

 EMG artifacts 4.6 5.7 4.9 6.6 6.1

 statistical outliers 4.6 5.6 3.0 4.1 4.6

**Table S3**

 Excluded trials (as % of all trials), including those containing severe EMG artifacts and statistical outliers (far-out values according Tukey, 1977) by muscle and prime emotion in the masked misattribution task of Study 2.

**Study 2:** Masked misattribution

 **Prime emotion**

 happiness anger fear sadness disgust

*Zygomaticus major*

 EMG-artifacts 5.1 6.0 5.8 5.6 4.7

 statistical outliers 4.9 3.8 4.8 6.3 6.0

*Corrugator supercilii*

 EMG-artifacts 5.3 6.2 6.0 6.0 4.9

 statistical outliers 1.2 0.9 1.5 1.1 0.9

*Frontalis lateralis*

 EMG-artifacts 5.0 6.2 5.6 5.8 4.7

 statistical outliers 1.2 0.5 0.8 0.9 0.9

*Depressor anguli oris*

 EMG-artifacts 7.5 7.2 8.2 8.3 6.7

 statistical outliers 4.7 3.3 4.3 4.9 4.8

*Levator labii*

 EMG-artifacts 5.9 6.6 6.5 6.1 5.5

 statistical outliers 3.4 3.1 2.1 4.0 3.4

# Prime awareness in Study 2

As noted in the manuscript, we measured prime awareness in Study 2 both through subjective self-report and an objective prime discrimination task. In this task, facial EMG responses were also recorded on a trial-by-trial basis. Results are provided below.

## Method

### Procedure

After the main part of Study 2 (i.e., the misattribution task), participants received a questionnaire with increasingly specific questions about subjective prime awareness (i.e., a funneled debriefing).[[1]](#footnote-1) Afterwards, participants completed the masked prime discrimination task. The procedure mirrored the main task but participants were now asked to intentionally categorize the masked primes. There was no response time limit, nor were participants given any feedback. As in the main task, a filler task (here: a confidence rating) was included at the end of each trial, to keep participants engaged during the long inter-trial intervals. The filler task ratings were not analyzed.

### Participants

Awareness measures were analyzed for *N* = 78 participants. In addition to the participants excluded because of EMG artifacts in the main task, three participants were excluded due to EMG artifacts in the objective prime discrimination task (i.e., less than half the trials per emotion condition and muscle remained after epochs contaminated with artifacts or statistically outlying values were rejected; see below for details)[[2]](#footnote-2), and one participant was excluded due to uniform responding on more than 75 % of trials of the objective prime discrimination task (i.e., they pressed the same key on 89 % of trials).

**Results**

### Subjective awareness measure

When asked about the aim of the experiment, most participants mentioned skin conductance or recognition of subtle emotions, in line with the provided cover story. Only eight participants referred to briefly flashed faces, and eleven participants mentioned facial muscle responses as a possible factor of interest. Thus, the majority of participants did not guess the experiment’s true purpose. When asked more specifically, 54 participants reported having perceived a flickering. On further questioning, however, only 28 participants referred to facial expressions, with many expressing a great deal of uncertainty about these perceptions; some participants stated they only realized there were briefly presented images the moment they were asked about the flickers. By contrast, when asked directly about the presence of emotional faces, 39 participants suggested they had perceived some emotional faces with moderate confidence (*M* = 3.07, *SD* = 1.53). Given the suggestive nature of the increasingly specific questions and the fact that only eight participants initially referred to briefly flashed images, it can be concluded that subjective unawareness in the main misattribution task was given for about two thirds of our participants.

### Objective prime discrimination task

 **Behavioral results.** The raw mean response frequencies across emotion conditions and response categories are provided in Table S4. First, we conducted a preliminary analysis of response category selection (disregarding prime emotion), which revealed unequal use of response categories, *F*(4, 74) = 28.94, *p* <.001, ηp² = .610. Follow-up paired *t*-tests (applying Bonferroni correction) showed that happiness (*M* = 23.14, *SD* = 8.90) was used significantly more often than any other category, all *ts*(77) > 2.73, *p ≤* .008, *d* ≥ .31. Anger (*M* = 19.33, *SD* = 6.33) was also used more often than fear (*M* = 13.96, *SD* = 6.49), sadness (*M* = 12.88, *SD* = 6.32), or disgust (*M* = 10.68, *SD* = 5.67), all *ts*(77) > 4.87, *p <*.001, *d* ≥ .55. Fear, sadness, and disgust were used to approximately the same extent. Thus, participants were biased toward happiness and anger when asked to discriminate the masked emotional faces, possibly because these two emotions are easiest to discriminate perceptually (i.e., teeth exposure; most expressive expressions).

As an index of prime discrimination, we calculated difference scores for each cell of the 5 × 5 design by subtracting the expected frequency of the given cell from the observed frequency. To examine prime (un)awareness, we ran a repeated measures MANOVA on the five concordant cells (i.e., prime-congruent responses) with emotion as a within-subjects factor. The constant test of this analysis indicated above-chance discrimination, *F*(1, 77) = 121.77, *p* < .001, ηp² = .613. There was also a significant main effect of emotion, *F*(4, 74) = 59.02, *p* < .001, ηp² = .761, indicating differences in discrimination across emotions. We followed this up with one-sample *t*-tests comparing the prime-discrimination indices of each emotion against zero. Discrimination was above chance for all emotions, *t*s(77) ≥ 5.44, *p*s *<* .001, *d*s ≥ 0.62, smallest *B*H(0, *0.37)* = 44297.05, RRB>100[0.00,2]; *F* (happiness: *M* = 6.44, *SD* = 3.87;anger: *M* = 1.66, *SD* = 2.69; fear: *M* = 3.73, *SD* = 3.71; sadness: *M* = 1.49, *SD* = 2.26; disgust: *M*= 2.58, *SD* = 2.89).

Furthermore, we examined whether prime-response incongruent cells with significant misattribution effects would yield above-chance responding in the prime discrimination phase. Such a result would indicate that participants perceptually mistook one emotion for another, meaning that misattribution effects may be explained by perceptual confusion. Significant above-chance misclassifications were observed for anger-sadness, *ts*(77) = 6.82, *p <* .001, *d*  = 0.77, *B*H(0, *0.37)* = 9,81 x 10⁶, RRB>100[0.00,2], as well as disgust-anger, *ts*(77) = 4.77, *p <* .001, *d*  = 0.54, *B*H(0, *0.37)* = 3976.57, RRB>100[0.00,2];. No other cells yielded significant above-chance misclassifications; thus, the theoretically important cross-misattributions of fear-anger and anger-fear cannot be explained by perceptual confusion.

#### **EMG results.**

Table S5 lists the proportion of trials excluded due to severe EMG artifacts or because they were statistical outliers. Group-averaged and *z*-standardized EMG responses for each muscle and prime emotion condition are presented in Figure S1. Analyses followed the same approach as in the main task of Study 2.

**Figure S1**

 *Z-standardized facial muscle activity across muscles and emotion categories in the masked intentional categorization task of Study 2*



*Note.* Error bars are 95 % within-subject confidence intervals for the main effect of emotion, specific to each muscle (Jarmasz & Hollands, 2009).

A 5 (emotion: happiness, anger, fear, sadness, disgust) × 5 (muscle: *zygomaticus major*, *corrugator supercilii*, *frontalis lateralis, depressor anguli oris, levator labii*) repeated measures MANOVA yielded a significant emotion × muscle interaction, *F*(16, 62) = 2.69, *p* = .003, ηp² = .410. Again, we ran additional one-factorial within-subject MANOVAs on activity data from each muscle with prime emotion as the within-subjects factor. Significant emotion main effects were found for the *corrugator supercilii*, *F*(4, 74) = 7.54, *p* < .001, ηp² = .289, and the *frontalis lateralis*, *F*(4, 74) = 3.84, *p* = .007, ηp² = .172 (all other *F*s(4, 74) ≤ 1.36, *p*s ≥ .257).

#### For the *corrugator supercilii*, the contrast of main a priori interest—happiness versus negative emotions—was significant, *F*(1, 77) = 23.65, *p* < .001, ηp² = .235. As can be seen in Figure S1, there were further differences within the set of negative emotions, *F*(3, 75) = 4.08, *p* = .010, ηp² = .140, with the numerically greatest activation for sadness. Comparing each specific negative emotion with happiness, however, yielded significant differences for all emotions: sadness, *t*(77) = 5.29, *p* <.001 (< .05/4, one-tailed), *dZ* = 0.60; disgust, *t*(77) = 4.28, *p* <.001 (< .05/3, one-tailed) *dZ* = 0.48; anger, *t*(77) = 3.99, *p* <.001 (< .05/2, one-tailed), *dZ* = 0.45; and finally, fear, *t*(77) = 2.87, *p* = .003 (< .05, one-tailed) *dZ* = 0.32. Importantly, the contrast of main interest for the *frontalis lateralis*—fear versus other emotions—was also significant, *F*(1,77) = 13.16, *p* < .001, ηp² = .146, indicating specific activation for fear. Accordingly, there were no further differences between the remaining emotions, *F*(3, 75) = 0.52, *p* = .672, ηp² = .020.

## Discussion

The results of the subjective awareness and prime discrimination tasks showed that the emotional primes were presented under conditions of subjective unawareness for most participants. However, when informed about the primes and instructed to discriminate them, participants were able to do so. Thus, as in our previous study (Rohr et al., 2018), masking only led to a degraded visible percept, not entirely non-conscious processing. Importantly, however, the observed pattern of effects clearly shows that indirect versus intentional conditions led to differences in the processing of the masked stimuli. In the discrimination phase, participants were able to discriminate expressions with regard to the specific emotion. Although there was some confusion between disgust/sadness and anger, the fear-anger and anger-fear cross-misattributions observed in the main misattribution phase were not observed. Regarding EMG responses *corrugator supercilii* and the *frontalis lateralis* responses were observed in the prime discrimination phase. Most importantly, a different pattern of activation compared to the main task occurred: The *frontalis lateralis* was activated for fear primes only, in line with the above-chance discrimination of fear primes. *Corrugator supercilii* activity was increased for several negative emotions, in line with its known responsiveness to negative emotions.Thus, the behavioral and EMG results of the misattribution phase cannot be explained by perceptual confusion.

# MLMM analyses of Study 1 and Study 2

We analyzed the EMG data with a MLMM approach specifying random slopes for items and subjects, as recommended for social science data (Judd, Westfall, & Kenny, 2012).

As these analyses did not converge, we re-sorted to random intercept models. However, we decided to report MANOVA results in the main manuscript because, in the present case, the essential reason for MLMM analyses is gone if random slopes are dropped, and because of better understanding and readability. Specifically, it requires always a model comparison to test for the omnibus model (i.e., is model fit improved if an interaction is in the model compared to a model without interaction = is the interaction significant according to the MANOVA approach; does inclusion of the prime emotion category lead to an improved model of muscle activity compared to the null model = is there a main effect of muscle according to the MANOVA approach), and then specific contrasts (i.e., regressions) give an insight into the exact pattern of responses. Thus, the random intercept MLMM analyses would be much harder to understand than the MANOVA-approach, while the information gain from MLMM analyses (i.e., random slopes) compared to MANOVA would not be present. Furthermore, there is no straightforward way to apply MLMM to the categorical behavioral responses: A multinomial hierarchical regression (with five categories) would be required. We think that this approach would increase the difficulty of understanding immensely, in addition to the issues concerning random slopes and lack of convergence. By contrast, the MANOVA approach is understandable straightforward and in line with the study by Rohr et al. (2018), providing better comparability between studies. Thus, all in all, we decided to stick to the MANOVA approach in the main manuscript, but present MLMM analyses for the facial muscle responses in the Supplementary Material.

Here, we provide a summary of these random intercept analyses. Tables S6 and S7 gives you an overview which analyses are reported here and which MLMM analyses did not converge. The tables also specifies whether results are comparable to the MANOVA approach. All R scripts are available on OSF. All analyses were built in parallel to the reported MANOVA analyses.

## Study 1

First, we examined whether muscle (5 categories) and prime emotion (5 categories) predict differences in facial muscle activity. The random intercept model including the interaction term was compared to the model containing only the two main effects of prime emotion category and muscle. This model was significant, χ²(16) = 280.42, p < .001.

Then, we conducted the corresponding analyses for each muscle. Thus, we specified a model testing whether prime emotion (5 categories, Helmert contrasts) predicts facial muscle activity. If this analysis was significant, we also reported the specific significant contrasts (see below for details).

For the *zygomaticus major*, prime emotion did significantly predict facial muscle activity. The comparison of the null model to the model including prime emotion as predictor was significant, χ²(4) = 31.77, p <.001, mirroring the MANOVA results. The contrast of happy vs. the negative emotions was significant, b = 0.06, *t*(2503.35) = 5.54, *p* < .001 indicating increased zygomaticus activity following happy primes. No further differences within the negative emotions were significant, t < 1, p > .358.

For the *corrugator supercilii*, prime emotion did significantly predict facial muscle activity. The comparison of the null model to the model including prime emotion as predictor was significant, χ²(4) = 157.62, p <.001, mirroring the MANOVA results. The contrast of happy vs. the negative emotions was significant, b = -.012, *t*(2681) = - 12.45, *p* < .001 indicating increased corrugator activity following the negative emotions compared to the happy primes. Within the negative emotions, the contrast of disgust vs. anger (i.e., the 4th Helmert contrast) was significant as well, b = 0.07, t(2681) = 2.47, *p* = .01, indicating that corrugator activity was lower for disgust compared to angry primes (see Figure 2 in the main manuscript).

For the *frontalis lateralis*, the model including prime emotion as predictor had significant better fit than the null model, χ²(4) = 65.59, *p* <. 001. The contrast of fear vs. the remaining emotions was significant, b = 0.05, t(2675) = 4.90, *p* < .001, as was the contrast testing differences between the remaining emotions, b = - 0.06, t(2675) = -4.49, *p* < .001, thereby indicating that frontalis lateralis did not respond to fearful prime expressions only. Specifically,

frontalis lateralis increased following sad primes compared to the remaining anger and disgust primes, b = 0.08, t(2675) = 4.57, *p* < .001 (b = 0.03, t(2675) = 1.06, *p* = .289, for the anger vs. disgust comparison).

In case of the *depressor anguli oris,* the model including prime emotion as predictor did outperform the null model, χ²(4) = 14.89, *p* <. 001, in contradiction to the MANOVA results. However, the only significant contrast was the second one comparing happy vs. the remaining emotions (excluding sadness), thereby indicating cross-talk, b = 0.05, t(2539) = 3.79, *p* < .001.

Concerning levator labii, the model including prime emotion as predictor did outperform null model, χ²(4) = 24.05, *p* <. 001, as for the MANOVA results. The contrast comparing disgust vs. the remaining emotions was significant, b = 0.03, t(2589.23) = 2.67, *p* = .007.

## Study 2

Again, first we examined whether muscle (5 categories) and prime emotion (5 categories) predict differences in facial muscle activity. The random intercept model including the interaction term was compared to the model containing only the two main effects for prime emotion category and muscle. This model was significant one-sided, χ²(16) = 25.88, p = 0.0558.

Then, we conducted the corresponding analyses for each muscle. Thus, we specified a model testing whether prime emotion (5 categories, Helmert contrasts) predicts facial muscle activity. If this analysis was significant, we also reported the specific significant contrasts (see below for details).

For the *zygomaticus major*, prime emotion did not significantly predict facial muscle activity. The comparison of the null model to the model including prime emotion as predictor was not significant, χ²(4) = 4.18, p = 0.382, mirroring the MANOVA results.

For the *corrugator*, prime emotion did significantly predict facial muscle activity. The comparison of the null model to the model including prime emotion as predictor was significant, χ²(4) = 18.46, p < 0.001,again mirroring the MANOVA results. The contrast of happy vs. the negative emotions was significant, b = - 0.02, t(6106.81) = - 2.70, p = 0.007, indicating increased corrugator activity following the negative emotions. Differences within the negative emotions were also significant, χ²(3) = 11.32, p = 0.01, for the model comparison with only negative emotions included in the data.

The specific comparisons yielded the same pattern as in the MANOVA approach: The contrast of happy vs. angry prime emotions, b = - 0.06, t(2438.40) = - 3.10, p = 0.002; the contrast of happy vs. disgust prime emotions, b = - 0.07, t(2460.00) = - 3.44, p < 0.001. For fear and sadness results were non-significant.

For the frontalis, the comparison of the null model to the model including prime emotion as predictor was significant, χ²(4) = 9.51, p = 0.049. The contrast of anger vs. the negative emotions was b = 0.02, t(4912.30) = 1.88, p = 0.06.

**Table S4**

*Mean response frequencies (and standard errors) for all cells in the prime discrimination task*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |   | Prime emotion  |   |   |
| Response  |   | Happiness  | Anger  | Fear  | Sadness  | Disgust  | Exp. Freq.  | Σ  |  |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |  |
| Happiness  |   | 11.06 (.51)  | 2.33 (.24)  | 3.50 (.25)  | 3.17 (.26)  | 3.08 (.31)  | 4.63 (.20)  |   |  23.14 (1.01) |  |
| Anger  |   | 1.77 (.21)  | 5.53 (.34)  | 3.04 (.29)  | 3.92 (.25)  | 5.08 (.33)  | 3.87 (.14)  |   |   19.33 (.72) |  |
| Fear  |   | .96 (.13)  | 2.38 (.22)  | 6.53 (.50)  | 2.71 (.23)  | 1.38 (.17)  | 2.80 (.15)  |   |   13.96 (.73) |  |
| Sadness  |   | 1.38 (.28)  | 4.01 (.27)  | 1.68 (.18)  | 4.06 (.28)  | 1.74 (.24)  | 2.58 (.14)  |  |   12.88 (.72) |  |
| Disgust  |   | .82 (.13)  | 1.74 (.18)  | 1.26 (.16)  | 2.14 (.20)  | 4.72 (.41)  | 2.14 (.13)  |  | 10.68 (.64) |  |
| Σ  |   |  16  |   |  16  |   |  16  |   |  16  |   |  16  |   | 80 |  |   |  |

*Note.* Exp. Freq., expected frequencies calculated for each response by multiplying the row totals with the column totals divided by the grand total (excluding the neutral condition).

**Table S5**

Excluded trials (as % of all trials), including those containing severe EMG artifacts and statistical outliers (far-out values according Tukey, 1977) by muscle and prime emotion in the prime discrimination task of Study 2.

 **Prime emotion**

 happiness anger fear sadness disgust

*Zygomaticus major*

 EMG artifacts 4.9 5.5 5.1 4.3 4.6

 statistical outliers 6.6 5.8 5.3 7.2 6.1

*Corrugator supercilii*

 EMG artifacts 4.2 5.5 4.9 4.6 4.9

 statistical outliers 1.2 1.3 1.1 1.4 0.9

*Frontalis lateralis*

 EMG artifacts 4.3 5.3 5.1 4.5 4.1

 statistical outliers 1.5 1.0 0.8 1.6 1.3

*Depressor anguli oris*

 EMG artifacts 7.5 8.0 8.1 7.0 7.3

 statistical outliers 6.3 5.9 4.8 6.4 5.5

*Levator labii*

 EMG artifacts 5.9 6.5 5.8 5.0 6.2

 statistical outliers 3.9 3.1 3.2 3.2 3.2

**Table S6**

Comparison of the MLMM results with results from the MANOVA approach for Study 1

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Model** | **Result** | **Comment** |
| *Overall analysis* |  |  |  |
| MANOVA | 5 (emotion) × 5 (muscle) rm MANOVA | significant (see main manuscript) |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=EMG\_supra\_final) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE \* MU + (1|Subject)+(1|Trial), data= EMG\_supra\_final) | model comparison to model with two main effects significant  | same results as MANOVA |
| *Zygomaticus major* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA |  |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_zygo) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_zygo) | Comparison to Null Model significant, contrast: Happy vs. negative significant | same result as MANOVA |
| *Corrugator supercillii* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA | significant, significant contrasts: happy vs. neg,  |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_corru) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_corru) | Comparison to null model significant, contrast happy vs. neg, 4th Helmert indicating no Corrugator activity for disgust | same result as MANOVA |
| *Frontalis* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA | significant, contrasts: fear vs. other, further diff, sadness vs. remaining |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_front) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_front) | Comparison to null model significantContrast fear vs. other, differences within remaining significant, sadness vs. disgust/anger sign | Same result as MANOVA |
| *Depressor anguli oris* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA | Not significant |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_dep) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_dep) | Comparison to null model significant, significant 2nd contrast: happy vs. remaining (excluding sadness) | Result in contrast to MANOVA |
| *Levator labii* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA | significant |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_dep) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_dep) | Comparison to null model significant, significant contrasts: disgust vs. remaining | Same result as MANOVA |

Note. Detailed MANOVA results are reported in the main manuscript. More detailes about the MLMM analyses in the Supplementary Material above. Contrasts of the MLMM analyses were created in correspondence to the analyses reported in the main manuscript.

**Table S7**

Comparison of the MLMM results with results from the MANOVA approach for Study 2

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Model** | **Result** | **Comment** |
| *Overall analysis* |  |  |  |
| MANOVA | 5 (emotion) × 5 (muscle) rm MANOVA | significant (see main manuscript) |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=EMG\_sub\_long) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE \* MU + (1|Subject)+(1|Trial), data=EMG\_sub\_long) | model comparison to model with two main effects significant one-sided | Comparable to MANOVA results |
| *Zygomaticus major* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA |  |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_zygo) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_zygo) | Comparison to Null Model non-significant, no contrast significant | same result as MANOVA |
| *Corrugator supercilii* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA | significant, significant contrasts: happy vs. neg, within neg |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_corru) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_corru) | Comparison to null model significant, χContrasts: helmert-coded as in main manuscript, significant for disgust, anger, not for fear and sadness (see text above) | same result as MANOVA |
| *Frontalis* |  |  |  |
| MANOVA | 5 (emotion) rm MANOVA | significant, significant contrasts: anger vs. other |  |
| MLMM RS model | lmer(value ~ 1 + PE + (1 + PE|Subject)+( 1+ PE|Trial), data=subset\_front) | Model failed to converge |  |
| MLMM RI model | lmer1.00 = lmer(value ~ 1 + PE + (1|Subject)+(1|Trial), data=subset\_front) | Comparison to null model significantContrast anger vs. other: | Result comparable to MANOVA |

Note. Detailed MANOVA results are reported in the main manuscript. More detailes about the MLMM analyses in the Supplementary Material above. Contrasts of the MLMM analyses were created in correspondence to the analyses reported in the main manuscript.

1. Specifically, general questions about participants’ internal state during the experiment (i.e., motivation, concentration, tiredness) were followed by questions about perceived task difficulty, the perceived aim of the experiment, and any unusual occurrences. Participants were then asked directly if they had noted a flickering before the neutral faces, and if yes, what (if anything) they had perceived in this flickering. Then, they were informed that emotional faces had been presented and were asked whether they had perceived any emotional expressions, and how confident they were about their perceptions (on a scale from 1 = not at all confident to 7 = very confident). [↑](#footnote-ref-1)
2. Subjective awareness and objective discrimination performance results were essentially unaffected by the exclusions. [↑](#footnote-ref-2)