Supplementary Materials
Heart Rate Reveals the Difference between Disgust and Anger in the Domain of Morality

Table S1

Summary of Hierarchical Linear Model Estimations for the Analysis Predicting Moral Judgment from the Two Moral Emotions (Pilot Study 1)

Moral judgment	Coefficients		95% CI [lower, upper]	$\lvert t \rvert$	*df*	*p*-value
π_0						
Intercept θ_0	2.50	***	[2.39, 2.60]	46.608	3286	<.001
Gender γ_{01}	−0.07		[−0.14, 0.01]	1.679	234	0.094
Anger π_1						
Intercept θ_1	0.21	***	[0.19, 0.23]	21.109	3268	<.001
Disgust π_2						
Intercept θ_2	0.15	***	[0.13, 0.17]	14.163	3268	<.001

Table S2

Summary of the Results of Hierarchical Linear Model Estimations (with ΔHR Based on ECG Data)

	Coefficients		95% CI [lower, upper]	$|t|$	df	p-value
Pilot Study 2 (ΔHR ECG)						
π_0						
Intercept θ_0	1.94		[−2.57, 6.45]	0.845	242	.399
Gender γ_{01}	−1.22		[−4.53, 2.09]	0.755	26	.457
Anger β_{01}	0.65	**	[0.26, 1.04]	3.809	8	.005
Disgust β_{02}	−0.74	**	[−1.13, −0.35]	4.219	8	.003
Study1 (ΔHR ECG)						
π_0						
Intercept θ_0	−4.03		[−12.87, 4.81]	0.898	259	.37
Gender γ_{01}	3.69		[−8.32, 15.70]	0.643	19	.528
Order γ_{02}	3.66		[−8.35, 15.67]	0.638	19	.531
Anger β_{01}	0.38		[−0.25, 1.01]	1.345	12	.204
Disgust β_{02}	−0.16		[−0.70, 0.38]	0.633	12	.538
Study2 (ΔHR ECG)						
π_0						
Intercept θ_0	−2.24		[−9.64, 5.16]	0.596	259	.552
Gender γ_{01}	0.57		[−2.59, 3.73]	0.377	19	.710
Order γ_{02}	0.49		[−2.67, 3.65]	0.322	19	.751
Anger β_{01}	−0.11		[−0.65, 0.43]	0.439	12	.668
Disgust β_{02}	−0.30		[−0.76, 0.16]	1.386	12	.191

Table S3

Summary of Hierarchical Linear Model Estimations (with ΔHR Based on ECG) in Study 1 (Upper Panel) and Study 2 (Lower Panel)

ΔHR (ECG)	Coefficients	95% CI [lower, upper]	$|t|$	*df*	*p*-value
Study 1					
π_0					
Intercept β_{00}	−3.49	[−13.50, 6.52]	0.732	18	.474
Gender β_{01}	3.75	[−9.28, 16.79]	0.605	18	.553
Order β_{02}	3.62	[−9.41, 16.66]	0.584	18	.567
Anger π_1					
Intercept β_{10}	0.25	[−0.16, 0.66]	1.187	271	.236
Disgust π_2					
Intercept β_{20}	−0.27	[−0.60, 0.07]	1.579	271	.115
Study 2					
π_0					
Intercept β_{00}	−2.88	[−11.27, 5.52]	0.720	18	.481
Gender β_{01}	0.56	[−2.89, 4.00]	0.340	18	.738
Order β_{02}	0.46	[−2.99, 3.90]	0.278	18	.784
Anger π_1					
Intercept β_{10}	−0.03	[−0.42, 0.36]	0.145	271	.885
Disgust π_2					
Intercept β_{20}	−0.09	[−0.38, 0.20]	0.636	271	.525

Table S4

List of the Punitive Intention Items

Direct aggression
1   I would hit Person A.
2   I would insult Person A to his face.
3   I would shove Person A.
4   I would get in the face of Person A.
5   I would yell at or argue with Person A.

Indirect aggression
6   I would spread negative information about Person A to others.
7   I would mention something bad I've heard about Person A to other people who know him.
8   I would try to get others to dislike Person A.
9   I would try to exclude Person A from a social group.
10   I would tell a friend an embarrassing secret I've heard about Person A.

Other punitive intention
11   When Person A is in trouble, I would pretend not to know about it.
12   I would feel glad If a bad thing happens to Person A.
13   I would tell off Person A.
14   I would report Person A to the police.
15   If I happen to witness Person A drops his/her wallet, I would not tell him/her about it.
16   Even if Person A appears sick, I would not ask him/her "are you OK?"
17   I would avoid contact with Person A.

Note. Direct aggression and indirect aggression items were adapted from Molho et al. (2017). We translated the items into Japanese.

Table S5

Summary of Hierarchical Linear Model Estimations for the Analysis Predicting Moral Judgment from the Two Moral Emotions (Study 2)

Moral judgment	Coefficients		Standard Error	$|t|$	*df*	*p*-value
π_0						
Intercept β_{00}	2.98	***	[2.49, 3.46]	12.918	18	<.001
Gender β_{01}	−0.11		[−0.30, 0.08]	1.222	18	0.238
Order β_{02}	−0.01		[−0.20, 0.18]	0.090	18	0.929
Anger π_1						
Intercept β_{10}	0.13	***	[0.08, 0.18]	5.383	271	<.001
Disgust π_2						
Intercept β_{20}	0.12	***	[0.08, 0.16]	6.047	271	<.001

Re-analyses Removing the Corpse-Related Scenarios

To see whether the corpse-related scenarios (i.e., inherently disgusting scenarios) drove the significant negative correlations between disgust and HR change, we re-ran some analyses after removing those scenarios. In this section, we only analyzed the ΔHR scores based on PPG because the PPG-based ΔHR was more robustly associated with disgust in the main analyses.

In Pilot Study 2, a hierarchical linear model analysis revealed that scenario-specific disgust was negatively correlated with ΔHR. We re-ran the same analyses after removing Scenarios 1, 7, and 9 in Table 1. As shown in the upper panel of Table S6, once the corpse-related scenarios were removed, the significant effect of disgust on ΔHR became only marginally significant, while the effect of anger remained significant. We conducted a comparable analysis by combining the data sets from Studies 1 and 2. For this analysis, Scenarios 8, 9, 10, 11, and 14 in Table 3 were removed. As shown in the lower panel of Table S6, once the corpse-related scenarios were removed, the effect of disgust on ΔHR was no longer significant.

Finally, we analyzed the data including participants' subjective anger and disgust in the independent variables. It is noteworthy that removing the corpse-related scenarios (Scenarios 8, 9, 10, 11, and 14 in Table 3) substantially reduced the variance in the subjective disgust score (see Figure S1a) compared with the variance in the subjective anger score (Figure S1b). Within-participant variance in anger (i.e., variance of each participant's anger scores for the 14 vs. 9 scenarios) distributed almost equally regardless of the inclusion/removal of the corpse-related scenarios. However, within-participant variance in disgust for all but one participant was reduced to less than 2 once those scenarios were removed, although it distributed more widely (up to over 5) before their removal. Consequently, as shown in Table S7, disgust was no longer significantly predicted ΔHR. Taken together, these results suggest that the significant association between disgust and HR decrease was driven by the presence of inherently disgusting violations.

Table S6

Hierarchical Linear Model Estimations for Pilot Study 2 after Removing the Corpse-Related

Scenarios (with ΔHR Based on PPG Data)

|	Coefficients	95% CI [lower, upper]	$|t|$	*df*	*p*-value
Pilot Study 2 (ΔHR PPG)					
π_0					
Intercept θ_0	2.01	[−2.31, 6.34]	0.920	161	.359
Gender γ_{01}	−1.81	[−4.96, 1.34]	1.179	26	.249
Anger β_{01}	1.19 *	[0.15, 2.22]	2.942	5	.032
Disgust β_{02}	−1.38 +	[−2.91, 0.16]	2.309	5	.069
Studies 1 and 2 (ΔHR PPG)					
π_0					
Intercept θ_0	0.25	[−5.39, 5.90]	0.087	327	.930
Gender γ_{01}	0.10	[−1.84, 2.04]	0.104	40	.918
Order γ_{02}	0.42	[−1.52, 2.36]	0.438	40	.664
Anger β_{01}	−0.07	[−0.79, 0.66]	0.216	7	.835
Disgust β_{02}	−1.12	[−2.74, 0.50]	1.641	7	.145
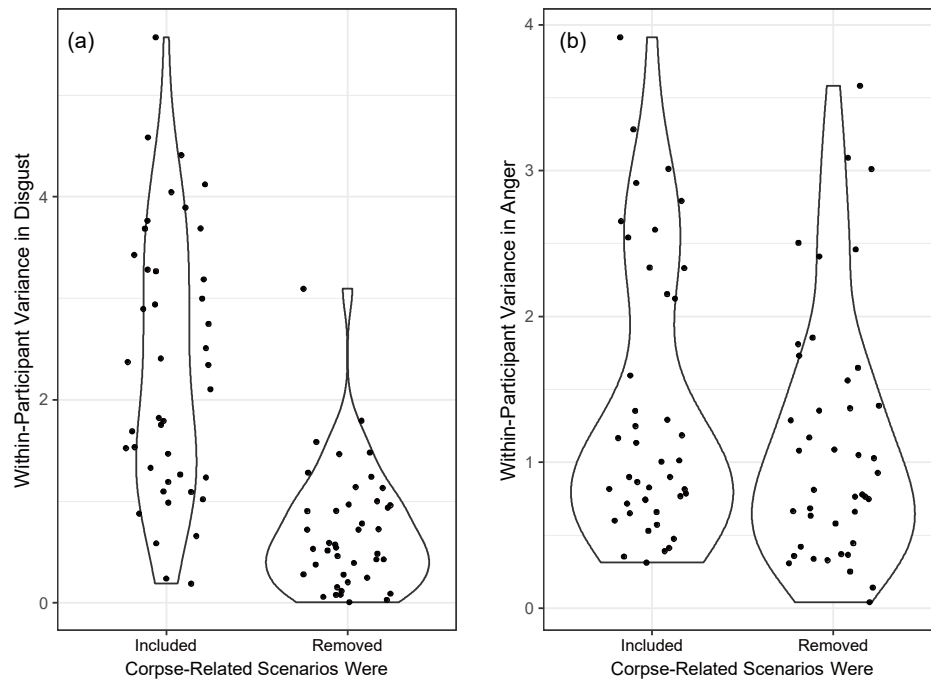
Figure S1. *Distributions (shown by violin plots) of within-participant variance in the disgust and anger scores as a function of the inclusion vs. removal of the corpse-related scenarios.*

Table S7

Summary of Hierarchical Linear Model Estimations (with ΔHR Based on PPG) of the Studies 1 and 2 Data Sets Combined

ΔHR (PPG)	Coefficients	95% CI [lower, upper]	$|t|$	df	p-value
Study 1 and 2					
π_0					
Intercept β_{00}	−2.07	[−6.69, 2.55]	0.908	39	.370
Gender β_{01}	0.10	[−1.94, 2.15]	0.103	39	.918
Order β_{02}	0.49	[−1.54, 2.51]	0.486	39	.630
Anger π_1					
Intercept β_{10}	0.02	[−0.32, 0.36]	0.118	334	.906
Disgust π_2					
Intercept β_{20}	0.09	[−0.17, 0.34]	0.662	334	.508