

## Supplemental Material

### S1. Study 1. Construction of Dynamic Smile Models

Table S1a *Distribution of responses across the four response categories.*

	<b>Reward</b>	<b>Affiliative</b>	<b>Dominance</b>	<b>Neutral/Other</b>
<i>M</i> %	16.44	31.93	25.67	25.96
<i>SE</i>	1.49	1.95	1.81	3.07

Table S1b *Distribution of participants' responses across the five intensity levels.*

	<b>Very low</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>Very high</b>
<i>M</i> %	45.25	24.96	19.35	6.98	3.45
<i>SE</i>	3.63	1.58	1.90	0.80	0.83

Table S1c *Number and percentage of smile models with each Action Unit.*

<b>Action Unit</b>	<b>Smile Types</b>					
	<b>Reward (N = 43)</b>		<b>Affiliative (N = 43)</b>		<b>Dominance (N = 43)</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
Inner Brow Raiser (AU1)	28	65	7	16	5	12
Inner and Outer Brow Raiser (AU1-2)	8	19	14	33	2	5
Outer Brow Raiser (AU2)	17	40	10	23	6	14
Outer Brow Raiser Left (AU2L)	8	19	5	12	9	21
Brow Lowerer (AU4)	1	2	6	14	8	19
Upper Lid Raiser (AU5)	9	21	1	2	17	40
Cheek Raiser (AU6)	0	0	1	2	27	63

Cheek Raiser Left (AU6L)	0	0	1	2	24	56
Cheek Raiser Right (AU6R)	3	7	2	5	12	28
Lid Tightener (AU7)	2	5	0	0	12	28
Lid Tightener Left (AU7L)	1	2	4	9	6	14
Lid Tightener Right (AU7R)	4	9	6	14	4	9
Nose Wrinkler (AU9)	1	2	0	0	27	63
Upper Lip Raiser (AU10)	3	7	0	0	23	53
Upper Lip Raiser Left (AU10L)	0	0	0	0	33	77
Upper Lip Raiser Right (AU10R)	0	0	0	0	31	72
Nasolabial Deepener Left (AU11L)	0	0	1	2	21	49
Nasolabial Deepener Right (AU11R)	2	5	2	5	14	33
Lip Corner Puller (AU12)	42	95	27	51	1	0
Lip Corner Puller Left (AU12L)	0	0	6	7	25	67
Lip Corner Puller Right (AU12R)	1	2	10	16	17	60
Sharp Lip Puller (AU13)	36	84	15	35	1	2
Dimpler (AU14)	30	70	18	42	2	5
Dimpler Left (AU14L)	8	19	20	47	0	0
Dimpler Right (AU14R)	11	26	28	65	0	0
Lip Corner Depressor (AU15)	0	0	7	16	0	0
Chin Raiser (AU17)	2	5	4	9	4	9
Lip Stretcher (AU20)	1	2	4	9	9	21
Lip Stretcher Left (AU20L)	0	0	2	5	5	12
Lip Stretcher Right (AU20R)	0	0	6	14	3	7

Lip Funneler (AU22)	0	0	0	0	0	0
Lip Tightener (AU23)	5	12	10	23	1	2
Lip Pressor (AU24)	1	2	17	40	3	7
Nostril Dilator (AU38)	0	0	3	7	1	2
Nostril Compressor (AU39)	4	9	9	21	1	2
Eyes Closed (AU43)	4	9	4	9	13	30

Table S1d *Bayesian classifier probabilities for smile models.*

Input stimulus (model)	Output response (smile label)		
	Reward	Affiliative	Dominance
<b>Reward</b>	0.9207	0.0563	0.0229
<b>Affiliative</b>	0.2141	0.7071	0.0788
<b>Dominance</b>	0.0279	0.0186	0.9535

## S2. Study 2. Detection of Smile Types

Table S2a *Detection statistics for each of the individual participant dynamic smile models (N = 43) generated in Study 1. For each individual model, false alarm rates were computed from the proportion of trials when a given model was erroneously detected as an instance of another smile (i.e. positive response to a reward smile model presented with the label “dominance smile”).*

Model	Smile Types								
	Reward			Affiliative			Dominance		
	H <sub>rate</sub>	FA <sub>rate</sub>	<i>d'</i>	H <sub>rate</sub>	FA <sub>rate</sub>	<i>d'</i>	H <sub>rate</sub>	FA <sub>rate</sub>	<i>d'</i>
1	0.76	0.48	0.78	0.56	0.29	0.72	0.78	0.02	2.79
2	0.03	0.46	-1.77	0.79	0.44	0.96	0.77	0.05	2.38
3	0.23	0.62	-1.03	0.86	0.39	1.38	0.72	0.02	2.61
4	0.67	0.49	0.45	0.74	0.47	0.71	0.73	0.04	2.36

5	0.60	0.50	0.25	0.43	0.25	0.50	0.61	0.10	1.53
6	0.76	0.44	0.85	0.42	0.26	0.45	0.76	0.03	2.49
7	0.76	0.40	0.94	0.81	0.40	1.15	0.63	0.11	1.56
8	0.23	0.53	-0.84	0.80	0.42	1.04	0.77	0.11	1.96
9	0.65	0.39	0.65	0.80	0.30	1.36	0.66	0.13	1.53
10	0.26	0.52	-0.70	0.64	0.24	1.07	0.80	0.06	2.33
11	0.55	0.52	0.07	0.32	0.28	0.12	0.70	0.01	2.69
12	0.01	0.41	-2.09	0.82	0.41	1.17	0.83	0.03	2.75
13	0.61	0.48	0.34	0.88	0.34	1.59	0.85	0.03	2.86
14	0.68	0.47	0.56	0.82	0.26	1.55	0.75	0.06	2.18
15	0.49	0.51	-0.06	0.54	0.19	0.96	0.72	0.01	2.80
16	0.65	0.54	0.28	0.56	0.28	0.73	0.73	0.04	2.33
17	0.61	0.50	0.29	0.84	0.44	1.15	0.83	0.03	2.82
18	0.58	0.49	0.22	0.71	0.33	1.00	0.76	0.05	2.35
19	0.71	0.51	0.54	0.76	0.24	1.43	0.75	0.01	2.90
20	0.52	0.48	0.10	0.66	0.14	1.48	0.76	0.00	3.23
21	0.62	0.53	0.22	0.73	0.23	1.34	0.77	0.02	2.70
22	0.69	0.44	0.66	0.78	0.44	0.92	0.74	0.08	2.02
23	0.69	0.49	0.52	0.80	0.40	1.11	0.72	0.14	1.64
24	0.78	0.47	0.83	0.88	0.35	1.57	0.81	0.04	2.62
25	0.19	0.53	-0.93	0.22	0.30	-0.23	0.60	0.16	1.22
26	0.77	0.44	0.91	0.74	0.43	0.82	0.71	0.03	2.40
27	0.40	0.56	-0.40	0.48	0.30	0.47	0.73	0.04	2.33

28	0.65	0.42	0.60	0.53	0.29	0.65	0.80	0.07	2.26
29	0.42	0.42	0.00	0.83	0.30	1.46	0.71	0.02	2.51
30	0.50	0.56	-0.14	0.75	0.47	0.75	0.79	0.01	2.99
31	0.34	0.52	-0.47	0.60	0.31	0.76	0.76	0.02	2.63
32	0.73	0.47	0.70	0.27	0.13	0.49	0.82	0.04	2.66
33	0.24	0.44	-0.56	0.75	0.36	1.04	0.73	0.02	2.64
34	0.62	0.46	0.43	0.83	0.19	1.84	0.66	0.15	1.41
35	0.64	0.51	0.32	0.55	0.28	0.72	0.79	0.04	2.45
36	0.31	0.63	-0.85	0.86	0.34	1.49	0.78	0.04	2.43
37	0.73	0.35	0.99	0.48	0.20	0.81	0.81	0.03	2.75
38	0.79	0.50	0.81	0.38	0.23	0.45	0.81	0.05	2.52
39	0.64	0.46	0.47	0.85	0.44	1.17	0.63	0.16	1.32
40	0.72	0.38	0.87	0.34	0.18	0.51	0.80	0.00	3.43
41	0.70	0.54	0.41	0.47	0.24	0.64	0.75	0.00	3.31
42	0.78	0.35	1.14	0.81	0.31	1.36	0.82	0.02	2.91
43	0.65	0.57	0.20	0.50	0.34	0.40	0.52	0.40	0.29
<b>Total</b>	<b>0.56</b>	<b>0.48</b>	<b>0.15</b>	<b>0.66</b>	<b>0.31</b>	<b>0.95</b>	<b>0.74</b>	<b>0.06</b>	<b>2.37</b>

Table S2b *Proportions of participants' yes responses in the smile detection task.*

Input stimulus (smile label)	Output response (model)		
	Reward	Affiliative	Dominance
<b>Reward</b>	0.7717	0.2170	0.0113
<b>Affiliative</b>	0.3374	0.6159	0.0467
<b>Dominance</b>	0.1162	0.1528	0.7310

#### **S4. Is it a smile? Categorization of the three smiles**

**Participants.** Seventy-three participants (69 in U.S., 38 female, age  $M = 35.79$  years,  $SD = 12.37$  years) were recruited on MTurk and paid for their time.

**Stimuli.** Informed by the dynamic models of reward, affiliative, and dominance smiles, we recorded a set of facial expression videos posed by experienced actors (7 females, 7 African Americans). Actors were coached about the Action Units diagnostic of each smile and asked to imagine themselves in the situations associated with the functional smiles: for the reward smile – ‘A person learns that he/she just got hired for his/her dream job’; for the affiliative smile – ‘A person thanks someone for their help in a store’; for the dominance smile – ‘A person crosses paths with an enemy after winning an important prize’ (Martin et al., 2017). In addition to the smile videos, actors were also asked to encode neutral and disgusted expressions.

Here, we used still 75 images (15 models X 5 expressions) representing apex intensities of each facial display (see <https://tinyurl.com/ztl425x> for the full stimuli set). On average, photographs of dominance smiles involved lower activation of Bilateral Lip Corner Puller (AU12;  $M = 1.05$ ,  $SD = 0.78$ ) and higher levels of Nose Wrinkler (AU9;  $M = 1.17$ ,  $SD = 0.69$ ) than photographs of reward smiles ( $M = 2.28$ ,  $SD = 0.82$ ),  $t(11) = -4.55$ ,  $p = .001$ ;  $M = 1.16$ ,  $SD = 0.05$ ,  $t(11) = 2.85$ ,  $p = .016$ , as quantified by an automatic facial expression recognition software (Computer Expression Recognition Toolbox; Littlewort et al., 2011<sup>1</sup>).

**Procedure.** We used an online interface created in Qualtrics to display the stimuli and collect responses (version 1.869s, Provo, UT). On each experimental trial, participants viewed the facial expression stimulus (size: 1668 x 938 pixels) along with the question: ‘Is it a smile?’

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<sup>1</sup> Feature detection was only possible for the 12 out of 15 reward-dominance pairs.

and responded ‘yes’ or ‘no’. We presented the stimuli in random order, displayed in the center of the screen on a white background, with the question above the facial expression and the response options below. After evaluating the 75 facial expressions, participants completed the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987); and the Social Phobia Inventory (SPIN; Connor et al., 2000). These two scales were included for the needs of another study and will not be discussed further.

**Results.** All analyses were conducted in the “R” statistical environment (R Core Team, 2014). Using the glmer function from the “lme4” package (Bates, Maechler, Bolker, & Walker, 2015), we fit a generalized linear mixed effects model with a binomial distribution and random intercepts for both participant and actor to model the probability of smile categorization for each of the five facial expressions (Reward, Affiliation, Dominance, Neutral, Disgust). Participants were more likely than not to categorize each of the three smile types as smiles (Reward: estimated probability = 98%,  $X^2(1) = 170.7$ ,  $p < .0001$ ; Affiliation: estimated probability = 86%,  $X^2(1) = 44.7$ ,  $p < .0001$ , Dominance: estimated probability = 69%,  $X^2(1) = 8.6$ ,  $p = .003$ ). Furthermore, participants were more likely to categorize Neutral and Disgust expressions as not a smile than as a smile (Neutral: estimated probability = 6%,  $X^2(1) = 91.8$ ,  $p < .001$ ; Disgust: estimated probability = 2%,  $X^2(1) = 167.4$ ,  $p < .001$ ).

#### **S4. Examples of dynamic smile models and videos of functional smiles**

Files are available to download at <http://tinyurl.com/zo4of3f>

## References

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