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Emotions Are Perceived Differently From Posed and Spontaneous Facial Expressions

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A widely used experimental paradigm in psychological research and clinical assessments involves identifying emotions from facial expressions, typically using posed expressions as stimuli. Perceptions of such stimuli are assumed to mirror those of naturally occurring emotional expressions. However, this assumption has been questioned because the perceptual equivalence of posed and spontaneous expressions has not been empirically established. To address this, we directly compared perceptual judgments of posed and spontaneous facial expressions produced by the same expressers in three preregistered studies. A total of 2,408 perceivers judged the emotions displayed in 1,244 dynamic facial expressions of eight emotions (anger, disgust, fear, sadness, joy, pride, compassion, and love). Consistent with our main hypothesis, emotions were much better recognized from posed compared to spontaneous expressions, by both Western (Study 1, $N = 470$) and non-Western perceivers (Study 2, $N = 438$). This pattern was replicated in a cross-cultural context in Study 3 ($N = 1{,}500$). Furthermore, in all three studies, we observed a "negativity bias" with only posed expressions. Specifically, negative emotions were better recognized than positive emotions from posed expressions, while the opposite was true for spontaneous expressions, such that positive emotions were better recognized than negative emotions. Our findings present clear evidence that perceptions of posed and spontaneous facial expressions meaningfully differ, and raise questions about the generalizability of findings from existing research that uses posed emotional expressions.

Keywords: facial expressions, emotion perception, recognition, posed, spontaneous

Supplemental materials: https://doi.org/10.1037/emo0001473.supp

A well-known number in popular psychology is that 90% of the total meaning in interpersonal interactions is communicated through nonverbal cues (Lapakko, 2015). This number is based on a study showing that when perceivers judged whether an expresser's attitude was positive, negative, or neutral, their judgments were 55% based on the expresser's facial expressions, 38% on tone of voice, and only 7% on words (Mehrabian & Ferris, 1967; Mehrabian & Wiener, 1967). Though the applicability of these numbers to real life is questionable, they do align with a substantive body of research showing the importance of nonverbal cues in interpersonal communication (Grahe & Bernieri, 1999; Phutela, 2015; Subapriya, 2009). Emotion expressions carry important social information (Kret et al., 2013; Van Kleef, 2009; Van Kleef & Côté, 2022), and both human and nonhuman primates have preferential attention to emotional stimuli over nonemotional stimuli (Calvo & Lang, 2004; Folz et al., 2024; Kret et al., 2014). The ability to correctly interpret the emotions conveyed through nonverbal expressions has also been shown to be key to effective social functioning and emotional well-being (Hall et al., 2009; McClure & Nowicki, 2001; Schlegel et al., 2021; Yoo et al., 2006). Therefore, it is important to understand the process of emotion perception from nonverbal cues.

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The face is a frequently studied channel of nonverbal emotion communication (Hall et al., 2019). To date, research on facial emotion perception has largely relied on posed, prototypical expressions (Dawel et al., 2022). These are often static images depicting the peak of an emotional expression. However, concerns have been raised that posed facial expressions are exaggerated and not representative of real-life emotion displays, with potential implications for how perceivers interpret them (Nelson & Russell, 2013; Russell, 1994). If this is the case, conclusions drawn from emotion perception research using posed expressions may not generalize to the naturally occurring, spontaneously exhibited expressions in day-to-day life. This could have significant implications for a wide range of psychological and clinical research and how their findings are interpreted. Indeed, some tentative empirical data lend credence to this concern: For example, studies using posed facial expressions find that people with schizophrenia are typically poorer at identifying emotions in faces compared to healthy controls, but the pattern reverses when spontaneous facial expressions are used instead (Davis & Gibson, 2000; Kohler et al., 2010). Nevertheless, research in many subdisciplines of psychology continues to rely almost exclusively on standardized posed expressions, despite the lack of evidence that the perceptions of posed stimuli are comparable to those of naturally occurring spontaneous expressions.

Here, we report three studies that directly compare the extent to which people recognize emotions expressed in posed versus spontaneous facial expressions, using dynamic expressions produced by the same expressers. We tested this research question in both within-cultural (Studies 1 and 2) and cross-cultural (Study 3) designs. Equal numbers of positive and negative emotions were included in order to test the auxiliary prediction that negative emotions would be better recognized than positive emotions.

Posed and Spontaneous Expressions of Emotion

In everyday interactions, we commonly infer other people's internal feelings from their facial expressions, implicitly making the assumption that these muscle movements carry meaning related to the expresser's internal experience (Horstmann, 2003). However, when emotion perception is studied in the lab, researchers typically use stimuli featuring facial expressions that do not necessarily reflect the emotional experiences of the expressers (see Dawel et al., 2022, for a review). These facial expressions are typically posed by an expresser who is instructed either to act out a particular emotion or to move specific muscles in their face based on theoretical prototypes. Standardizing facial expressions in this way minimizes variation across individual expressers and affords researchers a high level of experimental control. However, it means that posed expressions may not be representative of the facial expressions that people naturally produce in real-life contexts (e.g., Durán & Fernández-Dols, 2021; Reisenzein et al., 2006).

Indeed, empirical findings on facial expressions indicate that posed expressions differ from spontaneous expressions in multiple ways. For example, posed facial expressions differ from spontaneous ones in both amplitude and timing (Cohn & Schmidt, 2004; Park et al., 2020; Schmidt et al., 2009). Moreover, when facial expressions are broken down into standardized sets of muscle movements—called action units—posed expressions tend to display different action unit patterns than spontaneous ones (Krumhuber et al., 2021; Namba et al., 2017). There has also been some evidence suggesting that posed and spontaneous expressions are modulated by opposite cerebral hemispheres, as posed expressions begin more often on the right face whereas spontaneous expressions begin more often on the left face (Ross & Pulusu, 2013). The differences between posed and spontaneous expressions of emotions have also been shown in clinical samples (Dethier et al., 2012; Smith et al., 1996). These differences in the production of posed and spontaneous facial expressions suggest that they may also be perceived differently (Saumure et al., 2018).

In emotion perception research, there is a further important distinction between the recognition of posed and spontaneous expressions: A correct response is defined differently. In order to "correctly" identify the emotion in a posed expression, the perceiver must match what the researcher assumes is being represented by the expression based on theoretical prototypes or what the expresser was instructed to express. These expressions are often created independently of the emotional experiences of the posers. For spontaneous expressions, in contrast, the "correct" emotion is defined as the emotion experienced by the expresser when the expressions were displayed. Identifying the latter without context may be a more difficult task for the perceiver (Fischer et al., 2019).

Indeed, recent work on facial emotion perception from spontaneous expressions has shown that recognition is generally poorer compared to emotion perception from posed expressions. Specifically, emotion recognition rates are lower in stimulus sets with spontaneous compared to posed facial expressions by both automatic classifiers (Dupré et al., 2020; Krumhuber et al., 2021) and healthy human observers (Naab & Russell, 2007; Nelson & Russell, 2013; Wagner et al., 1986). Research on emotion recognition from other modalities than the face also points to differences in the perception of posed and spontaneous expressions, though the evidence is not conclusive (Juslin et al., 2018; Sauter & Fischer, 2018).

Previous works comparing the perception of posed and spontaneous expressions of emotions using different stimulus sets are confounded by systematic differences across stimuli, such as stimulus quality and expresser identities (Krumhuber et al., 2021; Sauter & Fischer, 2018). One way to rule out such systematic differences is to compare posed and spontaneous expressions produced by the same expressers in equivalent experimental conditions. In a rare study that applied this method, Zuckerman et al. (1976) found that perceivers' ratings of valence were more often accurate for posed than for spontaneous expressions, providing initial evidence of differences in perception. The authors replicated this finding in a later study (Zuckerman et al., 1979). A similar result was found by Motley and Camden (1988), but the expressers' felt emotions were not measured, and the study included only four expressers and 20 perceivers. The limited evidence means that we do not yet know whether the perception of posed and spontaneous expressions can be treated as equivalent. Despite this, research still predominantly uses posed facial expressions as stimuli, although results may not generalize to real-life contexts.

Recognition of Negative Versus Positive Emotions

The majority of existing research on facial expressions of emotions focuses on negative affective states, though this has started to change somewhat in the last decade (Fredrickson, 2003; Shiota et al., 2017). The well-known set of "basic emotions" (Ekman, 1992) includes several negative states (anger, disgust, fear, and sadness), but only one category of positive emotion: happiness. This emphasis of earlier research on negative emotions is unsurprising given their importance in human development and evolution: A substantial body of research has found that people preferentially attend to negative information when making sense of the world. This so-called negativity bias (Baumeister et al., 2001) has also been found for emotional stimuli, including facial expressions. For example, threatening (i.e., angry) faces are detected faster and more accurately than nonthreatening (i.e., neutral or happy) faces in visual search tasks (Eastwood et al., 2001; Öhman et al., 2001). Some theories posit that negative emotions are processed better due to their evolutionary importance (Cacioppo & Gardner, 1999; Marsh et al., 2005, 2007), and point to the finding that the negativity bias is already present during infancy (LoBue & DeLoache, 2010; Morales et al., 2017; Vaish et al., 2008). However, because the negativity bias for emotional stimuli has primarily been reported in detection tasks, it is unclear whether this preferential attention also leads to more accurate identification of negative emotions from emotional expressions.

In fact, research on the recognition of facial expressions has often found *happiness* to be the best recognized emotion (e.g., Elfenbein & Ambady, 2002; Leppänen & Hietanen, 2004; Nummenmaa & Calvo, 2015; Reyes et al., 2018). However, this finding may well reflect a methodological limitation rather than the superior recognition of positive emotions from facial expressions, since happiness is often the *only* positive emotion included in the list of emotions examined (Russell, 1994). Happiness is often used as an umbrella term for different positive states and functions as a nonspecific label that mainly taps positive valence (Sauter, 2010; Shiota et al., 2017). This means that happiness as a category differs more from the negatively valenced emotions than any of the negative emotions differ from each other. As such, it is easier for perceivers to correctly identify happiness than it is to distinguish any of the other (negative) emotions. In recent years, there has been increasing interest in differentiating discrete positive emotional states (e.g., Chin et al., 2023; Kamiloğlu et al., 2021; Shiota et al., 2014). The relative recognizability of negative and positive emotions can only be properly compared when using a balanced set of emotions.

The Present Studies

The present studies aimed to compare emotion perception from posed and spontaneous facial expressions. Across three preregistered studies, we tested two main hypotheses: (a) emotions will be more accurately identified from posed compared to spontaneous expressions, and (b) expressions of negative emotions will be more accurately identified than expressions of positive emotions.

To avoid systematic differences between posed and spontaneous expressions due to stimulus quality or extraneous features, we recorded facial expressions produced by the same expressers in the same physical environment. We validated the expresser's emotional states for the spontaneous expressions using self-report data. In order to test the hypothesis that negative emotions will be more accurately identified than positive, we used a balanced set of emotions, consisting of four negative (anger, disgust, fear, and sadness) and four positive (joy, compassion, love, and pride) emotions. The distinction between positive and negative emotions was based on theoretical grounds (Sauter, 2010, 2017; Shiota et al., 2021).

We collected posed and spontaneous emotional facial expressions from native Dutch and native Chinese individuals. In the first two studies, we examined within-culture emotion recognition (in the Netherlands in Study 1; in China in Study 2). In Study 3, we examined cross-cultural emotion recognition in a balanced design, with Dutch and Chinese perceivers judging expressions from both their own and the other culture. We measured emotion identification using a method commonly adopted in the field: multiple-choice questions with labels of emotion categories as response options (i.e., forced-choice; Frank & Stennett, 2001). All studies reported were preregistered.

Study 1: Emotion Perception in the Netherlands

In Study 1, we examined the perception of emotions from posed and spontaneous facial expressions displayed by Dutch expressers and judged by Dutch perceivers. We predicted that posed expressions would be better recognized than spontaneous expressions and that expressions of negative emotions would be better recognized than positive emotions. The study received ethical approval from the Ethics Review board at the University of Amsterdam.

Method

Materials

We created a video corpus of posed and spontaneous facial expressions produced by 40 Dutch individuals (20 women) aged between 18 and 40 ($M = 22.85$, $SD = 5.11$). The expressers were born and raised in the Netherlands and had not lived abroad for more than 3 months. Expressions were elicited for eight emotions: anger, disgust, fear, sadness, joy, compassion, love, and pride. The experimenter's nationality matched that of the expressers, and the expressers received instructions in Dutch.

To elicit spontaneous expressions, we video recorded expressers as they recalled events in their life in which they had experienced the target emotion. Expressers were asked to retell their emotional experience as clearly and in as much detail as possible so that someone else could understand exactly how they had felt. Participants rated how intensely they experienced the target emotion on a scale of 0–10, both during the actual experience ($M = 7.96$, $SD = 1.95$) and during recall ($M = 5.61$, $SD = 2.79$). Then, to elicit posed expressions, we asked expressers to show how they would express each target emotion to someone they know without speaking. Expressers always started with recalling experiences for all eight emotions before moving on to producing posed expressions. The eight emotion prompts were presented in a random order for the autobiographical recall and again in a random order for the expression posing. Expressers took a short break between the procedure for the spontaneous and posed expressions.

After the procedure for creating both spontaneous and posed expressions, expressers took another break, after which they were asked to watch their video recordings and, for each emotion, select a section of the video (maximally 5 s in length) that they thought best represented their expression. A research assistant then trimmed the videos to the selected portion to create the stimuli. On average, the videos were 2.72 s ($SD = 1.42$) in length. This process resulted in a total of 655 videos (325 posed and 330 spontaneous expressions) portraying the eight emotions.[1] The number of unique videos per emotion and expression type can be found in Supplemental Table 1.

To reduce the length of the study for perceivers, we created eight semirandom subsets (four for posed and four for spontaneous expressions) containing approximately equal numbers of expressions of all eight emotions. All video clips were muted.

Participants

We recruited participants using the online recruitment service Cint. We based our sample size on a previous study that compared the recognition of emotions from posed and spontaneous nonverbal vocalizations (Sauter & Fischer, 2018), which had up to 42 participants in each condition. We aimed to increase the sample size to 60 perceivers per stimuli set, resulting in an overall larger sample size per Emotion × Expression Type condition (which comprised data from four stimuli sets). A total of 470 adults between the ages of 18 and 40 years ($M = 29.79$, $SD = 6.46$) participated in the study, of which 238 identified as woman and 232 as man. Only people who were born and raised in the Netherlands and had not lived abroad for more than 6 months were allowed to participate. Participants received monetary compensation for their participation.

To ensure good data quality, we preregistered the exclusion of participants whose average response time was at least 2 *SD*s below the mean. No participants were excluded for this reason, due to the large variance in reaction times. We therefore applied an additional exclusion criterion (not preregistered). Participants who completed more than half of the trials in less than 1 s were deemed to have not watched the videos (the shortest of which was 1 s long) before responding. No participants were excluded for this reason. The final sample consisted of 470 participants, with each subset of the stimuli judged by between 50 and 72 participants. Each spontaneously expressed emotion category (e.g., spontaneous angry expressions) was judged by 220 unique participants, while each posed emotion category (e.g., posed angry expressions) was judged by 250 unique participants.

Design and Procedure

The study was administered online using Qualtrics (Provo, Utah) with instructions presented in Dutch. Participants were instructed to sit in a quiet room with no distractions. They were encouraged to finish the study in one sitting, with a short break halfway through, but were required to finish the study within 24 hr of starting it.

After giving informed consent, participants first answered demographic questions about their age, gender, birthplace, and whether they had ever lived abroad. Those who met the screening criteria then moved on to the emotion recognition task. Each participant was randomly presented with one of the eight video subsets. The order of expressions presented within the set was randomized. Participants were able to watch each video clip as many times as they wanted before answering the forced-choice question to indicate which emotion they thought was being expressed, with the response options anger, disgust, fear, sadness, joy, compassion, love, and pride (see Supplemental Material for the translation of the emotion labels in Dutch).

Transparency and Openness

We have reported how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. We preregistered our hypotheses, procedure, and analyses prior to data collection at https://osf.io/hvjaz. All anonymized data and analysis scripts are available at https://osf.io/48f2b/ (Cong et al., 2024). Data were analyzed using R Version 4.3.0 (R Core Team, 2023) and the packages *lme4* Version 1.1-33 (Bates et al., 2015), *lmerTest* Version 3.1-3 (Kuznetsova et al., 2017), *car* Version 3.1-2 (Fox & Weisberg, 2019), *broom.mixed* Version 0.2.9.4 (Bolker & Robinson, 2022), and *MuMIn* Version 1.47.5 (Bartoń, 2023).

Results

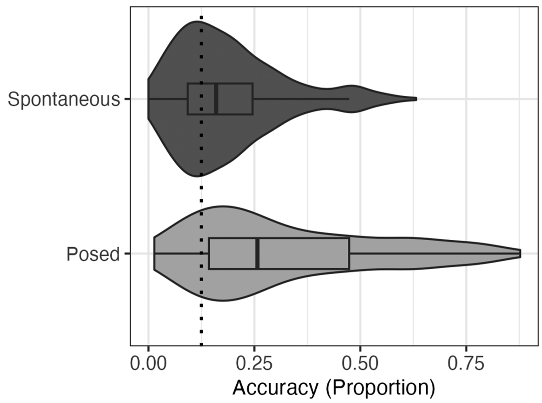
Before testing our main hypotheses, we first checked the overall recognition accuracy for each of the eight emotions. For the posed expressions, all emotions were recognized above chance level (0.125) except love; for spontaneous expressions, only compassion, joy, and pride were reliably identified (see Supplemental Text 1 for details).

Hypothesis 1

Our first hypothesis was that emotions would be identified more accurately from posed facial expressions than spontaneous facial expressions. The raw recognition accuracy percentages bore out this hypothesis: Participants were correct on 32.46% of trials with posed expressions, compared to only 18.70% of trials with spontaneous expressions (Figure 1). To test this prediction statistically, we performed a logistic regression with mixed effects using a generalized linear mixed model fit by maximum likelihood. We included recognition accuracy at the trial level as a binary outcome variable (correct vs. incorrect), emotion (eight levels) and expression type (spontaneous vs. posed) as fixed effects, and perceiver ID as a random effect. The variance explained by the random effects (calculated by subtracting the theoretical marginal R^2_m from the theoretical conditional R^2_c) was $R^2_{\text{random}} = 0.05$. In order to report overall significance tests for each effect, we ran a Type 3 analysis of variance (ANOVA) on the logit models: We found a significant effect of expression type, $\chi^2(1) = 169.24$, $p < .0001$, and of emotion, $\chi^2(7) = 1{,}261.55$, $p < .0001$, indicating that recognition accuracy differed between posed and spontaneous expressions and across different emotions. We also found an interaction between emotion and expression type, $\chi^2(7) = 266.84$, $p < .0001$, indicating that the size and/or direction of the difference between posed and spontaneous expressions depended on the emotion. To follow up on these effects, we fit a model with only the expression type variable, setting posed expressions as the intercept and spontaneous expressions as the comparison group. For these models, we report the exponentiated log odds, known as the odds ratio. A significant odds ratio below 1 indicates that the effect decreases the odds of an event—in this case, accurate recognition—occurring. The main aspect of interest for these analyses is the slope associated with spontaneous emotions: This number reflects the change in odds of

[1] On five occasions, a participant posed two expressions for a particular emotion, and on 10 occasions, a participant selected two segments for the spontaneous expressions. All of these videos were included as stimuli.

Figure 1
Recognition Accuracy for Posed and Spontaneous Facial Expressions in the Netherlands (Study 1)



Note. Recognition accuracy across emotions is plotted as the proportion of times each stimulus was correctly identified. The dotted line indicates chance level (0.125). The violins illustrate the distribution of the data, with boxes indicating the first quartile, median, and the third quartile.

accurate recognition for spontaneous expressions relative to posed expressions.

Emotions were more accurately identified from posed expressions ($OR_{\text{intercept}}$ = 0.47, 95% CI [0.44, 0.49], $p < .0001$) than from spontaneous expressions ($OR_{\text{spontaneous}}$ = 0.47, 95% CI [0.44, 0.52], $p < .0001$); the fact that the *OR* for spontaneous expressions is less than 1 indicates that spontaneous emotions are less likely to be identified than the reference category (posed expressions). We report the intercept for statistical transparency, but it is not readily interpretable beyond reflecting that participants were less likely to correctly identify posed expressions than to incorrectly identify them (as expected given the eight response options and that chance rate recognition would be equal to a correct response only 12.5% of the time). Follow-up analyses per emotion showed that all emotions except love and compassion were significantly better recognized from posed expressions than from spontaneous expressions. The results of these regressions, alongside the raw recognition rates for each emotion, are reported in Table 1. Note that we chose to perform logistic regressions because of the nested structure of the data and because they preserve more variance at the trial level compared to analyses with percentage recognition accuracy calculated at the participant level. However, because previous research on emotion recognition has often used unbiased hit rates (Wagner, 1993) as the outcome variable, we also preregistered and performed analyses comparing the recognition of posed and spontaneous expressions using unbiased hit rates. In these analyses, all emotions were significantly better recognized from posed expressions (see Supplemental Text 2 for details).

Hypothesis 2

Our second hypothesis was that negative emotions would be recognized more accurately than positive emotions. To test this, we coded joy, compassion, love, and pride as positive emotions and anger, disgust, fear, and sadness as negative emotions. We then performed a logistic regression with recognition accuracy at the trial level as a binary outcome variable (correct vs. incorrect), emotion valence (positive vs. negative) and expression type (posed vs. spontaneous) as fixed effects, and perceiver ID as a random effect (R^2_{random} = 0.04). In order to report overall significance tests for each effect, we ran a Type 3 ANOVA on the logit models. We found a significant main effect of expression type, $\chi^2(1) = 407.89$, $p < .0001$, and valence, $\chi^2(1) = 51.42$, $p < .0001$, as well as an interaction, $\chi^2(1) = 132.58$, $p < .0001$, indicating that the relationship between valence and recognition accuracy differed per expression type. To tease apart this interaction, we fitted models for posed and spontaneous expressions separately and regressed recognition accuracy onto valence, with negative valence set as the reference category. These models revealed that for posed expressions, negative emotions ($OR_{\text{intercept}}$ = 0.52, 95%

Table 1
Comparison of Recognition Rates for Posed and Spontaneous Facial Expressions per Emotion, for Dutch Perceivers (Study 1)

Emotion	Term	Percent recognized	Log odds	*OR*	CI	*SE*	Statistic	*p*
Anger	Posed	36.6	−0.60	0.55	[0.49, 0.62]	0.06	−10.25	**<.0001**
	Spontaneous	17.1	−1.10	0.33	[0.28, 0.40]	0.09	−11.89	**<.0001**
Compassion	Posed	21.5	−1.34	0.26	[0.23, 0.29]	0.06	−23.76	**<.0001**
	Spontaneous	19.5	−0.13	0.88	[0.75, 1.03]	0.08	−1.57	=.12
Disgust	Posed	40.8	−0.42	0.66	[0.58, 0.75]	0.06	−6.66	**<.0001**
	Spontaneous	16.7	−1.35	0.26	[0.21, 0.31]	0.10	−13.65	**<.0001**
Fear	Posed	28.2	−1.01	0.36	[0.32, 0.41]	0.06	−16.15	**<.0001**
	Spontaneous	15.6	−0.81	0.44	[0.37, 0.54]	0.10	−8.30	**<.0001**
Joy	Posed	57.4	0.34	1.41	[1.22, 1.63]	0.07	4.62	**<.0001**
	Spontaneous	32.3	−1.21	0.30	[0.24, 0.37]	0.11	−10.95	**<.0001**
Love	Posed	17.2	−1.72	0.18	[0.16, 0.21]	0.07	−23.69	**<.0001**
	Spontaneous	15.5	−0.13	0.87	[0.71, 1.07]	0.10	−1.28	=.2
Pride	Posed	26.1	−1.12	0.33	[0.29, 0.37]	0.06	−18.09	**<.0001**
	Spontaneous	17.1	−0.56	0.57	[0.48, 0.68]	0.09	−6.04	**<.0001**
Sadness	Posed	33.6	−0.77	0.46	[0.40, 0.53]	0.07	−11.26	**<.0001**
	Spontaneous	15.3	−1.15	0.32	[0.26, 0.39]	0.11	−10.71	**<.0001**

Note. To test the difference between posed and spontaneous expressions, we carried out logistic regressions for each emotion separately, with recognition accuracy for each trial as a binary outcome variable (correct vs. incorrect), expression type (posed vs. spontaneous) as a fixed effect, and perceiver ID as a random effect. The intercept was set to posed expressions. We also report the percentage of trials where the target emotion was correctly recognized by participants. The *p* values in bold are statistically significant. CI = confidence interval; *SE* = standard error.

CI [0.48, 0.55], $p < .0001$) were more accurately recognized than positive emotions ($OR_{\text{positive}} = 0.80$, 95% CI [0.76, 0.85], $p < .0001$), as we had predicted. However, this effect was reversed for spontaneous facial expressions, for which positive emotions ($OR_{\text{positive}} = 1.42$, 95% CI [1.31, 1.53], $p < .0001$) were more accurately recognized than negative emotions ($OR_{\text{intercept}} = 0.19$, 95% CI [0.17, 0.20], $p < .0001$). These effects are illustrated in Figure 2.

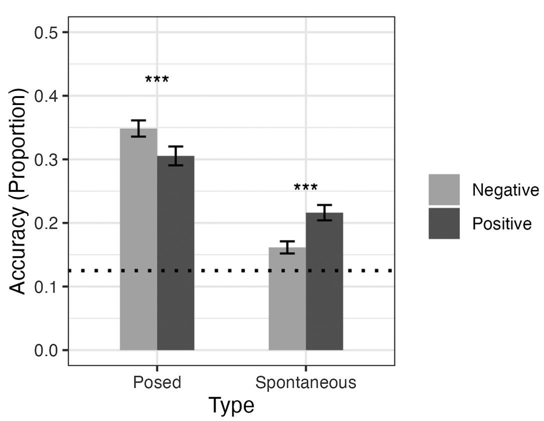
Our hypothesis that negative emotions would be better recognized than positive emotions was thus confirmed only for posed expressions. In contrast, spontaneously expressed negative emotions were significantly less likely to be accurately inferred than spontaneously expressed positive emotions.

Discussion

In Study 1, we found support for the hypothesis that emotions are more accurately inferred from posed as compared to spontaneous facial expressions. These findings are consistent with previous work (e.g., Motley & Camden, 1988; Zuckerman et al., 1976) but provide the first well-powered, preregistered study investigating this research question. Moreover, we used dynamic posed and spontaneous expressions produced by the same expressers, thereby ruling out potential confounds due to systematic differences between the stimulus sets. These findings support the suggestion that the use of posed expressions can inflate the recognizability of emotions compared to naturally occurring facial expressions (Naab & Russell, 2007).

We found only partial support for our second hypothesis that negative emotions would be better recognized than positive emotions. Specifically, negative emotions were better recognized than positive emotions only when the expressions were posed. In contrast, for spontaneous facial expressions, positive emotions were better recognized than negative emotions. These findings challenge the idea of a general negativity bias; under certain circumstances, negative stimuli do not have a perceptual advantage over positive stimuli but, instead, may have a disadvantage. In sum, these initial findings demonstrate that emotion perception from spontaneous expressions is not equivalent to posed expressions. Next, we sought to replicate these findings in a different cultural context.

Figure 2
The Effect of Expression Valence on Recognition Accuracy for Dutch Perceivers (Study 1)



Note. Negative emotions were better recognized than positive emotions when the expressions were posed ($ps < .0001$). However, this effect was reversed when the expressions were spontaneously elicited: Positive emotions were significantly more likely to be accurately recognized than negative emotions from spontaneous expressions ($ps < .0001$). The dotted line indicates chance-level recognition accuracy. Error bars reflect 95% confidence intervals (CIs). Recognition accuracy was calculated per participant as the proportion of correct responses per emotion and expression type. We then calculated average recognition within each Valence × Expression Type combination.
*** $p < .001$.

Study 2: Emotion Perception in China

The reliance on WEIRD (Western, Educated, Industrialized, Rich, and Democratic; Henrich et al., 2010) populations to study questions about human behavior is a well-documented problem in the field of psychology (Arnett, 2008). This is also true of emotion research, and there have been calls for more efforts to study non-Western populations (Gendron et al., 2014; Hoemann et al., 2024). Study 2 contributes to this effort by replicating Study 1 in China. We aimed to investigate whether findings from Study 1 generalize to non-WEIRD populations. Study 2 received ethical approval from the Ethics Review board at the University of Amsterdam.

Method

Materials

The Chinese stimuli were produced using the same method as the Dutch stimuli by 39 expressers (24 women) who were born and raised in China. They were aged between 18 and 40 ($M = 23.08$, $SD = 2.65$) and had not lived abroad for more than 3 months. Expressions were elicited for the same eight emotions as in Study 1: anger, disgust, fear, sadness, joy, compassion, love, and pride. The experimenter's nationality matched that of the expressers, and the instructions were given in Mandarin Chinese. As in Study 1, the procedure started with the episodic recall to elicit spontaneous expressions, followed by the procedure for posed expressions, and ended with participants selecting their spontaneous expressions. On average, Chinese expressers reported experiencing the target emotion at an intensity of 8.40 ($SD = 1.78$) out of 10 for the events and 6.73 ($SD = 2.87$) out of 10 during recall.

The procedure resulted in a total of 596 expressions (294 posed and 302 spontaneous), which we divided into eight semirandom subsets (four with posed and four with spontaneous expressions). Each subset contained approximately equal numbers of expressions of all eight emotions. All video clips were muted. On average, the videos were 2.81 s ($SD = 1.32$) in length. The number of unique videos per emotion and expression type can be found in Supplemental Table 1.

Participants

We recruited 438 adults between the ages of 18 and 40 from China ($M_{\text{age}} = 30.40$, $SD_{\text{age}} = 5.95$, 240 identified as woman and 198 as man) using the online recruitment service Cint. Sample size was determined using the same method as in Study 1. Individuals who were born and raised in China and had not lived abroad for more than 6 months were eligible to participate, and all participants received monetary compensation for their participation.

We had preregistered the exclusion of participants whose average response time was at least 2 *SD*s below the sample mean, but excluded no one for this reason. Additionally, we checked for participants who completed more than half of the trials in less than 1 s, but none did. The final sample consisted of 438 Chinese participants. Each subset of stimuli was viewed by between 43 and 60 participants. Each spontaneously expressed emotion category (e.g., spontaneous angry expressions) was judged by 211 unique participants, while each posed emotion category (e.g., posed angry expressions) was judged by 227 unique participants.

Design and Procedure

The design of the study was identical to that of Study 1, except that the instructions were presented in Mandarin Chinese and that the stimuli featured Chinese rather than Dutch expressers. The Chinese translation of the emotion labels can be found in the Supplemental Material.

Transparency and Openness

We have reported how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. We preregistered our hypotheses, procedure, and analyses prior to data collection at https://osf.io/hvjaz. All anonymized data and analysis scripts are available at https://osf.io/48f2b/ (Cong et al., 2024). Data were analyzed using R Version 4.3.0 (R Core Team., 2023) and the packages *lme4* Version 1.1-33 (Bates et al., 2015), *lmerTest* Version 3.1-3 (Kuznetsova et al., 2017), *car* Version 3.1-2 (Fox & Weisberg, 2019), *broom.mixed* Version 0.2.9.4 (Bolker & Robinson, 2022), and *MuMIn* Version 1.47.5 (Bartoń, 2023).

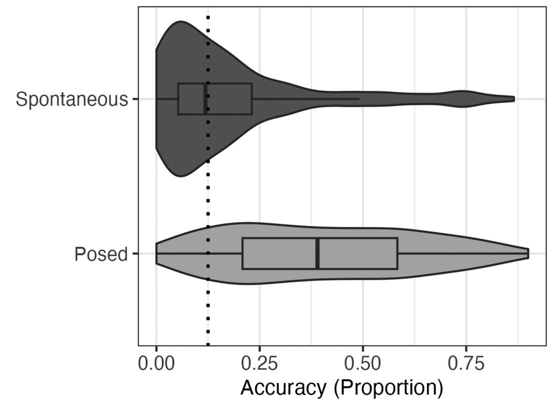
Results

As in Study 1, we first tested the emotion recognition accuracy for each of the 16 emotion and expression type combinations against chance level. As in Study 1, emotion recognition from posed expressions was significantly better than chance for all eight emotions except love. Emotion recognition from spontaneously elicited expressions was better than chance only for expressions of joy and compassion (see Supplemental Text 1 for details).

Hypothesis 1

Participants correctly categorized the emotions in 40.23% of trials with posed expressions, compared to 18.65% of the trials with spontaneous expressions (Figure 3). To statistically test the prediction that Chinese participants would be better at recognizing emotions from posed than spontaneous expressions, we used a mixed logistic regression. Recognition accuracy for each trial was a binary outcome variable (correct vs. incorrect), emotion (eight factors) and expression type (spontaneous vs. posed) were fixed effects, and perceiver ID was a random effect ($R^2_{\text{random}} = 0.05$). We then ran a Type 3 ANOVA on the logit model to assess the significance of each effect. We found significant effects of expression type, $\chi^2(1) = 324.06$, $p < .0001$, and emotion, $\chi^2(7) = 1{,}152.63$, $p < .0001$, and a significant interaction

Figure 3
Recognition Accuracy of Posed and Spontaneous Expressions in China (Study 2)



Note. Recognition accuracy across emotions is plotted as the proportion of times each stimulus was correctly identified. The dotted line indicates chance-level recognition (0.125). The boxes indicate the first quartile, median, and the third quartile.

between emotion and expression type, $\chi^2(7) = 606.12$, $p < .0001$. Follow-up pairwise comparisons with posed expressions set as the reference category showed that emotions were more accurately inferred from posed expressions ($OR_{\text{intercept}} = 0.65$, 95% CI [0.61, 0.69], $p < .0001$) than from spontaneous expressions ($OR_{\text{spontaneous}} = 0.34$, 95% CI [0.31, 0.37], $p < .0001$).

Follow-up analyses per emotion found all eight emotions to be better identified from posed expressions than from spontaneous expressions (Table 2). The same pattern of results was found when analyzing the data using unbiased hit rates (Wagner, 1993); see Supplemental Text 2 for details.

Hypothesis 2

To test our hypothesis that participants would be better at recognizing expressions of negative as compared to positive emotions, we performed a mixed effects logistic regression with trial-level recognition accuracy as an outcome variable, emotion valence and expression type as fixed effects, and perceiver ID as a random effect ($R^2_{\text{random}} = 0.05$). We found a significant interaction between valence and expression type, $\chi^2(1) = 132.58$, $p < .0001$, indicating that the relationship between valence and recognition accuracy differed per expression type. We then fitted two separate models (one for each of the expression types) with only valence as a fixed effect and negative valence set as the intercept. For posed expressions, negative emotions ($OR_{\text{intercept}} = 0.71$, 95% CI [0.65, 0.78], $p < .0001$) were better recognized than positive emotions ($OR_{\text{positive}} = 0.81$, 95% CI [0.76, 0.86], $p < .0001$), but this effect was reversed for spontaneous expressions; positive emotions ($OR_{\text{positive}} = 3.05$, 95% CI [2.80, 3.33], $p < .0001$) were more accurately recognized than negative emotions ($OR_{\text{intercept}} = 0.12$, 95% CI [0.11, 0.13], $p < .0001$) from spontaneous facial expressions. These results provide partial support for our prediction. As in Study 1, negative emotions were better recognized only from posed

Table 2
Comparison of Recognition Rates for Posed and Spontaneous Facial Expressions per Emotion, for Chinese Perceivers (Study 2)

Emotion	Term	Percent recognized	Log odds	*OR*	CI	*SE*	Statistic	*p*
Anger	Posed	37.0	−0.58	0.56	[0.49, 0.64]	0.07	−8.83	**<.0001**
	Spontaneous	8.1	−2.05	0.13	[0.10, 0.16]	0.12	−16.93	**<.0001**
Compassion	Posed	29.1	−0.99	0.37	[0.33, 0.43]	0.07	−14.24	**<.0001**
	Spontaneous	24.6	−0.25	0.78	[0.64, 0.95]	0.10	−2.47	**=.01**
Disgust	Posed	44.2	−0.29	0.75	[0.64, 0.87]	0.08	−3.78	**<.001**
	Spontaneous	5.9	−2.81	0.06	[0.05, 0.08]	0.15	−19.14	**<.0001**
Fear	Posed	37.6	−0.60	0.55	[0.47, 0.64]	0.08	−7.83	**<.0001**
	Spontaneous	8.7	−2.06	0.13	[0.10, 0.17]	0.13	−15.51	**<.0001**
Joy	Posed	66.8	0.85	2.34	[1.96, 2.79]	0.09	9.44	**<.0001**
	Spontaneous	55.9	−0.57	0.56	[0.44, 0.72]	0.13	−4.52	**<.0001**
Love	Posed	23.8	−1.29	0.28	[0.24, 0.32]	0.08	−17.16	**<.0001**
	Spontaneous	11.1	−0.99	0.37	[0.30, 0.47]	0.12	−8.46	**<.0001**
Pride	Posed	31.4	−0.85	0.43	[0.38, 0.49]	0.06	−13.18	**<.0001**
	Spontaneous	14.7	−1.05	0.35	[0.29, 0.43]	0.10	−10.35	**<.0001**
Sadness	Posed	51.6	0.06	1.07	[0.92, 1.23]	0.07	0.88	=.38
	Spontaneous	20.2	−1.61	0.20	[0.16, 0.25]	0.11	−14.34	**<.0001**

Note. To test the difference between posed and spontaneous expressions, we carried out logistic regressions for each emotion separately, with recognition accuracy for each trial as a binary outcome variable (correct vs. incorrect), expression type (posed vs. spontaneous) as a fixed effect, and perceiver ID as a random effect. The intercept was set to posed expressions; a significant difference between the recognition rates of posed and spontaneous expressions is therefore indicated by a significant estimate associated with the spontaneous versions of a given emotion. We also report the percentage of trials where the target emotion was correctly recognized by participants. The *p* values in bold are statistically significant. CI = confidence interval; *SE* = standard error.

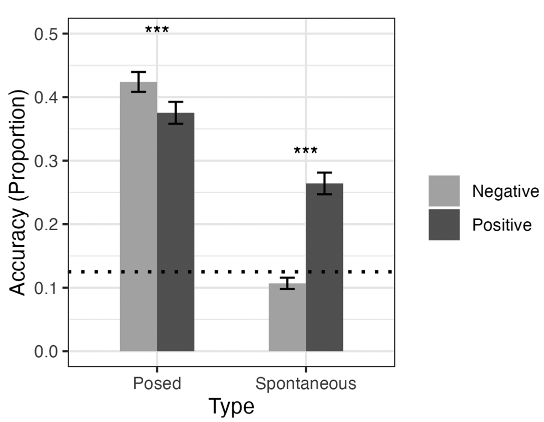
expressions, while the reverse pattern was found for spontaneous expressions. These results are illustrated in Figure 4.

Discussion

In Study 2, we investigated the recognition of posed and spontaneous expressions of eight emotions, using Chinese expressions and perceivers. The results fully replicate those from Study 1, with perceivers being better at identifying emotions from posed compared to spontaneous expressions. Moreover, we partly confirmed our hypothesis that negative emotions would be better recognized than positive emotions. As in Study 1, this was only the case for posed expressions, while the pattern reversed for spontaneous expressions. The consistency of these patterns of results across two studies with different stimuli and perceiver samples suggests that this finding is robust.

To our knowledge, this is the first time that the superiority of emotion identification from posed as compared to spontaneous expression has been directly tested in a non-Western sample. These results also provide the first empirical evidence indicating that emotion valence relates to emotion perception differently for posed and spontaneous expressions. Next, we sought to test the robustness of these results in a cross-cultural context.

Figure 4
The Effect of Expression Valence on Recognition Accuracy for Chinese Perceivers (Study 2)



Note. Negative emotions were better recognized than positive emotions when the expressions were posed ($ps < .0001$), but this effect was reversed when the emotions were spontaneously elicited. The dotted line indicates chance-level recognition accuracy. Error bars reflect 95% confidence intervals (CIs). Recognition accuracy was calculated per participant, as the proportion of correct responses per emotion and expression type. We then calculated average recognition within each Valence × Expression Type combination.
*** $p < .001$.

Study 3: Cross-Cultural Emotion Perception

Cross-cultural comparisons are important for many research questions in psychology, and they are particularly central to many debates in emotion research, including investigations into emotional expressions (Ekman et al., 1987; Gendron et al., 2014; Nelson & Russell, 2013). Individuals' cultural background has been shown to influence how they express and perceive emotions nonverbally (Elfenbein & Ambady, 2002; Wood et al., 2016), and it is therefore important to investigate questions related to nonverbal emotion perception in a cross-cultural context.

Existing cross-cultural research on emotion perception has predominantly used posed facial expressions from standardized stimulus sets (Elfenbein & Ambady, 2002), but the generalizability of findings from these studies has been questioned (Naab & Russell, 2007). Specifically, the conclusions drawn about the role culture plays in emotion communication might be different when spontaneous rather than posed expressions are used. For example, Naab and Russell (2007) showed participants in the United States spontaneous facial expressions collected from members of the South Fore of New Guinea. Recognition rates were found to be much lower when compared to those typically found in cross-cultural studies using posed facial expressions. However, the recognition levels of spontaneous expressions in this study were not directly compared to posed expressions in the same experiment. In Study 3, we directly compared the perception of posed and spontaneous emotional expressions produced by the same expressers cross-culturally. Using posed and spontaneous emotional expressions produced by the same expressers, we utilized a fully balanced design to investigate Dutch and Chinese perceivers' emotion perception from their own as well as from the other culture. As in Studies 1 and 2, we expected emotion identification to be better for posed facial expressions compared to spontaneous ones, and negative emotions to be better recognized than positive ones. The study received ethical approval from the Ethics Review board at the University of Amsterdam.

Method

Materials

The stimuli used in Study 3 were taken from the stimuli from Studies 1 and 2. Acquiring reliable estimates per stimuli with a feasible sample size necessitated a reduction in the total number of stimuli included in Study 3. We therefore excluded stimuli that were not recognized at above chance level by the within-cultural perceivers from Studies 1 and 2. This resulted in 267 Dutch posed expressions, 207 Dutch spontaneous expressions, 255 Chinese posed expressions, and 147 Chinese spontaneous expressions. See the supporting data available at https://osf.io/48f2b/ for the full list of stimuli and their associated within-cultural recognition rates from Studies 1 and 2.

Participants

Participants were recruited using the online service Cint. Individuals who were born and raised in their respective country and who had not lived abroad for more than 6 months were eligible to participate. Eight hundred seventy-seven adults from the Netherlands (431 identified as woman, 441 as man, and five as other) and 825 adults from China (417 identified as woman and 408 as man) participated in the study.[2] Participants received monetary compensation for their participation.

We preregistered the exclusion of participants whose overall performance was two or more standard deviations lower than the average accuracy of their respective country and participants whose average response time was two or more standard deviations below the mean of their group. This led to the exclusion of 23 Dutch and 21 Chinese participants for poor performance; no participants were excluded for very low response times. Since the exclusion of participants based on performance is confounded with the main outcome variable, we reran all analyses reported in the article with the full data set (i.e., including poorly performing participants). We found no differences between those results and the ones we report here (see Supplemental Text 3). As in Studies 1 and 2, we also applied an additional exclusion criterion to detect careless participants. This led to the exclusion of 105 Dutch and 74 Chinese participants who finished more than half of the trials in under 1 s.[3] After exclusions, a total of 1,500 adults between the ages of 18 and 85 years ($M_{\text{age}} = 30.56$, $SD_{\text{age}} = 8.36$) participated in the study.[4] The final sample consisted of 738 Chinese ($M_{\text{age}} = 34.09$, $SD_{\text{age}} = 8.49$) and 762 Dutch ($M_{\text{age}} = 27.14$, $SD_{\text{age}} = 6.64$) participants. Each Emotion × Expression Type category (e.g., spontaneously elicited angry expressions) was judged by 762 Dutch participants and 738 Chinese participants.

Design and Procedure

The stimuli were divided into four subsets, grouped by expresser culture (Chinese or Dutch) and expression type (posed or spontaneous). Each participant judged 16 expressions from each of the four subsets. The stimulus selection was semirandom such that each of the eight emotions was represented twice within the 16 stimuli per subset. Each participant thus saw a total of 64 videos, representing both posed and spontaneous expressions of all eight emotions and from both cultures (i.e., all conditions were represented within-subject).

The online study was administered using Gorilla Experiment Builder (Anwyl-Irvine et al., 2020). Instructions were in Dutch for participants in the Netherlands and in Mandarin Chinese for participants in China. Participants were instructed to sit in a quiet room with no distractions. They were encouraged to finish the study in one sitting, with a short break halfway, but were required to finish the study within 24 hr before their session expired.

After giving informed consent, participants first answered a few demographic questions about their age, gender, and birthplace, and whether they had lived abroad. Those who met the screening criteria then moved on to the emotion recognition task. Participants were able to watch each video clip as many times as they wanted before answering a forced-choice question to indicate which emotion they thought was being expressed. The task auto-progressed to the next trial when a response had been selected.

Transparency and Openness

We have reported how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. The study was preregistered at https://osf.io/3vb2p. All anonymized data and analysis scripts are available at https://osf.io/48f2b/. Data were analyzed using R Version 4.3.0 (R Core Team., 2023) and the

[2] Sample size was determined based on a power analysis using the effect size estimate of another research question not discussed in this article.

[3] This number contrasts significantly with Studies 1 and 2, where no participants were excluded for skipping through the majority of trials. This is likely explained by a difference in the survey set up: The survey used in Study 3 auto-progressed after a response option was selected (i.e., participants did not have to additionally press a button to move to the next trial), making it easier to identify participants who skipped through trials rapidly.

[4] We aimed to recruit people aged between 18 and 40 (as in Studies 1 and 2), but due to a technical error, a small portion of our sample fell outside of this age bracket. Fourteen participants were under the age of 18, 142 participants were above 40, and 1,344 were within the target age bracket. We excluded three participants who were below the age of 16, as they were below the age of consent for the study. We then compared the emotion recognition performance (as measured by percentage of correct responses) of the participants within the target age range to those above it using a two-sided t test. As no difference in recognition rates was found, we included all participants in the final analyses. We were unable to compare the performance of participants under the age of 18 to those in the age bracket due to the small sample size of $n = 11$.

packages *lme4* Version 1.1-33 (Bates et al., 2015), *lmerTest* Version 3.1-3 (Kuznetsova et al., 2017), *car* Version 3.1-2 (Fox & Weisberg, 2019), *broom.mixed* Version 0.2.9.4 (Bolker & Robinson, 2022), and *MuMIn* Version 1.47.5 (Bartoń, 2023).

Results

We preregistered the hypothesis that posed expressions would be better recognized than spontaneous expressions, but due to an oversight, we did not preregister a hypothesis regarding stimulus valence. However, Study 3 allowed us to test whether the pattern of results found in Studies 1 and 2 (negatively valenced emotional expressions being better recognized than positively valenced expressions for posed expressions, and the reverse for spontaneous expressions) would replicate in the context of cross-cultural emotion recognition. Comparisons to chance accuracy per emotion are reported in Supplemental Text 4.

Following our preregistered analysis plan, we first performed a mixed logistic regression with recognition accuracy as a binary outcome variable, and stimulus culture, perceiver culture, expression type, and emotion as fixed effects. We included perceiver ID as a random effect. This model did not converge, indicating that we were trying to draw inferences about too many variables given the amount of data. Because we did not have a priori hypotheses about recognition rates across different emotions, we removed emotion as a factor from the model, which allowed the model to reach convergence ($R^2_{\text{random}} = 0.03$). In order to report overall significance tests for each effect, we ran a Type 3 ANOVA on the logit models. We found significant main effects of expression type, $\chi^2(1) = 32.38$, $p < .0001$; stimulus culture, $\chi^2(1) = 11.68$, $p < .001$; and perceiver culture, $\chi^2(1) = 83.27$, $p < .0001$, as well as significant interactions between expression type and stimulus culture, $\chi^2(1) = 18.05$, $p < .0001$, and expression type and perceiver culture, $\chi^2(1) = 7.77$, $p = .005$. To directly test our hypotheses, we conducted a series of follow-up logistic regressions focusing on the factors of interest one at a time.

Hypothesis 1

We first tested whether emotions were better recognized from posed than spontaneous expressions. In trials where participants rated expressions from their own culture, we found that participants correctly categorized the emotions in 33.58% of trials with posed expressions, compared to 24.32% of trials with spontaneous expressions. For cross-cultural trials, participants correctly categorized the emotions in 31.99% of trials with posed expressions, compared to 23.70% of trials with spontaneous expressions. To quantify these effects statistically, we first looked at the direction of the significant main effect by including only expression type in the model. As expected, posed expressions (set as the intercept) were recognized more accurately than spontaneous expressions ($OR_{\text{spontaneous}} = 0.64$, 95% CI [0.62, 0.66], $p < .0001$). We then looked separately at Dutch and Chinese perceivers' emotion recognition from each culture. For Dutch perceivers, posed expressions were better recognized than spontaneous expressions for both Dutch ($OR_{\text{spontaneous}} = 0.63$, 95% CI [0.59, 0.66], $p < .0001$) and Chinese stimuli ($OR_{\text{spontaneous}} = 0.60$, 95% CI [0.57, 0.64], $p < .0001$). Chinese perceivers showed the same pattern: They were also better at recognizing posed than spontaneous expressions for both Dutch ($OR_{\text{spontaneous}} = 0.72$, 95% CI [0.68, 0.77], $p < .0001$) and Chinese stimuli ($OR_{\text{spontaneous}} = 0.63$, 95% CI [0.60, 0.67], $p < .0001$). Our hypothesis was thus confirmed for both within- and cross-cultural emotion recognition. These findings provide strong support for emotions being better recognized from posed, as compared to spontaneous, expressions. The same pattern of results was found using unbiased hit rates. These analyses are reported in Supplemental Text 5.

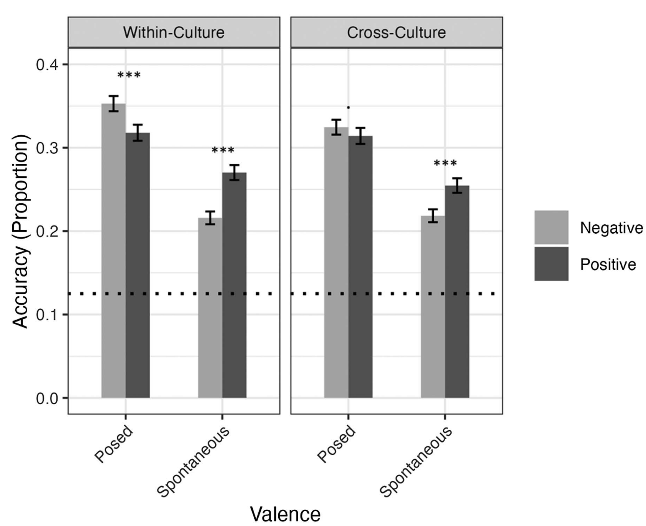
Hypothesis 2

Next, we tested whether recognition of positive versus negative emotions would differ for posed and spontaneous expressions, taking the culture of expressers and perceivers into account. As in Studies 1 and 2, joy, compassion, love, and pride were coded as positive emotions and anger, disgust, fear, and sadness as negative emotions. Since this study investigated both within-cultural and cross-cultural emotion recognition, we split the data based on whether perceivers were rating stimuli from their own culture (within-cultural judgments) or the other culture (cross-cultural judgments). For each of these data sets, we performed a logistic regression with recognition accuracy at the trial level as a binary outcome variable (correct vs. incorrect), valence and expression type as fixed effects, and perceiver ID as a random effect. The results of these analyses are visualized in Figure 5 and discussed in turn below.

Within-Cultural Effect of Valence. When perceivers judged expressions produced by individuals from their own culture, main effects of expression type, $\chi^2(1) = 559.19$, $p < .0001$, and valence, $\chi^2(1) = 33.70$, $p < .0001$, emerged, as well as an interaction effect between valence and expression type, $\chi^2(1) = 126.98$, $p < .0001$;

Figure 5

The Relationship Between Emotion Valence and Emotion Recognition Accuracy for Within- and Cross-Cultural Judgments



Note. Accuracy is calculated per participant and averaged across emotions within conditions. The dotted line indicates chance level (0.125); error bars indicate 95% confidence intervals (CIs). The dot indicates a nonsignificant p value that is less than 0.1.
*** $p < .001$.

$R^2_{\text{random}} = 0.03$. Follow-up tests with negative valence set as the reference category indicated that, as in Studies 1 and 2, negative emotions ($OR_{\text{intercept}} = 0.54$, 95% CI [0.51, 0.56], $p < .0001$) were more accurately recognized than positive emotions ($OR_{\text{positive}} = 0.85$, 95% CI [0.81, 0.90], $p < .0001$) from posed expressions. This effect was reversed for spontaneous expressions: Positive emotions ($OR_{\text{positive}} = 1.35$, 95% CI [1.27, 1.43], $p < .0001$) were more accurately recognized than negative emotions ($OR_{\text{intercept}} = 0.27$, 95% CI [0.26, 0.29], $p < .0001$) from spontaneous expressions.

Cross-Cultural Effect of Valence. When perceivers judged expressions produced by individuals from the other culture, we found a main effect of expression type, $\chi^2(1) = 341.70$, $p < .0001$, and an interaction effect between valence and expression type, $\chi^2(1) = 35.54$, $p < .0001$; $R^2_{\text{random}} = 0.03$. For posed expressions, negative emotions ($OR_{\text{intercept}} = 0.47$, 95% CI [0.45, 0.49], $p < .0001$) were better recognized than positive emotions ($OR_{\text{positive}} = 0.95$, 95% CI [0.90, 1.01], $p = .09$), though this effect did not reach statistical significance. On the other hand, for spontaneous expressions, positive emotions ($OR_{\text{positive}} = 1.22$, 95% CI [1.15, 1.29], $p < .0001$), were recognized significantly more accurately than negative emotions ($OR_{\text{intercept}} = 0.28$, 95% CI [0.27, 0.29], $p < .0001$).

Discussion

Study 3 investigated Dutch and Chinese perceivers' recognition of emotions in facial expressions from the other culture as well as from their own culture. We adopted a fully within-subject design, which afforded more statistical power and minimized the effects of individual differences on the findings. We replicated the findings from Studies 1 and 2, showing that emotions were more accurately recognized from posed as compared to spontaneous expressions. This was the case for both Dutch and Chinese perceivers, and in both within-cultural and cross-cultural contexts, demonstrating that the pattern of results is robust. This is, to our knowledge, the first comparison of emotion perception from posed and spontaneous expressions across cultures using a fully balanced design. These findings have important implications for cross-cultural research on interpersonal emotion communication.

We also found that, as in Studies 1 and 2, negative emotions were better recognized than positive emotions from posed expressions, while positive emotions were better recognized from spontaneous expressions. This reverse relationship between emotion valence and the relative recognizability of emotions for posed and spontaneous expressions was largely consistent for both within- and cross-cultural perceptual judgments, though the effect size was smaller in the cross-cultural comparison, resulting in the follow-up comparison between positive and negative emotions for posed expressions not being statistically significant. The smaller effect size may relate to the introduction of the additional independent variable in this study: culture. Study 3 thus substantiates the findings from Studies 1 and 2 and provides additional cross-cultural evidence that conclusions drawn from the perception of posed expressions cannot be assumed to generalize to spontaneous expressions.

General Discussion

The present studies tested two hypotheses: (a) emotion recognition would be more accurate from posed as compared to spontaneous facial expressions; (b) emotion recognition accuracy would be higher for negative than for positive emotions. In three preregistered studies with a total of 2,408 participants, our results consistently showed that emotions were significantly better recognized from posed compared to spontaneous expressions: This finding held across two very different cultures (Dutch and Chinese) for judgments both within (Studies 1–3) and across (Study 3) cultures. Our second hypothesis was only partially supported: We consistently found that negative emotions were better recognized than positive emotions from posed expressions only. For spontaneous expressions, we found across all three studies that positive emotions were better recognized than negative emotions. These studies provide strong empirical evidence that perceptions of posed and spontaneous emotional expressions are not equivalent and also that the type of stimuli influences emotion recognition depending on the valence of the emotion. These findings have theoretical implications for our understanding of interpersonal emotion communication. Moreover, they are relevant to other domains of research where emotional facial expressions are commonly used as stimuli, as the type of stimuli used could influence the results and conclusions (Davis & Gibson, 2000; Georgopoulos et al., 2022; Naab & Russell, 2007). We discuss the implications of our findings, as well as potential explanations for our results, below.

Superior Recognition of Posed Over Spontaneous Emotional Expressions

The starting point for the present work was earlier studies suggesting that emotions are more accurately inferred from posed than spontaneous facial expressions (Krumhuber et al., 2021; Motley & Camden, 1988; Zuckerman et al., 1976). The present contribution establishes this as a robust effect, thanks to the use of posed and spontaneous expressions from the same expressers, the verification of the expressers' emotional experience, preregistration, and the inclusion of a large number of expressers and perceivers. These features address important limitations of earlier work, ruling out potential alternative explanations of the results.

What might explain the difference in emotion recognition accuracy between posed and spontaneous expressions? First, the increased difficulty in decoding spontaneous expressions may, at least in part, be attributed to the inherent complexity and ambiguity present in spontaneously displayed emotional expressions, as prototypicality and complexity have been shown to influence emotion classification by both machines and human decoders (Kim et al., 2023). Posed expressions rely on prototypes and contain less varied patterns of facial muscle movements (Cohn et al., 2007; Krumhuber et al., 2021). In contrast, naturally occurring facial expressions are associated with more complex action units involving a wider range of muscle movements, which may make their emotional content more ambiguous (Gosselin et al., 1995; Krumhuber et al., 2021).

Second, the better recognition rates for posed expressions may also be attributed to differences in the intensity of the expressions (Sauter & Fischer, 2018). The intensity of the expressions is qualified by the magnitude of the muscle movements associated with the facial expressions, which may be independent of the intensity of the emotional experience at the moment of expression production. Posed facial expressions are often associated with pronounced, even exaggerated, muscle movements in the face compared to spontaneous expressions (Matsumoto & Hwang, 2014). Recognition has been shown to be poorer for expressions that are of low intensity or subtle in movements (Eskritt & Zupan, 2023; Yitzhak et al., 2017), as is often the case for spontaneous expressions. Having said that, the spontaneous expressions in the present studies were generated in a context fairly representative of real-life situations where emotional events are recalled and shared during interpersonal interactions (Rimé et al., 2020). Our findings therefore raise questions about perceivers' ability to correctly identify emotions from naturally occurring facial expressions alone, in the absence of further context.

This relates to the third potential explanation for the relatively poor recognition of spontaneous expressions, which is the lack of contextual information and emotion cues from other channels that perceivers could make use of (Carroll & Russell, 1996; Hess & Kafetsios, 2021; Paulmann & Pell, 2011). Under typical circumstances in everyday life, perceivers would have access to a wealth of additional information beyond facial expressions to base their inferences of the other's emotions on, such as vocal cues, semantic information from speech, body language, and context. During real-life interactions, the role of context may be highly important when interpreting nonverbal emotional expressions (Israelashvili et al., 2019). It is possible that the lack of context disproportionally hinders the understanding of spontaneous emotional stimuli given their complexity, making recognition extra challenging.

The different recognition accuracy of posed and spontaneous expressions demonstrates that the perception of the two is not equivalent. As such, it is important for researchers to reflect on how nonverbal emotion communication is studied. The reliance on emotion identification from de-contextualized posed facial expressions arguably not only limits the conclusions drawn from research on emotion perception but also has implications for various research using facial expressions as stimuli to investigate other questions. To further our understanding of interpersonal communication and other related processes in the real world, which is what researchers ultimately want to achieve, it is important to study phenomena in situations that resemble real life.

Emotion Valence and Perception

We predicted that negative emotions would be better recognized than positive emotions but found only partial support for this hypothesis. Across three studies, negative emotions were better recognized than positive emotions only from posed expressions. This superior perception of negative emotions is consistent with the proposed evolutionary function of negative emotions in signaling potential threats in the environment (Cacioppo & Gardner, 1999; Schmidt & Cohn, 2001; Williams et al., 2006). Conveying information relevant to survival and safety is adaptive, and as such, negative emotional expressions can be expected to be relatively easy to identify (Gosselin et al., 2002; Hampson et al., 2006; Schmidt et al., 2009).

However, we consistently found that when using spontaneous expressions as stimuli, positive emotions were better identified. This may be related to the interpersonal evolutionary functions that positive emotions have been theorized to serve, such as building social bonds and fostering cooperation (Sels et al., 2021). The context in which the spontaneous expressions were created in this study was similar to social interactions involving the sharing of emotional autobiographical experiences (Israelashvili et al., 2019; Rimé et al., 2020). Spontaneous expressions of positive emotions may be effective in conveying positive social information in this context, as they are an honest signal of warmth and a willingness to engage (Harker & Keltner, 2001; Shiota et al., 2014). Our findings suggest that during interpersonal interactions, positive emotions are easier to identify from nonverbal cues compared to negative emotions.

The superior recognition of positive emotions in spontaneous expressions might be explained by emotion regulation. When people recall emotional events, they might downregulate the experience of negative emotions more than positive emotions. We therefore examined the data to inspect the emotional experience reported by the expressers. We found that expressers from both cultures did report experiencing positive emotions more intensely during recall than negative emotions. These additional analyses are reported in Supplemental Text 6. The more intense emotional experiences of positive emotions might have led to clearer signals of these emotions, which could in turn lead to better emotion recognition. People might also directly downregulate their *expressions* of negative emotions during social interactions next to the intensity of their emotional *experience*. One recent study on the habitual expressive suppression of emotions found that people suppress their expressions of negative emotions more than positive emotions (Yu et al., 2023). Taken together, emotion regulation could be a potential mechanism underlying the difference between the recognition of positive versus negative emotions from spontaneous expressions. Testing this question could be a worthwhile pursuit for future research.

Our findings challenge the idea of a universal "negativity bias" (Baumeister et al., 2001). They do, however, align with some prior research that has pointed to a "positivity bias." For example, positively valenced words are processed faster than negative words by both adults and children (Goh et al., 2016; Sylvester et al., 2016). Research on the processing of facial stimuli has also sometimes found that people allocate less attention to negative emotional stimuli compared to positive ones (Hunnius et al., 2011). Interestingly, a review on the effect of valence in face processing found that all of the studies that found a positivity bias used naturalistic stimuli, while few of the studies that found a negativity bias did (Kauschke et al., 2019). Together, these findings point to the importance of testing theories using ecologically valid stimuli.

Theoretical and Applied Implications

The present studies provided robust evidence for a clear discrepancy in the perception of emotions from posed and spontaneous expressions. The stark differences in results for posed and spontaneous expressions have broad implications for a wide range of research using emotional facial expressions as stimuli, as well as applied contexts where emotion recognition tasks are utilized.

One area where emotional facial expressions are often used is in social cognition research. This includes studies investigating the effect of emotional facial expressions on interpersonal attitudes (e.g., Marsh et al., 2005; Ruggiero et al., 2017; Seidel et al., 2010), their effects on individuals' responses in various contexts such as negotiation and persuasion (e.g., Pietroni et al., 2008; Van Kleef et al., 2015), and neuroimaging research investigating how the brain responds to emotional faces (e.g., Vuilleumier & Pourtois, 2007; Wang et al., 2017). If, as our results demonstrate, the perception of naturally occurring emotional expressions is different from that of deliberately posed expressions, the results of many past studies using posed emotional facial expressions may not generalize to real-life situations. Therefore, it is important to test theories using ecologically valid stimuli to yield findings with meaningful implications for our understanding of human behavior in the real world.

Another domain that frequently makes use of emotional facial expressions is clinical assessments, since emotion recognition deficits have been associated with various psychological and neurological conditions (e.g., Argaud et al., 2018; Işık Ulusoy et al., 2020; Kohler et al., 2010; Krause et al., 2021; Lozier et al., 2014). The majority of research in this area, including established clinical tests (e.g., Froming et al., 2006; Nowicki & Duke, 1994), uses prototypical posed emotional facial expressions as stimuli. Given our findings with general population samples, which indicate a divergence in emotion perception between posed and spontaneous facial expressions, it is reasonable to infer that these differences may also manifest in clinical samples. There is little research on this question to date, but one study with schizophrenic patients did compare emotion recognition from posed and spontaneous expressions directly. They found that individuals with schizophrenia have an emotion recognition deficit when using posed expressions, but when using genuine spontaneous expressions of emotions, they actually outperformed healthy controls (Davis & Gibson, 2000). Another recent study (Georgopoulos et al., 2022) investigated emotion recognition in autistic adults and also found stimulus type to matter. Though the authors did not compare posed and spontaneous expressions directly, they found that when they included dynamic and social stimuli that resemble real-life situations, the distribution of emotion recognition accuracy mostly overlapped between autistic individuals and healthy controls. Unfortunately, most research in this field still relies on prototypical posed expressions. Studying perceptions of spontaneous expressions that resemble those that occur in real life will likely bring new insights into the emotional and social functioning of both healthy individuals and clinical samples. Together with previous research, our results point to the importance of the choice of stimuli and highlight how this choice could directly impact the results of theory testing.

Constraints on Generality

The present studies have several strengths, including the use of large stimulus sets and sample sizes, the use of preregistration, and sampling from two different cultures. Nevertheless, it is also important to acknowledge several limitations. First, the specific procedure used to elicit posed and spontaneous expressions in our study may have influenced the nature and recognizability of these expressions. Though we used posed and spontaneous expressions from the same individuals as stimuli, we did not control for the intensity of the muscle movements in the expressions. Moreover, we did not compare the expressers' subjective emotional experiences when producing the posed and spontaneous expressions. Furthermore, there are limitations to using an autobiographic recall procedure to elicit the spontaneous expressions. For example, some selected spontaneous expressions occurred at moments where expressers were speaking, which might have obscured some facial movements, potentially impairing the recognizability of the expressions. Additionally, depending on how long ago the recalled events occurred, the intensity of the emotion experience during recall may not always be high and the extent to which memories elicit emotional expressions may vary across individuals (Nandrino et al., 2019). That being said, the spontaneous expressions in our study are highly ecologically valid and representative of the real-life emotional expressions, which often occur in situations where people are speaking (Sowden et al., 2021). Future research might consider creating spontaneous expressions using other procedures and comparing the recognizability of different types of spontaneous expressions. Future research might also include emotion expressions that vary in intensity, and systematically examine the relationship between expression intensity and recognizability in naturally occurring emotional expressions, including in comparison to posed expressions.

Second, forced-choice emotion categorization tasks, although common in emotion recognition research, have been criticized (Barrett et al., 2019; Russell, 1994). Forcing participants to assign one emotion label to an emotional expression may artificially inflate accuracy, compared to allowing perceivers to generate their own emotion labels or choose multiple emotion categories. We nevertheless opted to use this approach, as it is arguably the most frequently used method to investigate emotion perception (Elfenbein & Ambady, 2002; Lozier et al., 2014; Wood et al., 2016), thus allowing us to directly compare findings from the present studies to the existing literature.

Third, while we included a larger range of emotions than is typically used, there is certainly scope for further expanding the repertoire to capture a broader spectrum of emotional experiences. Recent research has shown that a wide range of negative and positive emotions are associated with distinct nonverbal displays (Cordaro et al., 2018; Cowen et al., 2021; Cowen & Keltner, 2020). To achieve a more complete understanding of emotion communication processes, it will be important to include a richer range of emotions. Furthermore, although we replicated our findings in a non-Western sample, there are many more underrepresented cultures in psychological research (Henrich et al., 2010; Rad et al., 2018). In order to truly establish the generalizability of these findings, future work will need to examine additional sociocultural contexts. Finally, the present studies only examined emotion perception from facial expressions. Future research could investigate whether these findings generalize to other channels of nonverbal communication.

Conclusion

The three studies reported here contribute to our understanding of emotion communication by revealing differences in perceptions of posed and spontaneous facial expressions. These findings demonstrate that conclusions drawn from studies using posed emotional facial expressions may not be applicable to the naturalistic, spontaneous emotional expressions occurring in everyday interactions. These findings highlight the importance for psychological research to incorporate emotional stimuli that are more representative of real-life experiences (Israelashvili et al., 2019).

Only by adopting a more ecologically valid approach can we effectively investigate emotion processes and social functioning, both in general and in more specific populations, such as infants, or people with psychopathologies. Moving forward, it is imperative to prioritize the inclusion of stimuli that are representative of real-life situations to be able to make accurate inferences about human behaviors in their natural environments. By embracing this paradigm shift, future studies can further advance our knowledge of the intricate nature of human emotions and how we communicate them.

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