

The impact of spontaneity and presentation mode on the ingroup advantage in recognizing angry and disgusted facial expressions

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Abstract

Previous research has found that individuals are more accurate at recognizing facial expressions of individuals from their own cultural background than those from a different cultural background, known as the ingroup advantage. However, most studies investigating the ingroup advantage have primarily focused on posed and static facial expressions, paying less attention to spontaneous and dynamic facial expressions. To investigate whether the ingroup advantage is influenced by spontaneity (posed and spontaneous) and presentation mode (static and dynamic) of facial expressions, we recruited participants from China, Canada, and the Netherlands to recognize posed and spontaneous facial expressions of anger and disgust displayed by Chinese and Dutch models (Experiment 1), as well as static and dynamic facial expressions (Experiment 2). The results showed that, in most cases, there was an ingroup advantage in the recognition of both posed and spontaneous expressions, with the ingroup advantage being significantly higher for posed expressions compared to spontaneous expressions. Additionally, an ingroup advantage was observed in the recognition of both static and dynamic expressions, although there was no significant difference between the two overall. These findings suggest that the ingroup advantage in facial expression recognition is influenced by the spontaneity of the expressions, but may not be affected by the mode of expression presentation. The implications of this research are significant in expanding our understanding of the ingroup advantage and deepening our knowledge of cross-cultural facial expression recognition.

Keywords facial expression recognition, ingroup advantage, posed and spontaneous facial expressions, static and dynamic facial expressions, culture difference

In today's era of globalization, communication between individuals from different cultures is becoming increasingly frequent. In such cross-cultural and cross-linguistic interactions, accurately interpreting nonverbal behaviors, particularly facial expressions, is of great importance (Fang, Rychlowska, & Lange, 2022; Van Kleef & Côté, 2022). Nonetheless, deciphering facial expressions with precision poses a challenge, particularly when attempting to interpret the expressions of individuals from other cultures. Previous research has found that non-verbal emotional communication is impaired when it occurs between individuals from different cultural groups, compared to communication within the same cultural group (Elfenbein & Ambady, 2002). Specifically, individuals tend to be more accurate in recognizing facial expressions of individuals from their own cultural background compared to those from a different cultural background (Elfenbein & Ambady, 2002; Zhang et al., 2011). This phenomenon is commonly referred to as the ingroup advantage.

Previous research on the ingroup advantage in facial expression recognition has primarily focused on posed and static facial expressions (Elfenbein & Ambady, 2002). Posed facial expressions refer to deliberate displays of specific emotions by individuals (Elfenbein & Ambady, 2002), while static facial expressions are captured at specific moments in time. However, in real-life situations, facial expressions are often spontaneous, naturally occurring during interactions (Matsumoto, Olide, Schug, et al., 2009), and dynamic, evolving over time

(Krumhuber et al., 2023; Zhang et al., 2015). In recent years, more and more research has revealed potential differences in the expression and perception of posed and spontaneous facial expressions, as well as static and dynamic facial expressions (Kang & Lau, 2013; Krumhuber et al., 2021; Matsumoto, Olide, & Willingham, 2009; Valente et al., 2018). Consequently, it becomes imperative to examine whether the ingroup advantage is moderated by the spontaneity and presentation mode of facial expressions. To address this, we will begin by reviewing the ingroup advantage and the dialect theory of emotion. Subsequently, we will explore potential differences in the recognition of posed versus spontaneous expressions, as well as static versus dynamic expressions. Finally, through two experiments, we will investigate whether the ingroup advantage in recognizing angry and disgusted expressions is moderated by the spontaneity and presentation mode of expressions. This research holds significant implications for expanding the knowledge on the ingroup advantage in facial expression recognition and deepening our understanding of cross-cultural expression recognition.

The Ingroup Advantage and Dialect Theory of Emotion

While early research suggests that emotional facial expressions, at least basic emotions, are universally recognized and unaffected by culture (e.g., Ekman et al., 1969), recent studies have increasingly highlighted both the universality and cultural specificity of emotional expressions (Elfenbein et al., 2007; Fang et al., 2021). One perspective posits that although indi-

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The original article is in Chinese. The Chinese version shall always prevail in case of any discrepancy or inconsistency between the Chinese version and its English translation.

viduals from different cultures can recognize the facial expressions of individuals from other cultures at above-chance levels, they tend to exhibit higher accuracy in recognizing expressions from individuals within their own culture (Elfenbein & Ambady, 2002).

To explain this phenomenon, researchers have proposed the dialect theory of emotion (Elfenbein, 2013; Elfenbein et al., 2007). According to this theory, emotions can be seen as a universal language shared across cultures. However, individuals from different cultural backgrounds exhibit subtle variations in emotional expression and perception, giving rise to what is known as “emotion dialects” (Elfenbein & Ambady, 2002). Within the same cultural group, emotion recognition benefits from better alignment with their “emotion dialect,” whereas poorer alignment of “emotion dialects” between different cultural groups leads to decreased accuracy in emotion recognition. Empirical support for the dialect theory of emotion was provided by Elfenbein et al. (2007). In their study, participants from Canada and Gabon were asked to pose facial expressions of emotion such as anger, disgust, fear, surprise, sadness, and happiness. Facial Action Coding System (FACS; Ekman et al., 2002) was employed to analyze the Action Units (AUs) involved in these expressions. The results revealed that although expressions from different cultural groups contained AUs of standardized expressions outlined in the FACS manual, they also displayed consistent variations (i.e., emotion dialects). Subsequently, a new group of participants from Canada and Gabon were asked to recognize these expressions. Consistent with the dialect theory of emotion, the ingroup advantage became more pronounced as the dissimilarities between emotional dialects increased.

The Influence of Posed and Spontaneous Facial Expressions on the Ingroup Advantage

While the ingroup advantage in recognizing facial expressions has been extensively studied, most research has focused on posed expressions, with less attention given to spontaneous expressions (see Elfenbein & Ambady, 2002, for a meta-analysis). In recent years, research has found significant differences in the activated AUs between posed and spontaneous expressions conveying the same emotion (Namba, Kagamihara, et al., 2017; Namba, Makihara, et al., 2017). Additionally, Fang, Sauter, et al. (2022) discovered that posed expressions activated a greater number of AUs compared to spontaneous expressions. These findings collectively suggest potential differences in facial muscle movement patterns between posed and spontaneous expressions.

This raises the question: are there differences in the ingroup advantage when recognizing posed versus spontaneous expressions? Previous research has suggested that posed expressions may be more susceptible to cultural influences compared to spontaneous expressions (for a review, see Valente et al., 2018). Both early observational studies and later studies that utilized facial muscle movement measurements have found that blind individuals produced spontaneous expressions similar to those of sighted individuals, while considerable differences between blind and sighted individuals were found for posed expressions. The findings suggest that posed expressions may be influenced by social learning to a higher degree than spontaneous expressions. Consequently, we predicted that posed expressions may contain more emotional dialects, thereby potentially leading to a more pronounced ingroup advantage in their recognition

when compared to spontaneous expressions.

This hypothesis received preliminary support from a study by Matsumoto, Olide, and Willingham (2009). In their study, American and Japanese participants were asked to judge the happy or sad expressions produced by American and Japanese athletes immediately after a medal match at the 2004 Athens Olympic Games. The results did not find an ingroup advantage, suggesting that the ingroup advantage may not apply to spontaneous expressions. However, Kang and Lau (2013) found different results. They asked European American and Asian American participants to recognize pictures of standardized facial expressions (based on prototypes from the Japanese and Caucasian Facial Expressions of Emotion, JACFEE; Matsumoto & Ekman, 1988) and video clips of spontaneous expressions displayed by both European American and Asian American models. The spontaneous expressions were elicited through discussions of personal experiences. Results indicated that Asian Americans exhibited an ingroup advantage in recognizing both standardized and spontaneous facial expressions, while European Americans did not show an ingroup advantage in either case. It is worth noting that the standardized expressions in this study were presented statically, while the spontaneous expressions were presented dynamically. Furthermore, the emotional categories of the two types of expressions were not entirely identical (standardized expressions: sadness, surprise, fear, anger, disgust, and joy; spontaneous expressions: sadness, surprise, disappointment, anger, and joy). Therefore, it remains to be determined if the spontaneity of expressions moderates the ingroup advantage.

On the other hand, posed expressions tend to have higher intensity and prototypicality compared to spontaneous expressions (Krumhuber et al., 2021; Tcherkassof et al., 2007). These characteristics may contribute to a higher recognition rate for posed expressions. Consistent with this notion, previous research has demonstrated better recognition of posed expressions by both humans and machines (Fang, Sauter, et al., 2022; Krumhuber et al., 2021). Therefore, we predicted that this heightened recognition characteristic may reduce the differences in recognition rates for posed expressions across individuals from different cultures, resulting in a smaller ingroup advantage in the recognition of posed expressions compared to spontaneous expressions.

The Influence of Static and Dynamic Facial Expressions on the Ingroup Advantage

In addition to investigating whether the ingroup advantage is moderated by the spontaneity of expressions, the second goal of this research was to examine whether the presentation mode of expressions impacts the ingroup advantage. Compared to static expressions, dynamic expressions contain unique dynamic features, such as the direction, quality, and velocity of facial movements (Bould & Morris, 2008; Cunningham & Wallraven, 2009; Jack et al., 2014). These dynamic cues activate higher-order cognitive processes that support social and emotional inferences, thereby facilitating the recognition of facial expressions (Blais et al., 2017; Sato et al., 2008).

Nevertheless, it remains unclear whether the facilitation of dynamic information is specific to the ingroup perceivers or universally applicable to all cultural groups. In other words, it is uncertain whether the dynamic information encompasses emotional dialects. If dynamic information indeed includes emotional dialects, then these additional emotional dialects

would further strengthen the ingroup advantage. Therefore, we hypothesized that the ingroup advantage in the recognition of dynamic expressions will be greater than that of static expressions. This hypothesis received preliminary support from a meta-analysis by Elfenbein and Ambady (2002). They found that studies using dynamic expressions as experimental stimuli showed a larger magnitude of ingroup advantage compared to studies utilizing static expressions. It is worth noting that the effect of presentation mode on the ingroup advantage, as revealed in the meta-analysis, was only marginally significant. Additionally, the studies included in this meta-analysis differed not only in the presentation mode of expressions but also in other factors, such as the spontaneity, cultural background, and emotional categories of expressions. Due to the lack of control over these factors, it remains uncertain whether the presentation mode alone moderates the ingroup advantage.

However, if the dynamic information does not contain emotional dialects and instead universally enhances the performance of emotion recognition for all cultural groups of perceivers, then there would be no difference in the ingroup advantage between dynamic and static expression recognition. Therefore, we hypothesized that the presentation mode of expressions may not moderate the ingroup advantage.

The Present Research

Overall, despite initial explorations, the existing research on whether the ingroup advantage in cross-cultural emotion recognition is influenced by the spontaneity of facial expressions is limited. Some studies have exclusively focused on the recognition of spontaneous expressions but without considering posed expressions (Matsumoto, Olide, & Willingham, 2009), making direct comparisons between the two types of expressions challenging. Other studies have encountered mismatches in emotion categories and presentation modes between spontaneous and posed expressions (Kang & Lau, 2013), making it difficult to exclude the impact of these factors on the results. Moreover, the existing research draws inconsistent conclusions regarding whether the spontaneity of expressions moderates the ingroup advantage. Notably, no previous research has investigated whether the ingroup advantage in cross-cultural emotion recognition is influenced by the presentation mode of facial expressions.

The present research aimed to investigate whether the ingroup advantage in cross-cultural emotion recognition is moderated by the spontaneity (posed expressions versus spontaneous expressions; experiment 1) and presentation mode (static expressions versus dynamic expressions; experiment 2) of facial expressions. Specifically, Experiment 1 recruited participants from Eastern and Western cultures to recognize posed dynamic expressions and spontaneous dynamic expressions displayed by individuals from both cultural backgrounds. Experiment 2 recruited participants from Eastern and Western cultures to recognize static posed expressions and dynamic posed expressions displayed by individuals from both cultural backgrounds. The posed expressions were obtained by asking models to pose specific expressions that would be easy for their friends to understand their feelings, while the spontaneous expressions were elicited by instructing models to recall experiences related to specific emotions from their own lives. In contrast to prior studies that utilized standardized facial expressions (e.g., Kang & Lau, 2013), the posed expressions used in the present research were tailored to align more closely with

the cultural norms of emotional expression in each respective culture. This approach aimed to avoid the issue of cultural differences being masked by standardized posed expressions, and potentially affecting the ingroup advantage in emotion recognition (Elfenbein et al., 2007).

The present research focused on facial expressions of anger and disgust. These emotions were chosen for three main reasons. Firstly, anger and disgust are widely regarded as basic emotions (Izard, 2007; Ekman, 1992), and thus they are expected to be universally experienced and expressed across Eastern and Western cultures. Secondly, despite being distinct emotions, anger and disgust are conceptually related (Giner-Sorolla et al., 2018) and associated with morphologically similar facial configurations (Cordaro et al., 2018; Fang, Sauter, et al., 2022). These similarities contribute to potential confusion between the two expressions (Fang et al., 2018, 2019; Jack et al., 2009; Pochedly et al., 2012). By utilizing these facial expressions that exhibit confusion, the ingroup advantage in emotion recognition can be better elicited. Conversely, when using two completely dissimilar expressions of emotion, such as anger and happiness, individuals tend to perform well in recognizing these expressions regardless of their cultural background, thus diminishing the likelihood of observing the ingroup advantage. Thirdly, existing facial expression databases predominantly consist of static posed expressions, with limited coverage of dynamic or spontaneous expressions (for reviews, see Dawel et al., 2022; Krumhuber et al., 2017). Moreover, there is a scarcity of cross-cultural databases that incorporate both posed and spontaneous expressions, as well as static and dynamic expressions. To the best of the authors' knowledge, only one previous study on cross-cultural emotion expression has encompassed all four expression conditions, depicting static and dynamic posed and spontaneous expressions of anger and disgust from Chinese and Dutch models (Fang, Sauter, et al., 2022). Therefore, the present research employed these materials to investigate whether the ingroup advantage in angry and disgusted expression recognition is influenced by the spontaneity and presentation mode of facial expressions.

Experiment 1

This study aimed to investigate whether the spontaneity of facial expressions influences the ingroup advantage effect in emotion recognition. Participants from Canada and China were recruited for Experiment 1, where they were asked to recognize dynamic expressions of anger and disgust displayed by Dutch and Chinese models, both in spontaneous and posed conditions.

Method

Participants

Based on previous relevant studies (Elfenbein & Ambady, 2002; Kang & Lau, 2013), we sought to recruit 100 Canadian and 100 Chinese participants. It was predetermined to stop data collection at the end of the day on which we approached 100 participants (Simmons et al., 2013). The final sample consisted of 126 participants each from Canada and China. Among them, 62 Canadian participants (52 females; $M_{\text{age}} = 20.67$ years, $SD = 6.91$ years) and 62 Chinese participants (52 females; $M_{\text{age}} = 20.18$ years, $SD = 1.29$ years) completed the posed expression recognition task. Additionally, 64 Canadian participants (58 females; $M_{\text{age}} = 20.89$ years, $SD = 6.07$ years) and 64 Chinese participants (58 females; $M_{\text{age}} = 20.03$ years, $SD = 1.33$ years) completed the spontaneous expression recognition task. A sensitivity analysis using G*Power 3.1 software (Faul et al., 2007)

showed that the final sample size ($N = 252$) could detect an effect size of $f = 0.21$ ($\eta_p^2 = 0.04$; power = 0.80, $\alpha = 0.05$) for the critical interaction effect (Spontaneity \times Expresser Culture \times Perceiver Culture). All participants provided written informed consent, and the Ethics Committee of York University in Canada approved the study (e2018-028).

Design and Materials

Experiment 1 employed a 2 (Emotion: Anger, Disgust) \times 2 (Spontaneity: Posed, Spontaneous) \times 2 (Expresser Culture: Eastern, Western) \times 2 (Perceiver Culture: Eastern, Western) mixed-design. Specifically, Emotion and Expresser Culture were within-subjects factors, and Spontaneity and Perceiver Culture were between-subjects factors.

The materials used in this experiment were sourced from a study conducted by Fang, Sauter et al. (2022), which contained both posed and spontaneous expressions. In the posed condition, participants were instructed to pose facial expressions of anger and disgust in front of a camera in such a way that their feelings could be easily understood by their friends. After producing expressions of anger and disgust, participants watched the video of their own expressions and chose the frame they thought best represented the instructed emotion. The chosen frames were then utilized as static posed expressions (utilized in Experiment 2; see Figure 1 for examples). This approach ensures that the chosen frame accurately represents the participants' intended expressions and avoids introducing any bias from the experimenters (similar procedures can be found in Cordaro et al., 2018; Elfenbein et al., 2007). Dynamic expressions were derived from the selected frames, with 2 seconds of video footage extracted before and after each frame.¹ A total of 45 Chinese participants (22 females) and 49 Dutch participants (36 females) posed expressions of anger and disgust, so 188 static posed expressions and an equal number of dynamic posed expressions were generated. In the spontaneous condition, participants were informed of their role in assisting the development of a robot capable of understanding human emotions. They were instructed to recall an event from their own life that involved angry or disgusted emotional experiences and tell the experiences in detail to the robot. During the storytelling, participants' facial expressions were recorded. Prior studies have demonstrated the effectiveness of this relived-emotion method in eliciting spontaneous expressions (e.g., Siedlecka & Denson, 2019; Tsai & Chentsova-Dutton, 2003). The rest of the procedure was identical to that of the posed condition. A total of 35 Chinese participants (24 females) and 35 Dutch participants (24 females) engaged in storytelling sessions depicting anger

and disgust, resulting in 140 dynamic spontaneous expressions. Due to the presence of mouth movements during storytelling in the spontaneous condition, it was not feasible to discern whether mouth movements in static spontaneous expressions were a result of speaking or making specific facial expressions. Hence, we focused solely on the comparison of dynamic spontaneous expressions with dynamic posed expressions.

Procedure

The experiment was conducted using PsychoPy (Peirce et al., 2019). Participants were randomly assigned to either the posed condition or the spontaneous condition. Each trial began with a fixation cross displayed in the center of the screen for 500 ms, followed by a dynamic facial expression video with a size of $18^\circ \times 12^\circ$ displayed for 2000 ms. After the video playback, emotion intensity rating scales immediately appeared on the screen. Participants were asked to move the sliders to rate the intensity of anger, disgust, fear, sadness, and happiness conveyed by the preceding dynamic facial expression. The rating scale ranged from 0 (not at all) to 100 (very much).² The utilization of rating scales was motivated by the recognition that perceivers may identify multiple emotions within facial expressions (Fang et al., 2018, 2019; Hess et al., 2016). Unlike forced-choice methods, the rating scales provided participants with the flexibility to rate the intensity of different emotions they perceived in a specific facial expression, rather than being constrained to selecting a single emotion.

The posed facial expression recognition task consisted of 4 blocks, with each block containing 47 trials, resulting in a total of 188 trials. Similarly, the spontaneous facial expression recognition task consisted of 4 blocks, with each block containing 35 trials, resulting in a total of 140 trials. Each facial expression was presented only once, and the presentation order was fully randomized. All participants were tested in their own languages.

Result and Discussion

The calculation method for recognition accuracy of expressions was as follows: If the participant's rating on the target emotion dimension was greater than or equal to the ratings on other emotion dimensions and not equal to 0, it was coded as 1 (correct judgment). Otherwise, it was coded as 0 (incorrect judgment). To examine the ingroup advantage more intuitively, we calculated an index of an ingroup advantage by subtracting recognition accuracy for expressers from the other cultural background from recognition accuracy for expressers from perceivers' own cultural background for each presentation mode and each emotion. If the difference is significantly greater than zero, it indicates the presence of an ingroup advantage. If the difference is significantly less than zero, it indicates the presence of an outgroup advantage. If the difference is not significantly different from zero, it indicates no significant difference in perceivers' accuracy in recognizing facial expressions of expressers from different cultural backgrounds. The results showed that an ingroup advantage was observed when Western perceivers recognized posed expressions as well as spontaneous expressions. Eastern perceivers also showed an ingroup advantage in recognizing posed expressions, but not in recognizing spontaneous expressions. These findings will be further discussed in the General Discussion section. The means, standard deviations, and results of one-sample t -tests for the ingroup advantage under each condition are presented in Table 1. The means, standard deviations, and results of one-sample



Figure 1. Examples of Static Posed Facial Expressions in the Present Study

Note. Examples of dynamic posed and spontaneous facial expressions are available at https://osf.io/8f5cd/?view_only=197bfe65e1be4723bf3ba0efb6294ba4.

Table 1
The Means, Standard Deviations, and Results of One-Sample T-Tests for the Ingroup Advantage under Each Condition in Experiment 1

Perceiver Culture	Spontaneity	Emotion	Ingroup Advantage	df	t	p	Cohen's d	95% CI
Eastern	Posed	Anger	0.09 (0.11)	61	6.50	<0.001	0.83	[0.53, 1.11]
		Disgust	0.06 (0.10)	61	4.38	<0.001	0.56	[0.29, 0.82]
	Spontaneous	Anger	-0.05 (0.11)	63	-3.48	<0.001	-0.44	[-0.69, -0.18]
		Disgust	0.02 (0.10)	63	1.47	0.147	0.18	[-0.06, 0.43]
Western	Posed	Anger	0.03 (0.10)	61	2.55	0.013	0.32	[0.07, 0.58]
		Disgust	0.14 (0.11)	61	9.86	<0.001	1.25	[0.92, 1.58]
	Spontaneous	Anger	0.10 (0.10)	63	7.84	<0.001	0.98	[0.68, 1.28]
		Disgust	0.04 (0.09)	63	3.43	0.001	0.43	[0.17, 0.68]

Note. The one-sample *t*-test was two-tailed, $H_0: \mu = 0$.

t-tests for the accuracy of facial expression recognition under each condition are provided in Supplementary Table S1.

We conducted a 2 (Emotion: Anger, Disgust) \times 2 (Spontaneity: Posed, Spontaneous) \times 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on the ingroup advantage. ³ A complete overview of effects can be found in Table 2.

Table 2
Emotion (Anger, Disgust) \times Spontaneity (Eastern, Western) \times Perceiver Culture (Eastern, Western) Mixed-Design ANOVA on the Ingroup Advantage in Experiment 1

Effect	df	F	p	η_p^2
Emotion	1, 248	6.54	0.011	0.03
Spontaneity	1, 248	31.34	<0.001	0.11
Perceiver Culture	1, 248	27.19	<0.001	0.10
Emotion \times Spontaneity	1, 248	4.02	0.046	0.02
Emotion \times Perceiver Culture	1, 248	0.21	0.648	<0.01
Spontaneity \times Perceiver Culture	1, 248	13.09	<0.001	0.05
Emotion \times Spontaneity \times Perceiver Culture	1, 248	57.08	<0.001	0.19

The main effect of Emotion was significant, $F(1, 248) = 6.54$, $p = 0.011$, $\eta_p^2 = 0.03$, with a larger ingroup advantage for disgust ($M = 0.06$, $SD = 0.11$) compared to anger ($M = 0.04$, $SD = 0.12$). The main effect of Perceiver Culture was significant, $F(1, 248) = 27.18$, $p < 0.001$, $\eta_p^2 = 0.10$, with a larger ingroup advantage for Western perceivers ($M = 0.08$, $SD = 0.07$) compared to Eastern perceivers ($M = 0.03$, $SD = 0.09$).

Importantly, the main effect of Spontaneity, which is central to the hypotheses of our study, was significant, $F(1, 248) = 31.34$, $p < 0.001$, $\eta_p^2 = 0.11$. The ingroup advantage for posed expressions ($M = 0.08$, $SD = 0.08$) was significantly greater than that for spontaneous expressions ($M = 0.03$, $SD = 0.09$). Additionally, the two-way interaction of Spontaneity and Perceiver Culture, $F(1, 248) = 57.08$, $p < 0.001$, $\eta_p^2 = 0.19$, and the three-way interaction of Emotion, Spontaneity and Perceiver Culture, $F(1, 248) = 13.09$, $p < 0.001$, $\eta_p^2 = 0.05$, were both significant (see Figure 2). To further elucidate this three-way interaction, it was broken down by Perceiver Culture. The results revealed that for both Eastern and Western perceivers, the two-way interaction of Emotion and Spontaneity was significant (Eastern: $F(1, 124) = 15.23$, $p < 0.001$, $\eta_p^2 = 0.11$; Western: $F(1, 124) = 46.20$, $p < 0.001$, $\eta_p^2 = 0.27$). Given our primary interest in whether the ingroup advantage is moderated by the

spontaneity of expressions, the two-way interaction was broken down by Emotion. The results showed that, for Eastern perceivers, a larger ingroup advantage was observed for posed expressions of anger and disgust compared to spontaneous expressions of anger and disgust (anger: $t(124) = 6.98$, $p < 0.001$, Cohen's $d = 1.24$, 95% CI = [0.86, 1.62]; disgust: $t(124) = 2.09$, $p = 0.039$, Cohen's $d = 0.37$, 95% CI = [0.02, 0.72]). For Western perceivers, a larger ingroup advantage was observed for posed expressions of disgust compared to spontaneous expressions of disgust, $t(124) = 5.66$, $p < 0.001$, Cohen's $d = 1.01$, 95% CI = [0.64, 1.38]. However, Western perceivers exhibited a significantly greater ingroup advantage when recognizing spontaneous expressions of anger compared to posed expressions of anger, $t(124) = 3.82$, $p < 0.001$, Cohen's $d = 0.68$, 95% CI = [0.32, 1.04].

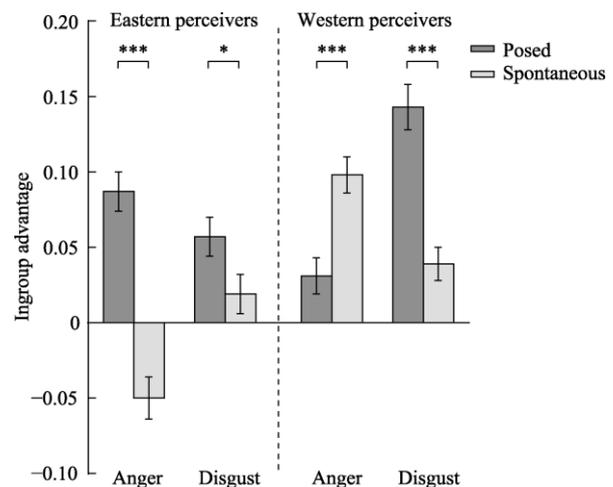


Figure 2. The Ingroup Advantage across Emotion, Spontaneity, and Perceiver Culture in Experiment 1

Note. All error bars stand for the standard error; * $p < 0.05$, *** $p < 0.001$.

The findings of Experiment 1 revealed that the ingroup advantage in recognizing dynamic facial expressions was moderated by the spontaneity of expressions. Overall, the ingroup advantage was significantly larger for posed expressions compared to spontaneous expressions. This may be attributed to the fact that posed expressions are more susceptible to social learning compared to spontaneous expressions (Matsumoto & Willingham, 2009; Rinn, 1991), thereby including more emotional dialects. These additional emotional dialects further amplify the differences in expression recognition between indi-

viduals from the same culture and those from different cultures, thus amplifying the ingroup advantage. The only exception was observed in Western perceivers, where the ingroup advantage for spontaneous angry expressions was significantly greater than that for posed angry expressions. Further discussion on this exception will be addressed in the General Discussion section.

Experiment 2

This study aimed to investigate whether the presentation mode of facial expressions influences the ingroup advantage effect in emotion recognition. Participants from the Netherlands and China were recruited for Experiment 2, where they were asked to recognize posed expressions of anger and disgust displayed by Dutch and Chinese models, both in static and dynamic conditions.

Method

Participants

Similar to Experiment 1, we sought to recruit 60 Canadian and 60 Chinese participants to complete the static facial expression recognition task. Notably, the participants who completed the dynamic expression recognition task in this experiment were drawn from Experiment 1. It was decided a priori to stop data collection at the end of the day on which we approached 60 participants (Simmons et al., 2013). The final sample consisted of 75 Dutch (59 females; $M_{\text{age}} = 21.53$ years, $SD = 4.15$ years) and 82 Chinese participants (58 females; $M_{\text{age}} = 24.16$ years, $SD = 5.10$ years). A sensitivity analysis using G*Power 3.1 software (Faul et al., 2007) showed that the final sample size ($N = 283$) could detect an effect size of $f = 0.19$ ($\eta_p^2 = 0.03$; power = 0.80, $\alpha = 0.05$) for the critical interaction effect (Presentation Mode \times Expresser Culture \times Perceiver Culture). All participants provided written informed consent, and the Ethics Committee of the University of Amsterdam in the Netherlands approved the study (2018-SP-9379).

Design and Materials

Experiment 2 employed a 2 (Emotion: Anger, Disgust) \times 2 (Presentation Mode: Static, Dynamic) \times 2 (Expresser Culture: Eastern, Western) \times 2 (Perceiver Culture: Eastern, Western) mixed-design. Specifically, Emotion and Expresser Culture were within-subjects factors, and Presentation Mode and Perceiver Culture were between-subjects factors. For details on the development of materials, please refer to the Method section of Experiment 1.

Procedure

The static facial expression recognition task was conducted

on Qualtrics (<https://www.qualtrics.com/>). In each trial, a facial expression image depicting either anger or disgust was presented on the screen, along with rating scales below the image to rate the intensity of anger, disgust, fear, and sadness. Considering the notable disparity in valence between the positive emotion of happiness and the two negative emotions of anger and disgust, happiness was not included as a rating item in Experiment 2. Apart from this modification, the procedure remained consistent with Experiment 1. The dynamic facial expression recognition task was adopted from Experiment 1.

Result and Discussion

The calculation method for recognition accuracy and ingroup advantage mirrored that of Experiment 1. The results showed that an ingroup advantage was observed for both Eastern and Western perceivers when recognizing static and dynamic posed expressions. The means, standard deviations, and results of one-sample t -tests for the ingroup advantage under each condition are presented in Table 3. The means, standard deviations, and results of one-sample t -tests for the accuracy of facial expression recognition under each condition are provided in Supplementary Table S3.

We conducted a 2 (Emotion: Anger, Disgust) \times 2 (Presentation Mode: Static, Dynamic) \times 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on the ingroup advantage.⁴ A complete overview of effects can be found in Table 4.

The main effect of Emotion was significant, $F(1, 277) = 13.25$, $p < 0.001$, $\eta_p^2 = 0.05$, with a larger ingroup advantage for disgust ($M = 0.10$, $SD = 0.12$) compared to anger ($M = 0.07$, $SD = 0.11$). The main effect of Perceiver Culture was significant, $F(1, 277) = 18.87$, $p < 0.001$, $\eta_p^2 = 0.06$, with a larger ingroup advantage for Western perceivers ($M = 0.11$, $SD = 0.08$) compared to Eastern perceivers ($M = 0.07$, $SD = 0.07$).

Importantly, the main effect of Presentation Mode, which is central to the hypotheses of our study, was not significant, $F(1, 277) = 2.52$, $p = 0.113$. However, the two-way interaction of Presentation Mode and Perceiver Culture, $F(1, 277) = 7.44$, $p = 0.007$, $\eta_p^2 = 0.03$, and the three-way interaction of Emotion, Presentation Mode and Perceiver Culture, $F(1, 277) = 4.81$, $p = 0.029$, $\eta_p^2 = 0.02$, were both significant (see Figure 3). The three-way interaction was broken down by Perceiver Culture. The results revealed that the two-way interaction of Emotion and Presentation Mode was marginally significant for Western perceivers, $F(1, 135) = 3.55$, $p = 0.062$, $\eta_p^2 = 0.03$, but not significant for Eastern perceivers, $F(1, 142) = 1.44$, $p = 0.233$. Given our interest in whether the ingroup advantage is moderated

Table 3
The Means, Standard Deviations, and Results of One-Sample T -Tests for the Ingroup Advantage under Each Condition in Experiment 2

Perceiver Culture	Presentation Mode	Emotion	Ingroup Advantage	df	t	p	Cohen's d	95% CI
Eastern	Static	Anger	0.06 (0.11)	81	4.96	< 0.001	0.55	[0.31, 0.78]
		Disgust	0.06 (0.12)	81	4.88	< 0.001	0.54	[0.31, 0.77]
	Dynamic	Anger	0.09 (0.11)	61	6.50	< 0.001	0.83	[0.53, 1.11]
		Disgust	0.06 (0.10)	61	4.38	< 0.001	0.56	[0.29, 0.82]
Western	Static	Anger	0.10 (0.12)	74	7.20	< 0.001	0.83	[0.57, 1.09]
		Disgust	0.16 (0.13)	74	10.55	< 0.001	1.22	[0.92, 1.52]
	Dynamic	Anger	0.03 (0.10)	61	2.55	0.013	0.32	[0.07, 0.58]
		Disgust	0.14 (0.11)	61	9.86	< 0.001	1.25	[0.92, 1.58]

Note. The one-sample t -test was two-tailed, $H_0: \mu = 0$.

Table 4
Emotion (Anger, Disgust) × Presentation Mode (Static, Dynamic) × Perceiver Culture (Eastern, Western) Mixed-Design ANOVA on the Ingroup Advantage in Experiment 2

Effects	<i>df</i>	<i>F</i>	<i>p</i>	η_p^2
Emotion	1, 277	13.25	< 0.001	0.05
Presentation Mode	1, 277	2.52	0.113	0.01
Perceiver Culture	1, 277	18.87	< 0.001	0.06
Emotion × Presentation Mode	1, 277	0.29	0.589	< 0.01
Emotion × Perceiver Culture	1, 277	26.52	< 0.001	0.09
Presentation Mode × Perceiver Culture	1, 277	7.44	0.007	0.03
Emotion × Presentation Mode × Perceiver Culture	1, 277	4.81	0.029	0.02

by Presentation Mode, the two-way interaction for Western perceivers was broken down by Emotion. The results showed that, for Eastern perceivers, a larger ingroup advantage was observed for static expressions of anger compared to dynamic expressions of anger, $t(135) = 3.60$, $p < 0.001$, Cohen's $d = 0.62$, 95% CI = [0.27, 0.96], while no significant difference in the ingroup advantage was found for static and dynamic expressions of disgust, $t(135) = 0.66$, $p = 0.513$.

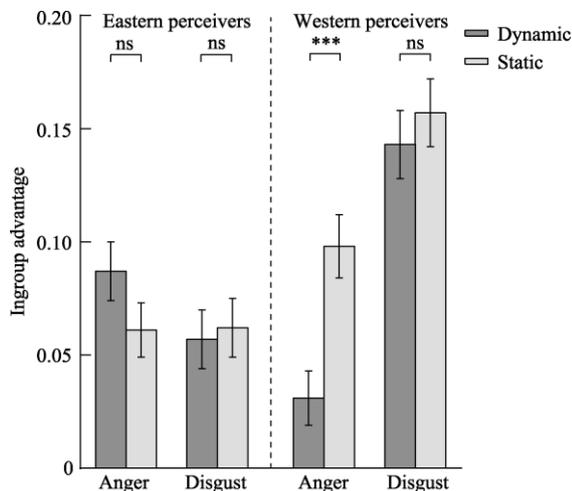


Figure 3. The Ingroup Advantage Across Emotion, Presentation Mode, and Perceiver Culture in Experiment 2

Note. All error bars stand for the standard error; * $p < 0.05$, *** $p < 0.001$.

The results of Experiment 2 indicated that, in most cases, the ingroup advantage was not moderated by the presentation mode of posed facial expressions. The only exception was observed among Western perceivers when it came to angry expressions. In this case, the ingroup advantage was significantly greater for static expressions compared to dynamic expressions. These results will be further discussed in the General Discussion section.

General Discussion

With the acceleration of globalization, people have gained increased opportunities to interact with individuals from different cultural groups. Understanding how individuals from different cultural backgrounds perceive each other's emotions has become of paramount importance. Previous research has consistently found the presence of an ingroup advantage in emotion recognition, whereby individuals are better at recog-

nizing emotions displayed by individuals from their own cultural background compared to those from different cultural groups (Elfenbein, 2013; Elfenbein et al., 2007). However, most studies have primarily focused on static expressions posed by models, with limited exploration of whether the ingroup advantage extends to the recognition of spontaneous and dynamic expressions. In everyday life, facial expressions are often dynamic, and they differ in intensity and prototypicality compared to expressions performed by models in laboratory settings (Dawel et al., 2022; Krumbhuber et al., 2021; Scherer et al., 2011). Therefore, it remains unclear whether findings based on static and posed expressions can be generalized to real-life contexts.

By examining Chinese and Canadian/Dutch perceivers' recognition of angry and disgusted expressions displayed by Chinese and Dutch expressers, the present research investigated, for the first time, whether the ingroup advantage was moderated by the spontaneity (posed vs. spontaneous) and presentation mode (static vs. dynamic) of expressions. The results revealed that, overall, the ingroup advantage in emotion recognition was moderated by the spontaneity of expressions but not by the presentation mode. Specifically, a larger ingroup advantage was observed for posed expressions compared to spontaneous expressions, while no significant difference was found in the ingroup advantage between static and dynamic expressions. These findings will be further discussed in the subsequent sections.

The Ingroup Advantage in Recognizing Posed and Spontaneous Facial Expressions

The present study demonstrated that, in most cases (Emotion × Perceiver Culture), the ingroup advantage in recognizing posed expressions was greater than that in recognizing spontaneous expressions. This may be attributed to the fact that posed expressions, which are consciously enacted, are more influenced by socialization, while spontaneous expressions are less susceptible to social learning (Matsumoto & Willingham, 2009; Rinn, 1991). Consequently, posed expressions may include more emotional dialects compared to spontaneous expressions. Notably, the posed and spontaneous expressions in our study were adapted from the study conducted by Fang, Sauter, et al. (2022). Their findings indicated that, except for the fewer frequent AUs observed in posed angry expressions by Dutch expressers compared to their spontaneous counterparts, posed expressions consistently exhibited a larger number of frequent AUs compared to spontaneous expressions. These additional frequent AUs suggest that posed expressions might convey more information and are more likely to include emotional dialects. Hence, the ingroup advantage was greater for posed expressions compared to spontaneous expressions.

However, a notable exception emerged in Experiment 1, where Western perceivers exhibited a larger ingroup advantage in recognizing spontaneous expressions of anger compared to posed expressions of anger. This finding can potentially be attributed to the fact that the posed expressions of anger displayed by Dutch expressers utilized fewer frequent AUs than their spontaneous expressions of anger. Specifically, the frequent AUs of posed expressions of anger displayed by Dutch expressers are AU4 (brow lowerer), AU7 (lids tightener), AU23 (lip tightener), AU54 (dead down), and AU63 (eyes up), whereas the frequent AUs of spontaneous expressions of anger are AU1 (inner brow raiser), AU2 (outer brow raiser), AU4, AU7, AU61

(eyes left), and AU64 (eyes down). These findings highlight significant disparities between the posed and spontaneous posed and spontaneous expressions of anger by Dutch expressers. It is possible that the spontaneous expressions encompassed a broader range of emotional dialects, thereby resulting in a greater ingroup advantage for spontaneous expressions.

Moreover, although the ingroup advantage was observed in most cases (Emotion \times Spontaneity \times Perceiver Culture), it was absent when Eastern perceivers recognized spontaneous expressions of anger and disgust. These results may be attributed to two reasons. Firstly, besides the influence of emotional dialects on cross-cultural emotional communication, historical heterogeneity serves as another common factor (Niedenthal et al., 2018). Historical heterogeneity refers to the number of source countries that have contributed to a country's present-day population over the last 500 years (Rychlowska et al., 2015; Wood et al., 2016). Societies with higher historical heterogeneity possess more diverse values and beliefs. To live in such a diverse social environment, individuals need to convey their emotions and intentions directly and accurately. Therefore, individuals from historically heterogeneous societies (such as the United States and Canada) tend to express different emotions more clearly through facial expressions compared to individuals from historically homogeneous societies (such as China and Japan), and thus are more easily recognized by others (Fang, Rychlowska et al., 2022; Wood et al., 2016). In the present research, historical heterogeneity may have a greater impact on spontaneous expressions compared to posed expressions. For Chinese perceivers, although emotional dialects enabled them to better recognize spontaneous expressions from Chinese (compared to those from Dutch), historical heterogeneity enabled them to better recognize spontaneous expressions from Dutch (compared to those from Chinese). These two effects offset each other, resulting in no ingroup advantage for Chinese perceivers in recognizing spontaneous expressions of anger and disgust.

Secondly, in addition to historical heterogeneity, collectivism/individualism also influences cross-cultural emotional communication (Matsumoto et al., 2008). In Eastern cultures, individuals tend to exhibit more collectivistic tendencies and prioritize group harmony, which may lead to a tendency to downplay the expression of negative emotions during interactions (Ekman, 1971; Matsumoto et al., 2008). The study by Fang, Sauter, et al. (2022), partially supports this hypothesis. They found that Chinese individuals used significantly fewer frequent AUs when spontaneously expressing anger and disgust (only 2 frequent AUs for anger and 3 frequent AUs for disgust) compared to Dutch individuals (6 frequent AUs for anger and 7 frequent AUs for disgust). The diminished emotional expression increased the difficulty of emotion recognition. Therefore, even for Chinese perceivers, it may be challenging to recognize spontaneous negative expressions from Chinese expressers, resulting in the absence of ingroup advantage when recognizing spontaneous expressions. Future research should delve deeper into these potential explanations.

The Ingroup Advantage in Recognizing Static and Dynamic Facial Expressions

This research revealed that the ingroup advantage in the recognition of posed expressions was not moderated by the presentation mode. However, contrary to our expectations, this result did not result from dynamic information universally en-

hancing emotion recognition. Instead, in most cases (Emotion \times Expresser Culture), perceivers showed no significant difference in the recognition accuracy between static and dynamic expressions (see Supplementary Materials for more details). The findings indicated that the dynamic information in this research did not improve the recognition of posed expressions. Although previous research has often shown higher recognition rates for dynamic expressions compared to static expressions, other studies have found no such difference (e.g., Fiorentini & Viviani, 2011; Wehrle et al., 2000). These inconsistent findings may be attributed to variations in facial expressions and perceptual contexts. When facial expression information is limited, such as when the authenticity of expressions is comprised (Käsryri et al., 2008; Wehrle et al., 2000) or when the intensity of expressions is weak (Bould & Morris, 2008; Yitzhak et al., 2018), dynamic information can compensate for the deficiencies in static expressions, thereby improving emotion recognition. However, when the information of facial expressions is sufficient, such as in cases where expressions are clear and intense, recognition of static expressions may have already reached a high level, and additional dynamic information does not improve recognition accuracy (Bould & Morris, 2008; Gold et al., 2013). Furthermore, when facial expressions are presented briefly and participants have limited response time, static expressions receive more thorough processing than dynamic expressions, resulting in higher recognition rates for static expressions (Jiang et al., 2014). In the present research, the comparison between static and dynamic expressions was based on models' posed expressions of specific emotions, which often include relatively intense emotional cues (Kayyal & Russell, 2013). These strong emotional cues resulted in comparable recognition accuracy for static and dynamic expressions, further leading to the finding that the ingroup advantage was not moderated by the presentation mode of expressions.

However, Experiment 2 showed an exception: When Western perceivers recognized posed expressions of anger, a greater ingroup advantage was observed for static expressions compared to dynamic expressions. Further analysis revealed that this disparity was driven by Western perceivers' higher recognition rates for static angry expressions from Western expressers compared to dynamic angry expressions from Western expressers, while there was no significant difference in the recognition of static and dynamic expressions of anger from Eastern expressers (see Supplementary Materials for more details). This finding is entirely contrary to previous studies on the facilitative effect of dynamic information in emotion recognition (Ambadar et al., 2005; Krumhuber et al., 2023). It is noteworthy that, unlike previous studies that predominantly used morphing software to generate dynamic expressions transitioning from neutral to specific emotions (Krumhuber et al., 2023), the dynamic expressions used in this research consisted of authentic video clips capturing individuals' natural dynamic displays. Consequently, unlike the linear changes of emotion observed in previous studies, the emotional changes in this research may exhibit non-linear and irregular patterns. These irregular dynamic cues may lack clear emotional signals, leading to comparable or even lower recognition rates for dynamic expressions compared to static expressions.

Limitations and Future Directions

Certain limitations of the present research should be kept in mind. Firstly, this research only examined the ingroup ad-

vantage for two negative emotions: anger and disgust. Additionally, we only investigated the performance of participants from Canada, China, and the Netherlands in recognizing facial expressions. It remains unclear whether the conclusions of this research apply to emotions other than anger and disgust and whether they generalize to other cultural groups. Therefore, future research could explore whether the ingroup advantage can be observed in other emotions and other cultural groups, as well as whether such effects are moderated by the spontaneity or presentation mode of expressions. This would provide a more comprehensive understanding of cultural similarities and differences in emotional communication among members from different cultural groups.

Secondly, the present research only used dynamic expressions (posed dynamic expressions vs. spontaneous dynamic expressions) when investigating the moderating role of spontaneity on the ingroup advantage, and only used posed expressions (static posed expressions vs. dynamic posed expressions) when examining the moderating role of presentation mode on the ingroup advantage. This choice was made because the spontaneous expressions used in our studies were obtained from individuals' self-reports of their past experiences accompanied by facial expressions. If specific frames were extracted from these spontaneous expressions as static spontaneous expressions, participants might have difficulty distinguishing whether the mouth movements were caused by speaking or by specific emotional actions. Thus, after excluding the option of static spontaneous expressions, we chose the aforementioned comparisons. In the future, alternative techniques for eliciting spontaneous expressions could be explored, such as instructing models to watch film clips with specific emotional content (Gross & Levenson, 1995) or exposing them to specific odors (Zhang et al., 2014), to capture static spontaneous expressions while avoiding the influence of mouth movements.

Lastly, although this research indicated that the ingroup advantage was moderated by the spontaneity of dynamic expressions, and we speculated a potential association between the number of activated AUs and the ingroup advantage, the specific underlying mechanisms still require further empirical testing. Additionally, the findings revealed that the ingroup advantage may not be moderated by the presentation mode of posed expressions. However, this observation could be attributed to the absence of differences in perceivers' recognition of static and dynamic expressions within this research. Future research could situations where the recognition accuracy of static expressions is low, exploring whether dynamic information confers distinct benefits to perceivers when discerning expressions from individuals within their own culture, as compared to individuals from other cultures.

Conclusion

The present research investigated for the first time whether the ingroup advantage in recognizing angry and disgusted facial expressions was moderated by the spontaneity (posed and spontaneous) and presentation mode (static and dynamic) of expressions. Overall, the ingroup advantage was greater for posed expressions than that for spontaneous expressions, but it was not moderated by the presentation mode. These findings contribute to the advancement of knowledge in the field of cross-cultural emotion recognition, shedding light on the differential ingroup advantage observed in the recognition of

posed and spontaneous expressions. Moreover, they provide new empirical evidence that enhances our understanding of how people perceive and interpret expressions exhibited by individuals from diverse cultural backgrounds.

References

- Ambadar, Z., Schooler, J. W., & Cohn, J. F. (2005). Deciphering the enigmatic face: The importance of facial dynamics in interpreting subtle facial expressions. *Psychological Science*, *16*(5), 403–410. <https://doi.org/10.1111/j.0956-7976.2005.01548.x>
- Bain, A. (2006). *The emotions and the will*. New York, NY: Cosmo Classics. (Original work published 1859)
- Blais, C., Fiset, D., Roy, C., Saumure R é gimbald, C., & Gosselin, F. (2017). Eye fixation patterns for categorizing static and dynamic facial expressions. *Emotion*, *17*(7), 1107–1119. <https://doi.org/10.1037/emo0000283>
- Bould, E., & Morris, N. (2008). Role of motion signals in recognizing subtle facial expressions of emotion. *British Journal of Psychology*, *99*(2), 167–189. <https://doi.org/10.1348/000712607X206702>
- Cordaro, D. T., Sun, R., Keltner, D., Kamble, S., Huddar, N., & McNeil, G. (2018). Universals and cultural variations in 22 emotional expressions across five cultures. *Emotion*, *18*(1), 75–93. <https://doi.org/10.1037/emo0000302>
- Cunningham, D. W., & Wallraven, C. (2009). Dynamic information for the recognition of conversational expressions. *Journal of Vision*, *9*(13), 7–7. <https://doi.org/10.1167/9.13.7>
- Dawel, A., Miller, E. J., Horsburgh, A., & Ford, P. (2022). A systematic survey of face stimuli used in psychological research 2000–2020. *Behavior Research Methods*, *54*(4), 1889–1901. <https://doi.org/10.3758/s13428-021-01705-3>
- Ekman, P. (1971). Universals and cultural differences in facial expressions of emotion. *Nebraska Symposium on Motivation*, *19*, 207–283.
- Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, *6*(3–4), 169–200. <https://doi.org/10.1080/02699939208411068>
- Ekman, P., Friesen, W. V., & Hager, J. C. (2002). *The facial action coding system: A technique for the measurement of facial movement*. San Francisco, CA: Consulting Psychologists Press.
- Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science*, *164*(3875), 86–88. <https://doi.org/10.1126/science.164.3875.86>
- Elfenbein, H. A. (2013). Nonverbal dialects and accents in facial expressions of emotion. *Emotion Review*, *5*(1), 90–96. <https://doi.org/10.1177/1754073912451332>
- Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin*, *128*(2), 203–235. <https://doi.org/10.1037/0033-2909.128.2.203>
- Elfenbein, H. A., Beaupré M., Lévesque, M., & Hess, U. (2007). Toward a dialect theory: Cultural differences in the expression and recognition of posed facial expressions. *Emotion*, *7*(1), 131–146. <https://doi.org/10.1037/1528-3542.7.1.131>
- Fang, X., Rychlowska, M., & Lange, J. (2022). Cross-cultural and inter-group research on emotion perception. *Journal of Cultural Cognitive Science*, *6*(1), 1–7. <https://doi.org/10.1007/s41809-022-00102-2>
- Fang, X., Sauter, D. A., Heerdink, M. W., & van Kleef, G. A. (2022). Culture shapes the distinctiveness of posed and spontaneous facial expressions of anger and disgust. *Journal of Cross-Cultural Psychology*, *53*(5), 471–487. <https://doi.org/10.1177/00220221221095208>
- Fang, X., Sauter, D. A., & Van Kleef, G. A. (2018). Seeing mixed emotions: The specificity of emotion perception from static and dynamic facial expressions across cultures. *Journal of Cross-Cultural Psychology*, *49*(1), 130–148. <https://doi.org/10.1177/0022022117736270>
- Fang, X., van Kleef, G. A., Kawakami, K., & Sauter, D. A. (2021).

- Cultural differences in perceiving transitions in emotional facial expressions: Easterners show greater contrast effects than Westerners. *Journal of Experimental Social Psychology*, 95, 104143. <https://doi.org/10.1016/j.jesp.2021.104143>
- Fang, X., van Kleef, G. A., & Sauter, D. A. (2019). Revisiting cultural differences in emotion perception between easterners and westerners: Chinese perceivers are accurate, but see additional non-intended emotions in negative facial expressions. *Journal of Experimental Social Psychology*, 82, 152–159. <https://doi.org/10.1016/j.jesp.2019.02.003>
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175–191. <https://doi.org/10.3758/BF03193146>
- Fiorentini, C., & Viviani, P. (2011). Is there a dynamic advantage for facial expressions? *Journal of Vision*, 11(3), 17. <https://doi.org/10.1167/11.3.17>
- Giner-Sorolla, R., Kupfer, T., & Sabo, J. (2018). Chapter Five - What makes moral disgust special? An integrative functional review. In J. M. Olson (Ed.), *Advances in experimental social psychology* (Vol. 57, pp. 223–289). Academic Press. <https://doi.org/10.1016/bs.aesp.2017.10.001>
- Gold, J. M., Barker, J. D., Barr, S., Bittner, J. L., Bromfield, W. D., Chu, N., Goode, R. A., Lee, D., Simmons, M., & Srinath, A. (2013). The efficiency of dynamic and static facial expression recognition. *Journal of Vision*, 13(5), 23–23. <https://doi.org/10.1167/13.5.23>
- Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition and Emotion*, 9(1), 87–108. <https://doi.org/10.1080/0269939508408966>
- Hess, U., Kafetsios, K., Mauersberger, H., Blaison, C., & Kessler, C.-L. (2016). Signal and noise in the perception of facial emotion expressions: From labs to life. *Personality and Social Psychology Bulletin*, 42(8), 1092–1110. <https://doi.org/10.1177/0146167216651851>
- Hoffmann, H., Traue, H. C., Bachmayr, F., & Kessler, H. (2010). Perceived realism of dynamic facial expressions of emotion: Optimal durations for the presentation of emotional onsets and offsets. *Cognition and Emotion*, 24(8), 1369–1376. <https://doi.org/10.1080/0269930903417855>
- Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspectives on Psychological Science*, 2(3), 260–280. <https://doi.org/10.1111/j.1745-6916.2007.00044.x>
- Jack, R. E., Blais, C., Scheepers, C., Schyns, P. G., & Caldara, R. (2009). Cultural confusions show that facial expressions are not universal. *Current Biology*, 19(18), 1543–1548. <https://doi.org/10.1016/j.cub.2009.07.051>
- Jack, R. E., Garrod, O. G. B., & Schyns, P. G. (2014). Dynamic facial expressions of emotion transmit an evolving hierarchy of signals over time. *Current Biology*, 24(2), 187–192. <https://doi.org/10.1016/j.cub.2013.11.064>
- Jiang, Z., Li, W., Recio, G., Liu, Y., Luo, W., Zhang, D., & Sun, D. (2014). Time pressure inhibits dynamic advantage in the classification of facial expressions of emotion. *PLOS ONE*, 9(6), e100162. <https://doi.org/10.1371/journal.pone.0100162>
- Kang, S.-M., & Lau, A. S. (2013). Revisiting the out-group advantage in emotion recognition in a multicultural society: Further evidence for the in-group advantage. *Emotion*, 13(2), 203–215. <https://doi.org/10.1037/a0030013>
- Käsäryi, J., Saalasti, S., Tiippana, K., von Wendt, L., & Sams, M. (2008). Impaired recognition of facial emotions from low-spatial frequencies in Asperger syndrome. *Neuropsychologia*, 46(7), 1888–1897. <https://doi.org/10.1016/j.neuropsychologia.2008.01.005>
- Kayyal, M. H., & Russell, J. A. (2013). Americans and Palestinians judge spontaneous facial expressions of emotion. *Emotion*, 13(5), 891–904. <https://doi.org/10.1037/a0033244>
- Krumhuber, E. G., Küster, D., Namba, S., & Skora, L. (2021). Human and machine validation of 14 databases of dynamic facial expressions. *Behavior Research Methods*, 53(2), 686–701. <https://doi.org/10.3758/s13428-020-01443-y>
- Krumhuber, E. G., Skora, L. I., Hill, H. C. H., & Lander, K. (2023). The role of facial movements in emotion recognition. *Nature Reviews Psychology*, 2(5), 283–296. <https://doi.org/10.1038/s44159-023-00172-1>
- Krumhuber, E. G., Skora, L., Küster, D., & Fou, L. (2017). A review of dynamic datasets for facial expression research. *Emotion Review*, 9(3), 280–292. <https://doi.org/10.1177/1754073916670022>
- Matsumoto, D., & Ekman, P. (1988). *Japanese and Caucasian facial expressions of emotion and neutral faces (JACFEE and JACNeuF)* [Slides]: San Francisco, CA: Intercultural and Emotion Research Laboratory, Department of Psychology, San Francisco State University.
- Matsumoto, D., & Ekman, P. (2004). The relationship among expressions, labels, and descriptions of contempt. *Journal of Personality and Social Psychology*, 87(4), 529–540. <https://doi.org/10.1037/0022-3514.87.4.529>
- Matsumoto, D., Olide, A., Schug, J., Willingham, B., & Callan, M. (2009). Cross-cultural judgments of spontaneous facial expressions of emotion. *Journal of Nonverbal Behavior*, 33(4), 213–238. <https://doi.org/10.1007/s10919-009-0071-4>
- Matsumoto, D., Olide, A., & Willingham, B. (2009). Is there an ingroup advantage in recognizing spontaneously expressed emotions? *Journal of Nonverbal Behavior*, 33(3), 181–191. <https://doi.org/10.1007/s10919-009-0068-z>
- Matsumoto, D., & Willingham, B. (2009). Spontaneous facial expressions of emotion of congenitally and noncongenitally blind individuals. *Journal of Personality and Social Psychology*, 96(1), 1–10. <https://doi.org/10.1037/a0014037>
- Matsumoto, D., Yoo, S. H., & Fontaine, J. (2008). Mapping expressive differences around the world: The relationship between emotional display rules and individualism versus collectivism. *Journal of Cross-Cultural Psychology*, 39(1), 55–74. <https://doi.org/10.1177/0022022107311854>
- Namba, S., Kagamihara, T., Miyatani, M., & Nakao, T. (2017). Spontaneous facial expressions reveal new action units for the sad experiences. *Journal of Nonverbal Behavior*, 41(3), 203–220. <https://doi.org/10.1007/s10919-017-0251-6>
- Namba, S., Makihara, S., Kabir, R. S., Miyatani, M., & Nakao, T. (2017). Spontaneous facial expressions are different from posed facial expressions: Morphological properties and dynamic sequences. *Current Psychology*, 36(3), 593–605. <https://doi.org/10.1007/s12144-016-9448-9>
- Niedenthal, P. M., Rychlowska, M., Wood, A., & Zhao, F. (2018). Heterogeneity of long-history migration predicts smiling, laughter and positive emotion across the globe and within the United States. *PLOS ONE*, 13(8), e0197651. <https://doi.org/10.1371/journal.pone.0197651>
- Oatley, K., & Johnson-Laird, P. N. (1987). Towards a cognitive theory of emotions. *Cognition and Emotion*, 1(1), 29–50. <https://doi.org/10.1080/02699938708408362>
- Ortony, A. (2022). Are all “basic emotions” emotions? A problem for the (basic) emotions construct. *Perspectives on Psychological Science*, 17(1), 41–61. <https://doi.org/10.1177/1745691620985415>
- Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., & Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*, 51(1), 195–203. <https://doi.org/10.3758/s13428-018-01193-y>
- Pochedly, J. T., Widen, S. C., & Russell, J. A. (2012). What emotion does the “facial expression of disgust” express? *Emotion*, 12(6), 1315–1319. <https://doi.org/10.1037/a0027998>
- Rinn, W. E. (1991). Neuropsychology of facial expression. In R. S. Feldman & B. Rimé (Eds.), *Fundamentals of nonverbal behavior* (pp. 3–30). Cambridge University Press.

- Rychlowska, M., Miyamoto, Y., Matsumoto, D., Hess, U., Gilboa-Schechtman, E., Kamble, S., Muluk, H., Masuda, T., & Niedenthal, P. M. (2015). Heterogeneity of long-history migration explains cultural differences in reports of emotional expressivity and the functions of smiles. *Proceedings of the National Academy of Sciences*, *112*(19), E2429–E2436. <https://doi.org/10.1073/pnas.1413661112>
- Sato, W., Fujimura, T., & Suzuki, N. (2008). Enhanced facial EMG activity in response to dynamic facial expressions. *International Journal of Psychophysiology*, *70*(1), 70–74. <https://doi.org/10.1016/j.ijpsycho.2008.06.001>
- Scherer, K. R., Clark-Polner, E., & Mortillaro, M. (2011). In the eye of the beholder? Universality and cultural specificity in the expression and perception of emotion. *International Journal of Psychology*, *46*(6), 401–435. <https://doi.org/10.1080/00207594.2011.626049>
- Siedlecka, E., & Denson, T. F. (2019). Experimental methods for inducing basic emotions: A qualitative review. *Emotion Review*, *11*(1), 87–97. <https://doi.org/10.1177/1754073917749016>
- Simmons, J. P., Nelson, L. D., & Simonson, U. (2013, January). *Life after p-hacking*. Paper presented at the Meeting of the Society for Personality and Social Psychology, New Orleans, LA, 17–19. <https://ssrn.com/abstract=2205186> or <http://dx.doi.org/10.2139/ssrn.2205186>
- Tcherkassof, A., Bollon, T., Dubois, M., Pansu, P., & Adam, J.-M. (2007). Facial expressions of emotions: A methodological contribution to the study of spontaneous and dynamic emotional faces. *European Journal of Social Psychology*, *37*(6), 1325–1345. <https://doi.org/10.1002/ejsp.427>
- Tsai, J. L., & Chentsova-Dutton, U. (2003). Variation among European Americans in emotional facial expression. *Journal of Cross-Cultural Psychology*, *34*(6), 650–657. <https://doi.org/10.1177/0022022103256846>
- Valente, D., Theurel, A., & Gentaz, E. (2018). The role of visual experience in the production of emotional facial expressions by blind people: A review. *Psychonomic Bulletin & Review*, *25*(2), 483–497. <https://doi.org/10.3758/s13423-017-1338-0>
- Van Kleef, G. A., & Côté, S. (2022). The social effects of emotions. *Annual Review of Psychology*, *73*(1), 629–658. <https://doi.org/10.1146/annurev-psych-020821-010855>
- Wehrle, T., Kaiser, S., Schmidt, S., & Scherer, K. R. (2000). Studying the dynamics of emotional expression using synthesized facial muscle movements. *Journal of Personality and Social Psychology*, *78*(1), 105–119. <https://doi.org/10.1037/0022-3514.78.1.105>
- Widen, S. C., Christy, A. M., Hewett, K., & Russell, J. A. (2011). Do proposed facial expressions of contempt, shame, embarrassment, and compassion communicate the predicted emotion? *Cognition and Emotion*, *25*(5), 898–906. <https://doi.org/10.1080/02699931.2010.508270>
- Wood, A., Rychlowska, M., & Niedenthal, P. M. (2016). Heterogeneity of long-history migration predicts emotion recognition accuracy. *Emotion*, *16*(4), 413–420. <https://doi.org/10.1037/emo0000137>
- Yitzhak, N., Gilaie-Dotan, S., & Aviezer, H. (2018). The contribution of facial dynamics to subtle expression recognition in typical viewers and developmental visual agnosia. *Neuropsychologia*, *117*, 26–35. <https://doi.org/10.1016/j.neuropsychologia.2018.04.035>
- Zhang, Q., Yin, T. Z., & Ran, G. M. (2015). Psychological and neural mechanisms for the superiority effect of dynamic facial expressions. *Advances in Psychological Science*, *23*(9), 1514–1522.
- Zhang, Q. Y., Chen, J. W., Yu, Q. L., & Xin, P. (2011). An in-group advantage in recognizing emotion. *Advances in Psychological Science*, *19*(2), 209–216.
- Zhang, X., Yin, L., Cohn, J. F., Canavan, S., Reale, M., Horowitz, A., Liu, P., & Girard, J. M. (2014). BP4D-Spontaneous: A high-resolution spontaneous 3D dynamic facial expression database. *Image and Vision Computing*, *32*(10), 692–706. <https://doi.org/10.1016/j.imavis.2014.06.002>

Notes

¹ In the posed condition, participants often maintained facial expressions of specific emotion for a period of time (typically 3 seconds or even longer), accompanied by changes in intensity. In contrast, in the spontaneous condition, participants recounted past life experiences related to specific emotions, resulting in continuous dynamic changes in their facial expressions. We chose a two-second time interval to ensure that participants could clearly observe the changes in expressions and avoid the introduction of other non-intended expressions. Additionally, the approximately 2-second duration of expression changes reflects a natural progression of expressions (Fang et al., 2018, 2019 used a 2000 ms interval for expression transitions; Hoffmann et al., 2010 used a range of 1649 ms to 3108 ms to capture the duration from the initiation to the completion of an expression).

² The emotions evaluated in this research included most of the basic emotions that are generally acknowledged in previous research (Ortony, 2022). Considering the controversy in previous studies regarding whether surprise (Bain, 1859/2006; Oatley & Johnson-Laird, 1987) and contempt (Matsumoto & Ekman, 2004; Widen et al., 2011) are basic emotions, the present experiments chose not to include these two emotions.

³ We conducted the same analysis after excluding participants whose recognition accuracy fell below the threshold of the mean minus 2.5 times the standard deviation ($M-2.5SD$). The results were similar to those reported in the main text (see Table S5). Additionally, we conducted a 2 (Emotion: Anger, Disgust) \times 2 (Spontaneity: Posed, Spontaneous) \times 2 (Expresser Culture: Eastern, Western) \times 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on recognition accuracy (see Table S2).

⁴ We conducted the same analysis after excluding participants whose recognition accuracy fell below the threshold of the mean minus 2.5 times the standard deviation ($M-2.5SD$). The results were similar to those reported in the main text (see Table S6). Additionally, we conducted a 2 (Emotion: Anger, Disgust) \times 2 (Presentation Mode: Static, Dynamic) \times 2 (Expresser Culture: Eastern, Western) \times 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on recognition accuracy (see Table S4).

Supplementary Materials

Analysis of Recognition Accuracy of Facial Expressions in Experiment 1

To examine whether the recognition accuracy of facial expression in Experiment 1 was significantly higher than the chance level (i.e., 1/5 of the emotional dimensions = 0.2), we conducted a one-sample *t*-test on the recognition accuracy under each condition (see Table S1). The results indicated that the recognition accuracy was significantly higher than 0.2 in most conditions, suggesting that participants were able to recognize the target emotions at above-chance performance. However, when Western perceivers recognized spontaneous expressions of anger from Eastern expressers, the recognition accuracy did not significantly differ from 0.2, indicating that Western perceivers may encounter challenges in recognizing spontaneous expressions of anger from Eastern expressers.

Table S1

The Means, Standard Deviations, and Results of One-Sample *T*-Tests for Recognition Accuracy under Each Condition in Experiment 1

Perceiver Culture	Spontaneity	Emotion	Expresser Culture	Recognition Accuracy	<i>df</i>	<i>t</i>	<i>p</i>	Cohen's <i>d</i>	95% CI
Eastern	Posed	Anger	Eastern	0.42(0.14)	61	12.24	< 0.001	1.55	[1.18, 1.92]
			Western	0.33(0.14)	61	7.61	< 0.001	0.97	[0.66, 1.27]
		Disgust	Eastern	0.46(0.16)	61	12.89	< 0.001	1.64	[1.25, 2.02]
			Western	0.40(0.15)	61	10.40	< 0.001	1.32	[0.98, 1.66]
	Spontaneous	Anger	Eastern	0.24(0.11)	63	2.71	0.004	0.34	[0.09, 0.59]
			Western	0.29(0.14)	63	4.93	< 0.001	0.62	[0.35, 0.88]
		Disgust	Eastern	0.31(0.14)	63	6.13	< 0.001	0.77	[0.49, 1.04]
			Western	0.29(0.13)	63	5.54	< 0.001	0.69	[0.42, 0.96]
Western	Posed	Anger	Eastern	0.49(0.14)	61	16.22	< 0.001	2.06	[1.62, 2.50]
			Western	0.52(0.15)	61	16.31	< 0.001	2.07	[1.63, 2.51]
		Disgust	Eastern	0.47(0.14)	61	15.77	< 0.001	2.00	[1.57, 2.43]
			Western	0.62(0.16)	61	20.60	< 0.001	2.62	[2.09, 3.14]
	Spontaneous	Anger	Eastern	0.21(0.10)	63	0.83	0.206	0.10	[-0.14, 0.35]
			Western	0.31(0.11)	63	8.11	< 0.001	1.01	[0.91, 1.31]
		Disgust	Eastern	0.24(0.14)	63	2.44	0.009	0.30	[0.05, 0.55]
			Western	0.28(0.13)	63	4.88	< 0.001	0.61	[0.34, 0.88]

Note. The one-sample *t*-test was two-tailed, $H_0: \mu = 0.2$.

We conducted a 2 (Emotion: Anger, Disgust) \times 2 (Spontaneity: Posed, Spontaneous) \times 2 (Expresser Culture: Eastern, Western) \times 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on recognition accuracy (see Table S2). The results showed that the main effect of Perceiver Culture was significant, $F(1, 248) = 21.08, p < 0.001, \eta_p^2 = 0.08$, with recognition accuracy of Western perceivers ($M = 0.39, SD = 0.16$) being higher than recognition accuracy of Eastern perceivers ($M = 0.34, SD = 0.10$). The main effect of Expresser Culture was significant, $F(1, 248) = 27.18, p < 0.001, \eta_p^2 = 0.10$, with the expressions displayed by Western Expressers ($M = 0.38, SD = 0.15$) being recognized with higher accuracy than those displayed by Eastern Expressers ($M = 0.35, SD = 0.14$). The main effect of Spontaneity was significant, $F(1, 248) = 295.42, p < 0.001, \eta_p^2 = 0.54$, with pose expressions ($M = 0.46, SD = 0.12$) being recognized with higher accuracy than spontaneous expressions ($M = 0.27, SD = 0.07$). The main effect of Emotion was significant, $F(1, 248) = 8.87, p = 0.003, \eta_p^2 = 0.04$, with the expressions of disgust ($M = 0.38, SD = 0.17$) being recognized more accurately than the expressions of anger ($M = 0.35, SD = 0.15$).

The three-way interaction of Spontaneity, Expresser Culture and Perceiver Culture, which is central to the hypotheses of our study, was significant, $F(1, 248) = 31.34, p < 0.001, \eta_p^2 = 0.11$. Furthermore, the four-way interaction of Emotion, Spontaneity, Expresser Culture and Perceiver Culture was also significant, $F(1, 248) = 4.02, p = 0.046, \eta_p^2 = 0.02$. Further analysis revealed that for all conditions, Western perceivers recognized expressions displayed by Western expressers more accurately than expressions displayed by Eastern expressers (Posed Anger: $t(61) = 2.55, p = 0.013, \text{Cohen's } d = 0.32, 95\% \text{ CI} = [0.01, 0.06]$; Posed Disgust: $t(61) = 9.86, p < 0.001, \text{Cohen's } d = 1.25, 95\% \text{ CI} = [0.11, 0.17]$; Spontaneous Anger: $t(63) = 7.84, p < 0.001, \text{Cohen's } d = 0.98, 95\% \text{ CI} = [0.07, 0.12]$; Spontaneous Disgust: $t(63) = 3.43, p = 0.001, \text{Cohen's } d = 0.43, 95\% \text{ CI} = [0.02, 0.06]$). As for Eastern perceivers, they recognized posed expressions displayed by Eastern expressers more accurately than those displayed by Western expressers (Posed Anger: $t(61) = 6.50, p < 0.001, \text{Cohen's } d = 0.83, 95\% \text{ CI} = [0.06, 0.11]$; Posed Disgust: $t(61) = 4.38, p < 0.001, \text{Cohen's } d = 0.56, 95\% \text{ CI} = [0.03, 0.08]$). However, they recognized spontaneous expressions of anger displayed by Eastern expressers less accurately than those displayed by Western expressers, $t(63) = 3.48, p < 0.001, \text{Cohen's } d = 0.44, 95\% \text{ CI} = [0.02, 0.08]$, while no significant difference was found between the recognition accuracy for spontaneous expressions of disgust displayed by Eastern expressers and Western expressers, $t(63) = 1.47, p = 0.147, \text{Cohen's } d = 0.18, 95\% \text{ CI} = [-0.01, 0.04]$.

Table S2
Emotion (Anger, Disgust) × Spontaneity (Eastern, Western) × Expresser Culture (Eastern, Western) × Perceiver Culture (Eastern, Western) Mixed-Design ANOVA on Recognition Accuracy in Experiment 1

Effects	<i>df</i>	<i>F</i>	<i>p</i>	η_p^2
Emotion	1, 248	8.87	0.003	0.04
Spontaneity	1, 248	295.42	< 0.001	0.54
Expresser Culture	1, 248	27.18	< 0.001	0.10
Perceiver Culture	1, 248	21.08	< 0.001	0.08
Emotion × Spontaneity	1, 248	2.00	0.159	0.01
Emotion × Expresser Culture	1, 248	0.21	0.648	< 0.01
Emotion × Perceiver Culture	1, 248	0.78	0.378	< 0.01
Spontaneity × Expresser Culture	1, 248	13.09	< 0.001	0.05
Spontaneity × Perceiver Culture	1, 248	39.79	< 0.001	0.14
Expresser Culture × Perceiver Culture	1, 248	125.08	< 0.001	0.34
Emotion × Spontaneity × Expresser Culture	1, 248	57.08	< 0.001	0.19
Emotion × Spontaneity × Perceiver Culture	1, 248	0.27	0.607	< 0.01
Emotion × Expresser Culture × Perceiver Culture	1, 248	6.54	0.011	0.03
Spontaneity × Expresser Culture × Perceiver Culture	1, 248	31.34	< 0.001	0.11
Emotion × Spontaneity × Expresser Culture × Perceiver Culture	1, 248	4.02	0.046	0.02

Analysis of Recognition Accuracy of Facial Expressions in Experiment 2

To examine whether the recognition accuracy of static expression in Experiment 2 was significantly higher than the chance level (i.e., 1/4 of the emotional dimensions = 0.25), we conducted a one-sample *t*-test on the recognition accuracy under each condition (see Table S3). The results indicated that the recognition accuracy was significantly higher than 0.25 in all conditions, suggesting that participants were able to recognize the target emotions at above-chance performance.

Table S3
The Means, Standard Deviations, and Results of One-Sample T-Tests for Recognition Accuracy under Each Condition in Experiment 2

Perceiver Culture	Presentation Mode	Emotion	Expresser Culture	Recognition Accuracy	<i>df</i>	<i>t</i>	<i>p</i>	Cohen's <i>d</i>	95% CI
Eastern	Static	Anger	Eastern	0.44(0.15)	81	12.05	< 0.001	1.33	[1.03, 1.63]
			Western	0.38(0.14)	81	8.57	< 0.001	0.95	[0.68, 1.21]
		Disgust	Eastern	0.46(0.14)	81	14.13	< 0.001	1.56	[1.24, 1.88]
			Western	0.40(0.17)	81	8.24	< 0.001	0.91	[0.65, 1.17]
	Dynamic	Anger	Eastern	0.42(0.14)	61	12.24	< 0.001	1.55	[1.18, 1.92]
			Western	0.33(0.14)	61	7.61	< 0.001	0.97	[0.66, 1.27]
		Disgust	Eastern	0.46(0.16)	61	12.89	< 0.001	1.64	[1.25, 2.02]
			Western	0.40(0.15)	61	10.40	< 0.001	1.32	[0.98, 1.66]
Western	Static	Anger	Eastern	0.50(0.11)	74	19.07	< 0.001	2.20	[1.78, 2.62]
			Western	0.60(0.13)	74	22.94	< 0.001	2.65	[2.16, 3.13]
		Disgust	Eastern	0.44(0.14)	74	11.61	< 0.001	1.34	[1.03, 1.65]
			Western	0.59(0.15)	74	20.23	< 0.001	2.34	[1.90, 2.77]
	Dynamic	Anger	Eastern	0.49(0.14)	61	16.22	< 0.001	2.06	[1.62, 2.50]
			Western	0.52(0.15)	61	16.31	< 0.001	2.07	[1.63, 2.51]
		Disgust	Eastern	0.47(0.14)	61	15.77	< 0.001	2.00	[1.57, 2.43]
			Western	0.62(0.16)	61	20.60	< 0.001	2.62	[2.09, 3.14]

Note. The one-sample *t*-test was two-tailed, $H_0: \mu = 0.25$. The results of one-sample *t*-tests for recognition accuracy of dynamic expressions were the same as the results for recognition accuracy of posed expressions in Table S1.

We conducted a 2 (Emotion: Anger, Disgust) × 2 (Presentation Mode: Static, Dynamic) × 2 (Expresser Culture: Eastern, Western) × 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on recognition accuracy (see Table S4). The results showed that the main effect of Perceiver Culture was significant, $F(1, 277) = 99.74, p < 0.001, \eta_p^2 = 0.27$, with recognition accuracy of Western perceivers ($M = 0.53, SD = 0.10$) being higher than recognition accuracy of Eastern perceivers ($M = 0.41, SD = 0.09$). The main effect of

Expresser Culture was significant, $F(1, 277) = 18.87, p < 0.001, \eta_p^2 = 0.06$, with the expressions displayed by Western Expressers ($M = 0.48, SD = 0.15$) being recognized with higher accuracy than those displayed by Eastern Expressers ($M = 0.46, SD = 0.10$). The main effect of Presentation Mode was not significant, $F(1, 277) = 2.35, p = 0.126$. The main effect of Emotion was marginally significant, $F(1, 277) = 3.77, p = 0.053, \eta_p^2 = 0.01$.

Table S4

Emotion (Anger, Disgust) × Presentation Mode (Static, Dynamic) × Expresser Culture (Eastern, Western) × Perceiver Culture (Eastern, Western) Mixed-Design ANOVA on Recognition Accuracy in Experiment 2

Effects	<i>df</i>	<i>F</i>	<i>p</i>	η_p^2
Emotion	1, 277	3.77	0.053	0.01
Presentation Mode	1, 277	2.35	0.126	0.01
Expresser Culture	1, 277	18.87	< 0.001	0.06
Perceiver Culture	1, 277	99.74	< 0.001	0.27
Emotion × Presentation Mode	1, 277	6.75	0.010	0.02
Emotion × Expresser Culture	1, 277	26.52	< 0.001	0.09
Emotion × Perceiver Culture	1, 277	1.99	0.159	0.01
Presentation Mode × Expresser Culture	1, 277	7.44	0.007	0.03
Presentation Mode × Perceiver Culture	1, 277	0.17	0.684	< 0.01
Expresser Culture × Perceiver Culture	1, 277	345.35	< 0.001	0.56
Emotion × Presentation Mode × Expresser Culture	1, 277	4.81	0.029	0.02
Emotion × Presentation Mode × Perceiver Culture	1, 277	1.06	0.304	< 0.01
Emotion × Expresser Culture × Perceiver Culture	1, 277	13.25	< 0.001	0.05
Presentation Mode × Expresser Culture × Perceiver Culture	1, 277	2.52	0.113	0.01
Emotion × Presentation Mode × Expresser Culture × Perceiver Culture	1, 277	0.29	0.589	< 0.01

The three-way interaction of Presentation Mode, Expresser Culture and Perceiver Culture, which is central to the hypotheses of our study, was not significant, $F(1, 277) = 2.52, p = 0.113, \eta_p^2 = 0.01$. However, the two-way interaction of Expresser Culture and Perceiver Culture was significant, $F(1, 277) = 345.35, p < 0.001, \eta_p^2 = 0.56$. Eastern perceivers recognized expressions displayed by Eastern expressers ($M = 0.45, SD = 0.10$) more accurately than expressions displayed by Western expressers ($M = 0.38, SD = 0.10$), $t(143) = 10.64, p < 0.001$, Cohen's $d = 0.89$, 95% CI = [0.69, 1.08]. Western perceivers recognized expressions displayed by Western expressers ($M = 0.59, SD = 0.12$) more accurately than expressions displayed by Eastern expressers ($M = 0.48, SD = 0.10$), $t(136) = 15.31, p < 0.001$, Cohen's $d = 1.31$, 95% CI = [1.08, 1.54]. These results suggested that the ingroup advantage was observed for both Eastern and Western perceivers when they recognized posed expressions.

To investigate the influence of presentation mode on expression recognition, we also focused on the effects associated with presentation mode. Although the main effect of presentation mode was not significant, $F(1, 277) = 2.35, p = 0.126$, the two-way interaction of Presentation Mode and Expresser Culture was significant, $F(1, 277) = 7.44, p = 0.007, \eta_p^2 = 0.03$, and three-way interaction of Emotion, Presentation Mode and Expresser Culture was also significant, $F(1, 277) = 4.81, p = 0.029, \eta_p^2 = 0.02$. Further analysis of the three-way interaction found that, with the exception of expressions of anger displayed by Western expressers, no significant difference was found in the recognition accuracy (Eastern Anger: $t(279) = 1.29, p = 0.200$; Eastern Disgust: $t(279) = 0.68, p = 0.495$; Western Disgust: $t(279) = 0.55, p = 0.582$) between static expressions (Eastern Anger: $M = 0.47, SD = 0.14$; Eastern Disgust: $M = 0.45, SD = 0.14$; Western Disgust: $M = 0.50, SD = 0.19$) and dynamic expressions (Eastern Anger: $M = 0.45, SD = 0.14$; Eastern Disgust: $M = 0.47, SD = 0.15$; Western Disgust: $M = 0.51, SD = 0.19$). For expressions of anger displayed by Western expressers, the recognition accuracy for static expressions ($M = 0.49, SD = 0.18$) was significantly higher than that for dynamic expressions ($M = 0.42, SD = 0.17$), $t(279) = 3.11, p = 0.002$, Cohen's $d = 0.37$, 95% CI = [0.14, 0.61].

Analysis of Ingroup Advantage after Excluding Participants with Low Recognition Accuracy

In Experiment 1, we excluded participants whose recognition accuracy fell below the threshold of the mean minus 2.5 times the standard deviation ($M-2.5SD$) and analyzed the data from the remaining 249 participants. We conducted a 2 (Emotion: Anger, Disgust) × 2 (Spontaneity: Posed, Spontaneous) × 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on ingroup advantage. The results showed similar findings before and after excluding participants (see Table S5).

In Experiment 2, we also excluded participants whose recognition accuracy fell below the threshold of the mean minus 2.5 times the standard deviation ($M-2.5SD$) and analyzed the data from the remaining 277 participants. We conducted a 2 (Emotion: Anger, Disgust) × 2 (Presentation Mode: Static, Dynamic) × 2 (Perceiver Culture: Eastern, Western) mixed-design ANOVA on ingroup advantage. The results showed similar findings before and after excluding participants (see Table S6).

Table S5

Emotion (Anger, Disgust) × Spontaneity (Posed, Spontaneous) × Perceiver Culture (Eastern, Western) Mixed-Design ANOVA on Ingroup Advantage after Excluding Participants in Experiment 1

Effects	<i>df</i>	<i>F</i>	<i>p</i>	η_p^2
Emotion	1, 245	6.54	0.011	0.03
Spontaneity	1, 245	33.17	< 0.001	0.12
Perceiver Culture	1, 245	27.47	< 0.001	0.10
Emotion × Spontaneity	1, 245	4.05	0.045	0.02
Emotion × Perceiver Culture	1, 245	0.30	0.583	< 0.01
Spontaneity × Perceiver Culture	1, 245	12.62	< 0.001	0.05
Emotion × Spontaneity × Perceiver Culture	1, 245	57.51	< 0.001	0.19

Table S6

Emotion (Anger, Disgust) × Presentation Mode (Static, Dynamic) × Perceiver Culture (Eastern, Western) Mixed-Design ANOVA on Ingroup Advantage after Excluding Participants in Experiment 2

Effects	<i>df</i>	<i>F</i>	<i>p</i>	η_p^2
Emotion	1, 273	12.69	< 0.001	0.04
Presentation Mode	1, 273	1.75	0.187	0.01
Perceiver Culture	1, 273	18.48	< 0.001	0.06
Emotion × Presentation Mode	1, 273	0.38	0.539	< 0.01
Emotion × Perceiver Culture	1, 273	26.23	< 0.001	0.09
Presentation Mode × Perceiver Culture	1, 273	6.72	0.010	0.02
Emotion × Presentation Mode × Perceiver Culture	1, 273	5.36	0.021	0.02