Imitation of in-group versus out-group members' facial expressions of anger: A test with a time perception task

Laurie Mondillon a; Paula M. Niedenthal b; Sandrine Gil a; Sylvie Droit-Volet a

a University of Clermont-Ferrand, Clermont-Ferrand, France
b CNRS and University of Clermont-Ferrand, Clermont-Ferrand, France

Online Publication Date: 01 January 2007
To cite this Article: Mondillon, Laurie, Niedenthal, Paula M., Gil, Sandrine and Droit-Volet, Sylvie (2007) 'Imitation of in-group versus out-group members' facial expressions of anger: A test with a time perception task', Social Neuroscience, 2:3, 223 - 237
To link to this article: DOI: 10.1080/17470910701376894
URL: http://dx.doi.org/10.1080/17470910701376894

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.informaworld.com/terms-and-conditions-of-access.pdf

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.
Imitation of in-group versus out-group members’ facial expressions of anger: A test with a time perception task

Laurie Mondillon  
*University of Clermont-Ferrand, Clermont-Ferrand, France*

Paula M. Niedenthal  
*CNRS and University of Clermont-Ferrand, Clermont-Ferrand, France*

Sandrine Gil and Sylvie Droit-Volet  
*University of Clermont-Ferrand, Clermont-Ferrand, France*

This research investigated the automatic imitation of facial expressions of anger by in-group and out-group members, using a temporal estimation task. Individuals typically overestimate duration represented by angry faces, probably due to increases in arousal (Droit-Volet, Brunot, & Niedenthal, 2004). Overestimation is not observed when imitation of the facial expressions is inhibited, suggesting that embodied simulation mediates the changes in arousal (Effron, Niedenthal, Gil, & Droit-Volet, 2006). This method thus provides an implicit measure of imitation and was used to test the hypothesis that individuals imitate in-group, but not out-group members’ facial expressions of emotion. In separate studies Chinese and French Caucasian participants were presented with short (400 ms) and long (1600 ms) standard durations in a temporal bisection task. They then categorized standard and intermediate durations, represented by angry and neutral faces, in terms of similarity to the short and long standard durations. Half of the face stimuli were Chinese, and half Caucasian. Results revealed a bias in the temporal perception of emotion for the Caucasian participants when they were presented with Caucasian facial expressions and not Chinese ones. In contrast, this bias in time perception was observed when Chinese individuals imitated faces of both in- and out-group members. The results of the Chinese participants are interpreted in terms of familiarity with and motivations to understand the emotional expressions of members of a host culture.

How do we understand other people? The study of social cognition, which was for years impelled toward important advances by its endorsement of the computer metaphor and associated symbolic models of mental representation, is in the midst of a paradigm shift. Increasingly, understanding other people—judging their intentions and emotions, their goals, and making attributions for their actions—is proving to be importantly based on the ability to embody the physical and emotional states of the perceived. That is, embodied simulation in the motor system (e.g., Gallese, 2005a,b; Gallese & Metzinger, 2003; Glenberg, 1997), the perceptual systems (e.g., Barsalou, 1999), and the affect systems (e.g., Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Decety & Jackson, 2003; Niedenthal, Barsalou, Ric, & Krauth-Gru¨ ber, 2005a) appear to ground the...
higher-order cognitive processes of interest to students of social cognition. For example, and of specific interest in the present research, the imitation of facial expressions of others, which in turn reproduces at least in part the associated feeling state (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Gallese, Keysers, & Rizzolatti, 2004; Vaughan & Lanzetta, 1980, 1981), is importantly implicated in the recognition of facial expression and the understanding of the other’s emotional state. To summarize, Meltzoff and Decety (2003) stated that imitation and its neural correlates provide the system by which empathy occurs in humans (see also Meltzoff, 2002).

Although showing that simulation in sensory, motor, and affect systems supports, rather than merely co-occurs with, social cognition is a scientific agenda that is well underway, a concurrent concern is the demonstration that individuals can distinguish the embodied simulations of others’ experiences from their own experiences (e.g., Decety & Sommerville, 2003), and that this distinction is related to systematic constraints on embodied simulation. Indeed, people do not simulate the experiences of all of the people all the time. We are concerned here with the hypothesis that individuals embody the emotional expressions of in-group and not out-group members, or at least the former to a great degree. Secondarily we also examine the hypothesis that empathic individuals embody in-group members’ emotional expressions more than do less-empathic individuals.

**Imitation of in-group and out-group members**

Most researchers agree that imitation of emotional gestures, but also of self-grooming, self-regulatory and other communicative and non-communicative nonverbal behaviors, serves the adaptive function of increasing affiliation, liking, and smoother rapport between people. (Anderson, Keltner, & John, 2003; Bernieri, 1988; Chartrand & Bargh, 1999; Friedlmeier, in press; LaFrance & Broadbent, 1976; Lakin & Chartrand, 2003; Lakin, Jefferis, Cheng, & Chartrand, 2003; Lanzetta & Englis, 1989; Neumann & Strack, 2000; Zajonc, Adelmann, Murphy, & Niedenthal, 1987; see Dijksterhuis, 2005, for a review of these studies). Van Baaren, Holland, Steenaert, and van Knippenberg (2003) showed the imitation-like effect with a set of studies that took place in a restaurant. In these experiments, while some waitresses were instructed to repeat exactly the order of each customer (i.e., verbal behavior imitated condition), others had not to repeat any customer’s words (i.e., control condition). The results showed that verbal mimicry significantly improved the tips assigned to the waitresses compared to the control condition in which there was no imitation.

However, people are not equally motivated to affiliate and have positive rapport with all individuals (LaFrance, 1979, 1985). According to primitive emotional contagion theory (Hatfield, Cacioppo, & Rapson, 1992, 1993), people spontaneously mimic the facial, bodily expressions, and speech duration of people with whom they have a close relationship of some kind (see also Gump & Kulik, 1997). Cheng and Chartrand (2003) showed that self-monitoring individuals, who are motivated and able to control their social appearance, were more likely to mimic a confederate’s subtle gestures when they believed the confederate to be a peer or their superior, that is to say when their interaction partner was someone with whom it would have been beneficial to get along. Lakin and Chartrand (2005) showed that mimicry increases after an individual is socially excluded from his or her group, suggesting that those who are particularly motivated to be accepted tend to engage in more imitation. Relatedly, Smoski and Bachorowski (2003) showed that dyads composed of peers produced significantly more antiphonal laughter (i.e., “laughter that occurs during or immediately after a social partner laugh”) than those composed of strangers.

**Imitation of facial expression**

The imitation of facial expression of emotion is of particular interest because recent neuroscientific evidence suggests that it is a mechanism underlying the recognition of facial expression, and thus a possible fundamental basis of empathy (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Decety & Chaminade, 2003; Dimberg, 1982, 1990; Gallese, 2003a,b; Gallese et al., 2004). Furthermore, there is evidence that people tend to imitate emotional facial expressions (whether positive or negative) in a relatively automatic and unintentional way, this processing taking place without awareness (Dimberg, Thunberg, & Elmehed, 2000; Hatfield et al., 1992), even if the emotional expression is not consciously perceived.
Despite the prevalent tendency to imitate facial expression, recent findings indirectly suggest constraints on this type of embodiment as well. Specifically, some recent research suggests that individuals are more accurate at recognizing emotions expressed by members of their own cultural group than by members of a different cultural group (Elfenbein & Ambady, 2003a,b; Elfenbein, Mandal, Ambady, Harizuka, & Kumar, 2004; Matsumoto, 2002). This relative performance difference in facial expression recognition has been called the “in-group advantage” effect (Elfenbein & Ambady, 2002b).

In the Elfenbein, and Ambady studies (2003c), Caucasian American participants were more accurate and also faster at recognizing emotions expressed by Caucasian American than by Chinese faces. Conversely, Chinese participants were better at identifying expressions displayed by individuals of their own culture than Caucasian American individuals. This in-group bias was also found when participants were simply told that the displayed faces corresponded to members of their own versus a different ethnic and socio-linguistic group (Hess, Sénécal, & Kirouc, 1996). Elfenbein and Ambady (2002a) propose a number of cultural differences to account for this effect such as cultural learning, differences in emotional concept, or cultural learning of emotional behavior. To us, however, these findings suggest the hypothesis that individuals do not imitate the facial expressions of others to the same degree. Specifically, based on such indirect evidence, we hypothesized that individuals tend to automatically imitate the facial expressions of in-group members to a greater degree than out-group members.

Finally, some studies have emphasized the moderator role of empathy on imitation. Zajonc et al.(1987) showed that couples who have been married for a long period of time resemble each other more than random couples of the same age or even than they did when they were first married. This finding was attributed to the fundamental role of facial imitation in empathizing with the spouse, and is consistent with embodied simulation theories of empathy (e.g., Bavelas, Black, Lemery, & Mullett, 1986; Decety & Jackson, 2004; Pacherie, 2004). In addition, however, that study showed that couples who grew more facially alike over their marriage also reported being happier in their marriage and more similar in their attitudes to their spouse. Relatedly, Chartrand and Bargh’s (1999) study showed that empathic individuals exhibit more nonconscious mimicry of postures, mannerisms and facial expressions than other people. Such a finding suggests the hypothesis that empathic individuals imitate facial expressions more or more accurately than do less empathic individuals.

An implicit measure of automatic mimicry

To test the present prediction, we adapted a task recently used by Droit-Volet et al. (2004) to assess the effects of emotion on the perception of duration (e.g., Effron et al., 2006; Gil, Niedenthal, & Droit-Volet, 2007). Their findings showed that individuals tend to overestimate duration when it was represented by emotional faces, especially angry faces. The effect was observed in a temporal bisection task in which participants first learned to categorize two standard durations: a short (400 ms) and a long (1600 ms) one. The two standard durations were represented by a pink oval presented on a computer screen. After the initial learning phase, participants then had to categorize comparison durations of the same value as the two standard durations and of intermediate values in terms of similarity to the short or the long standard durations. In the test phase, duration was, however, represented by faces expressing one of three emotions, namely anger, joy, or sadness, or neutral emotion. For anger and joy expressions, compared to neutral ones, participants categorized intermediate durations more often as long durations, revealing that the duration of these high-arousal emotional stimuli was judged to be longer than that of the neutral emotion. Other crucial analyses of the data permitted the authors to conclude that the facial expressions augmented the arousal levels of the participants, and that this augmented arousal was responsible for the biased temporal perception. For instance, the internal clock model predicts a multiplicative effect on time judgment between the tested duration values and the emotions when the arousal speeds up the internal clock (Burle & Casini, 2001; Droit-Volet, Meck, & Penney, 2007; Mariq & Church, 1983; Meck, 1983; see Droit-Volet & Wearden, 2002, for complete discussion). Consistent with this predicted effect, the distortion in temporal
judgment with the angry faces was more marked for the longer duration values.

Of interest for the present study, Effron and colleagues (2006) subsequently showed that facial expression imitation mediates the biased perception of duration represented by facial expressions of emotion. Specifically, these researchers replicated the study of Droit-Volet and colleagues (2004), using facial expressions of anger, joy, and neutral emotion (omitting sadness). Half of their participants performed the temporal bisection task with no other changes, allowing free facial movements, thus imitation. The remaining participants were instructed to hold a pencil lightly between both their teeth and their lips during the entire task. The pencil held in this manner significantly inhibits imitation (see Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001, for details). Results of the bisection task revealed that participants overestimated the duration of emotional faces relative to the neutral faces, but only when imitation was possible. That is, when facial expression could not be imitated, no significant effect of arousal on temporal perception was observed.

The Effron and colleagues’ study suggests that inhibiting imitation eliminates the effect of emotion on the perception of duration. We thus decided to use the temporal bisection task to study the effect of imitation of facial expressions for in-group and out-group members. Using a temporal bisection task to measure imitation in this way has a number of advantages. One is the implicit nature of the task: imitation is not directly measured, so participants are not led inadvertently to generate correct experimental hypotheses and to adhere to experimental demand. This might occur if, for example, participants’ imitative behavior were measured with electromyographic recording (EMG) because the placement of electrodes could easily suggest an interest in facial expression. A second advantage is that the measure is not only implicit, but also subtle. Small changes in arousal such as those due to the imitation of facial expression can be expected to cause biased temporal perception. Thus the task is both implicit and sensitive.

**Overview of the present experiments**

Because our interest was in the automatic imitation of the facial expressions of in- and out-group members, and because recent research shows cultural differences in the recognition of facial expression, we chose to use the same in-group and out-group as in Elfenbein and Ambady’s studies (2003b). In the temporal bisection task developed for this research, duration was therefore represented by faces that expressed anger or neutral emotion. Half of these faces were those of Caucasian individuals and half were those of Chinese individuals. All expressions had been FACS-coded for their authenticity (see Ekman & Friesen, 1978). In the first study, participants were all French Caucasians. In the second study, all participants were Chinese nationals studying in France. Our primary prediction for each study was that duration of presentations of facial expressions of anger, compared to neutral emotion, would be overestimated, and increasingly so over durations, and that this interaction would only be observed for in-group faces. Conversely, the duration of facial expressions displayed by out-group members would suggest no particular bias attributable to changes in arousal.

We also had a secondary interest. We measured individual differences in empathy in both of the following studies, and tested the secondary hypothesis that personal empathy levels moderate imitation such that biases in temporal perception of emotion are more marked for high-empathic individuals because they engage in more effective imitation.

**STUDY 1**

**Method**

**Participants**

Forty-seven female students participated in the study. All were first-year psychology students recruited from the University of Blaise Pascal in Clermont-Ferrand, France. The participants received course credit as compensation.

**Materials**

**Bisection task.** The participants were tested individually in a quiet laboratory room. Stimulus presentation and response collection were controlled by a program created in PsyScope for Macintosh (Cohen, MacWhinney, Flatt, & Provost, 1993). The stimuli used for the representation of
durations were a pink oval (12 × 16 cm) for the training phase, and 12 photographs of 6 different women (3 Chinese and 3 Caucasian) expressing anger or neutrality for the testing phase (from Beaupré & Hess, 2005; see Figure 1 for examples).

Empathy quotient questionnaire. The Baron-Cohen Emotional Quotient Inventory (EQ-i; Baron-Cohen & Wheelwright, 2004) was used to measure individual differences in empathy. The EQ-i consists of 60 items (i.e., 40 empathy items and 20 fillers/control items) for use with adults of normal intelligence and gives an overall EQ score. The questionnaire was translated into French to produce a French-language version. A back-translation showed that the translation was acceptable.

Procedure

Participants first read and signed a statement of informed consent. Then, they performed a bisection task, which consisted of a training phase and a test phase. During the training phase, participants were shown a short (400 ms) and a long (1600 ms) standard stimulus duration, both represented by a neutral stimulus (i.e., a pink oval). The two standard durations were presented five times each in alteration. Participants pressed the D or the K key on the computer keyboard to indicate whether the duration was the short or the long one. The D/K response position was counterbalanced across participants. Participants then performed a block of 10 training trials in which the two standard durations had 50% probability of appearance.

The test phase maintained the conditions of training, except that the stimulus presented was a Chinese or Caucasian face rather than a pink oval. Each participant completed 3 blocks of 84 trials (i.e., 252 trials), in which the 12 photographs (3 different faces × 2 different expressions × 2 ethnicities) were presented three times for each of the seven durations in a random order. Each stimulus was presented at the two standard durations and five intermediated values (i.e., 400, 600, 800, 1000, 1200, 1400, and 1600 ms). The intertrial interval varied randomly between 1000 and 2000 ms.

After the test phase, participants completed the Baron Emotional Quotient Inventory, which

Figure 1. Examples of Caucasian and Chinese faces with angry and neutral expressions.
took about 15 minutes. Participants were then thanked for their participation.

**Results**

Four participants were excluded from analyses, including three due to their ethnicity (i.e., non-Caucasians) and one due to her tendency to strongly underestimate duration.

*Time perception*

Figure 2 shows the mean proportion of long responses plotted against the stimulus durations for the four experimental conditions: data from the two Stimulus Ethnicity conditions (Chinese faces vs. Caucasian faces) for the two types of Emotion (anger vs. neutral).

Because the observation of a three-way interaction in our 7 (Duration) × 2 (Emotion) × 2 (Ethnicity) model was judged as unnecessarily conservative,\(^1\) to test our hypotheses we analyzed the data for the two stimulus Ethnicity conditions separately (Chinese faces and Caucasian faces), using stimulus Duration (400, 600, 800, 1000, 1200, 1400 and 1600 ms) and Emotion (angry vs. neutral) as within-subjects factors in an analysis of variance (ANOVA). The analysis on the proportion of long responses revealed a significant main effect of Duration for both Chinese and Caucasian stimuli, \(F(6, 252) = 560.20, p < .001\) and \(F(6, 252) = 562.91, p < .001\), respectively, indicating that participants were able to judge changes in duration length appropriately. Most importantly, an interaction between Duration and Emotion was observed for Caucasian stimuli, \(F(6, 252) = 2.50, p < .05\), but not for Chinese stimuli, \(p > .05\).

---

\(^1\)The three-way interaction involves the comparison of 28 conditions (7 × 2 × 2) and therefore lacks statistical power (e.g., participants sample, degree of freedom) for interpretation.
Figure 3. $D$ scores plotted against stimulus durations, as a function of stimuli’s ethnicity, for Caucasian participants.

$F(6, 252) = 1.19, p = .312$. The significant interaction for Caucasian faces was due to the expected tendency to overestimate the length of presentation of angry compared to neutral expressions, particularly at longer durations. No other theoretically meaningful results were obtained.

To further evaluate our predictions, the average proportion of trials that subjects categorized as long for each duration value was transformed using the probit function into $z$-scores. Then, a difference measure ($D$) was calculated at each duration by subtracting the $z$-scores for each angry face from the $z$-scores for the neutral face. With 7 durations and 2 emotion pairs (happy–neutral and sad–neutral), this yielded 14 $D$ scores. Each score corresponded to the extent to which subjects’ categorization of emotional faces differed from that of neutral faces; a positive score therefore represented an overestimation and a negative score represented an underestimation of duration relative to the neutral baseline. These scores were treated as the dependent variable in an ANOVA with Duration and Ethnicity as within-subjects factors.

The analysis revealed a marginal interaction between Ethnicity and Duration, suggesting a tendency for the magnitude of overestimation of stimulus durations for the anger faces compared to the neutral faces to be larger in the case of Caucasian faces ($M = 0.022, SD = 0.422$), relative to Chinese faces ($M = -0.002, SD = 0.416$), $F(6, 252) = 2.00, p = .066$. In order to further evaluate the marginal interaction, we examined the two types of Ethnicity separately. Consistent with the findings of the previous analyses, for Caucasian faces, $D$ scores increased significantly as a function of time, $F(6, 252) = 2.31, p < .05$, going from negative to positive (overestimation) scores. In contrast, this was not the case for Chinese faces, $F(2, 252) = 1.20, p = .31$ (see Figure 3).

Empathy

Empathy Quotient scores varied from 27 to 62. They were subjected to a median split in order to obtain a categorical variable with 2 levels: low-empathic individuals ($M = 35.17, SD = 2.97$) and high-empathic individuals ($M = 44.95, SD = 5.47$). We then conducted the same overall ANOVA as before, including empathy as a between-subjects categorical variable. Results revealed an Empathy $\times$ Ethnicity interaction, $F(1, 41) = 5.4, p < .05$ (see Figure 4), which was further qualified by a significant Empathy $\times$ Ethnicity $\times$ Duration 3-way interaction, $F(6, 246) = 3.48, p < .01$.

The 3-way interaction was decomposed by conducting ANOVAs on the two sets of faces (i.e., Caucasian and Chinese) separately. Results revealed a main effect of empathy in the Caucasian faces condition, $F(1, 41) = 5.2, p < .05$, that was not present in the Chinese faces condition, $F(1, 41) = 1.37, p = .25$. Indeed, high-empathic participants ($M = 0.095, SD = 0.043$) overestimated duration represented by angry faces compared to neutral faces more than low-empathic participants ($M = -0.036, SD = 0.038$) when stimuli were Caucasian faces but this was not the case for Chinese faces ($M = -0.044, SD = 0.04$ and $M = 0.031, SD = 0.028$, respectively; see Figure 5).

Additionally, a series of $t$-test analyses showed that for high-empathic participants, $D$ scores differed significantly from zero when duration was represented by Caucasian faces, $t(18) = 2.24, p < .05$, but not Chinese faces, $t(18) = 1.11, p = .28$. $D$ differed from zero for low-empathic

Note also that, in order for this transformation to be accomplished on proportions, values of 1 and 0 had to be replaced with a high and low decimal, respectively. We substituted 0.944 for 1, and 0.056 for 0.
participants neither for Caucasian faces, \( t(23) = -0.93, \ p = .36 \), nor for Chinese ones, \( t(23) = 0.65, \ p = .52 \).

Discussion

The first study found support for the hypothesis that individuals imitate the facial expressions of individuals from their own group but not from an (ethnic) out-group. We used ethnicity to manipulate group membership in order to be able to inform and extend the current literature on possible cultural advantages in the recognition of facial expression of emotion, and because ethnicity constitutes a salient group membership. In our study, French Caucasian participants judged the duration of presentations of facial expressions (i.e., angry or neutral) on a computer screen, which were either displayed by other Caucasians or by Chinese individuals. Results of analyses of their performance on a temporal bisection task suggested that the participants tended to overestimate the duration of angry relative to neutral Caucasian faces, and that this overestimation had a propensity to increase over stimulus duration, thus producing a significant Emotion \( \times \) Duration interaction. The same effect

![Figure 4](image1.png)

**Figure 4.** \( D \) scores’ means for the Chinese versus Caucasian faces as a function of participants’ empathy level, for Caucasian participants.

![Figure 5](image2.png)

**Figure 5.** \( D \) scores plotted against stimulus durations, for the low- versus high-empathic participants as a function of stimuli’s ethnicity, for Caucasian participants.
was not observed for Chinese faces. This suggests that the participants were imitating the anger expressions of the Caucasian faces, and that this had predictable effects on arousal (thus leading to overestimation of duration). Because there was no bias in judgments of the duration of angry compared to neutral expressions for the Chinese faces, we can suppose that the participants were not imitating these faces (e.g., Effron et al., 2006).

At a slightly later date, Chinese nationals were recruited for a similar study. Because the participants were run later in the academic year, and because historical events can affect performance on all tasks sensitive to psychological processes, we were obliged to consider this as constituting a separate study.

STUDY 2

Method

Participants, materials and procedure

Forty-one female students participated in the second study. All were Chinese nationals students residing and studying in France, and recruited from the University of Clermont-Ferrand, France. Because the participants were able to speak French, the French instructions from Study 1 were retained for use in this study.

The equipment, material, device model and procedure were the same as for Study 1 for both training and experimental tasks.

Results

Time perception

Figure 6 shows the mean proportion of long responses plotted against the stimulus duration for the four experimental conditions: data from the two Ethnicity conditions (Chinese faces vs. Caucasian faces) for the two types of emotion expressed (anger vs. neutral). Again, the scores expressed the extent to which the duration of emotional facial expressions was over- or underestimated compared to neutral ones.

As in Study 1, because of a non-conservative three-way interaction, we examined the proportion of long responses for the two Ethnicity conditions separately, using stimulus Duration

Figure 6. Average proportion of long responses plotted against stimulus durations, for the angry versus neutral faces as a function of stimuli’s ethnicity, for Chinese participants.
and the expression of emotion as within-subjects factors (Figure 7). Analyses revealed a significant main effect of duration for both Chinese and Caucasian stimuli, $F(6, 240) = 476.52$, $p < .001$ and $F(6, 240) = 428.53$, $p < .001$, respectively, again suggesting that participants were able to appropriately judge duration.

A main effect of emotion was observed for Chinese stimuli, $F(1, 40) = 5.84$, $p < .05$, but not for Caucasian stimuli, $F(1, 40) = 0.94$, $p = .34$. However, an interaction between emotion and duration was observed for Chinese stimuli, $F(6, 240) = 2.35$, $p < .05$, and for Caucasian stimuli, $F(6, 240) = 3.43$, $p < .01$. This suggests that the proportion of long responses for anger and neutral expressions differed with the duration value when Chinese participants saw Chinese and Caucasian faces.

As in the first study, we also computed difference ($D$) scores. Once more, the scores were treated as the dependent variable in a $7 \times 2$ ANOVA, with duration (400, 600, 800, 1000, 1200, 1400, and 1600 ms) and ethnicity (Chinese faces vs. Caucasian faces) as within-subjects factors. The analysis on difference score yielded only a main effect of duration, revealing that the difference between angry and neutral faces varied as a function of the duration value, $F(6, 222) = 3.09$, $p < .01$. There was no interaction between duration and ethnicity, $F(6, 222) = 1.72$, $p = .119$, thus indicating that this overestimation occurred regardless of ethnicity (Figure 7).

**Empathy**

Empathy Quotient scores varied from 16 to 48 and were subjected to a median split in order to obtain a categorical variable with two levels: low-empathic individuals and high-empathic individuals. We then conducted the same ANOVA as before, including Empathy as a between-subjects categorical variable. Results revealed neither a main effect of Empathy, $F(1, 39) = 0.03$, $p = .87$, nor any interaction effect involving empathy as an interacting variable.

**Discussion**

Study 2 was a replication of the first study using Chinese participants. Interestingly, the Chinese participants overestimated duration when it was represented by angry facial expressions, compared to neutral, when the expressions were displayed by both Chinese and Caucasian faces. The interaction between emotion and duration for those faces suggests that the Chinese participants were imitating the faces and that attendant increases in arousal produced overestimation of the duration of angry faces. Indeed, there was a tendency to overestimate the duration represented by Chinese and Caucasian faces as suggested by the analyses on the proportion of long responses. However, as we will discuss, other processes, probably related to decisional or attentional processes, may have interfered with the arousal effect.

Unlike in the first study, empathy did not moderate the temporal distortions observed for either type of stimulus (i.e., Chinese vs. Caucasian). We take up the differences between the two studies in the general discussion.

**GENERAL DISCUSSION**

In the two studies reported here, we were concerned with the automatic imitation of
emotional facial expressions as a function of group membership (i.e., in-group vs. out-group). We assessed processes of imitation using a temporal bisection task. In this type of task, when using relatively short durations (i.e., inferior to 2000 ms), it is well accepted that individuals typically overestimate durations of displayed angry faces (see Droit-Volet et al., 2004, for discussion). The effect of anger on temporal perception appears to be due to an increased arousal, which enhances the speed of the internal clock. In the framework of pacemaker-accumulator clock models, the arousal increases the number of pulses generated per unit of time by the pacemaker (Church, 1984; Gibbon, Church, & Meck, 1984). Such an increase in arousal seems to be mediated by embodied simulations (i.e., imitation) of the target’s emotional expression (Effron et al., 2006). If perceivers do not imitate the expression displayed by a face representing duration, no distortion in temporal perception of emotional vs. neutral faces is observed (Effron et al., 2006). The task is thus ideal as an implicit measure of facial imitation.

We used ethnicity, or race, to represent in- and out-groups because of the now burgeoning literature on the recognition of facial expressions displayed by culturally (racially) similar and dissimilar others (e.g., Elfenbein & Ambady, 2002a,b). Such a design allowed us to test the limits of the imitation of facial expression of emotion.

Time perception

For both studies, one using French Caucasian and one Chinese individuals as participants, the basic prediction was, put statistically, that of an interaction between facial emotion (anger vs. neutral expression) and duration, and that this interaction would be greater (or exclusively observed) for in-group faces. For Caucasian participants, these results revealed the expected bias in the temporal perception of emotion when duration was represented by in-group members but not by out-group members. These results were consistent with the idea that the faces of out-group members were not imitated and therefore appeared to be quite consistent with Cheng and Chartrand’s (2003) considerations about imitation of fellow in-group members.

For Chinese participants of Study 2, results were most supportive of the fact that both Caucasian and Chinese faces were imitated. Indeed, analyses revealed an interaction between emotion and stimulus duration on the proportion of long responses when faces were both Chinese or Caucasian. Specifically, the magnitude of the anger–neutral difference changed with the duration values, suggesting that the faces of out-group members were imitated. However, so far as the Caucasian faces are concerned, the results on the variation of D scores with the duration values, suggesting a pure arousal effect, are less clear. Indeed, the magnitude of the anger–neutral difference appeared to be particularly high at the point of subjective equality (i.e., between 800 and 1000 ms). In the mathematical model of temporal bisection performance, a distortion of the bisection function at the point of subjective equality (i.e., the stimulus duration giving rise to 50% of long responses) may be also explained by decisional processes (Delgado & Droit-Volet, in press; Droit-Volet & Wearden, 2001). Therefore, we cannot exclude that decision processes have interfered with earlier imitation-related processes for the final temporal judgment of Chinese participants. Attentional processes may also have interfered with the arousal effect. According to attentional models of time perception, when attentional resources are distracted away from the processing of time, the perceived time shortens (Fortin, 1999; Lejeune, 1998). However, this shortening of judged time is independent of the judged duration value, which is inconsistent with our results showing both a temporal overestimation of emotional stimuli compared to neutral ones and that this overestimation changed with the different duration values.

In order to interpret the finding that the Chinese seemed to be imitating the Caucasian faces, it is important to note, as mentioned above, that the Chinese participants were all students residing in France since the start of their studies. This raises the possibility that the Chinese were motivated to imitate the out-group, but that this same motivation was not present for the French Caucasian participants. We mentioned in the introduction that the imitation of emotional expressions improves affiliation and relationships between people (Dijksterhuis, 2005). Thus, it is in fact likely that individuals living in another country are not only motivated to imitate the facial expressions of peers, but also the majority ethnic group, with the general aim of assimilating to the culture.
This idea is suggested by a study by Bourgeois, Herrera, and Hess (submitted). The contribution of their study was to show that Asian Canadians were more accurate at identifying intense expressions displayed by Caucasian Canadians than expressions displayed by Asians. Furthermore, Beaupré and Hess (2006) recently showed, using the same base of normed facial expressions used here, that Chinese immigrants to Canada were as confident in their judgments of facial expressions of Caucasians as in their judgments of facial expressions of Chinese. Also relevant to the present study, Elfenbein and Ambady (2003c) provided evidence for the role of cultural familiarity in accuracy and speed at recognizing facial expressions of emotion. Their results demonstrated that participants were faster and more accurate when evaluating emotions expressed by hosts versus initial in-group members. That is, Chinese participants residing in the United States (for an average of 2.4 years) could better recognize facial expressions of American individuals than fellow in-group members, with a large increase across time.

The contribution of the present study, then, is to highlight imitation effects that are consistent with recently published recognition effects. In our view, our results are more consistent with the possibility that imitation is the mechanism that is responsible for the types of cultural group effects observed in the literature on facial expression recognition. However, given the fact that decisional effects may interfere with the arousal effects, it will be necessary to further investigate this distinction.

However, another explanation of the present findings is suggested by the recent studies of van Baaren, Maddux, Chartrand, de Bouter, and van Knippenberg (2003). The authors found that Asian (i.e., Japanese) participants, who have a chronic interdependent self-construal, were more likely to engage in mimicry than chronic independent self-construal individuals such as American participants. That is, van Baaren et al. (2003) did not find an in-group bias in imitation, but a self-construal orientation effect on mimicry. As concerns the present study, it may be that Chinese participants are more interdependent than French Caucasian ones, and thus show more sensitivity to context cues, including others’ facial expressions. This interpretation may account for the lack of in-group bias effect for Chinese participants in Study 2. Participants’ self-construals should therefore be addressed in further research dealing with intergroup or interpersonal differences in mimicry.

Empathy. Our second prediction was that personal empathy levels moderate imitation such that empathic individuals imitate facial expressions more competently than do less empathic individuals (see also Cheng & Chartrand, 2003). In both studies, we thus measured the participants’ empathy quotient, and assessed the hypothesis that bias in temporal perception of emotion displayed by others is pronounced to a greater extent for high-empathic individuals, because they engage more in effective imitation.

Regarding Caucasian participants, the pattern of the results clearly supports the “empathy–imitation” assumption. The overestimation of time presentation of emotional expressions relative to neutral expressions revealed that the original in-group advantage effect was effective for empathic participants, whereas less-empathic participants did not show differences in time perception between emotional and neutral facial expressions for both Caucasian and Asian faces. Empathic individuals may exhibit more, and more efficiently, mimicry of others’ postures and facial expressions than do less empathic individuals. This skill should confer a greater ability to understand and be sympathetic with others (Chartrand & Bargh, 1999). In addition, it recently appeared that imitation and empathy processes may share a common neural location involving mirror neurons (Gazzola, Aziz-Zadeh, & Keysers, 2006; Iacoboni, 2005). As Decety (2002) has noted, “by imitation we may feel what another person felt, which is the very definition of human empathy”. That is empathy plays a central role via imitation in understanding accurately others’ emotions, and thus in behaving properly.

The same finding was not obtained for the Chinese participants. However, a number of experimenter observations and methodological considerations leads us to be very cautious in drawing any conclusions from that finding. Despite the fact that the Chinese participants did speak French, experimenters noted that they showed difficulty in comprehending the ideas and words used in the questionnaire. Participants took a long time to complete the questionnaire, and required the use of a French–Chinese dictionary. Thus, it does not appear to us that these results constitute a hindrance in previous effects’ reading in terms of empathy skills. Consequently,
conducting a replication using participants living in their country of origin would allow us to assess the classical in-group effect appropriately. In addition, this may provide further evidence for the crucial role of embodiment in social cognition.

In sum, the present study stands in line with the mounting evidence described earlier in suggesting a central role of embodiment in social perception (Niedenthal, Barsalou, Winkielman, Krauth-Grübler, & Ric, 2005b). In agreement with Effron et al. (2006), it suggests that the imitation of emotional faces modifies our subjective experience of time that speeds up our internal clock. However, this does not exclude the fact that other cognitive processes (decision, memory) may also affect the final temporal judgment in a given task, the time judgment resulting from a complex processing of information.

REFERENCES


Lakin, J. L., Jefferis, V. E., Cheng, C. M., & Chartrand, T. L. (2003). The chameleon effect as social glue: Evidence for the evolutionary significance of...
nonconscious mimicry Journal of nonverbal behavior, 27, 145–162.