

Facial Signs of Imminent Aggression

David Matsumoto and Hyeisung C. Hwang

San Francisco State University and Humintell, LLC, Berkeley, California

In real-world law enforcement encounters, a seemingly docile situation can turn violent in a matter of seconds. Being able to identify the signs of imminent aggression or violence may be extremely important in keeping safe those in harm's way. In four studies we examined the possibility that certain facial expressions are reliably associated with acts of immediate, subsequent violent behavior. Target expressions observed in videos of actual assaults were placed into an array of faces including distractors and shown to two groups of law enforcement officers (LEOs) in two countries (Study 1) and to university students with and without the experience of assault (Study 2). A different array of faces including targets and distractors were shown to another sample of LEOs (Study 3) and university students with and without the experience of assault (Study 4). A significant proportion of the observers across the four studies selected the target expressions associated with assault; importantly no expression was selected by the two samples with little or no experience with assault, suggesting that stereotypes about what such faces should look like did not affect the results. These findings suggest that reliable facial signs of imminent aggression or violence may exist, and if so that people in harm's way can be trained to identify the signs of imminent aggression before it happens.

Keywords: facial expressions, emotion, nonverbal behavior, aggression, violence

Being able to identify the signs of imminent aggression or violence may be important in keeping safe those in harm's way. Facial expressions of emotion offer a potential marker for such signs because emotions are rapid information-processing systems that aid individuals in making decisions and engaging in action with minimal conscious awareness (Tooby & Cosmides, 2008). They are immediate, unconscious, involuntary, and transient reactions that occur as a result of an appraisal of an event that has implications for the welfare of the organism and potentially require immediate response (Ellsworth & Scherer, 2003; Lazarus, 1991). When elicited, emotions prime behaviors by initiating unique, organized, and coordinated

physiological signatures and mental structures (e.g., fleeing in fear, fighting in anger; see Levenson, 1999, 2003). They aid in bonding memories and cognitions (Bower, 1981; Forgas & Bower, 1987), and are a major source of motivation and action by providing the impulse for behavior (Frijda, Kuipers, & ter Schure, 1989; Tomkins, 1962, 1963). Facial expressions are part of this coordinated response package, one that is readily available to outside observers.

Despite the potential for facial expressions to be markers of subsequent behavior, there are only a few studies examining this link. Facial expressions of emotion produced by children as they watched TV have been associated with subsequent hurtful behaviors and aggressive play (Ekman et al., 1972), and the facial emotions of preschool dyads as they played a game have been linked to cooperative or competitive actions of the game (Matsumoto, Haan, Gary, Theodorou, & Cooke-Carney, 1986). Facial displays of anger by adolescent boys observed in an interactive IQ testing context have been correlated with teacher ratings of delinquent and aggressive behavior at school; facial displays of fear correlated negatively with these behaviors and positively with withdrawal-related behav-

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David Matsumoto and Hyeisung C. Hwang, Department of Psychology, San Francisco State University and Humintell, LLC, Berkeley, California.

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Correspondence concerning this article should be addressed to David Matsumoto, Department of Psychology, San Francisco State University, 1600 Holloway Ave., San Francisco, CA, 94132. E-mail: dm@sfsu.edu

iors (Keltner, Moffitt, & Stouthamer-Loeber, 1995).

In this study, we examined the possibility that facial expressions of emotion, and specifically variants of anger, are reliably associated with acts of immediate, subsequent violent behavior. It makes sense that signs of anger may be seen before acts of aggression or assault, if anger primes the body to aggress and facial expressions are part of the anger response package. In one of the studies mentioned above (Keltner et al., 1995), angry expressions in one context were correlated with ratings of aggressive behavior in another. However, no study has documented that facial expressions of anger are associated with immediate and imminent assault or aggression in the same situation. Given that assassinations, shootings, and physical violence often occur in a matter of seconds, the existence of such signs is a distinct possibility and has important practical ramifications.

Even if one suspects that angry expressions immediately precede physical assault, a question arises concerning the exact type of angry expression. Emotions can be expressed in full-face prototypes, such as those depicted in the Pictures of Facial Affect (Ekman & Friesen, 1976) or the Japanese and Caucasian Facial Expressions of Emotion stimulus sets (Matsumoto & Ekman, 1988). However, emotions can also be displayed very subtly, with muscles innervated only slightly, or intensely with muscles innervated at maximum strength. Emotions can also be displayed in only parts of the face (aka partial expressions; see Ekman & Friesen, 1978; Matsumoto & Hwang, 2013). Furthermore, emotion signals may co-occur with each other in blended expressions such as in smiling angry faces. Thus, although there is good reason to suspect that an angry expression is likely to immediately precede an attack, we do not know exactly which type of angry expression it is. Is it the full-face, high intensity face of rage? The full-face but subtle version? A partial expression of anger? If so, which one? Or is it blended signs of anger mixed with smiles, depicting individuals who enjoy being angry, or are pretending to be angry as a joke?

Furthermore, are the signs of imminent aggression similar across cultures? If emotional expressions are universal and emotions evolved as a system to aid in adapting to the environment, there is good reason to believe that any

linkage between facial expressions of emotion and subsequent, immediate behavior is likely to be cross-cultural. To date, however, no study has provided evidence for this linkage cross-culturally.

The purpose of the studies reported here is to identify exactly which type of angry expression may be reliably associated with imminent aggression and to obtain cross-cultural evidence for this linkage. Expressions possibly related to two types of aggression were studied, one having to do with premeditated aggression, the other having to do with loss of impulse control aggression. Much research has distinguished these two types of aggression, the former also known as proactive, instrumental, predatory, or cold aggression, the latter also known as reactive, affective, emotional, hostile, or hot aggression (Dodge, 1991; Fontaine, 2007; Meloy, 2006; Siegel & Victoroff, 2009). Although the distinction is neither simple nor universally accepted (e.g., Bushman & Anderson, 2001), in broad terms it is a useful heuristic and reasonable starting point for this research.

In Study 1 law enforcement officers (LEOs) in two very different cultures who had experienced physical assault were presented with an array of angry expressions and selected the faces they saw immediately before the attack. We hypothesized that there would be high agreement in the faces they selected as the signs of imminent aggression and in the relative agreement of their selections across cultures. In Study 2 we replicated the findings from Study 1 in a sample of American university students who had experience with physical assault; we also included a group of students who had little or no experience with assault as a comparison. Studies 3 and 4 replicated Studies 1 and 2 using a different array of faces from a different expressor.

Study 1

LEOs in Two Different Cultures

Method.

Observers. Observers were 242 LEOs from the United States ($N = 58$, $M_{\text{years of service}} = 19.55$, $M_{\text{age}} = 44.26$, 88% men) and South Korea ($N = 184$, $M_{\text{years of service}} = 10.63$, $M_{\text{age}} = 37.22$, 89% men). The samples differed in number of years of service and mean age, but

these variables were not associated with the findings. All participants were recruited during training events and participated in groups. The Americans came from two different jurisdictions, while the South Koreans were recruited in Seoul. All officers included in this study answered “yes” to the following screening questions: (a) Have you ever been threatened with a physical assault; (b) Have you ever been actually assaulted; (c) Did you see the face of the attacker; (d) Do you remember it. Only participants who answered “yes” to all of these screening questions were included in this study.

Stimuli. The initial stimuli included 16 expressions posed by a White professional actor. The expressions were generated by first asking the actor to produce faces that had been seen in previous videos involving assaults, attacks, and assassination attempts. Two target expressions each for a premeditated assault and a loss of control assault were produced by asking the actor to move specific muscles on his face that corresponded to the known expressions. The premeditated assault faces included the following muscles: corrugator supercilii, depressor supercilii; levator palpebrae superioris; orbicularis oculi, pars palpebralis; with or without orbicularis oris and mentalis. One of the loss of control faces included corrugator supercilii, depressor supercilii; levator palpebrae superioris; orbicularis oculi, pars palpebralis; orbicularis oris; and jaw drop. The other loss of control face included corrugator supercilii, depressor supercilii; levator palpebrae superioris; orbicularis oculi, pars palpebralis; levator labii superioris alaquae nasi; risorius with platysma, with or without levator labii superioris, depressor labii inferioris; orbicularis oris, and jaw clench.

Because the target faces represented variants of the full-face prototypical facial expression of anger, distractor expressions were also produced by requesting the actor to portray as many different kinds of anger as he knew. Each of the distractors depicted a different variant of the angry expression; that is, all expressions included at least some of the muscles that are involved in the full-face prototype. The expressions differed in the amount and intensity of those muscles and in the presence or absence of zygomatic major (the smiling muscle). This initial effort resulted in a preliminary creation of 16 expressions. Pilot testing with a separate group of American LEOs before the current

study indicated that four of the expressions were almost never selected in the procedures described below; thus, they were dropped, resulting in the final stimulus set involving 12 expressions, which were placed in a random array and numbered. The target expressions for loss of control assault were Photos 2 and 6; for premeditated assault they were Photos 3 and 4.

Procedures. After answering the initial screening questions, all observers were given the following instructions:

Physical assaults may be **premeditated** or they can occur when a person was not intending to attack but **lost control** and then attacked. We are going to ask you to identify any facial expressions you remember seeing before either a premeditated assault, or a loss of impulse control assault. It is **VERY** important that you rely only on your memory. If none of the pictures fit your memory then check “I remember the faces but it was none of the photos you showed.”

The officers were then shown the array and were asked to select by number any they remembered resembling the face they saw before a premeditated assault. Officers were allowed to select up to three photos. They were also allowed to check a box to indicate that they remembered the expression on the face before the assaults but that it was not depicted in the array. (This response was selected ~1% of the time.) They then repeated those procedures for loss of control assault. After completing the selections, the officers provided basic demographic data including jurisdiction, years in the law enforcement or security profession, age, and sex.

Results and Discussion

We recoded the responses into dichotomous (selected vs. not selected) choices for each of the 12 expressions, separately for premeditated assault and loss of control, and computed the percentage of officers selecting each expression for both types of attacks (see Table 1). We then tested whether the proportion of officers in each country that selected each expression was significantly greater than chance, separately for the two types of attacks; chance was set at 1/8. Even though the 12 choices suggested chance = 1/12, we chose to set chance at 1/8 because we believed that four of the expressions were similar enough to another so that in actuality there were eight different expressions being depicted. In addition, setting chance at 1/8 allowed for a more conservative test of selection compared

Table 1
Studies 1 and 2: Percentage of Observers Selecting Each Photograph, Separately for Both Types of Assault, Original Faces

Expressions Photo no.	Study 1		Study 2	
	South Korea LEOs	U.S. LEOs	With experience	Little or no experience
Loss of control				
Photo 1	3.85%	0.00%	0.00%	0.00%
Photo 2 (target)	69.78%	31.03%	30.95%	18.87%
Photo 3	6.59%	8.62%	7.14%	9.43%
Photo 4	14.29%	8.62%	11.90%	3.77%
Photo 5	6.59%	10.34%	9.52%	5.66%
Photo 6 (target)	66.48%	37.93%	28.57%	18.87%
Photo 7	2.74%	0.00%	4.76%	1.89%
Photo 8	35.71%	22.41%	21.43%	13.21%
Photo 9	4.95%	12.07%	11.90%	5.66%
Photo 10	12.64%	1.72%	2.38%	3.77%
Photo 11	55.49%	32.76%	21.43%	15.09%
Photo 12	2.20%	5.17%	14.29%	1.89%
Premeditated				
Photo 1	19.78%	0.00%	7.14%	5.66%
Photo 2	6.04%	13.79%	7.14%	5.66%
Photo 3 (target)	37.36%	20.69%	28.57%	9.43%
Photo 4 (target)	57.69%	27.59%	35.71%	13.21%
Photo 5	47.80%	29.31%	21.43%	7.55%
Photo 6	7.14%	13.79%	9.52%	11.32%
Photo 7	13.19%	10.34%	4.76%	7.55%
Photo 8	13.19%	17.24%	9.52%	7.55%
Photo 9	27.47%	24.14%	9.52%	1.89%
Photo 10	14.84%	3.45%	2.38%	0.00%
Photo 11	15.38%	12.07%	19.05%	11.32%
Photo 12	12.64%	25.86%	28.57%	11.32%

Note. Boldfaced cells were significantly greater than chance.

with chance at 1/12. Chance was set at the same level for all studies reported below to allow for direct comparisons across studies.

For the premeditated assault expression, as predicted the proportions of Korean and American LEOs selecting the two target expressions (Photos 3 and 4) were significantly greater than chance. However, a significant proportion of both also selected Photos 5 and 9. Photo 5 was similar to the two target Photos 3 and 4 but included a relatively strong lip corner tightening and lower lip raise, which is often used when a person is attempting to control his or her anger. Photo 9 was also similar to the two target photos but included almost no brow lowering, which typically signifies focus or concentration. A significantly greater than chance proportion of Korean LEOs also selected Photo 1, which included a smile, and a greater than chance proportion of American LEOs selected Photo 12, which included only a tensing of the lips.

For the loss of control expression, as predicted the proportions of Korean and American LEOs selecting the target Photos 2 and 6 were significantly greater than chance. A significant proportion of both also selected Photos 8 and 11. Photo 8 was similar to the target Photo 6 but included a lip corner tightening and lower lip raise, which is often used when a person is attempting to control his or her anger as mentioned above. Photo 11 was also similar to target Photo 6 but did not include a strong upper eyelid raise, which would indicate intense rage.

Although the consistency between the American and Korean LEOs in the expressions selected above chance levels was evidence for cross-cultural agreement, we further examined the relative agreement between the American and Korean data by computing Pearson correlations across the observed proportions of the United States and Korean observers selecting each expression, separately for premeditated as-

sault and loss of control (expression was the unit of analysis). Both were significant, $r(12) = .61, p < .05$, and $r(12) = .94, p < .001$, respectively. We also recomputed these correlations using Spearman rank order and obtained the same results. Thus, there was cross-cultural agreement in the relative degree to which each expression was selected as an exemplar of premeditated assault and loss of control; the absolute levels of only a few, however, rose to levels greater than chance.

These findings provided initial evidence for a possible reliable and potentially cross-cultural link between specific facial expressions of emotion and subsequent, immediate behavior. One limitation of the study, however, was that it was possible that the observers selected the faces on the basis of stereotypes about what the face of imminent assault should look like, not what it actually looked like. Data from individuals without the experience of assault should address this issue. If people with little or no experience select the same faces, that would suggest that the selections are not based on experience but on stereotypes.

Study 2 addressed this limitation. American university students served as observers and were divided into two groups, one with little or no experience with physical assault and the other with relatively more experience. The same stimuli and judgment tasks as in Study 1 were used. We predicted that the group with the experience of physical assault would select the target photos but the group with little or no experience would not.

Study 2

U.S. Students With and Without Experience of Physical Assault

Method.

Observers. The participants were 121 university students recruited from the San Francisco State University Psychology Department participant pool system ($M_{age} = 25.28, SD = 8.06; N = 28$ men, 87 women, 6 declining to answer). They participated voluntarily in partial fulfillment of class requirements with no compensation. At the beginning of the survey participants answered “yes” or “no” to the following five screening questions: (a) Have you ever been threatened with a physical assault? (b)

Have you ever been actually assaulted? (c) Have you ever seen someone else assaulted? (d) Did you see the face of the attacker? (e) If you saw the expression do you think you will remember it? We summed the number of “yes” responses and computed a median split of the data ($Mdn = 3$), not including participants whose summed scores equaled the median. This resulted in two groups, one with relatively little or no experience with physical assault ($N = 53$) and one with relatively greater experience ($N = 42$).

Stimuli and procedures. The same stimuli, instructions, and judgment procedures used in Study 1 were used here.

Results and Discussion

We transformed and analyzed the data in the same way as in Study 1. For premeditated assault, as predicted the group that had greater experience with physical assault selected Photos 3 and 4 at greater than chance levels. Both South Korean and U.S. LEOs in Study 1 also selected these expressions. Photo 12 was also selected by this group, and by U.S. LEOs in Study 1 but not by South Korean LEOs. Interestingly, *none* of the expressions were selected at significantly greater than chance rates for the group with little or no experience with physical assault. These findings provided additional support for the possibility that the expressions in Photos 3 and 4 were reliable signs of premeditated assault.

For loss of control, the group that had relatively greater experience with assault selected Photos 2 and 6 at greater than chance levels. Both South Korean and U.S. LEOs in Study 1 also selected these expressions. An interesting finding was that *none* of the expressions were selected at significantly greater than chance rates for the group with little or no experience with physical assault. These findings provided additional support for the possibility that the expressions in Photos 2 and 6 were reliable signs of loss of control assault.

The target expressions portrayed in Photos 2 and 6 (for loss of control) and Photos 3 and 4 (for premeditated assault) were the only expressions selected by Korean and American LEOs and by American university students with experience with assault. Importantly, students with little or no experience with assault did not select any expression at significantly greater than chance levels.

This nonfinding suggested that stereotypes about what assault faces should look like probably did not influence the findings so far.

Studies 1 and 2 both used the images of only a single expressor. Thus, it was impossible to know if the findings from those studies were specific to the actor who portrayed the expressions. We remedied this limitation in the next two studies by creating and utilizing a new set of target and distractor faces with a different male expressor.

Study 3

U.S. LEOs Judging a Different Set of Faces

Method.

Observers. The participants were 147 American LEOs from six different departments ($M_{\text{years of service}} = 12.59$, $M_{\text{age}} = 38.84$, 84% men). All participants were recruited during training events and participated in groups. All LEOs included in this study answered “yes” to the same five screening questions used in Study 2.

Stimuli. We created a new array of stimuli by asking five White male actors to produce the two target expressions each for the premeditated assault and loss of control faces. For the distractors we asked the actors to pose faces corresponding to the prototypical facial expressions of contempt and disgust, as they are often confused with angry expressions (Matsumoto, 2005). We also asked the actors to produce prototypical expressions of fear and surprise as these include strong innervations of the upper eyelid, which shows the Whites above the irises as do the target expressions for loss of control faces. The other faces were variants of the angry expressions that either did not involve all of the muscles in the target faces or that included extraneous muscles. We then compared the arrays of faces across actors and selected one array to use that included what we considered to be the best exemplars of both the target and distractor expressions. The 12 expressions for this actor were then placed into an array in a random order. Photos 10 and 11 were the target exemplars for premeditated assault; Photos 4 and 12 were the target exemplars for loss of control.

Judgment tasks and procedures. The same instructions and judgment procedures used in Studies 1 and 2 were used here.

Results and Discussion

We transformed and analyzed the data in the same way as in Studies 1 and 2. As predicted the proportion of observers selecting the target Photos 10 and 11 for the premeditated assault face was significantly greater than chance. Furthermore, as predicted, the proportion of observers selecting the target Photos 4 and 12 for the loss of control face was significantly greater than chance. For both assault types, no other expression was selected by a statistically significant proportion of observers (see Table 2).

These findings provided additional evidence that the target expressions were reliably associated with both types of assault, as a significant proportion of LEOs with the experience of physical assault selected the target expressions for both types of assault. And importantly they selected no other expression. These data suggested that the findings from Studies 1 and 2 were not specific to the individual expressor used in those studies.

As with Study 1, however, use of a new array of faces, especially the distractors, raised questions about whether observers selected the faces on the basis of stereotypes about what the face of imminent assault should look like and not what it actually looked like. As in Study 2, data from individuals without the experience of assault should address this issue. In Study 4, therefore, we obtained judgments by American university students who were divided into two groups, one with little or no experience with physical assault and the other with relatively more experience. The same stimuli and judgment tasks in Study 3 were used. We predicted that the group with the experience of physical assault would select the target photos but that the group with little or no experience would not.

Study 4

U.S. Students With and Without Experience of Physical Assault Judging Different Set of Faces

Method.

Observers. The participants were 126 university students recruited from the San Francisco State University Psychology Department participant pool system ($M_{\text{age}} = 23.42$, $SD = 6.25$; $N = 35$ men, 85 women, 6 declining to

Table 2
Studies 3 and 4: Percentage of Observers Selecting Each Photograph, Separately for Both Types of Assault, New Faces

Expressions	Study 3		Study 4	
	Photo no.	U.S. LEOs	U.S. students with more experience ($N = 50$)	U.S. students little or no experience ($N = 58$)
Loss of control				
Photo 1		11.56%	6.00%	8.62%
Photo 2		7.48%	2.00%	5.17%
Photo 3		8.84%	2.00%	1.72%
Photo 4 (target)		29.93%	32.00%	18.97%
Photo 5		4.76%	4.00%	3.45%
Photo 6		8.84%	10.00%	3.45%
Photo 7		10.20%	2.00%	3.45%
Photo 8		7.48%	4.00%	0.00%
Photo 9		10.88%	0.00%	3.45%
Photo 10		11.56%	20.00%	13.79%
Photo 11		19.05%	22.00%	13.79%
Photo 12 (target)		42.86%	32.00%	17.24%
Premeditated				
Photo 1		17.01%	18.00%	10.34%
Photo 2		15.65%	4.00%	6.90%
Photo 3		8.16%	4.00%	1.72%
Photo 4		16.33%	6.00%	12.07%
Photo 5		0.68%	0.00%	0.00%
Photo 6		6.80%	4.00%	10.34%
Photo 7		16.33%	4.00%	8.62%
Photo 8		1.36%	0.00%	1.72%
Photo 9		16.33%	14.00%	6.90%
Photo 10 (target)		54.42%	50.00%	19.31%
Photo 11 (target)		35.37%	38.00%	20.69%
Photo 12		10.88%	6.00%	5.17%

Note. Boldfaced cells were significantly greater than chance.

answer). They participated voluntarily in partial fulfillment of class requirements with no compensation. At the beginning of the survey participants answered “yes” or “no” to the same five screening questions as in Studies 2 and 3. We summed the number of “yes” responses and computed a median split of the data, not including participants whose summed scores equaled the median. This resulted in two groups, one with relatively little or no experience with physical assault ($N = 58$) and one with relatively greater experience ($N = 50$).

Stimuli and procedures. The same stimuli, instructions, and judgment procedures used in Study 3 were used here.

Results and Discussion

We transformed and analyzed the data in the same way as in the previous studies. As pre-

dicted a significant proportion of the group with experience with physical assault selected the target Photos 10 and 11 for premeditated assault and target Photos 4 and 12 for loss of control assault. For the group with little or no experience with physical assault, none of the expressions were selected at above chance rates.

The findings provided additional evidence that the target expressions were associated with both types of assault. Importantly, American university students with little or no experience with assault did *not* select any expression for either type of assault at significantly greater than chance levels. These nonfindings suggested that stereotypes about what assault faces should look like probably did not influence the findings so far, as the judgments of the observers with little or no experience did not replicate those of observers with such experience.

General Discussion

The four studies provided evidence for the existence of specific facial expressions of emotion, and more specifically variants of angry expressions, that may precede imminent assault. The same expressions were identified by three samples of LEOs in two very different cultures and by two samples of university students who had experience with physical assault, and across different stimulus sets. Importantly, observers who had little or no experience with physical assault did *not* select the target faces as expressions immediately preceding attacks, suggesting that stereotypes about what such faces should look like did not affect the results.

These findings were not produced without limitations, especially concerning the nature of the stimuli. While the target faces were based on expressions seen in videos of attacks and assaults, a survey of the actual faces that are produced immediately before an assault involving coding of the actual facial expressions produced would provide much better evidence for the faces of attack. Unfortunately, a systematic examination of spontaneously produced faces in actual situations in which violence or aggression has occurred is virtually impossible (although our review of available videos and films of real-life assassinations and violence informed our creation of the stimuli and the target faces used were analogous to those faces). Thus, we opted to conduct the studies in the manner described above as a way of generating reliability data concerning the expressions that were observed in the videos. In doing so, we had to rely on memory and recall, and there is always the possibility that recall may not be the same as what actually happens. This limitation was mitigated somewhat because we screened observers in terms of whether or not they witnessed and remembered the face of their attacker; many individuals in harm's way remember these faces. The fact that essentially the same findings were obtained in multiple groups across different cultures suggests that memory or recall did not affect the findings overall. The nonfindings from students who had little or no experience also speak to this point. Nevertheless, readers are cautioned to interpret our findings with this caveat.

Other limitations of the stimuli include the fact that we tested expressors of only one eth-

nicity, that we used static photos and not dynamic stimuli such as videos, and because we only tested facial expressions. Clearly, the findings need to be replicated using stimuli of expressors of different ethnicities with observers from more cultures, especially to examine further the possible cross-cultural generalizability of the findings. Moreover, facial expressions occur as a package of bodily responses, and it is entirely possible that some bodily cues of imminent aggression exist, such as the making of fists, face coloring, and quick breathing. These potential signs deserve research attention in the future.

Furthermore, the types of attacks that we examined here do not exhaust all the different types of attacks and assaults and there is no reason to believe that the faces we have studied are the same for different types of attacks. Suicide bombers, for example, likely have different expressions as they carry out their plans. The faces of individuals with extensive experience or training in attack and assault may be different than those of individuals with relatively less experience.

A final limitation concerns the nature of the methodology we used and the examination of group-level differences. Our methodology did not allow for an investigation of the ability of facial expressions to predict which people would or would not engage in violence. It may very well be the case that some individuals who produce the target expressions in this study do not engage in violence, and some people who engage in violence may not always produce the target expressions. Readers should interpret the findings with this caveat. Addressing individual-level predictors requires a different methodology and should be a topic of study in the future.

The premeditated assault face is the face you might see on someone who has planned to attack another and is carefully waiting for the opportunity to make the attack. It might be shown while he or she waits for the target to appear, or for the target or those protecting the target to be off guard. The expression was characterized by a slight lowering of the brows, slight raising of the upper eyelid that produces a staring quality, and a slight tightening of the lips. One of the target premeditated assault faces also included the tightening of the lip corners and pushing up of the lower lip. When

present, this action gives the appearance that the attacker is trying to control his or her emotions in carrying out the attack. This is a low intensity, controlled expression of anger that displays the look of determination and concentration.

The loss of control face is one you might see on people who have just lost their temper and are about to attack. These expressions were characterized by a slight lowering of the brows, strong raising of the upper eyelid that produces a bulging, staring quality to the eyes; a strong tightening of the lips; and an *absence* of the pushing up of the lower lip. This is a high-intensity expression of anger with a large staring quality to the eyes and a lack of control in the mouth. The absence of the lower lip push may be significant because it is usually associated with emotion control (as with the premeditated assault face), and in this expression the person has obviously lost control of his anger.

These findings lead to interesting theoretical questions concerning the relationship between expression and behavior. Darwin (1872) claimed, in his principle of serviceable habits, that facial expressions are the residual actions of more complete, whole body responses that prepare individuals for action by priming the body to act. Anger is expressed by furrowing the brow and tightening the lips with teeth displayed because these actions are part of an attack response; disgust is expressed with an open mouth, nose wrinkle, and tongue protrusion as part of a vomiting response. However, specific variants of emotions, depicted in different expressions, may prime different types of behaviors related to the same family of emotion. Thus, a different anger expression variant may be associated with verbal aggression or aggressive thoughts. This notion is consonant with the idea that different variants of full-face, prototypical emotional expressions are displayed depending on different appraisals associated with the situation or context (Scherer & Ellgring, 2007). Future research may explore the link between the specific appraisals associated with different types of assaults and the specific variants of the emotional expressions associated with them.

The findings also suggest that different variants of other emotions as well may be associated with different, specific actions, all associated with that emotion family. For example, although fear leads to either fleeing or freezing, it may be that some

variants of fear expressions are associated with flight while another variant is associated with freezing. Relatedly, Rozin and colleagues (1999) suggested that different variants of the disgust expression (nose wrinkle vs. upper lip raise) may be associated with different targets of disgust (i.e., contaminated objects such as feces or urine vs. interpersonal disgust). If correct, that would lead to the interesting hypothesis that a specific variant of the disgust expression may be associated with escalations to violence, or even terrorist acts, but other variants of disgust are not, especially given that the combination of anger and disgust (along with contempt) are important markers in the escalation to intergroup violence (Matsumoto, Hwang, & Frank, 2014, 2013). The same may be true for other emotions portrayed in the face and future research may explore these possibilities.

The findings also speak to debates concerning the utility of the distinction between premeditated and loss of control aggression. Although many writers maintain that this distinction is a useful one, citing meaningful differences in antecedents, psychological mechanisms, and neurological correlates (Dodge, 1991; Meloy, 2006; Siegel & Victoroff, 2009), others have suggested that the distinction has outlived its utility and is not as clear as it may appear (Bushman & Anderson, 2001). The fact that we were able to find reliable differences between facial expressions of the two different types of aggression certainly provide further evidence for their distinctiveness. However, the difference between the premeditated and loss of control expressions may be one of intensity and degree of control, with the former being more controlled and less intense than the latter. That the premeditated expression is less intense, however, should not be a basis to infer that the underlying experience is less intense compared with that when loss of impulse control aggression occurs; indeed, premeditated aggressors may feel intense anger. These notions would support Bushman and Anderson's (2001) claim that the distinction between the two types of aggression is not that clear, because premeditated aggression is often considered cold and void of emotion.

The fact that the premeditated aggression face was less intense than the loss of control face may have also contributed to the relatively stronger findings for the loss of control face compared with the premeditated face, at least in Study 1. The lower intensity and greater control in the premeditated assault face may be because of the relative

lack of signaling among predators, which in turn may be an evolutionary adaptation in response to hunting success. Alternatively, the slightly lower recognition rates of the premeditated faces may have been related to the greater difficulty of recognizing this face just before violence when compared with the face of loss of control, making split second recognition more difficult.

These findings have implications for policy and practice (see Table 3). For example, the findings suggest that the examination of demeanor may provide valid and reliable behavioral indicators of imminent threat, and should be considered as part of a multilayered approach to threat assessment and management. Moreover, identification of the specific facial signs that immediately precede aggression of any type allows the field to develop ways of training individuals in harm's way to recognize them quickly, thus allowing for evasive or defensive action to occur, perhaps preventing the violence or aggression. The findings concerning the facial expressions associated with premeditated assault are especially relevant to the training of individuals involved in security and protection services because these faces may be incorporated in scanning and surveillance to identify persons of interest. The findings concerning the loss of control expression may be relevant to all individuals in harm's way, from law enforcement officers, military personnel, and perhaps even victims of abuse. The fact that observers in two very different cultures identified the same facial signs to

imminent aggression suggests that these signs are universal. If so, training the ability to detect these signs has applicability to individuals in harm's way around the world in many different cultures, not just the United States. Future research documenting the specific variants of anger and other emotions (e.g., disgust, contempt) that are associated with acts of hostility in terrorist or other ideologically based groups would lead to the production of similar warning systems and training tools.

Finally, the additional faces identified by Korean and American LEOs in Study 1 suggested the possibility that other variants of the anger expression may be associated with different types of attacks. The findings for the American LEOs were not replicated in Study 3; but that study utilized a different array of faces with a different set of distractors. While the nontarget photos selected by the American and Korean LEOs in Study 1 did have many of the elements of the target photos, they also differed in some key ways (described earlier). Future research may need to examine if these expressions are indeed reliable markers of assault (especially Photos 5, 8, and 11 in Study 1), potentially culture-specific signs of assault (NB Photo 12 selected by both samples of U.S. LEOs and university students in Study 1), or artifacts of that study.

References

Table 3
Implications of the Findings for Policy and Practice

1. The examination of demeanor may provide valid and reliable behavioral indicators of imminent threat, and should be considered as part of a multilayered approach to threat assessment and management.
2. Specific facial expressions of emotion may be indicative of imminent aggression or violence. Individuals in harm's way may benefit from learning to identify these expressions to avoid or reduce threats.
3. The findings concerning the facial expressions associated with premeditated assault are especially relevant to the training of individuals involved in security and protection services. These faces may be incorporated in the scanning and surveillance to identify persons of interest.
4. Findings concerning the loss of control expression may be relevant to all individuals in harm's way, from law enforcement officers, military personnel, and perhaps even victims of abuse.

- Bower, G. H. (1981). Mood and memory. *American Psychologist*, *36*, 129–148. doi:10.1037/0003-066X.36.2.129
- Bushman, B. J., & Anderson, C. A. (2001). Is it time to pull the plug on the hostile versus instrumental aggression dichotomy? *Psychological Review*, *108*, 273–279. doi:10.1037/0033-295X.108.1.273
- Darwin, C. (1872). *The expression of emotion in man and animals*. New York, NY: Oxford University Press. doi:10.1037/10001-000
- Dodge, K. A. (1991). The structure and function of reactive and proactive aggression. In D. J. Pepler & K. H. Rubin (Eds.), *The development and treatment of childhood aggression* (pp. 201–218). Hillsdale, NJ: Erlbaum, Inc.
- Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.
- Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: Investigator's guide*. Palo Alto, CA: Consulting Psychologists Press.
- Ekman, P., Liebert, R. M., Friesen, W. V., Harrison, R., Zlatchin, C., Malmstrom, E. J., & Baron, R. A.

- (1972). Facial expressions of emotion while watching televised violence as predictors of subsequent aggression. In G. A. Comstock, E. A. Rubinstein, & J. P. Murray (Eds.), *Television and social behavior: A technical report to the Surgeon General's Scientific Advisory Committee on television and social behavior* (Vol. I: Television's effects: Further explorations, pp. 22–58). Washington, DC: U.S. Government Printing Office.
- Ellsworth, P. C., & Scherer, K. (2003). Appraisal processes in emotion. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 572–595). New York, NY: Oxford University Press.
- Fontaine, R. G. (2007). Disentangling the psychology and law of instrumental and reactive subtypes of aggression. *Psychology, Public Policy, and Law*, *13*, 143–165. doi:10.1037/1076-8971.13.2.143
- Forgas, J. P., & Bower, H. G. (1987). Mood effects on person-perception judgments. *Journal of Personality and Social Psychology*, *53*, 53–60. doi:10.1037/0022-3514.53.1.53
- Frijda, N. H., Kuipers, P., & ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *Journal of Personality and Social Psychology*, *57*, 212–228. doi:10.1037/0022-3514.57.2.212
- Keltner, D., Moffitt, T., & Stouthamer-Loeber, M. (1995). Facial expressions of emotion and psychopathology in adolescent boys. *Journal of Abnormal Psychology*, *104*, 644–652. doi:10.1037/0021-843X.104.4.644
- Lazarus, R. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.
- Levenson, R. W. (1999). The intrapersonal functions of emotion. *Cognition and Emotion*, *13*, 481–504. doi:10.1080/026999399379159
- Levenson, R. W. (2003). Autonomic specificity and emotion. In R. J. Davidson, K. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 212–224). New York, NY: Oxford University Press.
- Matsumoto, D. (2005). Scalar ratings of contempt expressions. *Journal of Nonverbal Behavior*, *29*, 91–104. doi:10.1007/s10919-005-2742-0
- Matsumoto, D., & Ekman, P. (1988). *Japanese and Caucasian Facial Expressions of Emotion and Neutral Faces (JACFEE and JACNeuF)*. Retrieved from <http://www.humintell.com>
- Matsumoto, D., Haan, N., Gary, Y., Theodorou, P., & Cooke-Carney, C. (1986). Preschoolers' moral actions and emotions in Prisoner's Dilemma. *Developmental Psychology*, *22*, 663–670. doi:10.1037/0012-1649.22.5.663
- Matsumoto, D., & Hwang, H. C. (2013). *Judgments of subtle facial expressions of emotion*. Advance online publication. doi:10.1037/a0035237
- Matsumoto, D., Hwang, H. C., & Frank, M. G. (2014). Emotions expressed in speeches by leaders of ideologically motivated groups predict aggression. *Behavioral Sciences of Terrorism and Political Aggression*, *6*, 1–18. doi:10.1080/19434472.2012.716449
- Matsumoto, D., Hwang, H. C., & Frank, M. G. (2013). Emotions expressed by leaders in videos predict political aggression. *Behavioral Sciences of Terrorism and Political Aggression*. Advance online publication. doi:10.1080/19434472.2013.769116
- Meloy, J. R. (2006). Empirical basis and forensic application of affective and predatory violence. *Australian and New Zealand Journal of Psychiatry*, *40*, 539–547. doi:10.1080/j.1440-1614.2006.01837.x
- Rozin, P., Lowery, L., Imada, S., & Haidt, J. (1999). The CAD triad hypothesis: A mapping between three moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity). *Journal of Personality and Social Psychology*, *76*, 574–586. doi:10.1037/0022-3514.76.4.574
- Scherer, K. R., & Ellgring, H. (2007). Are facial expressions of emotion produced by categorical affect programs or dynamically driver by appraisal? *Emotion*, *7*, 113–130. doi:10.1037/1528-3542.7.1.113
- Siegel, A., & Victoroff, J. (2009). Understanding human aggression: New insights from neuroscience. *International Journal of Law and Psychiatry*, *32*, 209–215. doi:10.1016/j.ijlp.2009.06.001
- Tomkins, S. S. (1962). *Affect, imagery, and consciousness* (Vol. 1: *The positive affects*). New York, NY: Springer.
- Tomkins, S. S. (1963). *Affect, imagery, and consciousness* (Vol. 2: *The negative affects*). New York, NY: Springer.
- Tooby, J., & Cosmides, L. (2008). The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In M. Lewis, J. M. Haviland-Jones, & L. Feldman Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 114–137). New York, NY: The Guilford Press.

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