

## Affective Intensity and Emotional Responses

Dacher Keltner

*University of Wisconsin-Madison, USA*

Paul Ekman

*University of California, San Francisco, USA*

The AIM, a questionnaire intended to measure affective intensity has, to date, only been related to differences in self-reported intensity of emotional experience (Larsen & Diener, 1987). We investigated whether it is also related to the intensity of facial expressions of emotion shown by subjects after having been startled. Although the AIM was related to some self-report measures of emotion, the AIM was not related to post-startle facial expressions of emotion.

### INTRODUCTION

The Affective Intensity Measure (AIM, Larsen, 1984; Larsen & Diener, 1987) is a widely used measure of individual differences in emotional intensity. Most research on the AIM has related it to other self-report measures of emotion (Larsen & Diener, 1987; Larsen, Diener, & Emmons, 1985; Weed & Diener, 1986). As Larsen and Diener note (1987, p. 11), it is necessary to determine whether the AIM predicts other kinds of emotional response, such as facial expression or autonomic activity. Such evidence pertains to whether the AIM predicts emotional response in general or only self-reported emotion. Research examining whether the AIM predicts measures of emotion other than self-report also avoids the problem of the semantic overlap between the items of the AIM and self-report emotion inventories.

We examined the AIM's relation to the self-report and facial responses associated with being startled by a loud, sudden noise both in an unanticipated and an anticipated condition, both of which produce facial expressions of positive and negative emotion (Ekman, Friesen, & Simons, 1985; Landis & Hunt, 1939). Based on previous research, we expected the AIM to be correlated with self-reports of (1) baseline and (2) post-startle emotion, as well as with (3) facial expressions of emotion.

---

Requests for reprints should be sent to Dr Dacher Keltner, Department of Psychology, 1202 West Johnson Street, University of Wisconsin-Madison, Madison, WI 53706, USA.

Paul Ekman's work is supported by a Research Scientist Award from the National Institute of Mental Health (MH 06092).

## METHOD

## Subjects

Subjects completed the AIM three weeks before the laboratory session in which they were startled. Fifty-five subjects were exposed to the unanticipated startle, and 54 of those subjects to the anticipated startle.

## Procedure

*Video.* A partially concealed, high-resolution video-camera mounted on the wall facing the subject recorded the subject's facial and torso behaviour.

*Startle elicitation.* The startle stimulus was a 110 decibel burst of white noise with a duration of 100 milliseconds that was recorded on a video-tape and transmitted through speakers placed 1 metre directly behind subjects at ear level.

*Experimental instructions.* The startle stimuli were guided by prerecorded, video-taped instructions that were presented on a 27-inch video monitor 1.5 metres in front of subjects. Post-startle self-reports of emotion were gathered in an emotion inquiry guided by an experimenter in an adjacent room who could see the subject on a video-monitor and communicate over an intercom. Subjects were first instructed to "please empty your mind of all thoughts, memories, and emotions" for 30 seconds (the same wording prompted each pre-startle rest period). Subjects then rated their negative and then positive baseline emotion on a 9-point scale used for all self-reports of emotion (0 = no emotion, 8 = the most emotion ever experienced by the subject).

*Unanticipated startle.* Following a 1-minute rest period during which subjects were told white noise would be turned on, subjects again rated their baseline emotion. The unanticipated startle occurred 10 seconds after subjects rated their positive emotion.

*Post-startle emotion inquiry.* After 1 minute the television monitor was turned off and the experimenter asked whether the subject had "experienced any emotions, sensations, or memories". Subjects who reported startle, surprise, anger, fear, sadness, disgust, amusement, or contentment, or terms that through the experimenter's querying were classified as one of those emotions, rated the experienced intensity of each emotion.

*Anticipated startle.* Subjects were then asked to rest, the monitor was turned on, and the following instructions explained the anticipated startle:

This time I want you to know exactly when the loud noise will occur. I will count down from 10 to 1 and when I say 1 the loud noise will happen again.

Following a rest period subjects rated their baseline emotion for a third time and then were asked to look at the screen for the 10-second countdown, which began at 10 and counted to 1 in decrements of 1, at which point the startle stimulus occurred. The experimenter began the post-startle emotion inquiry one minute later.

*Facial measurement.* Facial activity during the startle and for 15 seconds following the startle was scored with Ekman and Friesen's Facial Action Coding System (FACS; 1976, 1978). The duration and intensity (5 levels) of facial activity was scored, as was the intensity (5 levels) of head, shoulder, and trunk movements.

*Reliability of measurement.* Two coders, unaware of subjects' AIM scores, coded the facial behaviour. One person (D.K.) scored all subjects' behaviour, and a second person scored five randomly selected trials from each startle condition. Inter-coder reliability was evaluated by using a ratio in which the number of action units the two coders observed was multiplied by two and then divided by the total number of action units scored by the coders. This agreement ratio was calculated for each event observed by one or both coders. The mean ratio agreement for post-startle events was 0.81. Eighty-six per cent of the coders' intensity ratings were within 1 point of each other.

### Dependent Measures

Based on theory and research (see Ekman, 1984), subjects' facial events were categorised into six emotions (anger, fear, disgust, sadness, contempt, and surprise), blends of emotions, and Duchenne (enjoyment) and nonDuchenne smiles (see Ekman, 1990, for a discussion of the distinction between these two types of smiling). Analyses focused on three measures of the Duchenne smiles, the non-Duchenne smiles, and negative facial expressions that each subject showed. The mean intensity and duration scores of the Duchenne and nonDuchenne smiles were equal to the mean of the intensity and duration scores of the zygomatic major muscle actions; highest intensity scores were equal to the intensity scores of the most intense smile observed in each category. The mean intensity and duration scores for the negative facial expressions were equal to the mean intensity and duration scores of the emotion-relevant facial actions for each negative emotion; highest intensity scores were equal to the intensity scores of the most intense negative expression observed. Because some theorists do not consider the startle itself to be an emotion, we do not report the findings on it here, but focus instead on the emotional reaction to being startled.

## RESULTS

Table 1 presents the occurrence of self-reports and facial expressions of emotion following the two startle conditions.

Because post-startle self-reports and facial expressions of emotion were relatively infrequent, we examined the point biserial correlations between the AIM and emotional response (coded as present or absent) as well as the Pearson correlations.

The AIM was positively correlated with the self-reported intensity of negative emotion reported prior to the experimental trials ( $r = 0.43$ ,  $P < 0.01$ ), prior to the unanticipated startle ( $r = 0.20$ ,  $P < 0.10$ ), and prior to the anticipated startle ( $r = 0.26$ ,  $P < 0.05$ ). The AIM was not significantly correlated with post-startle self-reports of emotion in either condition (all  $P$ s  $> 0.10$ ).

TABLE 1  
Incidence of Self-reports and Facial Expressions of Negative and Positive Emotion after Startle Elicitation

	Condition	
	Unanticipated	Anticipated
% reporting negative emotion	56	42
Mean intensity of negative emotion report	4.42 (1.75)	4.08 (1.55)
% reporting positive emotion	29	17
Mean intensity of positive emotion report	4.57 (1.56)	4.67 (1.58)
% reporting positive or negative emotion	70	60
% showing negative facial expression	30	19
% showing Duchenne smiles	42	19
% showing negative exp. or Duchenne smiles	62	40
% showing nonDuchenne smiles	72	51

Note: Standard deviations are in parentheses.

In each startle condition, we examined the correlations between the AIM and three kinds of expression (Duchenne smiles, nonDuchenne smiles, negative emotion) measured in three ways (mean intensity, mean duration, highest intensity) with two correlations (point biserial, Pearson), or 18 correlations overall. Not one of the correlations between the AIM and Duchenne smiles or facial expressions of negative emotion was significant, all  $P$ s > 0.10.<sup>1</sup> Both the Pearson ( $r = 0.39$ ,  $P < 0.05$ ) and point biserial ( $r = 0.35$ ,  $P < 0.05$ ) correlations between the AIM and the most intense nonDuchenne smile shown during the unanticipated startle condition were significant, although these should be interpreted with extreme caution given the number of correlations examined.

We examined the Pearson and point biserial (coded for each measure as present or absent) correlations between self-report and facial expression measures to determine whether: (1) these measures varied sufficiently to permit significant correlations; and (2) the startle produced a coherent emotional response. In the unanticipated and anticipated conditions, the Pearson ( $r$ s = 0.30 and 0.24) and point

<sup>1</sup> The AIM similarly did not correlate with the magnitude of the startle facial response, or with the report of being startled or surprised. Detailed report of these findings are available from the authors.

biserial ( $r_s = 0.27$  and  $0.32$ ) correlations between self-reports of positive emotion and Duchenne smile intensity scores were significant ( $P_s < 0.05$ ), as were the Pearson correlations ( $r_s = 0.31$  and  $0.23$ ) between self-reports and facial expressions of negative emotion ( $P_s < 0.05$ ).

## DISCUSSION

Our study, the first to examine whether the AIM predicts facial expressions of emotion, questions the generality of the AIM. The AIM was positively correlated with the intensity of self-reports of negative emotion gathered during the baseline periods, consistent with findings showing that the AIM predicts reports of global emotional experience (Larsen & Diener, 1987). Contrary to hypothesis, the AIM did not predict self-reports or facial expressions of emotion following the startle trials. The AIM did predict one measure of nonDuchenne smiles in the unanticipated startle condition, but more than a dozen studies have shown that nonDuchenne smiles are not emotional behaviour (see Ekman, 1990 for review of studies).

Clearly, one limitation of the current study is the use of the startle stimulus as the elicitor of emotion. By design, the AIM was put to the unusually stringent test of predicting emotional response during a brief period (30 seconds total) following a stimulus that primarily elicits a reflex-like response (Davis, 1984; Ekman et al., 1985). Clearly, research is needed that addresses whether the AIM predicts facial expressions of emotion observed over longer time periods in response to more complex emotional stimuli.

Notwithstanding these limitations, the current study suggests that the AIM may only measure self-reports of emotion. The post-startle self-reports and facial expressions of emotion were consistently correlated, suggesting that the startle produced a coherent emotional response much like other more complex, emotional stimuli (e.g. Ekman, Friesen, & Ancoli, 1980). The current study points to the conclusion drawn in other studies (e.g. Blascovich et al., 1992) that the AIM may only measure self-reports of emotional intensity and not the intensity of other components of emotional response, such as elevated heart rate or facial expression.

Manuscript received 9 November 1994

Revised manuscript received 28 July 1995

## REFERENCES

- Blascovich, J., Brennan, K., Tomaka, J., Kelsey, R.M., Hughes, P., Coad, M.L., & Adlin, R. (1992). Affect intensity and cardiac arousal. *Journal of Personality and Social Psychology*, *63*, 164-174.
- Davis, M. (1984). The mammalian startle response. In R.C. Eaton (Ed.), *Neural mechanisms of startle behavior* (pp. 287-351). New York: Plenum Press.
- Ekman, P. (1984). Expression and the nature of emotion. In K. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 319-344). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.
- Ekman, P. (1990). Duchenne and facial expression of emotion. In A. Cuthbertson (Ed. and Transl.), *The mechanism of human facial expression*, by G.B. Duchenne de Boulogna (pp. 270-284). New York: Cambridge University Press.

- Ekman, P., & Friesen, W.V. (1976). Measuring facial movement. *Journal of Environmental Psychology and Nonverbal Behavior*, 1, 56-75.
- Ekman, P., & Friesen, W.V. (1978). *Facial action coding system: A technique for the measurement of facial movement*. Palo Alto, CA: Consulting Psychologists Press.
- Ekman, P., Friesen, W.V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology*, 39, 1125-1134.
- Ekman, P., Friesen, W.V., & Simons, R.C. (1985). Is the startle reaction an emotion? *Journal of Personality and Social Psychology*, 49, 1416-1426.
- Landis, C., & Hunt, W.A. (1939). *The startle pattern*. New York: Farrar, Straus & Giroux.
- Larsen, R.J. (1984). Theory and measurement of affect intensity as an individual difference characteristic. *Dissertation Abstracts International*, 85, 2297B. [University Microfilms No. 84-22112]
- Larsen, R.J., & Diener, E. (1987). Affect intensity as an individual difference characteristic: A review. *Journal of Research in Personality*, 21, 1-39.
- Larsen, R.J., Diener, E., & Cropanzano, R.S. (1987). Cognitive operations associated with individual differences in affective intensity. *Journal of Personality and Social Psychology*, 53, 767-774.
- Larsen, R.J., Diener, E., & Emmons, R.A. (1985). Affect intensity and reactions to daily life events. *Journal of Personality and Social Psychology*, 51, 803-814.
- Weed, R., & Diener, E. (1986). *The relation of controlled emotional stimuli to affective change and intensity*. Unpublished manuscript.