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Subtly Different Positive Emotions Can Be Distinguished by Their Facial Expressions

Marcello Mortillaro[1], Marc Mehu[1], and Klaus R. Scherer[1]

Abstract

Positive emotions are crucial to social relationships and social interaction. Although smiling is a frequently studied facial action, investigations of positive emotional expressions are underrepresented in the literature. This may be partly because of the assumption that all positive emotions share the smile as a common signal but lack specific facial configurations. The present study investigated prototypical expressions of four positive emotions—interest, pride, pleasure, and joy. The Facial Action Coding System was used to microcode facial expression of representative samples of these emotions taken from the Geneva Multimodal Emotion Portrayal corpus. The data showed that the frequency and duration of several action units differed between emotions, indicating that actors did not use the same pattern of expression to encode them. The authors argue that an appraisal perspective is suitable to describe how subtly differentiated positive emotional states differ in their prototypical facial expressions.

Keywords

emotion, positive emotions, facial expression, appraisal

For a long time, emotion research has privileged the study of negative over positive emotions (Fredrickson & Levenson, 1998). However, in recent years, positive emotions have received increased interest, partly because of evolutionary considerations of well-being (Fredrickson, 2001, 2007) and the role of positive emotions in shaping interpersonal processes. Indeed, showing positive emotions promotes social relationships (Shiota, Campos, Keltner, & Hertenstein, 2004) and favors a more inclusive categorization in defining the individual's reference groups (Dovidio, Gaertner, Isen, & Lowrance, 1995). Recent studies have shown that Duchenne smiles (Ekman, 1992) predict social integration (Papa & Bonanno, 2008) and are related to dimensions that are important for prosocial relationships (Brown, Palameta, & Moore, 2003; Mehu, Little, & Dunbar, 2007). Positive emotions are essential to the development of cooperation and social relationships that constitute the core of human sociality (Frank, 1988; Trivers, 1971).

Despite the relevance of positive emotions to individuals and society, the expression of these emotions has been relatively understudied for at least two reasons. First, early studies suggested the existence of facial configurations that correspond to discrete basic emotions (Ekman, Sorenson, & Friesen, 1969; Izard, 1977; Tomkins, 1962, 1963)—anger, fear, sadness, disgust, surprise, and enjoyment—and thus directed research toward them. With only one positive emotion among the set, research focused mainly on negative states (Ekman, 1993). Second, researchers tended to consider all positive emotions as states within the same family with only minor differences in facial expressions (Ekman, 1992, 1993).

However, recent evidence shows that positive affect states not previously considered as basic emotions could show a specific pattern of expressive features (Shiota, Campos, & Keltner, 2003). In particular, Tracy and Robins (2004) found pride to have a distinctive, recognizable pattern of expression that involves a small smile, head tilted back, and other postural elements. Pure facial discrimination remains problematic, however, because the only facial feature in the typical pride expression is the smile, which is also typical of joy expressions.

Discrete emotion theory hypothesizes the simultaneous onset of all constituent expressive features. A more flexible mechanism of production is hypothesized by appraisal theorists (Roseman, Antoniou, & Jose, 1996; Scherer, 1992; Scherer & Ellgring, 2007b; Smith & Scott, 1997), for whom single movements should be regarded as ''indices of appraisal-generated information gathering processes or adaptive action tendencies'' (Scherer & Ellgring, 2007a, p. 120). The mechanism is thus partitioned into a series of appraisal checks, the efferent effects of which cumulate to produce an emergent dynamic expression (Scherer, 1992, 2009). From this perspective, if two emotions have identical outcomes for an appraisal check, their facial expressions display appraisal-specific commonalities. Appraisal

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Table 1. Predictions of the Component Process Model of Emotion

Appraisal domain	Check	Outcome	Action units (AUs)[a]
Relevance	Novelty	Sudden	1 + 2
		Unfamiliar, unpredictable	4 + 7
	Intrinsic pleasantness	Pleasant	12 + 25 + 38
		Unpleasant	9, 10, 15, 39
Implications	Expectation	Discrepant	4 + 7
	Goal attainment	Conducive	6 + 12 + 25
		Obstructive	17 + 23, 17 + 24
Coping potential	Power or control	Low	20, 26, 27
		High	23 + 25, 17 + 23, 6 + 17 + 24
Norm compatibility	External standards	Violated	10
	Internal standards	Violated	14

[a] AUs joined by + represent two or more AUs that are supposed to appear simultaneously; AUs separated by a comma are alternative outcomes. AU description: AU 38 = nostril dilatation; AU39 = nostril compression; AU14 = dimpler. For a description of the other AUs, see Table 4.
Source: Modified from Scherer and Ellgring (2007a).

Table 2. Illustrative Descriptions of the Four Emotions Included in the Present Study

Emotion	Description
Pride	Feeling of triumph following a success or a personal achievement (of one's own or that of someone close)
Interest	Being attracted, being fascinated, or having one's attention captured by a person or a thing
Joy (elated)	Feeling of great happiness caused by an unexpected event
Pleasure (sensory)	Experiencing an extraordinary feeling of well-being or sensual delight

outcomes that differ between two emotions account for differences between their expressions. In the framework of the component process model of emotion (CPM), Scherer (1984, 2001) elaborated appraisal-related predictions for facial expression (Table 1), and—although most predictions still require investigation—growing evidence supports this perspective (Scherer, 2009).

In this article, we focus on four positive emotions: elated joy, pride, sensory pleasure, and interest. Virtually all studies that investigate the facial expression of emotions include the prototypical or modal positive emotion (Scherer, 1994, 2001) labeled either joy or happiness.[1] The central expression associated with joy—the Duchenne smile—is believed to be common to most positive emotions (Ekman & Friesen, 1982). Pride has been empirically shown to be a positive emotion with a distinct, recognizable expression that goes beyond a simple smile, as described by Tracy and Robins (2004, 2008), and is expected to be based on appraisal characteristics that are different from those of joy.

The remaining two emotions can be considered as "borderline" positive emotions: They are not always considered as positive (interest) or as emotion (sensory pleasure).[2] Sensory pleasure was included because it is based on physical sensations that produce changes in other emotion components (Ekman, 2003; Ekman & Friesen, 1982; Lazarus, 1991; Scherer, 2001) and so might differ from other positive emotions. Interest is characterized by an appraisal structure that differs from that expected for simple enjoyment (Silvia, 2005). Two appraisal checks seem to have high relevance for determining interest: novelty or complexity and coping potential. Ellsworth and Smith (1988) hypothesized that the evaluation of pleasantness is part of the appraisal profile that leads to interest, whereas Silvia (2005) did not find the appraisal of pleasantness as necessary for interest. In our description, interest is a mildly positively valenced state (Table 2). The expression of interest involves facial features such as eye closure, eyeball exposure, eyebrows down, and duration of lips parting (Reeve, 1993; Reeve & Nix, 1997; Tomkins & McCarter, 1964). Recently, Scherer and Ellgring (2007a) found the presence of smiles in almost a third of the examined portrayals of interest.

The main objectives of the present research are to investigate (a) whether there are stable differences among the facial expressions of these four positive emotions and (b) whether these differences are emotion specific and/or if they can be plausibly interpreted as efferent results of emotion-specific appraisal checks (Scherer, 1992, 2001).

Method

Emotion Portrayals

A total of 40 audio-video emotion portrayals were selected from the Geneva Multimodal Emotion Portrayals database on the basis of high recognition rates for the targeted emotion (Bänziger & Scherer, 2010). Each of the four emotions is instantiated by 10 portrayals (by 10 professional actors). Actors were provided, beforehand, with short illustrative descriptions of the emotional states (Table 2) and emotion scenarios, which established a "minimal context" for the expression (for a more complete description, see Bänziger & Scherer, 2007, 2010; Scherer & Bänziger, 2010).[3]

Table 3. Appraisal Outcomes of the Four Positive Emotions for the Appraisal Checks of Suddenness, Intrinsic Pleasantness, and Goal Conduciveness

	Suddenness	Intrinsic pleasantness	Goal conduciveness
Pride	Open	Open	Open
Interest	Sudden	Open	Open
Joy	Sudden	Pleasant	Goal conducive
Pleasure	Open	Pleasant	Open

Facial Action Coding System (FACS) Coding

Each portrayal was FACS coded (Ekman, Friesen, & Hager, 2002) by two certified FACS coders (average interobserver agreement = .86) with ANVIL software (Kipp, 2004). A total of 21 action units (AUs) were statistically analyzed (see Table 4 for the list), each coded from beginning to end. A new AU was recorded each time that a new onset was observed or when it was seen increasing after a decrease in intensity. The apex of each AU was also recorded. Speech was coded as Action Descriptor 50, and, except for AUs 25, 26, and 27 (coded only before and after the utterance), all other AUs were coded during speech by using guidelines in the FACS manual (Ekman et al., 2002).

For each AU, three variables were defined: (a) *AU presence* indicated whether an AU was displayed, (b) *AU apex rate per second* (frequency of apexes divided by clip duration) measured occurrences of the AU while controlling for the total portrayal duration, and (c) *AU duration* (AU duration divided by portrayal duration) estimated the temporal prevalence of an AU in the complete emotional portrayal.

Appraisal Profiles

To evaluate whether appraisal differences are potential factors for the facial behaviors coded in the portrayals, we identified the appraisal profiles that typically characterize the four emotions studied. We used empirical evidence on the cross-cultural meaning of emotion terms (Fontaine, Scherer, Roesch, & Ellsworth, 2007), which includes features for the appraisal component. Differences among the four positive emotions included in our study were found for three appraisal checks: suddenness, intrinsic pleasantness, and goal conduciveness (Table 3).[4] Although appraisal theories posit that the result of an evaluation is continuous and not discrete (e.g., moderately pleasant or unpleasant, very pleasant or unpleasant), it was necessary to transform the output into discrete categories. To avoid overstating the differences among emotions, we restricted specific appraisal labels (e.g., *pleasant*, *goal conducive*) to those cases in which the results were unambiguous, leaving all other cases as "open" (i.e., undetermined).

Elated joy is characterized by an eliciting event appraised as sudden, pleasant, and goal conducive, confirming theoretical predictions (Scherer, 2001). The eliciting event of pride is not characterized by these three specific appraisals (open outcome in all three checks). Intuitively, sudden is not a necessary prerequisite for experiencing pride. Intrinsic pleasantness for pride was rated high, but the large standard deviation led to classify this appraisal check as open (the supplemental materials are available at http://spp.sagepub.com/supplemental). A possible explanation of the large standard deviation is the double-edged nature of pride, authentic and *hubristic*, the latter being sometimes characterized by negative descriptors (Carver, Sinclair, & Johnson, in press; Tracy & Robins, 2007). In the available data, researchers did not make this distinction, and raters may have described the typical meaning of either of the two different types of pride. Finally, the undetermined outcome for goal conduciveness may be because the object of pride is the achievement rather than the goal conduciveness of an event. Interest is characterized by a sudden appraisal and open outcomes for intrinsic pleasantness and goal conduciveness checks. This profile confirms the proposition of Silvia (2005) that novelty (suddenness is part of the novelty check) is a critical appraisal outcome characteristic of this emotion. Pleasure is characterized by an event appraised as pleasant and open for goal conduciveness and suddenness. A pleasant appraisal was theoretically expected, and the undetermined outcomes for suddenness and goal conduciveness can be explained similarly to the case of pride: Pleasure is the enjoyment of an ongoing agreeable sensation, and the goal has already been reached.

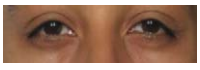
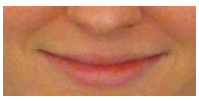
Results

The mean proportion of occurrence for each coded AU in the four emotions is reported in Table 4. AUs that occurred in fewer than 15% of the portrayals were excluded from subsequent analyses (AU9, AU16, AU24, and AU28).

To test whether there were differences in facial expression among the four emotions, we performed for each AU two ANOVAs with repeated measures, one on the AU apex rate and one on the AU duration, with emotion as the within-subjects factor (four levels). Additional contrasts were performed by comparing groups of emotions based on their outcome on the three appraisal checks: suddenness (pride and pleasure vs. interest and joy), intrinsic pleasantness (pride and interest vs. joy and pleasure), and goal conduciveness (joy vs. pride, interest, and pleasure). A significant effect of emotion on apex rate was found for six AUs: AU1, $F(3, 27) = 4.83$, $p < .05$; AU2, $F(3, 27) = 5.25$, $p < .05$; AU6, $F(3, 27) = 5.31$, $p < .01$; AU12, $F(3, 27) = 6.36$, $p < .01$; AU17, $F(3, 27) = 5.28$, $p < .01$; and AU43, $F(3, 27) = 4.60$, $p < .05$ (Figure 1). A significant effect of emotion on AU duration was also found for six AUs: AU1, $F(3, 27) = 8.73$, $p < .001$; AU2, $F(3, 27) = 10.63$, $p < .001$; AU6, $F(3, 27) = 6.83$, $p < .01$; AU7, $F(3, 27) = 4.77$, $p < .01$; AU17, $F(3, 27) = 6.72$, $p < .01$; and AU43, $F(3, 27) = 5.42$, $p < .01$ (Figure 2).[5]

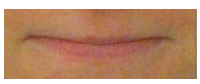
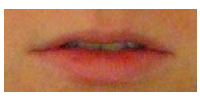
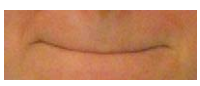
Among the 21 AUs analyzed, 7 appeared to be used with different proportions across the selected positive emotions. This result suggests a sizeable variation in expressive patterns among the four emotions. AU1 and AU2 have been shown to have very salient communicative functions, and they are likely more controlled than other AUs (Ekman, 1979). AU6 and AU12 are typical facial movements involved in the expression

Table 4. Mean Proportion of Occurrences of the 21 Coded Action Units (AUs) in the Four Emotions and Reliability of Coding for Each AU

AU		Cohen's κ	Pride	Interest	Joy	Pleasure	Total
AU1: Inner brow raiser		.87	.60	.40	.70	.30	.500
AU2: Outer brow raiser		.90	.60	.50	.80	.20	.525
AU4: Brow lowerer		.85	.40	.50	.40	.00	.325
AU5: Upper lid raiser		.84	.00	.40	.30	.00	.175
AU6: Cheek raiser		.88	.70	.20	.90	.80	.650
AU7: Lid tightener		.99	.60	.90	.30	.80	.650
AU9: Nose wrinkler		.78	.00	.10	.30	.10	.125
AU10: Upper lip raiser		.92	.70	.60	.70	.70	.675
AU12: Lip corner puller		.90	1.00	.80	1.00	1.00	.950
AU15: Lip corner depressor		.78	.20	.20	.20	.20	.200
AU16: Lower lip depressor		.99	.10	.10	.30	.00	.125

(continued)

Table 4 (continued)

AU		Cohen's κ	Pride	Interest	Joy	Pleasure	Total
AU17: Chin raiser		.62	.90	.70	.90	.50	.750
AU18: Lip puckerer		.47	.50	.50	.10	.50	.400
AU20: Lip stretcher		.92	.40	.30	.10	.00	.200
AU22: Lip funneler		.78	.20	.30	.00	.10	.150
AU23: Lip tightener		.78	.20	.30	.10	.10	.175
AU24: Lip pressor		1	.10	.10	.10	.20	.125
AU25: Lips part		1	.90	1.00	.90	1.00	.950
AU26: Jaw drops		.92	.40	.50	.80	.70	.600
AU28: Lips suck		1	.20	.20	.00	.10	.125
AU43: Eye closure		1	.40	.00	.00	.60	.250

Note: Each emotion category consists of 10 portrayals.

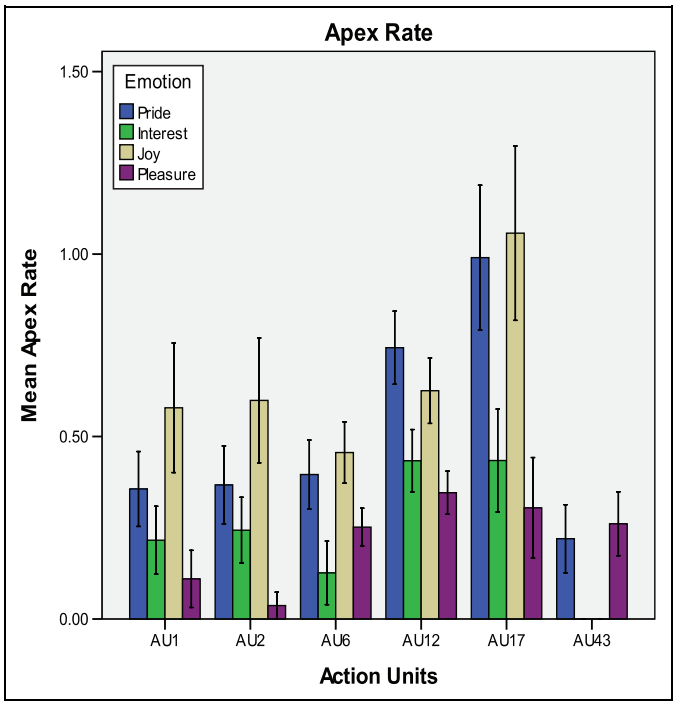


Figure 1. Mean values of apex rate for the action units (AUs) that were significant in the ANOVA
Note: Error bars represent ± 1 standard error.

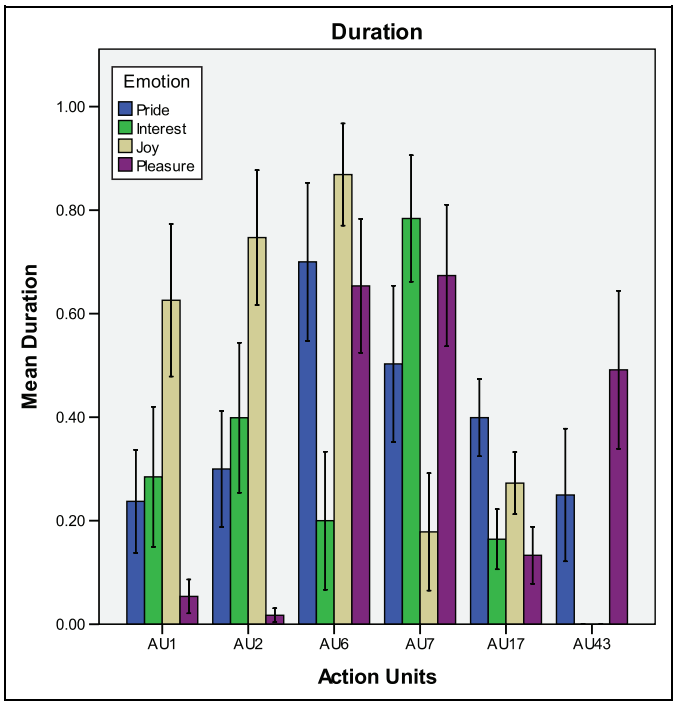


Figure 2. Mean values of duration for the action units (AUs) that were significant in the ANOVA
Note: Error bars represent ± 1 standard error.

of positive emotions; still, these AUs could have important functions in conveying subtle differences. AU7 and AU43 concern the movements of the eyelids, and no specific relationship has been found with positive emotions, except for interest with eye closure (Reeve, 1993). Finally, AU17 (chin raiser) has been linked to coping potential and goal obstruction, but no specific relationship with positive emotions has been predicted (Table 1).

Differences Among Discrete Emotions

To assess whether these differences are specific to the encoding of different positive emotions, we looked at the pairwise comparisons among the four emotions (Table 5). Results grouped emotions into two pairs, pride and joy versus interest and pleasure. No difference was observed between the emotions of a pair, but both emotions in a pair differed from the emotions in the other pair.

Pride portrayals showed more frequent but shorter smiles (AU12) compared to interest and pleasure. This result corresponds with recent descriptions of a prototypical expression of pride that includes a "small smile" (Tracy & Robins, 2004, 2008). The AU12 apex rate was the only difference between pride and interest, whereas AU17 and AU2 distinguished pride from pleasure. Scherer and Ellgring (2007a) also reported a high proportion of AU17 in pride expression, indicating that this feature could be a key element in pride, even though this has not been explicitly hypothesized in previous accounts.

Joy was clearly distinguished from interest by the more frequent and longer presence of AU6. AU6 is generally considered typical for the expression of the family of enjoyable emotions (Ekman, 2003), and the current results show variations in its use in the expressions of different positive emotions. However, AU6 did not differentiate joy from pride or pleasure, and so this AU cannot be considered as specific to joy only. Similarly, AU1 and AU2 distinguished joy from pleasure, but not from pride or interest, and thus cannot be considered a distinctive feature of joy despite its frequent occurrence. It is noteworthy that Ekman and Friesen (2003) did not consider AU1 and AU2 as elements of the prototypical expression of joy, but their presence is expected for expressions that result from the blend of joy and surprise (elated joy).

Interest was different from joy for AU6 and from pride for AU12. This finding supports the claim of Silvia (2008) that interest displays do not systematically include cheek raise (AU6), which is considered a reliable marker of an "enjoyment smile." Interest was also distinguished from joy by the longer presence of AU7. This AU (lid tightener) can be considered a FACS equivalent of "eye closure," a behavior that has already been suggested as a marker of interest (Reeve, 1993) and could reflect the cognitive effort that results from focusing attention (Silvia, 2008). This difference was found only for the duration of the AU, signaling the importance of considering the temporal unfolding of the expression.

Pleasure showed less frequent smiles (AU12) than did pride (but not less than joy), and "eyebrow rise" movements (AU1 and AU2) were less present in pleasure than in joy and pride. This finding confirms Ekman and Friesen's (1982) suggestion that there are different forms of smiling used in different proportions across different emotional expressions. Pleasure

Table 5. Summary of the Significant Differences in Apex Rate and Duration for the Different Action Units (AUs) Among the Four Emotions (Pairwise Comparisons With Bonferroni Correction)

Emotion 1	Emotion 2	AU	Variable	Mean difference (Emotion 1 – Emotion 2)	*p*
Pride	Interest	AU12	Apex rate	.31	.031
Pride	Pleasure	AU2	Apex rate	.33	.046
		AU12	Apex rate	.40	.035
		AU17	Duration	.27	.021
		AU17	Apex rate	.69	.012
Pride	Joy	None			
Joy	Interest	AU6	Duration	.67	.009
		AU6	Apex rate	.33	.028
		AU7	Duration	–.61	.012
Joy	Pleasure	AU1	Duration	.57	.016
		AU2	Duration	.73	.002
		AU2	Apex rate	.56	.042
Interest	Pleasure	None			

Table 6. Summary of the Significant Contrasts of Emotions Based on Appraisal Dimensions on Action Unit (AU) Apex Rate and Duration

Appraisal dimension	AU	Variable	*F*(1, 9)	*p*	*r*
Suddenness	AU1	Duration	13.08	.006	.77
	AU2	Duration	22.04	.001	.84
	AU43	Apex rate	15.92	.003	.80
		Duration	15.29	.004	.79
Intrinsic pleasantness	AU6	Duration	9.71	.012	.72
Goal conduciveness	AU1	Duration	11.79	.007	.75
	AU2	Duration	14.32	.004	.78
	AU6	Duration	5.82	.039	.63
	AU7	Duration	10.80	.009	.74
	AU43	Apex rate	15.92	.003	.80
		Duration	15.29	.004	.79

Figure 3. Hypothesized expressive mapping of the appraisal check of suddenness
Note: The degree that eyes open supposedly reflects the degree of suddenness of the appraised event.

seems to be characterized by a different smiling behavior, marked by a more infrequent occurrence and shorter duration of the ''eyebrow rise'' configuration in conjunction with the smile.

These results indicate systematic differences in the expressions of diverse positive emotions, but no emotion-specific prototype emerged from the analysis. Several features distinguish different pairs of emotions, but no feature clearly sets one emotion apart from the others nor distinguishes pride from joy or interest from pleasure. This might seem to confirm Ekman's (1993) proposition that these emotions belong to the same emotion family, and the identification of emotion-specific features is likely to be inconclusive.

Appraisal Checks and Facial Expressions

However, this conclusion is at odds with the fact that judges were able to categorize the emotional portrayals into the four categories with high accuracy. Also, the present results show systematic differences between their respective facial expressions, suggesting that judges' performance must be based on emotion-specific cues. Thus, we examined whether differences and commonalities can be plausibly explained with typical appraisal profiles for these emotions (and the expressions they engender). For doing this, we contrasted emotions by grouping them based on their outcomes for the three appraisal checks: suddenness (pride and pleasure vs. interest and joy), intrinsic pleasantness (pride and interest vs. joy and pleasure), and goal conduciveness (joy vs. pride, interest, and pleasure).

Analysis of contrasts showed variation in the use of different AUs for the three appraisal checks under consideration (Table 6). Larger effects were found for duration variables (AU1, AU2, AU6, AU7, and AU43) than for apex rates (AU43), suggesting that an appraisal account of emotional expressions might be best investigated using *temporal aspects.* This is in line with the argument that specific facial movements are activated as effects of appraisal outcomes that cumulate sequentially rather than being activated from scratch several times during the expression (Scherer, 2001).

Contrasting the expressions on the basis of underlying appraisal checks revealed meaningful consistencies. The longer duration of AU1 and AU2 in emotions characterized by a sudden appraisal replicated earlier findings (Smith & Scott, 1997) and confirmed CPM predictions (Table 1). In contrast, AU43 (eye closure) was present in emotions that did not have a sudden appraisal—pride and pleasure. Contrasting AU43 with AU1 and AU2 yielded a continuous behavioral reference onto which the suddenness appraisal could be mapped. The degree of suddenness may be partly expressed by the degree

of eye opening (Figure 3). This speculation was further supported by the result related to AU5 (upper lid raiser): Although nonsignificant in the general ANOVA, AU5 was present only in emotions characterized by a sudden appraisal. This behavior appears to be easily explainable in relation to adaptation: The person faces an unexpected situation, and opening one's eyes wide can be seen as information-seeking behavior.

Contrasting the emotions on the basis of appraisal of intrinsic pleasantness revealed that the characteristic feature is the presence of AU6 in emotions that included a pleasant appraisal. The CPM predicted the presence of AU12 and not AU6 (see Table 1). The absence of any difference related to AU12 agrees with the idea that this AU is the common signal for all positive emotions, whereas differential use of AU6 distinguishes between the enjoyment smile and other forms of smiling.

The presence of a goal conducive appraisal was related to a longer activation of AU1, AU2, and AU6. On one hand, this appraisal check contrasted joy against the other three emotions, with joy being characterized by both a sudden and pleasant appraisal: Findings for the goal conducive appraisal can depend on the two other checks (i.e., AU1 and AU2 related to sudden appraisal, and AU6 related to pleasant appraisal). On the other hand, current results seem to support the CPM predictions for AU6 being an efferent effect of a goal conducive appraisal, even though the pleasant appraisal can have a confounding effect. We find it interesting that emotions without a clear goal conducive appraisal showed a longer temporal presence of AU7 and AU43. We speculate that indetermination for this appraisal involves uncertainty and relates to an expressive feature of concentration (AU7) or retreat (AU43).

Discussion

The current research indirectly tested the hypothesis that facial expressions can be viewed as appraisal-related movements. A direct test requires direct manipulation of each appraisal check (e.g., Johnstone, van Reekum, Hird, Kirsner, & Scherer, 2005) but is virtually impossible to apply to many emotions and interdependent appraisal checks. A suitable approach is to rely on plausibility analysis of the observed frequency and patterning of AU occurrences in well-recognized actor portrayals (Scherer & Ellgring, 2007a). Although this approach does not allow drawing conclusions about underlying causes, it is appropriate for assessing whether an appraisal perspective can be useful and meaningful for studying emotional expression (Scherer, 2000). Actors use different facial movements to convey different positive emotions that are correctly inferred by judges. Our research approach allows testing the possibility that these different movements are used (by both actors and judges) in ways that are consistent with the typical appraisal structure of those emotions as described in Table 2. More importantly, it can be argued that these prototypical portrayals result from communicative intentions that, along with physiological effects, usually drive emotional expression in social contexts (Scherer, 1985; Scherer & Bänziger, 2010; Scherer & Ellgring, 2007a; Scherer & Kappas, 1988).

Our study has some limitations. First, to ensure that expressions would be reliable and comparable we used illustrative word descriptions and scenarios to ensure that actors would portray emotional experiences of a similar nature. The drawback of this approach is that the expressions produced may have been in part determined by the way we described the emotions; other descriptions of the four emotion terms may have resulted in somewhat different expressions. However, it seems preferable to use standardized emotion descriptions rather than risking differential interpretations of emotion terms by the actors. Second, we derived the appraisal profiles from a study on the cross-cultural meaning of emotion words, that is, typical appraisals implied by the typical meaning of the word. It would be desirable to complement this approach by experimental paradigms or diary studies to assess which appraisals are necessary for actual experiences of one particular emotion. So, for example, we could verify how frequently suddenness is involved in the experience of elated joy. Third, even if most available studies of emotion expression used fewer than 10 actors, our sample size is still rather small, and future studies should use a larger set of portrayals to increase statistical power. Finally, we used prototypical acted portrayals for testing the general plausibility of an appraisal account. Future studies should attempt, despite the numerous difficulties and constraints, to test specific hypotheses on spontaneous expressions of emotion, expressions that may have different characteristics from acted expressions.

Two major conclusions can be drawn from the present results: First, comparing emotions by using discrete categories did not show significant differences between, for example, joy and pride, whereas contrasting emotions for appraisal checks showed significant differences. In the case of subtly differentiated positive emotions, the many commonalities in the facial expressive features render the identification of emotion-specific configurations more difficult. The four emotions studied here are nevertheless encoded by actors in different ways, as we hypothesized from their strong interpersonal relevance. The differences found do not seem to be the product of an on–off affect program mechanism, as witnessed by the difficulty of identifying emotion-specific facial configurations but rather the cumulative result of a series of individual facial actions. The appraisal perspective suggests that the many commonalities in the appraisal profiles of these emotions are reflected in similarities in the facial expressions, with few differences because of variations in specific appraisal checks that differentiate the emotional quality. An alternative explanation compatible with a discrete perspective would be that some positive emotions co-occurred, limiting the possibility of identifying emotion-specific features. For example, several studies have shown that the experience of joy frequently involves achievement that is also a key element for pride (Smith & Ellsworth, 1987; Summerfield & Green, 1986). This explanation is compatible with an appraisal perspective: The experience of mixed emotions depends on the arrangement of appraisals that can generate emotion processes without clear categorical boundaries (Scherer, 2009). Future studies should use an induction paradigm and measure the extent to which different positive emotions typically co-occur.

Second, comparisons among discrete emotion categories showed the same number of AUs being affected for either apex rate or duration. Conversely, contrasts based on appraisal checks showed more differences concerning AU durations than AU apex rates. As theoretically proposed (Scherer, 1992), the dynamics of emotional expression are essential for analyzing and differentiating expressive behaviors. In particular, we argue that it is not the simple presence of an AU that conveys certain information but rather the unfolding of an AU pattern with all its temporal characteristics. Subtle differences among emotions may be more clearly conveyed by the dynamics of the expressions than by the presence of different AU combinations.

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Notes

1. No systematic distinction between elated joy and quiet happiness is made in the literature, even though they intuitively refer to two rather different emotional experiences. We used elated joy (abbreviated as joy) to better differentiate it from sensory pleasure.
2. With *sensory pleasure*, we mean something more specific than the valence dimension in dimensional approaches to emotions (Russell, 2003).
3. Scenarios can be downloaded from http://www.affective-sciences.org/gemep.
4. The details of the procedure through which the appraisal profiles were computed are available as supplemental material at http://spp.sagepub.com/supplemental.
5. Because of space limitation we did not include a table reporting means and standard deviations of apex rate and duration for all the coded action units. It can be downloaded from http://www.affective-sciences.org/gemep/positive_emotions.

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