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What are emotions? And how can they be measured?

Abstract. *Defining "emotion" is a notorious problem. Without consensual conceptualization and operationalization of exactly what phenomenon is to be studied, progress in theory and research is difficult to achieve and fruitless debates are likely to proliferate. A particularly unfortunate example is William James's asking the question "What is an emotion?" when he really meant "feeling", a misnomer that started a debate which is still ongoing, more than a century later. This contribution attempts to sensitize researchers in the social and behavioral sciences to the importance of definitional issues and their consequences for distinguishing related but fundamentally different affective processes, states, and traits. Links between scientific and folk concepts of emotion are explored and ways to measure emotion and its components are discussed.*

Key words. *Affective processes – Emotion – Feeling – Folk concepts of emotion – Measurement of emotion – Scientific concepts of emotion*

Résumé. *Définir les emotions est un problème bien connu. Sans consensus quant à la conceptualisation et l'opérationnalisation du phénomène exact que l'on étudie, tout*

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progrès en termes de théorie et de recherche se révèle difficile et il est vraisemblable que l'on assiste à des débats infructueux. Un exemple particulièrement malheureux en est la question posée par William James "Qu'est-ce qu'une 'émotion'" alors qu'en réalité il s'interrogeait sur ce qu'était un "sentiment", malheureuse dénomination qui lança un débat qui plus d'un siècle plus tard perdure encore. Cet article souhaite sensibiliser les chercheurs en sciences sociales et sciences du comportement à l'importance des problèmes de définitions et à leurs conséquences pour opérer une distinction entre des processus, des états et des traits affectifs liés, mais fondamentalement différents. L'article examine les relations entre les concepts scientifiques des émotions et les concepts populaires et discute les manières de mesurer les émotions et leurs composantes.

Mots-clés. *Concepts populaires des émotions – Concepts scientifiques des émotions – Emotion – Mesure des émotions – Processus affectifs – Sentiment*

One of the major drawbacks of social science research is the need to resort to everyday language concepts in both theory and empirical investigation. The inherent fuzziness and the constant evolution of these language categories as well as inter-language, inter-cultural, and inter-individual differences make it difficult to define central working concepts in the universal, invariant, and consensual fashion generally required by a systematic scientific approach. Isolated attempts to artificially create more appropriate concepts that are unaffected by the multiple connotations of natural language terms (e.g. Cattell's attempt to create a new taxonomy of personality traits using synthetic labels; Cattell, 1990) seem doomed to failure, not only because of the difficulty of obtaining widespread consensus in the scientific community but also because of the need of much of social science to work with lay persons' self-report, which makes it mandatory to employ lay or naive concepts.

The concept of "emotion" presents a particularly thorny problem. Even though the term is used very frequently, to the point of being extremely fashionable these days, the question "What is an emotion?" rarely generates the same answer from different individuals, scientists or laymen alike. William James tried to give an authoritative answer in 1884, but only started a continuing debate which is currently finding renewed vigor (Niedenthal et al., 2005). The number of scientific definitions proposed has grown to the point where counting seems quite hopeless (Kleinginna and Kleinginna already reviewed more than one hundred in 1981). In frustration,

scientists have attempted to have recourse to the analysis of the everyday use of the folk concepts: emotions are what people say they are (e.g. Averill, 1980; Frijda et al., 1995). However, as the debate in this journal, following the report of the first quasi-representative study of emotional experience (Scherer et al., 2004; Scherer, 2004a) has shown, scholars from different disciplines in the humanities and the social and behavioral sciences rarely agree on how to use this evidence. While this kind of conceptual and definitional discussion can have a stimulating effect in the short run, it can have stifling consequences for the advancement in the field and for collaborative research between different disciplines. At a time when it is increasingly recognized that affective and emotional phenomena need to be addressed in a genuinely inter-disciplinary fashion (see the *Handbook of the Affective Sciences*; Davidson et al., 2003b), it becomes imperative to generate a minimal consensus about the defining features of the different types of affective phenomena.

In this piece I do not systematically review these issues. Rather, I want to describe and defend a programmatic statement of a *component process* definition of emotion that I first proposed in 1982 in this journal (Scherer, 1982; see also Scherer, 1984a, 2001). Mention of "componential theories of emotion" is quite widespread today and the notion of emotions as component processes seems to gain increasing acceptance. Following a brief description of the component process definition, I examine what the defining characteristics of emotion are and how these differ from other affect states. In addition, I explore the problem of linking folk concepts of emotion to a scientific, component process conceptualization. Finally, I discuss how emotions can best be measured empirically and introduce two new instruments.

A component process definition of emotion and feeling

In the framework of the component process model, emotion is defined as *an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism* (Scherer, 1987, 2001). The *components* of an emotion episode are the respective states of the five subsystems and the *process* consists of the coordinated changes

over time. Table 1 shows the relation between components and subsystems as well as presumed substrata and functions. Three of the components have long-standing status as modalities of emotion – expression, bodily symptoms and arousal, and subjective experience. The elicitation of action tendencies and the preparation of action have also been implicitly associated with emotional arousal (e.g. fight–flight tendencies) but it is only after explicit inclusion of these motivational consequences in componential theories (and Frijda's forceful claim for the emotion-differentiating function of action tendencies, see Frijda, 1986, 1987), that these important features of emotion episodes have acquired the status of a major component in their own right. The inclusion of a cognitive, information processing component, as I have suggested above, is less consensual. Many theorists still prefer to see emotion and cognition as two independent but interacting systems. However, one can argue that all subsystems underlying emotion components function independently much of the time and that the special nature of emotion as a hypothetical

TABLE 1
Relationships between organismic subsystems and the functions and components of emotion

Emotion function	Organismic subsystem and major substrata	Emotion component
Evaluation of objects and events	Information processing (CNS)	Cognitive component (appraisal)
System regulation	Support (CNS, NES, ANS)	Neurophysiological component (bodily symptoms)
Preparation and direction of action	Executive (CNS)	Motivational component (action tendencies)
Communication of reaction and behavioral intention	Action (SNS)	Motor expression component (facial and vocal expression)
Monitoring of internal state and organism–environment interaction	Monitor (CNS)	Subjective feeling component (emotional experience)

Note: CNS = central nervous system; NES = neuro-endocrine system; ANS = autonomic nervous system; SNS = somatic nervous system.

construct consists of the coordination and synchronization of all of these systems during an emotion episode, driven by appraisal (Scherer, 2004b).

How can emotions, as defined above, be distinguished from other affective phenomena such as feelings, moods, or attitudes? Let us take the term *feeling* first. As shown in Table 1, the component process model reserves the use of this term for the subjective emotional experience component of emotion, presumed to have an important monitoring and regulation function. In fact, it is suggested that "feelings integrate the central representation of appraisal-driven response organization in emotion" (Scherer, 2004b), thus reflecting the total pattern of cognitive appraisal as well as motivational and somatic response patterning that underlies the subjective experience of an emotional episode. Using the term *feeling*, a single component denoting the subjective experience process, as a synonym for *emotion*, the total multi-modal component process, produces serious confusions and hampers our understanding of the phenomenon. In fact, it can be argued that the long-standing debate generated by William James's peripheral theory of emotion is essentially due to James's failure to make this important distinction: when in 1884 he asked "What is an emotion?", he really meant "What is a feeling?" (see Scherer, 2000a).

Using a design feature approach to distinguish emotion from other affective phenomena

Having clarified the distinction between emotion and feeling, it remains to differentiate emotion (with feeling as one of its components) from other types of affective phenomena. Instances or tokens of these types, which can vary in degree of affectivity, are often called "emotions" in the literature (or at least implicitly assimilated with the concept). Examples are liking, loving, cheerful, contemptuous, or anxious. I have suggested four such types of affective phenomena that should be distinguished from emotion proper, although there may be some overlap in the meaning of certain words: preferences, attitudes, affective dispositions, and interpersonal stances. How can we differentially define these phenomena in comparison to emotion?

The difficulty of differentiating emotion from other types of affective phenomena is reminiscent of a similar problem in defining the

specificity of language in comparison with other types of communication systems, human or animal. The anthropological linguist Charles Hockett made a pioneering effort to define 13 elementary design features of communication systems, such as semanticity, arbitrariness, or discreteness, that can be used for the profiling of different types of communication, allowing him to specify the unique nature of language (Hockett, 1960; see summary in Hauser, 1996: 47–8).

I suggest that we use some of the elements of the definition of emotion suggested above for such a distinction. These elements of features can be seen as equivalent to design features in Hockett's sense. These features will now be described in detail.

Event focus

The definition given above suggests that emotions are generally elicited by *stimulus events*. By this term I mean that something happens to the organism that stimulates or triggers a response after having been evaluated for its significance. Often such events will consist of natural phenomena like thunderstorms or the behavior of other people or animals that may have significance for our well-being. In other cases, one's own behavior can be the event that elicits emotion, as in the case of pride, guilt, or shame. In addition to such events that are more or less external to the organism, *internal events* are explicitly considered as emotion elicitors by the definition. These could consist of sudden neuroendocrine or physiological changes or, more typically, of memories or images that might come to our mind. These recalled or imagined representations of events can be sufficient to generate strong emotions (see also the debate between Goldie, 2004, Parkinson, 2004, and Scherer, 2004a, in this journal). The need for emotions to be somehow connected to or anchored in a specific event, external or internal, rather than being free-floating, resulting from a strategic or intentional decision, or existing as a permanent feature of an individual, constitutes the event focus design feature.

Appraisal driven

A central aspect of the component process definition of emotion is that the eliciting event and its consequences must be *relevant to*

major concerns of the organism. This seems rather obvious as we do not generally get emotional about things or people we do not care about. In this sense, emotions can be seen as *relevance detectors* (Frijda, 1986; Scherer, 1984a). Componential theories of emotion generally assume that the relevance of an event is determined by a rather complex yet very rapidly occurring evaluation process that can occur on several levels of processing ranging from automatic and implicit to conscious conceptual or propositional evaluations (Leventhal and Scherer, 1987; van Reekum and Scherer, 1997). The component process model postulates that different emotions are produced by a sequence of cumulative stimulus evaluation or appraisal checks with emotion-specific outcome profiles (Ellsworth and Scherer, 2003; Scherer, 1984a, 1993, 2001). For the purposes of design feature analysis I suggest distinguishing between intrinsic and extrinsic appraisal. Intrinsic appraisal evaluates the feature of an object or person independently of the current needs and goals of the appraiser, based on genetic (e.g. sweet taste) or learned (e.g. bittersweet food) preferences (see Scherer, 1987, 1988). Transactional appraisal (see Lazarus, 1968, 1991) evaluates events and their consequences with respect to their conduciveness for salient needs, desires, or goals of the appraiser. The design features event focus and appraisal basis are linked, highlighting the adaptational functions of the emotions, helping to prepare appropriate behavioral reactions to events with potentially important consequences.

Response synchronization

This design feature of the proposed emotion definition is also implied by the adaptational functions of emotion. If emotions prepare appropriate responses to events, the response patterns must correspond to the appraisal analysis of the presumed implications of the event. Given the importance of the eliciting event, which disrupts the flow of behavior, all or most of the subsystems of the organism must contribute to response preparation. The resulting massive mobilization of resources must be coordinated, a process which can be described as *response synchronization* (Scherer, 2000b, 2001). I believe that this is in fact one of the most important design features of emotion, one that in principle can be operationalized and measured empirically.

Rapidity of change

Events, and particularly their appraisal, change rapidly, often because of new information or due to re-evaluations. As appraisal drives the patterning of the responses in the interest of adaptation, the emotional response patterning is also likely to change rapidly as a consequence. While we are in the habit of talking about "emotional states" these are rarely steady states. Rather, emotion processes are undergoing constant modification allowing rapid readjustment to changing circumstances or evaluations.

Behavioral impact

Emotions prepare adaptive action tendencies and their motivational underpinnings. In this sense they have a strong effect on emotion-consequent behavior, often interrupting ongoing behavior sequences and generating new goals and plans. In addition, the motor expression component of emotion has a strong impact on communication which may also have important consequences for social interaction.

Intensity

Given the importance of emotions for behavioral adaptation, one can assume the intensity of the response patterns and the corresponding emotional experience to be relatively high, suggesting that this may be an important design feature in distinguishing emotions from moods, for example.

Duration

Conversely, as emotions imply massive response mobilization and synchronization as part of specific action tendencies, their duration must be relatively short in order not to tax the resources of the organism and to allow behavioral flexibility. In contrast, low-intensity moods that have little impact on behavior can be maintained for much longer periods of time without showing adverse effects.

Following Hockett's example of characterizing different animal and human communication systems with the help of a set of design features, Table 2 shows an attempt to specify the profiles of different affective phenomena and the emotion design features described above (the table shows a revised version of the matrix first proposed in Scherer, 2000c). Based on these assumptions, one can attempt as follows to differentially define affective phenomena in distinguishing them from emotions.

1) Preferences. Relatively stable evaluative judgments in the sense of liking or disliking a stimulus, or preferring it or not over other objects or stimuli, should be referred to as *preferences*. By definition, stable preferences should generate intrinsic appraisal (intrinsic pleasantness check), independently of current needs or goals, although the latter might modulate the appraisal (Scherer, 1988). The affective states produced by encountering attractive or aversive stimuli (event focus) are stable and of relatively low intensity, and do not produce pronounced response synchronization. Preferences generate unspecific positive or negative feelings, with low behavioral impact except tendencies towards approach or avoidance.

2) Attitudes. Relatively enduring beliefs and predispositions towards specific objects or persons are generally called attitudes. Social psychologists have long identified three components of attitudes (see Breckler, 1984): a cognitive component (beliefs about the attitude object), an affective component (consisting mostly of differential valence), and a motivational or behavioral component (a stable action tendency with respect to the object, e.g. approach or avoidance). Attitude objects can be things, events, persons, and groups or categories of individuals. Attitudes do not need to be triggered by event appraisals although they may become more salient when encountering or thinking of the attitude object. The affective states induced by a salient attitude can be labeled with terms such as hating, valuing, or desiring. Intensity and response synchronization are generally weak and behavioral tendencies are often overridden by situational constraints. While it may seem prosaic, I suggest treating *love* as an interpersonal attitude with a very strong positive affect component rather than an emotion. The notion of loving someone seems to imply a long-term affective disposition rather than a brief episodic feeling, although thoughts of or the interaction with a loved person can produce strong and complex

TABLE 2
Design feature differentiation of different types of affective phenomena

Design features / Type of affect	Event focus	Intrinsic appraisal	Transactional appraisal	Synchronization	Rapidity of change	Behavioral impact	Intensity	Duration
Preferences	VL	VH	M	VL	VL	M	L	M
Attitudes	VL	L	L	VL	L	L	M	H
Moods	L	M	L	L	M	H	M	H
Affect dispositions	VL	L	VL	VL	VL	L	L	VH
Interpersonal stances	H	L	L	L	VH	H	M	M
Aesthetic emotions	H	VH	L	MH	H	L	L–M	L
Utilitarian emotions	VH	M	VH	VH	VH	VH	H	L

Note: VL = very low, L = low, M = medium, H = high, VH = very high.

emotions, based on intrinsic and transactional appraisal and characterized by strong response synchronization. This is an example of how more stable affect dispositions can make the occurrence of an emotion episode more likely as well as introducing specific response patterns and feeling states.

3) Mood. Emotion psychologists have often discussed the difference between mood and emotion (e.g. Frijda, 2000). Generally, moods are considered as diffuse affect states, characterized by a relative enduring predominance of certain types of subjective feelings that affect the experience and behavior of a person. Moods may often emerge without apparent cause that could be clearly linked to an event or specific appraisals. They are generally of low intensity and show little response synchronization, but may last over hours or even days. Examples are being cheerful, gloomy, listless, depressed, or buoyant.

4) Affect dispositions. Many stable personality traits and behavior tendencies have a strong affective core (e.g. nervous, anxious, irritable, reckless, morose, hostile, envious, jealous). These dispositions describe the tendency of a person to experience certain moods more frequently or to be prone to react with certain types of emotions, even upon slight provocation. Not surprisingly, certain terms like irritable or anxious can describe both affect dispositions as well as momentary moods or emotions and it is important to specify whether the respective term is used to qualify a personality disposition or an episodic state. Affect dispositions also include emotional pathology; while being in a depressed mood is quite normal, being always depressed may be a sign of an affective disturbance, including a clinical syndrome of depression requiring medical attention.

5) Interpersonal stances. The specificity of this category is that it is characteristic of an *affective style* that spontaneously develops or is strategically employed in the interaction with a person or a group of persons, coloring the interpersonal exchange in that situation (e.g. being polite, distant, cold, warm, supportive, contemptuous). Interpersonal stances are often triggered by events, such as encountering a certain person, but they are less shaped by spontaneous appraisal than by affect dispositions, interpersonal attitudes, and, most importantly, strategic intentions. Thus, when an irritable person encounters a disliked individual there may be a somewhat

higher probability of the person adopting an interpersonal stance of hostility in the interaction as compared to an agreeable person. Yet it seems important to distinguish this affective phenomenon from other types, because of its specific instantiation in an interpersonal encounter and the intentional, strategic character that may characterize the affective style used throughout the interaction.

So far, I have pitted emotions against other types of affective phenomena. Recently (Scherer, 2004c), I have suggested the need to distinguish between different types of emotions: *aesthetic* emotions and *utilitarian* emotions. The latter correspond to the common-garden-variety of emotions usually studied in emotion research such as anger, fear, joy, disgust, sadness, shame, guilt. These types of emotions can be considered utilitarian in the sense of facilitating our adaptation to events that have important consequences for our wellbeing. Such adaptive functions are the preparation of action tendencies (fight, flight), recovery and reorientation (grief, work), motivational enhancement (joy, pride), or the creation of social obligations (reparation). Because of their importance for survival and wellbeing, many utilitarian emotions are high-intensity emergency reactions, involving the synchronization of many organismic subsystems, as described above.

In the case of *aesthetic emotions*, the functionality for an immediate adaptation to an event that requires the appraisal of goal relevance and coping potential is absent or much less pronounced. Kant defined aesthetic experience as ''interesseloses Wohlgefallen'' (disinterested pleasure; Kant, 2001), highlighting the complete absence of utilitarian considerations. Thus, the aesthetic experience of a work of visual art or a piece of music is not shaped by the appraisal of the work's ability to satisfy my bodily needs, further my current goals or plans, or correspond to my social values. Rather, aesthetic emotions are produced by the appreciation of the intrinsic qualities of the beauty of nature, or the qualities of a work of art or an artistic performance. Examples of such aesthetic emotions are being moved or awed, being full of wonder, admiration, bliss, ecstasy, fascination, harmony, rapture, solemnity.

The absence of utilitarian functions in aesthetic emotions does not mean that they are disembodied. Music and many other forms of art can be demonstrated to produce physiological and behavioral changes (Bartlett, 1999; Scherer and Zentner, 2001). However, these bodily changes are not in the service of behavioral readiness

or the preparation of specific, adaptive action tendencies (Frijda, 1986). For example, the most commonly reported bodily symptoms for intense aesthetic experiences are goose pimples, shivers, or moist eyes – all rather diffuse responses which contrast strongly with the arousal and action-oriented responses for many utilitarian emotions.

Exploring the semantic space of folk concepts of emotion

How many emotions are there? I submit that there is currently no answer to this question. Proponents of discrete emotion theories, inspired by Darwin, have suggested different numbers of so-called *basic emotions* (Ekman, 1972, 1992; Izard, 1971, 1992; Tomkins, 1962, 1984). Most of these are utilitarian emotions as defined above and play an important role in adapting to frequently occurring and prototypically patterned types of significant events in the life of organisms. In consequence, emotions like anger, fear, joy, and sadness are relatively frequently experienced (with anger and joy outranking all others; see the quasi-representative actuarial survey reported by Scherer et al., 2004). Given the aspects of frequency and prototypicality, I have suggested calling these emotions *modal* rather than basic, given that there is little consensus as to the meaning and criteria for how *basic* is to be defined (Scherer, 1994). Obviously, the small number of basic or modal emotions (something between 6 and 14 depending on the theorists) is hardly representative for the range of human (or possibly even animal) emotionality. I have argued (Scherer, 1984a) that there are as many different emotions as there are distinguishably different profiles of appraisal with corresponding response patterning. Using the definition proposed above, in particular the necessary criterion of response synchronization, the number of different emotions could be determined empirically. However, this proposal is only of academic interest as, in addition to conceptual problems such as the criterion for a sufficient level of response synchronization, problems of access to a vast range of emotional episodes and measurement problems render such an empirical assessment impossible.

I suggest that we need to have recourse to the study of folk concepts of emotion in order to make headway on the question of the number and nature of discriminable types of emotions. If, in the evolution of languages, certain types of distinctions between different types of emotional processes have been considered important

enough for communication to generate different words or expressions, social and behavioral scientists should consider these distinctions worthy of study. Not surprisingly, different scholars have made efforts to do just that (Levy, 1984; Lutz, 1988; Russell, 1991; Russell et al., 1995; Wierzbicka, 1999). The problem is to map the fuzzy and complex semantic fields of the folk emotion concepts onto the scientific construct definitions. This is particularly important as in distinguishing emotions the task is not to identify common semantic primitives (as suggested by Wierzbicka, 1999) but to examine fine-grained differences, spanning all of the components of the respective emotion processes, to grasp the specificity of the processes referenced by the respective terms. While dictionary definitions of emotion labels in different languages, as well as thesaurus entries, may be useful, reflecting the learned intuitions of the language experts responsible for the respective entries, this approach is neither sufficiently comprehensive nor consensual enough to be appropriate for scientific *profiling* of emotion terms.

I submit that the design feature approach outlined above can be profitably used to establish semantic profiles of folk concepts of emotions represented by emotion terms from natural languages. Concretely, emotion terms can be rated by native speakers of different natural languages with respect to a number of items for each of the design features. For example, one can ask participants in such a study to imagine a person whose emotional experience at a particular point in time is consensually described by observers as "irritated". Then raters are asked to evaluate the *typical eliciting and response characteristics* that would warrant the description of the person's emotional state with this label. This would include items on the eliciting event, the type of appraisal the person is likely to have made of the event and its consequences, the response patterns in the different components, and the behavioral impact (action tendencies) generated, as well as the intensity and duration of the associated experience. Table 3 shows an example of such a *semantic grid* based on a design feature approach. For each of four domains, respondents have to indicate how a typical person would appraise and respond to a typical eliciting event for a given affect label. The items relative to appraisal dimensions were adapted from the Geneva Appraisal Questionnaire (GAQ – see References) and items on response characteristics were modeled on a questionnaire used in two large-scale collaborative studies on cross-cultural

similarities and differences in emotional experience (Scherer and Wallbott, 1994; Scherer et al., 1986).

Semantic grid profiles for different emotion terms allow, at least if there is reasonable agreement between raters (in the sense of inter-rater reliability) the definition of the semantic field, the meaning, of an emotion term in the respective language. In addition to allowing the examination of subtle differences in the meanings of different emotion terms and providing similarity-of-profile data that can be used to statistically determine the relationships between members of emotion families and the overall structure of the semantic space for emotions, such data for different languages inform us about potential cultural and linguistic differences in emotion encoding. This aspect, apart from the scientific interest (Breugelmans et al., 2005; Fontaine et al., 2002), is of great value in ensuring comparability of instruments in intercultural studies.

How can emotions be measured?

If one accepts the definition of emotion outlined above, there is no single gold-standard method for its measurement. Rather, given the component process nature of the phenomenon, only convergent measurement via assessment of all component changes involved can provide a comprehensive measure of an emotion. In other words, in an ideal world of science, we would need to measure (1) the continuous changes in appraisal processes at all levels of central nervous system processing (i.e. the results of all of the appraisal checks, including their neural substrata), (2) the response patterns generated in the neuroendocrine, autonomic, and somatic nervous systems, (3) the motivational changes produced by the appraisal results, in particular action tendencies (including the neural signatures in the respective motor command circuits), (4) the patterns of facial and vocal expression as well as body movements, and (5) the nature of the subjectively experienced feeling state that reflects all of these component changes. Needless to say, such comprehensive measurement of emotion has never been performed and is unlikely to become standard procedure in the near future. However, there have been major advances in recent years with respect to measuring individual components such as appraisal (Scherer et al., 2001), brain mechanisms (Davidson et al., 2003a), physiological response patterns (Stemmler, 2003), and expressive behavior (Harrigan et al., 2005).

TABLE 3
Representative items for a grid to profile the semantic fields of different affect labels

Appraisal of the eliciting event (E)	Physiological symptoms	Motor expression	Action tendencies	Feelings
How suddenly and abruptly did E occur?	Feeling cold shivers (neck, chest)	Smiling	Moving attention towards E	Intensity
How familiar was the person with E?	Weak limbs	Mouth opening	Moving attention away from E	Duration
How probable is the occurrence of E in general?	Getting pale	Mouth closing	Information search	Valence
How pleasant is E in general, independently of the current situation?	Lump in throat	Mouth tensing	Attention self-centered	Arousal
How unpleasant is E in general, independently of the current situation?	Stomach troubles	Frown	Attention directed towards others	Tension
How important/relevant is E to the person's current goals or needs?	Heart beat slowing down	Eyes closing	Physically moving towards E	
How likely is it that E was mostly caused by chance or natural causes?	Heart beat getting faster	Eyes opening	Physically moving away from E	
How likely is it that E was mostly caused by the person's own behavior?	Muscles relaxing, restful (whole body)	Tears		
How likely is it that E was mostly caused by someone else's behavior?	Muscles tensing, trembling (whole body)	Other changes in face		
If E is caused by a behavior, how likely is it that E was caused intentionally?	Breathing slowing down	Voice volume increasing		
Are the potential consequences of E clearly envisaged and may they occur in the near future?	Breathing getting faster	Voice volume decreasing		
	Feeling warm, pleasant (whole body)	Voice trembling		
	Perspiring, moist hands	Voice being assertive		
	Sweating (whole body)	Other changes in voice		
	Feeling hot, puff of heat (cheeks, chest)	Abrupt bodily movements		

How different is E from what the person expected at this moment?	Blushing	Moving towards people or things
How likely will the consequences of E bring positive, desirable outcomes to the person (i.e. helping the person to achieve a goal)?	Sweating	Withdrawing from people or things
How likely will the consequences of E bring negative undesirable outcomes to the person (i.e. preventing the person from achieving a goal)?		Moving against people or things
Did E require the person to react immediately (urgently)?		Other changes in gesture
Would the consequences of E be ineluctable or still be avoidable and modifiable?		Silence
Could the consequences of E still be avoided or modified to the person's advantage (through his/her own power or helped by others)?		Short utterance
Would the person be able to live with, and adjust to, the consequences of E?		Long utterance
How likely is it that E would not be consistent with the person's image of him-herself?		Speech melody change
How likely is it that E violated laws or social norms?		Speech disturbance
		Speech tempo changes

Note: E = event.

While both nonverbal behavior (e.g. facial and vocal expression) and physiological indicators can be used to infer the emotional state of a person, there are no objective methods of measuring the subjective experience of a person during an emotion episode. Given the definition of *feeling* as a subjective cognitive representation, reflecting a unique experience of mental and bodily changes in the context of being confronted with a particular event, there is no access other than to ask the individual to report on the nature of the experience. In many cases researchers provide participants with more or less standardized lists of emotion labels with different kinds of answer formats to obtain information on the qualitative nature of the affective state experienced. However, the use of fixed-response alternatives, while ensuring efficiency and standardization of data collection, has several serious disadvantages. One of the major ones is the possibility that one or several response alternatives can ''prime'' participants, i.e. suggest responses that they might not have chosen otherwise. The opposite problem is that a participant might want to respond with a category that is not provided in the list, thus forcing the person to respond with the closest alternative, or, if provided, with a residual category such as ''other'', with the specificity and accuracy of the data suffering in both cases. Even if one of the categories provided corresponds to the state experienced by the participant, he or she may not be familiar with the label chosen by the researcher, being used to referring to the affective state with a near synonym, for example, a more popular or slang expression (e.g. jittery in the place of anxious).

Free response measurement of emotional feeling – the Geneva Affect Label Coder

To avoid such problems, researchers sometimes choose to use a free-response format, asking participants to respond with freely chosen labels or short expressions that in their mind best characterize the nature of the state they experienced. This is not a panacea as some participants, especially those who do not normally attempt to label and communicate their emotional responses, may have problems coming up with appropriate labels. In addition, one can expect individual differences in the range of the active vocabulary which may constrain the responses of some respondents. However, in general the advantages in specificity and accuracy of the responses and the

elimination of the priming artifact would seem to privilege the use of a free-response format in cases in which maximal accuracy and a fine-grained resolution of the affect description are sought. Unfortunately, this advantage is compromised by the fact that it is generally impossible to analyze free responses in a quantitative, statistical fashion as their number is often extremely high and the response frequency per label extremely low.

In consequence, researchers generally sort free responses into a more limited number of emotion categories, using notions of family resemblances and synonyms. To date, there is neither an established procedure for sorting free-response labels or expressions into a smaller number of overarching categories nor agreement as to the number and nature of a standard set of emotion categories. In general, researchers will determine a list of emotion categories in an eclectic fashion or based on a particular theory and then ask coders to classify free responses with more or less explicit coding instructions and more or less concern for reliability.

In the interest of the comparability and cumulativeness of findings from different studies, it seems desirable to develop a standard list of emotion categories to be regularly employed in research using free-response report of subjective feeling states and to use a reliable, standardized coding procedure. In this article, I suggest a pragmatic solution, the Geneva Affect Label Coder (GALC), based on an Excel macro program that attempts to recognize 36 affective categories commonly distinguished by words in natural languages and parses text data bases for these terms and their synonyms (as based on established thesauri). I will briefly describe the development of the instrument in the context of a large-scale event sampling study of emotional experiences published in this journal (Scherer et al., 2004), where pertinent results are reported.

As the instrument was intended for use in a wide variety of emotion-inducing contexts, I decided to choose a rather extensive list of semantic categories that index different types of affect-related experiences covering emotions, moods, and other types of transitory affect states (see the design feature approach discussed above). The 36 categories shown in Table 4 were chosen on the basis of both empirical grounds (occurring in a quasi-representative population survey of what respondents freely report when asked which emotion they experienced yesterday) and published surveys of emotion terms in different languages (Averill, 1975; Gehm and Scherer, 1988; Russell, 1983). An additional criterion for selection of a category

TABLE 4
Affect categories and word stems of pertinent labels for category members

Affect categories	Pertinent words or word stems
Admiration/Awe	admir*, ador*, awe*, dazed, dazzl*, enrapt*, enthrall*, fascina*, marveli*, rapt*, reveren*, spellbound, wonder*, worship*
Amusement	amus*, fun*, humor*, laugh*, play*, rollick*, smil*
Anger	anger, angr*, cross*, enrag*, furious, fury, incens*, infuriat*, irate, ire*, mad*, rag*, resent*, temper , wrath*, wrought*
Anxiety	anguish*, anxi*, apprehens*, diffiden*, jitter*, nervous*, trepida*, wari*, wary, worried*, worry*
Being touched	affect*, mov*, touch*
Boredom	bor*, ennui, indifferen*, languor*, tedi*, wear*
Compassion	commiser*, compass*, empath*, pit*
Contempt	contempt*, denigr*, deprec*, deris*, despi*, disdain*, scorn*
Contentment	comfortabl*, content*, satisf*
Desperation	deject*, desolat*, despair*, desperat*, despond*, disconsolat*, hopeless*, inconsol*
Disappointment	comedown, disappoint*, discontent*, disenchant*, disgruntl*, disillusion*, frustrat*, jilt*, letdown, resign*, sour*, thwart*
Disgust	abhor*, avers*, detest*, disgust*, dislik*, disrelish, distast*, loath*, nause*, queas*, repugn*, repuls*, revolt*, sicken*
Dissatisfaction	dissatisf*, unhapp*
Envy	envious*, envy*
Fear	afraid*, aghast*, alarm*, dread*, fear*, fright*, horr*, panic*, scare*, terror*
Feeling	love, affection*, fond*, love*, friend*, tender*

Gratitude	grat*, thank*
Guilt	blame*, contriti*, guilt*, remorse*, repent*
Happiness	cheer*, bliss*, delect*, delight*, enchant*, enjoy*, felicit*, happ*, merr*
Hatred	acrimon*, hat*, rancor*
Hope	buoyan*, confident*, faith*, hop*, optim*
Humility	devout*, humility
Interest/Enthusiasm	absor*, alert, animat*, ardor*, attenti*, curi*, eager*, enrapt*, engross*, enthusias*, ferv*, interes*, zeal*
Irritation	annoy*, exasperat*, grump*, indign*, irrita*, sullen*, vex*
Jealousy	covetous*, jealous*
Joy	ecstat*, elat*, euphor*, exalt*, exhilar*, exult*, flush*, glee*, joy*, jubil*, overjoyed, ravish*, rejoic*
Longing	crav*, daydream*, desir*, fanta*, hanker*, hark*, homesick*, long*, nostalg*, pin*, regret*, wish*, wistf*, yearn*
Lust	carnal, lust*, climax, ecsta*, orgas*, sensu*, sexual*
Pleasure/Enjoyment	enjoy*, delight*, glow*, pleas*, thrill*, zest*
Pride	pride*, proud*
Relaxation/Serenity	ease*, calm*, carefree, casual, detach*, dispassion*, equanim*, eventemper*, laid-back, peace*, placid*, poise*, relax*, seren*, tranquil*, unruffl*
Relief	relie*
Sadness	chagrin*, deject*, dole*, gloom*, glum*, grie*, hopeles*, melancho*, mourn*, sad*, sorrow*, tear*, weep*
Shame	abash*, asham*, crush*, disgrace*, embarras*, humili*, shame*
Surprise	amaze*, astonish*, dumbfound*, startl*, stunn*, surpris*, aback, thunderstruck, wonder*
Tension/Stress	activ*, agit*, discomfort*, distress*, strain*, stress*, tense*
Positive	agree*, excellent, fair, fine, good, nice, positiv*
Negative	bad, disagree*, lousy, negativ*, unpleas*

was the existence of empirical research or theoretical discussion on specific differentiable states.

The category terms shown in Table 4 have been chosen as category descriptors on the assumption that they denote the central meaning of a fuzzy category that is implied by a much larger number of established words or popular expressions, including metaphors. The underlying assumption of the current approach is that the occurrence in verbal reports of any label or expression considered as being part of the family of affective states (denoted by an overarching category label) can be taken as evidence for the presence of a feeling state that is closely associated with the fuzzy category identified by the central concept. I selected the terms that constitute synonyms, near synonyms, or related emotion family members of the category labels based on extensive comparison of dictionary and thesaurus entries in English, German, and French. As Table 4 shows, each category, represented by the first term in the row, is indexed by a number of roots for adjectives or nouns denoting a related emotional state. Admittedly, the grouping of the related terms is currently based on my own judgment on the basis of the literature. The results of semantic grid studies, as described above, will allow the use of sophisticated cluster analysis and multidimensional scaling programs to empirically determine the well-foundedness of these linguistic intuitions.

The program GALC, which incorporates look-up tables like the one shown in Table 4 for English, French, and German, allows searching for the occurrences of the indexed word stems in ASCII text files. Based on the presence of the respective word stems, the occurrence of one or two emotion categories will be determined by the program (the detection of two different categories indicating potential ambivalence or the presence of emotion blends). The program, consisting of an Excel file containing a macro parser program, can be freely downloaded for research use (see References).

Forced choice response measurement of feeling – the Geneva Emotion Wheel

In many cases, especially those involving highly controlled experimental paradigms, the use of the free-response format is contraindicated, especially when fine-grained scalar measurement on a few standard feeling states is required for the purpose of comparison

between experimental groups. Psychologists have used two major methods to obtain forced-choice self-reports of emotional experience: (1) the discrete emotions approach, and (2) the dimensional approach.

The first, the discrete emotions approach, goes back to the origin of language and the emergence of words and expressions describing clearly separable states. The approach has a venerable scientific history in the sense that since the dawn of behavioral science philosophers have used emotion words to analyze human emotional experience. Darwin (1998) has made this approach palatable for the biological and social sciences in showing the evolutionary continuity of a set of "basic emotions" and identifying observable physiological and expressive symptoms that accompany them. The discrete emotions approach relies on the categorization that is reflected in the organization of the semantic fields for emotion in natural languages. The justification for accepting the structure provided by language is the fact that the language-based categories seem to correspond to unique response patterns, i.e. emotion-category specific patterns of facial and vocal expressions as well as physiological response profiles.

Given the primary role of natural language categories for emotions as reflected by emotion words, the method of assessing self-report used by researchers adopting the discrete emotions approach is the use of scales with nominal, ordinal, or interval characteristics. Generally the researcher provides the respondent with a list of emotion terms and the latter is alternatively asked (1) to check terms that best describe the emotion experienced (nominal scale), (2) to indicate on a 3- to 5-point scale whether the respective emotion was experienced a little, somewhat, or strongly (ordinal scale), or (3) to use an analog scale to indicate how much an emotion has been experienced (e.g. on an underlying dimension from 0 to 100 – interval scale). Methods vary on whether respondents are to respond on only the most pertinent emotion scale, to respond on two or more scales to indicate possible blends, or to respond to all scales in a list (replying with none or 0 for categories that are not at all appropriate to describe the experience). While there are some standardized instruments of this kind (e.g. Izard's Differential Emotion Scale; Izard, 1991), most investigators prefer to create ad hoc lists of emotion categories that seem relevant in a specific research context.

While the results obtained with this approach are highly plausible and easily interpretable (given that widely shared language labels are

used), there are serious problems of comparability of results across different studies in which widely different sets of emotion labels are used. Furthermore, the statistical analysis of these data suffers from the problem of an abundance of missing data (all scales with 0 or none as values) and the difficulty of analyzing and interpreting an extraordinary number of different blends of emotion (Scherer, 1998; Scherer and Ceschi, 2000).

The second method, the dimensional approach, was pioneered by Wilhelm Wundt (1905) who attempted to develop a structural description of subjective feeling as it is accessible through introspection. He suggested that these subjective feelings can be described by their position in a three-dimensional space formed by the dimensions of valence (positive–negative), arousal (calm–excited), and tension (tense–relaxed). Wundt believed that the mental phenomenon of feeling, as described by these three dimensions, covaried with measurable states of the body such as, for example, physiological arousal.

Wundt's suggestion has had an extraordinary impact, both on the measurement of feeling (e.g. Schlosberg, 1954) and on the emotional connotations of language concepts in general (e.g. Osgood et al., 1957). Given the difficulty of consistently identifying a third dimension (such as tension, control, or potency) from arousal or excitation, many modern dimensional theorists limit themselves to the valence and arousal dimension, sometimes suggesting circular structures as most adapted to mapping emotional feelings into this two-dimensional space (Russell, 1983).

Concretely, the methodology used in this approach consists in asking a respondent how positive or negative and how excited or aroused he or she feels (either in two separate steps or by providing a two-dimensional surface and asking the respondent to determine the appropriate position). In consequence, the emotional feeling of the person is described by a point in this valence-arousal space.

This method of obtaining self-report of emotional feeling is simple and straightforward and generally quite reliable. It also lends itself to advanced statistical processing since interval scaling can be used quite readily. On the other hand, the results are restricted to the degrees of positive or negative feeling and of bodily excitation. Most importantly, contrary to the discrete emotions approach, there is very little information on the type of event that has produced the emotion and the appraisal processes underlying the responses.

One of the major drawbacks of this approach is the difficulty of knowing whether the valence dimension describes the intrinsic quality of an eliciting object or the quality of the feeling (which need not coincide). Even more importantly, it is difficult to differentiate the aspect of intensity of feeling from bodily excitation. Thus, extremely intensive anger is likely to be characterized by high arousal whereas intense sadness may be accompanied by very low arousal.

Which of these two approaches is preferable? Until now, researchers have rarely specified why they chose one method over another. Generally, methodological choice has followed theoretical convictions as to the degree of differentiatedness of the emotion system that psychologists need to adopt to understand and predict emotional responses. However, one can apply more systematic criteria to justify particular choices. For example, how should one best describe the differences between two individuals who have just experienced an emotion as compared to differentiating between the feelings of the same person at different points in time? After all, psychological measurement is generally interested in describing differences between individuals or between states over time. Specifically, which are more comparable: two individuals who share the same point in valence-arousal space or two individuals who use the same word to describe their feelings? Chances are that two individuals who use the same verbal descriptor have more similar emotions than those sharing a point in semantic space. This can be easily demonstrated by the fact that both very fearful and very angry persons would be in a similar region of the two-dimensional space – negatively valenced high arousal (see Figure 1). While such regions in two-dimensional space can show sizeable overlap, verbal labels often uniquely identify major elements of the eliciting event (at least in terms of appraisal dimensions) as well as the integrated representation of response patterns. One of the potential shortcomings of dimensional approaches based on valence and arousal is that both dimensions are quite ambiguous. As mentioned above, it is often not clear whether a valence judgment (pleasant or unpleasant) concerns the appraisal of the nature of the stimulus object or event or rather the feeling induced by it. Similarly, arousal or activation ratings may refer to perceived activation in a situation (or image) or to the proprioceptive feeling of physiological arousal induced by the stimulus event. This ambiguity often exists even when the instructions given to participants clearly specify the meaning --

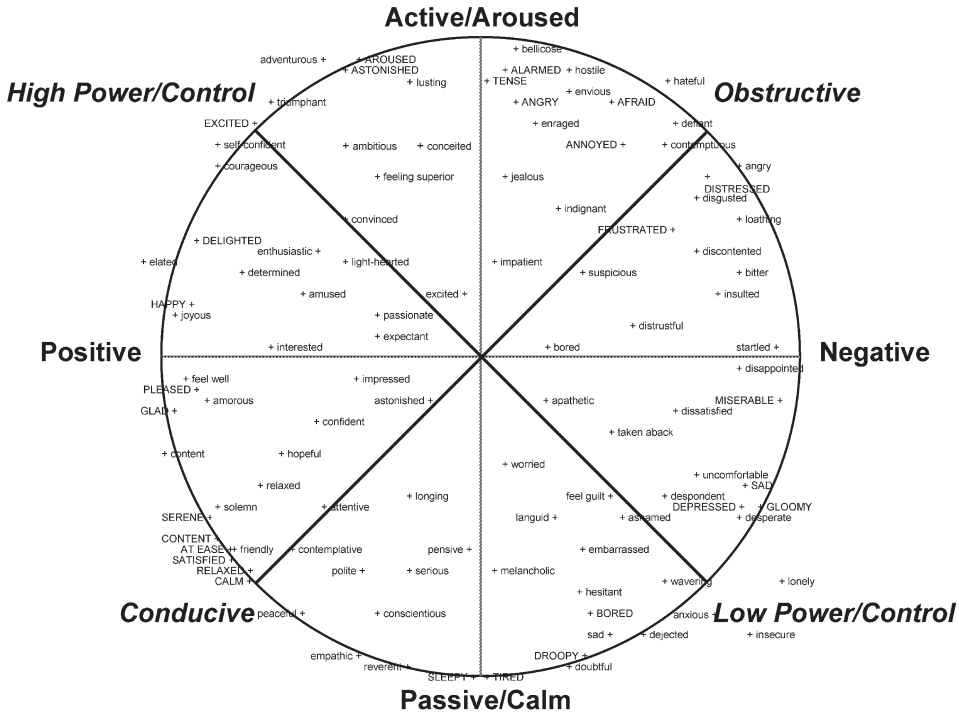

FIGURE 1

Alternative dimensional structures of the semantic space for emotions

which is not always the case. If arousal ratings are meant to measure induced physiological activation or excitement, there is the additional problem that this interoception is often erroneous (Vaitl, 1996).

Another criterion is the communicability of emotional states between individuals. To describe the coordinates of an individual's position in valence-arousal space is unlikely to provide much information to others, including a researcher who is ignorant of the eliciting situation. Similarly, while some researchers may find it sufficient to know about valence or arousal, others may need more specific information on emotional experience to make reliable inferences.

It is surprising that, given the central role of emotion self-report in this research area, there have been few attempts to develop new instruments that avoid some of the shortcomings of the existing approaches. In what follows I describe such an effort. The design characteristics for the instrument to be developed are as follows:

- concentrating on the feeling component of emotion, in the sense of qualia, rather than asking respondents to judge concrete response characteristics such as sympathetic arousal;
- going beyond a simple valence-arousal space in order to be better able to differentiate qualitatively different states that share the same region in this space;
- relying on standard emotion labels in natural languages in order to capitalize on respondents' intuitive understanding of the semantic field;
- allowing systematic assessment of the intensity of the feeling;
- going beyond the arbitrariness of choosing different sets of emotion terms and presenting them in very unsystematic fashion by building some emotion structure into the instrument;
- presenting the instrument in a graphical form that is user-friendly, allowing the respondent to rapidly understand the principle and use the instrument in a reliable fashion.

Starting with the last point, I decided to use appraisal dimensions (or stimulus evaluation checks) to impose structure on the emotion categories (as described by natural language labels) to be used in the instrument. If one adopts the notion that emotions are elicited and differentiated by appraisal, then the structure of the emotion system should be largely determined by the major appraisal dimensions. As shown by numerous studies, the appraisal dimensions that

seem to have the strongest impact on emotion differentiation are goal conduciveness (including valence) and coping potential (control/power). In consequence, I decided to arrange a number of frequently used and theoretically interesting emotion categories in a two-dimensional space formed by goal conduciveness vs goal obstructiveness on the one hand and high vs low control/power (reflecting the coping potential appraisal check) on the other. It is expected that different emotion terms can be appropriately on these dimensions.

Figure 1 shows an illustration. The graph shows the mapping of the terms Russell (1983) uses as markers for his claim of an emotion circumplex in two-dimensional valence by activity/arousal space (upper-case terms). Onto this representation I superimposed the two-dimensional structure based on similarity ratings of 80 German emotion terms (+, lower-case terms, translated to English) from an earlier study that demonstrated the justification for the assumption that semantic space may be organized by appraisal criteria (see Scherer, 1984b: 47–55). The plus (+) signs indicate the exact location of the terms in a two-dimensional space. Quite surprisingly, this simple superposition yields a remarkably good fit. It also shows that adding additional terms makes Russell's circumplex less of an obvious structural criterion – to obtain a perfect circle in a multidimensional scaling analysis seems to require the inclusion of non-emotion terms, as in the case of "sleepy, tired, and droopy" to mark the low arousal pole (as implicitly acknowledged by Russell himself; Russell, 1991: 439). More importantly for the present purposes, a 45° rotation of the axes corresponds rather nicely to an explanation of the distribution of the terms in a two-dimensional space formed by goal conduciveness and coping potential.

As argued above, verbal report measures the component of subjectively experienced feeling. Feelings that are members of any one specific emotion family can be expected to vary most among each other with respect to intensity (e.g. irritation–anger–rage), which, as argued above, may correlate with but is not the same as physiological arousal. It was therefore decided to map the intensity dimension as the distance of an emotion category's position in the goal conduciveness-coping potential space from the origin (see also Reisenzein, 1994; Russell, 1980: 1170). In line with the attempt to create a graphically intuitive presentation, members of each emotion family were represented as a set of circles with increasing circumference (comparable to a spike in a wheel). In the interest of the

ease of reading, the number of emotion families was limited to 4 per quadrant, yielding a total of 16 (which seems reasonable considering that the upper limit of the number of "basic emotions" is often considered to be around 14). The choice of the concrete families was also in large part determined by what are generally considered to be either basic or fundamental emotions or those frequently studied in the field.

Figure 2 shows the prototype of this instrument which because of its origin and shape has been called the Geneva Emotion Wheel (GEW). In this first version of the GEW, presented on a computer screen, all members of an emotion family were identified by a specific label, which became visible when moving the mouse across a circle. First attempts at validation of the instrument (Baenziger et al., 2005) showed that it is difficult to reproduce the theoretically predicted intensity scaling of the terms on some of the "spikes" in the wheel. In consequence, in more recent versions of the GEW we have abandoned the effort to label intermediate intensities with different labels

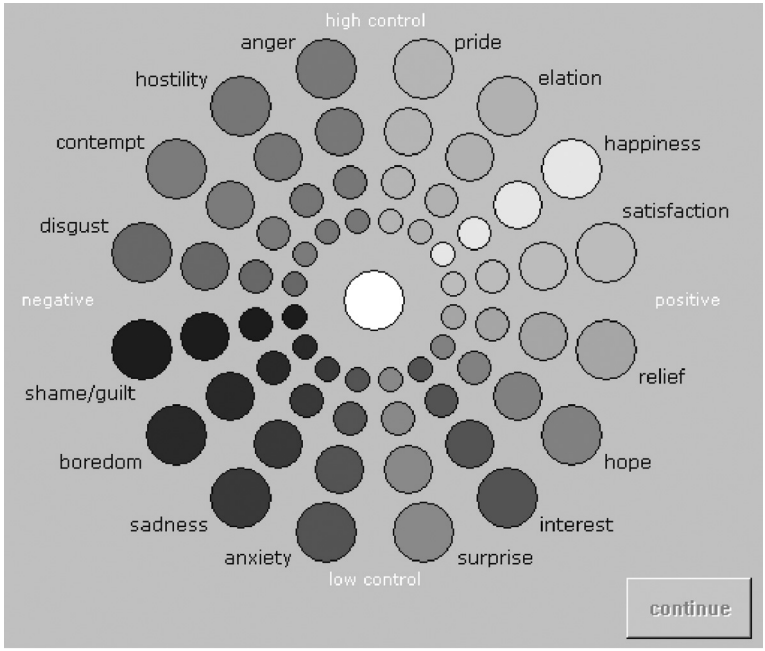

FIGURE 2
Prototype version of the Geneva Emotion Wheel

for members of the same emotion family. Rather, only the family as a whole is specified, asking participants to rate the intensity of an experienced or imagined emotion on the basis of the distance from the hub of the wheel and the size of the circles. The study of the reliability and validity of the instrument continues. Researchers interested in using the instrument can download a copy of the computer program or a paper-and-pencil version (see References). While further improvements seem possible, we feel that the GEW attains some of the aims outlined above and constitutes a useful addition to the methods toolbox in emotion research. While several instruments have been proposed that ask judges to conjointly evaluate two dimensions, such as valence and arousal (Cowie et al., 2000; Russell et al., 1989) or pleasantness and unpleasantness (Larsen et al., 2004), the Geneva Emotion Wheel may be the first such instrument to design the dimensional layout of the emotion qualities on pure appraisal dimensions (arrangement of emotion terms in two-dimensional space) and the intensity of the associated subjective feeling (distance from origin).

Conclusions

The definition of emotions, distinguishing them from other affective states or traits, and measuring them in a comprehensive and meaningful way have been a constant challenge for emotion researchers in different disciplines of the social and behavioral sciences over a long period of time. I have no illusion about the fact that this contribution will be little more than a drop in an ocean of writing about these topics. Definitions cannot be proven. They need to be consensually considered as useful by a research community in order to guide research, make research comparable across laboratories and disciplines, and allow some degree of cumulativeness, and they are quite central for the development of instruments and measurement operations – as well as for the communication of results and the discussion between scientists. If this article, following the discussion of some of these issues in the wake of our actuarial study of Swiss emotions in this journal (Scherer et al., 2004), can help to at least raise the consciousness of the need for progress in this domain, it will have fulfilled its purpose.

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