Emotion as a process: Function, origin and regulation

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DOI: 10.1177/053901882021004004
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Along with most other theorists of emotion, I assume that emotion is best treated as a psychological construct consisting of several aspects or components. These are specifically: cognitive appraisal or evaluation of stimuli and situations; physiological activation or arousal; motor expression; motivational tendencies, consisting of behavioral intention or behavioral readiness; and finally, subjective feeling state. There seems to be a fair amount of agreement in the literature (judging from a number of recent surveys) that the concept of emotion encompasses all of these components rather than just some of them (see Izard, 1977; Lazarus, Averill and Opton, 1970; Leventhal, 1979; Plutchik, 1980). However, a static view of emotional states, even one that takes all of the above components into consideration, does not satisfactorily resolve the conceptual and theoretical problems that emotion theorists have been struggling with. In order to deal with the dynamic nature of emotional behavior, we have to conceptualize emotion as a process rather than a steady state.

A preliminary version of this paper was prepared for a conference on "The nature and function of emotion" convened by Klaus R. Scherer and Paul Ekman (Bad Homburg, West Germany, 6-10 July 1981) and sponsored by the Deutsche Forschungsgemeinschaft and the Werner Reimers Stiftung. The purpose of this piece is to raise a number of points for discussion, some of which are fairly speculative. It is not a scholarly review and there is therefore no attempt at exhaustive referencing of all relevant prior work. I gratefully acknowledge helpful comments by Jens Asendorpf and Ruta Noreika.

Social Science Information (SAGE, London and Beverly Hills), 21, 4/5 (1982), pp. 555-570
Moreover, we have to think of it as a process characterized by sequential intraorganismic information processing and extremely complex interactions between the various components described above. Before turning to a somewhat more detailed exposition of this view, it is useful to discuss the adaptive significance of the emotional process.

The functions of emotion

One finds considerably less agreement in the field as far as the functions of emotion are concerned. There still seems to be a major split between theorists who view emotion exclusively as "disruption" or "interruption" of coordinated behavior sequences and those who view emotions as primarily adaptive, motivational mechanisms. Hebb (1949), Pribram (1967), Mandler (1975) and others take the interruption of ongoing behavior sequences with a resultant direction of attention towards the cause of the interruption to be the major criterion for defining emotion. This view has been very pervasive in the social and behavioral sciences and may have led to a somewhat one-sided and simplistic notion of emotion. For example, Simon (1967) argued that emotions could be easily represented in computer simulations of behavior by an interrupt system that would call upon corrective subroutines if the major program ran into difficulties. Much of our experience with affect, however, seems to contradict the notion of emotion as interruption. For example, increased interest and pleasure during the course of a successful behavioral routine would seem to be supportive rather than interruptive. The notion of an interrupt system usually implies relatively extreme, and mostly negative emotions that are incompatible with an ongoing plan of behavior. Yet mild emotional states, such as pleasure or weak anxiety, can be superimposed on plans and behavior sequences without necessarily interrupting them. Whether emotional processes interrupt, disturb or adaptively support cognitive or behavioral sequences depends on the respective situation, the nature of the task, degree of arousal and other factors, but does not constitute a specific criterion for describing emotion.

I view emotion more broadly as the interface between an organism and its environment, mediating between constantly changing situations and events and the individual's behavioral responses. The major aspects of this process are threefold: first,
evaluation of the relevance of environmental stimuli or events for
the organism’s needs, plans or preferences in specific situations; se-
cond, the preparation of actions, both physiological and
psychological, appropriate for dealing with these stimuli; and finally,
the communication of reactions, states and intentions by the
organism to the social surround (Scherer, 1979b, 1981a, b).

In terms of evolutionary history, the flexibility of the behavioral
adaptation of organisms to their environment is largely due to the
emotion system. Emotions “decouple” the behavioral reaction
from the stimulus event by replacing rigid reflex-like stimulus
response patterns or instinctive innate releasing mechanisms. In the
course of the evolution of higher species, there is a need for increas-
ingly complex information processing together with greater flexi-
ibility and variability of behavioral inventories. Therefore, a
mechanism which will allow for an adequate adaptation of the
organism’s behavior to changing external and internal stimuli is re-
quired. This is achieved by the process of emotion. In organisms
capable of emotion, rigid releasing mechanisms are replaced by
cognitive evaluation processes for stimuli and events. Reflex-like
reactions are replaced partly through physiological activation, pro-
viding the energy required for an adequate response, and partly
through the preparation of behavioral plans with high probability
of occurrence but a certain latency. This decoupling of stimulus and
response provides important advantages. The flexibility of
behavior is increased enormously. Most importantly, this
mechanism provides the possibility for constant reevaluation of
complex stimuli and/or situations without much time delay since
preparation of the behavioral reaction takes place as part of the
emotion process.

Experience with human affective behavior may give rise to the
objection that strong emotions, for example, rage or phobic fear and
their immediate behavioral reactions — fight or flight — seem to
contradict the notion of emotion as a decoupling device between
stimulus and response when compared with the relatively slow
rational weighing of behavioral alternatives. However, even
behavioral reactions which follow strong emotions almost im-
mediately are still more “flexible” (more easily suppressed or
modified) than reflexes or innate releasing mechanisms. Further-
more, it can be argued that if emotions are to be adaptive, then
strong emotions in the face of emergencies must result in ap-
propriate behaviors without an appreciable latency period. The
stronger the emotion, the more urgent is the behavioral response. In situations where emergency emotions may be quite adaptive — fleeing or mating, for example — rational problem solving does not seem to occur with any great frequency. Overall, it is quite probable that emotion prepared the ground for the evolutionary development of cognition and problem solving in primates by providing time to think about a stimulus before doing something about it. It would be erroneous to assume, however, that cognition has been superimposed on emotion as a more advanced mode of human functioning in the course of evolution. Contrary to the Platonic distinction between cognition, emotion, and conation, a distinction which has effectively hindered theoretical advances in philosophy and psychology, there is no clear separation between cognition and emotion. On the contrary, as I will now try to show, there can be no emotion without prior cognitive processing of environmental or intraorganismic stimulation.

**A process model of emotion**

In recent papers (Scherer, 1981a, b) I have postulated that one of the major functions of emotion is the constant evaluation of external and internal stimuli in terms of their relevance for the organism and the behavioral reactions which may be required in response to those stimuli. I assume that this process of evaluation consists of a very rapidly occurring sequence of hierarchically organized stimulus processing steps. In other words, I suggest that the evaluation of the relevance of any external stimulus which is registered by an organism’s sensorium is established by a sequence of specific checks in terms of relevant dimensions of its meaning for the organism. Take feature recognition by computer as an example: the program proceeds through a sequence of checks in which information about relevant dimensions is obtained. Given the function of emotion as a mechanism for survival, the sequence of evaluative checks must obviously be organized in such a way that the dimensions most relevant to the survival of the organism are checked first in order to prepare the organism for emergency action.

I will now describe a sequence of such stimulus evaluation checks (SEC) which would seem minimally necessary for adequately evaluating or appraising emotion producing stimuli (see Scherer,
The first SEC should be an evaluation of the novelty or unexpectedness of the stimulus. Obviously, this is very closely related to the orientation reflex. It is quite possible that this first check is at least partly independent of higher cortical functions and may be a direct result of neural firing patterns (see Tomkins, 1962). Thus, a startle reaction to a sudden loud noise may be the immediate result of a very basic novelty check. On the other hand, for less sudden and extreme stimuli there may well be higher cortical functions involved in checking the stimulus against expectations in memory. This first evaluative check is clearly involved in emotions such as boredom and surprise, although later SECs may affect the particular form of these emotions. This check must occur first and must be very fast, since the survival of the organism may depend on a quick reaction to an unexpected event.

The second SEC may be the evaluation of the inherent pleasantness or unpleasantness of a stimulus which causes the organism to experience pleasure or distress. It is important to stress that this check has to do with the inherent pleasantness or unpleasantness of a stimulus, regardless of its relevance for the goals of an organism at that particular moment. The pleasantness/unpleasantness evaluation is one of the major aspects of almost all studies of emotional meaning or expression, independent of whether their focus is verbal labels or emotional expressions. Similarly, this type of appraisal is central to most theories of emotion. It is an interesting question to what extent this check is independent of higher cortical functions (cf. Zajonc's 1980 postulate of a phylogenetically older affective evaluation system which according to his view functions independently of cognitive evaluation).

The next SEC has to do with the evaluation of the goal relevance of the stimulus, i.e. the appraisal of the extent to which the introduction of that particular stimulus or event will further or hinder the attainment of a specific goal high in priority for the organism at that particular point. I believe that this aspect of goal relevance must be clearly differentiated from the evaluation of the inherent pleasantness or unpleasantness of a stimulus. Even intrinsically pleasant stimuli can interrupt ongoing plans and thus be evaluated negatively by the organism in terms of goal attainment. If the result of the goal relevance SEC indicates an interruption of ongoing plans, fear or anger may be the result. Stimuli which further goal attainment on the other hand, will lead to a state of contentment. If the organism’s expectations are exceeded, joy will be
the result.

The next SEC, which requires even more complex information processing ability on the part of the organism, is a check of the extent to which it is capable of coping with the stimulus in terms of its goal/plan structure. The basis for this evaluation is often a causal attribution of the origin of a particular stimulus or event. Without the determination of the causes of events, an appraisal of the coping potential of the organism is often difficult if not impossible. If the organism can cope with a particular stimulus or event without endangering its existence or a major goal, the result is anger. If coping potential is insufficient, fear will result.

While all of the SECs discussed so far are likely to be present in many species of animals, certainly in the higher developed mammals, there seems to be an additional SEC for humans. This SEC consists of a comparison of stimuli, particularly of one's own actions or the actions of others and their results, with social norms and various aspects of self-concept. For example, if one's own behavior does not conform to social norms or if it is not compatible with one's self-concept, shame or guilt may result.

The assumption underlying this sequence of stimulus evaluation checks is that each consecutive SEC further differentiates the emotional state of the organism. I assume that our verbal emotion labels characterize the outcome of particular checks. In some cases, the emotion label may describe the outcome after a specific SEC, e.g. surprise may be the appropriate verbal description of the first SEC, the novelty check. However, in most cases, the emotional state is further differentiated by the subsequent SECs. Thus, surprise will be positive or negative, depending on the inherent pleasantness and/or the goal relevance of the stimulus. An important question to discuss is the extent to which this assumption is at variance with discrete theories of emotion such as those put forward by Tomkins (1962) and Izard (1977). Clearly, the notion that our emotional states are the complex result of a series of stimulus evaluation checks appraising particular dimensions of stimulus meaning for the organism, is well suited to explain the large number of highly differentiated emotional states which we seem to experience and be able to describe verbally. At the same time, the fact that particular types of outcomes of the stimulus evaluation process seem to reliably reoccur for many species would provide a basis for the idea that there are a number of discrete emotions as modal outcomes of stimulus evaluation processes.
TABLE 1
Stimulus evaluation prerequisites for the ontogenetic development of emotion

<table>
<thead>
<tr>
<th>Emotional expression</th>
<th>Age of onset (in months)</th>
<th>Stimulus evaluation checks (SECs) required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Novelty</td>
</tr>
<tr>
<td>Startle</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>Displeasure</td>
<td>0</td>
<td>●</td>
</tr>
<tr>
<td>Surprise</td>
<td>1-3</td>
<td>●</td>
</tr>
<tr>
<td>Joy</td>
<td>3-5</td>
<td>●</td>
</tr>
<tr>
<td>Anger</td>
<td>4-6</td>
<td>●</td>
</tr>
<tr>
<td>Fear</td>
<td>5-9</td>
<td>●</td>
</tr>
<tr>
<td>Shame/guilt</td>
<td>12-15</td>
<td>●</td>
</tr>
<tr>
<td>Contempt</td>
<td>15-18</td>
<td>●</td>
</tr>
</tbody>
</table>

X indicates that the respective SEC is a necessary prerequisite for the occurrence of a particular emotion (albeit not necessarily sufficient); ● indicates that the SEC is available but may not be centrally involved in determining which emotion will occur as a result of the stimulus evaluation sequence.

If this notion is correct one should be able to predict which types of emotional states should occur in particular species provided that the information processing capacity of a species can be specified. Since the SECs are sequentially ordered in terms of increasing complexity of the processing system, one would expect that only some of the highest developed species, such as primates, are equipped for the whole range of emotions, while simpler species may be restricted to very basic undifferentiated emotional states. In the same vein, one can attempt to predict the appearance of the different emotions in ontogenetic development based on the unfolding of the cognitive capacities of the infant. Table 1 shows some estimates of the first appearance of specific emotional expressions which were compiled from the relevant literature (see Scherer, 1979, p. 238). In the second column of Table 1, I list the SECs which, according to my view, are required for the respective emotion to appear as a result of stimulus processing. This sequence
seems to roughly correspond to the major stages in cognitive development as described by Piaget and others.

Another important developmental aspect is that emotional reactions provide an intraorganismic signal system which is most important in enabling the organism to acquire new behavior patterns and to avoid maladaptive behavior. As Mower (1960) and other learning theorists have pointed out, emotion is a major prerequisite for learning. According to this view, negative emotions signal distress or pain and thereby produce avoidance reactions whereas positive emotions signal success and reward. The classical learning theory paradigm for emotion has not been widely accepted because the nature of the processes through which emotion interacts with cognition, motivation and behavior was not spelled out in detail. Recent work in cognitive psychology is beginning to shed some light on the nature of the association between emotion, experience and memory. Most pertinent is Bower's (1981) associative network theory which is an attempt to model the role of emotion in memory and learning.

The development of emotions as a mechanism for decoupling stimulus and response is particularly important for socially organized species. Because of the component of motor expression and because of the fact that the intended behavioral reaction is often visible in rudimentary form in the pattern of motor expression, both the reaction and the behavioral intention of the individual are communicated to the social surround. This not only allows other organisms to predict the most likely behavior of the emoting organism and to plan their behavior appropriately, it also provides feedback about the likely reaction of others to the intentional movement or expression, allowing appropriate changes in one's own behavioral plans.

Darwin (1872) was one of the first to point out the important role of emotional communication for social behavior. He put great emphasis on the fact that particular types of functional emotional expression in terms of intention movements seem to have been selectively developed in the course of evolution for purposes of communication. Using the conceptual tools of modern biology and ethology, Leyhausen (1967) makes a very convincing case for the role of "impression" in shaping "expression" given the adaptational significance of communication. Unfortunately, this important aspect of emotion has been largely neglected in most theories of emotion so far.
The regulation of emotion in social interaction

Many writers have noted that the control of emotion may in many ways be central to the understanding of social behavior and social organization. Hebb (1949) pointed out very early that it is most likely that the human species has the highest emotionality of all animal species and further, that the rationalist view of human nature which has dominated much of the social and behavioral sciences could only have arisen because of the highly developed role of affect regulation and control which Hebb sees as the basis for social organization. Similarly, the German sociologist Elias (1977) has put forth the theory that the history of human civilization is essentially the history of affect control. However, control does not necessarily mean suppression or deamplification of affect. Very early on, Aristotle pointed out in the Nicomachean Ethics, that we have to show appropriate affect in an appropriate manner in appropriate situations if we don’t want to be taken for fools (Aristotle, 1941, p. 996). Thus, regulation and control of emotion require a complex set of mechanisms to bring both the expression and possibly the experience of emotion in line with strategic necessities of interpersonal interaction and with social and cultural norms. The empirical study of the control and regulation of emotion is very difficult, particularly since intraorganismic, interpersonal, and social factors all seem to be intricately interwoven. In this context I cannot even begin to do justice to the issue and I will restrict my comments to a few of the major issues in this area.

Which aspects or components of emotion are controlled or modified and which technique of modification is used? At one extreme, a coping strategy such as perceptual defense is one mechanism to control emotion since its purpose seems to be to avoid the occurrence of emotion altogether. On the other hand, perceptual defense seems theoretically impossible without at least subliminal recognition of the potential threat emanating from a stimulus. Thus, in terms of the stimulus processing model proposed above, this would seem to require at least a rudiment of emotion, as far as the cognitive evaluation component is concerned. Given the present state of our knowledge, we cannot exclude the possibility that there are also physiological changes and expressive behaviors, however minute. At the other extreme there seems to be a control technique in which a full-fledged emotion has been produced and the person deliberately attempts to change or modify one or several
aspects of the emotional components, such as physiological arousal or expressive behavior. One interesting question concerns the minimal prerequisites for achieving this (e.g. cognitive capacity, motor control, feedback processes). These will probably differ depending on the stage in the sequence of emotional processing and the type of modification that is attempted. Another important issue is the study of the antecedents of control attempts and the functions thereof, particularly the role of intentionality (which is of course one of the concepts psychologists have found most difficult to operationalize).

One important issue, which has been neglected so far, is the way in which people evaluate their success in controlling emotion. Particularly important is the question of to what degree people are even aware of the various components of their emotional behavior and to what extent they are able to modulate various aspects of it. While Paul Ekman and his associates have proposed some theoretical notions concerning nonverbal behavior (Ekman and Friesen, 1969), little has been done in the area of vocal behavior. We will have to learn much more about the feedback processes involved in emotion before satisfactory answers can be found. Zoologists and ethologists have recently started to look at the ability of various animal species to disguise or manufacture affect (e.g. Woodruff and Premack, 1979). This research may provide important insights into the evolutionary development of affect regulation.

The interrelationships between the different components of emotion, particularly between expressive behavior, subjective experience, and physiological substratum, are very complex. The extent to which attempts at the regulation of any one of these components leads to changes in the others, is a most important research issue. It would seem very important to take stock of the relevant research findings (e.g. Buck, 1980; Jones, 1950; Lanzetta, Cartwright-Smith and Kleck, 1976; Leventhal, 1979) to determine exactly where the data point at this time. I have a feeling that as with many other issues in psychology, neither the discharge or catharsis theory (expressive behavior discharges physiological arousal) nor the feedback amplification theory (expressive behavior increases arousal due to proprioceptive feedback; cf. Gellhorn, 1970; Tomkins, 1962) will turn out to be entirely correct, but that both mechanisms may be involved.

Given the intricate interrelationships between cortical and
autonomic processes, it seems reasonable to assume that the outcome of any attempts at control through modification of expressive behavior will be a complex result of autonomic changes, self-attribution, social comparison, normative constraints, and many other factors. For example, even if free expression of anger would serve to discharge arousal, the inappropriateness of and social sanctions against such free expression might increase the arousal at the same time. Or alternatively, if proprioceptive feedback from the muscles involved in expressive action serves to increase arousal, the actual results of such expressive behavior, e.g. an adversary backing down, may lead to a diminution in the total amount of arousal. Thus, it is probably not useful to try to devise studies in order to determine which of the two competing views is correct. It may be more appropriate to study under which conditions particular processes interact to produce particular outcomes.

One also needs to consider the role of sociocultural factors in the regulation of emotion. There are numerous cultural differences in terms of how appropriate particular affects are considered to be for particular situations, the degree of expressiveness allowed for emotional behavior, and the preferred affect management procedures. To some extent, this question is strongly linked to the issue of universals in antecedents for emotion. Another important aspect is the role of modal personality and modal interaction patterns in particular cultures. Since affect control is strongly linked to social interaction, it may not be possible to understand cultural differences in emotional control without looking at relationships and strategies in interaction (see Levy, in this section).

Apart from the diachronic aspect, it also seems promising to take a closer look at the synchronic or historical aspects of emotion control. I have already mentioned Elias' (1977) theory of civilization as a history of affect control. However, this may not necessarily be a linear development toward increasing affect control and greater civilization. It might be worth studying the possibility that there are cycles of more or less affect control in societies. I am obviously thinking of the recent social movements in most Western cultures, in which sizable portions of the youth culture are striving for greater freedom of affect expression (alternative life style). While in many of these movements, the emphasis is on greater freedom for the expression of positive affect (loving, caring, etc.), there is also some evidence for an increase in the expression of negative affect. In many large cities in the West conventional norms of af-
fect control in public seem to be violated with increasing frequency. One important issue is the question of to what extent the observ-
vance of norms of affect control is an indicator of the degree to
which norms are honored generally in a society, or to what extent
violation of affect control norms may be an indicator of anomie.
Since there are often no direct sanctions in the case of violations of
affect control norms, the observation of these norms strongly rests
upon the degree to which they are tacitly accepted by a large part of
the population.

One also needs to consider the consequences of affect control
and the functional use of various techniques of control given cer-
tain goals such as successful performance in social interaction or
psychological well-being. The question to what extent there are
signals of control attempts is of paramount importance for the
study of strategic interaction and social influence. I believe that
social psychological research is seriously deficient in that not
enough attention has been given to the role of affect management
in social situations. Erving Goffman (1963, 1971) is one of the few
to have pointed out the importance of signs of affect control in
social interaction. I believe that the cognitive bias of much of
modern social psychology is responsible for the neglect of this cen-
tral issue in empirical research on social interaction. It would be
useful to devise appropriate research designs to study the control of
emotional expression in affect management and the degree to
which participants in social interaction monitor behavior for signs
of affect control and/or attempt to provide appropriate signals for
lack of affect control.

Much of this paper has been programmatic in nature. I have
reviewed some of the issues that need to be attended to if the study
of emotion is to emerge from conceptual muddles, such as the at-
tempt to juxtapose emotion and cognition, and from theoretical
cul-de-sacs, such as the notion of emotion as disruption. The pro-
cess model of emotion which I have outlined above seems to have
potential to deal with at least some of the long-standing problems
in emotion theory. However, in spite of the fact that the model is
rather eclectic, combining various theoretical notions that have
been proposed before in the literature, at present it is little more
than a blueprint. I am now attempting to elaborate the details and
establish the feasibility of the model. In terms of research, it will be
particularly important to study emotional processes in everyday
life, concentrating on the important role of culture and social inter-

action in the antecedents and the regulation of emotion. This is a
task that forces us to transcend the narrow confines of laboratory
experimentation in the psychology of emotion. After many years of
a pitiful existence under the shadow of the “cognitive wave” in the
social and behavioral sciences, the study of emotion is again
becoming fashionable in many disciplines, particularly in an-
thropology, ethology, philosophy, psychology and sociology. A
joint, interdisciplinary approach to the issues raised here may yield
advances which have so far been difficult to achieve in any one of
these areas.

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