

ON THE NATURE OF EMOTION

E.A. Salzen
Aberdeen University

When James (1890) enlarged on his theory of emotion he bemoaned the descriptive nature of psychological works on emotion and wrote "They give one nowhere a central point of view, or a deductive or generative principle." (p. 448 of 1950 Dover reprint). Output of theories after James' publication remained high and continued into the 1930's (see bibliography by Raines, 1929, 1930, 1931; and historical reviews by Gardiner, Metcalf, & Beebe-Center, 1937; and Hillman, 1960). Then, although theories continued to appear, general interest in emotion flagged and in psychology textbooks the subject was relegated to chapters on motivation. Interest revived in the 1970's and is now high again. In a textbook on emotion Strongman (1973) gave vignettes of about thirty of the better known theories all post-dating James. More appeared by 1980 (Plutchik, 1980; Plutchik & Kellerman, 1980; and a bibliography by Rorty, 1980) and this continued unabated in the 80's. Many of these theories are very well known and are examined in the reviews cited. It is neither possible nor necessary to review yet again so many theories if the present one is to be stated, developed and its implications explored. Similarly, the data or phenomena of emotion are too familiar to require detailed presentation here and instead sources of relevant descriptions will be cited. In citing both theoretical and data sources I have tried to use the earliest references since I believe they should be given priority over more recent sources that are essentially saying the same thing but in different terminology or in more elaborate detail. Current sources are given where they are fundamentally or significantly "new."

With so many theories why add another? The very multiplicity of theories suggests that none has a central point of view or a deductive or generative principle that provides a satisfactory or complete explanation of the phenomena of emotion. But what is required of an adequate and satisfactory theory? I suggest it must meet the following requirements.

1. A theory must provide a clear and specific concept of emotion that distinguishes it from other affective states such as hedonic feelings, moods,

Address correspondence to E.A. Salzen, Department of Psychology, Aberdeen University, Aberdeen AB9 2UB, Scotland.

and sentiments. Existing theories too often deal with ill-defined and differing sets of phenomena and seldom make a clear distinction between emotion and these other affective states so that there is little agreement as to the precise usage and meaning of the term emotion. This confusion even led to the denial of the existence of emotion as a conceptual entity, as in such papers as "Is 'Emotion' more than a chapter heading?" (Bentley, 1928) and "An explanation of 'emotional' phenomena without the use of the concept 'emotional.'" (Duffy, 1941).

2. A theory must address all the phenomena of emotion. Historically the phenomena have come to be considered in terms of the following three classes: i) Behaviour, i.e., somatic responses or skeletal muscle actions; ii) Visceral changes, i.e., autonomic responses or smooth muscle and glandular actions; iii) Experience, i.e., conscious mental states of awareness of the behavioural state. Most existing theories of emotion emphasise one or two of these, commonly the visceral changes, in the tradition of the James-Lange theory, and the experience of emotion, as in either the psychoanalytic tradition or the currently popular cognitive processing approach. Few theorists, notably Plutchik (1980), follow the example of Darwin (1872) or McDougall (1936) in emphasising the somatic behaviour.

3. A theory must meet the requirement made of any biological explanation of behaviour (Tinbergen, 1963) of answering the following four classes of question: i) Causation. What is the immediate cause, i.e., what are the physiological, behavioural and cognitive (Sherman, 1988) processes or mechanisms? ii) Function. What is the effect, both immediate and long-term, i.e., what are the physiological, behavioural, cognitive and possible adaptive consequences? iii) Development. How has it come to be like this in the individual, i.e., what are the effects of maturation and experience? iv) Evolution. How has it come to be like this in the species, i.e., what are its evolutionary origins? Few theories of emotion even address all four questions, most concentrating on one or two, commonly causation and function. Plutchik (1980) provides an example of an emotion theory attempting a complete biological explanation and the differences from the present theory will be considered in due course.

In previous articles on the specific topics of attachment, fear, and facial expression (Salzen, 1978, 1979, 1981) I have published the essence of a theory of emotion which I believe can meet all the above requirements. The present article will present the theory in detail and for convenience I shall call it the "thwarted action state signalling" (TASS) theory. A realistic or veridical identification, classification and explanation of the phenomena of emotion should facilitate the recognition of associated brain systems and processes. Some theories of emotion have reversed this process and tried to explain emotion in terms of specific brain systems (e.g., Cannon, 1927; Papez, 1937; Lindsley, 1951; Panksepp, 1982). In doing so they have begged the question as to the nature of emotion.

TABLE 1
Thwarted Action State Signalling Theory of Emotion

<i>Desiderata</i>	<i>Behaviour</i>	<i>Experience</i>
Phenomena	Thwarted somatic and autonomic actions	Self-perception of thwarted action states
Causation	Thwarting and conflict	Intero- and exteroceptive feedback of own display
Function	Signalling for social partner to start/stop acting to change thwarting situation	Self-help and self-control made possible by self-perception of signals
Development	Differentiates with motor repertoire and cognitive development	Growth of self-concept, facilitated by speech and language
Evolution	Displays derived from thwarted action states	Speech derived from vocal displays

The implications of TASS theory for identifying the brain systems for emotion are significant but can not be considered here.

THE TASS THEORY OF EMOTION

The theory may be stated as propositions or assertions as follows (Table 1).

1. The phenomena of emotion can be understood as,
 - a. Incipient somatic actions or intention movements of consummatory acts and their associated appetitive behaviour that have been strongly aroused but cannot be performed, i.e., they are thwarted action states (unpleasant emotion) or are changing from thwarted action states to consummatory behaviour on release from thwarting (pleasant emotion).
 - b. Visceral changes that accompany and support the somatic actions and especially those that enhance the perceptibility of the somatic actions.
 - c. Both the somatic and visceral actions have signalling value for social partners and may evolve to form specialised displays.
 - d. Self-perception by external perception (exteroception) of these somatic and visceral action states integrated with internal perceptions (proprio- and interoception) provides the "awareness" or "experience" of emotion and enables self-signalling and self-responding or self-control. This gives emotional states the potential to act as intervening variables in learning and motivation (Brown & Farber, 1951).

2. The biological explanation of these phenomena is as follows,

a. Causation. The immediate cause is the thwarting of specific strongly motivated actions following arousal, or the subsequent release from such thwarting (for unpleasant and pleasant emotions respectively). Thwarting is defined as the absence of indispensable stimuli or simple physical obstruction following intense arousal, or the simultaneous arousal of two or more incompatible tendencies. Learned anticipation and memories of thwarting or end-of-thwarting circumstances are cognitive causes that may represent the "cognitive appraisal" postulated as the cause of emotion in many cognitive emotion theories.

b. Function. Emotional behaviour serves to signal the nature of the thwarted action state and to induce or "motivate" social partners to change their behaviour in a way that may remove thwarting. Emotional behaviour on release of thwarting serves to signal the success of the helping behaviour and switch to consummatory interactions and states and so may become reinforcing or "rewarding" to the social partner. Self-perception enables the individual to respond in a helping (coping) way to its own thwarted action states and circumstances as it might to the emotional displays of others. This is the "self-motivating" effect commonly regarded as the prime function of emotion. Similarly self-perception of end-of-thwarting states can lead to the commonly accepted "self-reinforcing" or rewarding effect of pleasant emotional states.

c. Development. Emotional behaviour will differentiate as specific appetitive and consummatory behaviours develop and differentiate. Perception of emotional displays and their associated circumstances in others enables the development of empathy. Self-perception of one's own displays and especially vocalizations as comparable with others leads to self-signalling and contributes to the development of self-awareness, self-control and sympathy. Speech development completes the process.

d. Evolution. Intention movements convey information as to the nature of the aroused behaviour and have been selected for their signalling values; so, too, have associated visceral changes that can be detected by social partners. They may become "ritualized" to form special displays as seen in agonistic, sexual, parental, infantile, and alarm displays and ceremonies. Social responses and helping behaviour that facilitate these interactions have been correspondingly selected with these signals. Vocalizations produced by these visceral and somatic actions are part of this signalling and at moderate levels of arousal could provide the basis for modulation and evolution into speech.

A definition or concept of emotion. An explicit definition of the term emotion must be consistent with any satisfactory theory since such a theory, by being totally descriptive of the phenomena and their properties, is itself an implicit definition. That is not to say that it must either reject or coincide with current usage, but rather that it should refine the

meaning of the term so as to decrease ambiguity and increase precision of application and usage, both in relation to the real world and in relation to other terms and concepts.

Historically, the term emotion derives from the Latin *e-movere* meaning "to move from" or "to disturb." It was originally used in the sense of migration of people and then for movements of the ground or earthquakes. In 16th century English, it was used for the agitation and tumult of social upheaval, as in "public emotions." By the 19th century, it had come to mean a disturbance of the mind or "affective upheaval" and finally a "tumult of feeling" (Young, 1943, p. 25). I agree, therefore, with Young (1961, p. 353) in his statement that "An emotion is a variety of affective process distinguished from the others as an acute (brief and intense) affective disturbance." TASS theory is consistent with this usage of the term. However, in addition it specifies the causes and nature of the disturbance in terms of response processes.

A preliminary definition of emotion based on TASS theory would be: emotions are the behavioural, visceral and mental states that occur when activated motivated behaviours are thwarted or in conflict. However thwarting can account only for the disturbances that we experience as unpleasant. In order to account for displays of pleasure and happiness, the decline of the responses to thwarting and the change into consummatory behaviour at the release from thwarting or the resolution of conflict must be included in the definition. Thus a concise definition of emotion would be: emotions are the behavioural, visceral and mental states that occur when activated motivated behaviours are thwarted or in conflict or when they are released from this thwarting or conflict. This definition allows us to distinguish emotion from other affective states which include hedonic feelings, moods, and sentiments. They can be broadly defined and distinguished as shown in Table 2.

In summary, I suggest that *Affect* be the generic term for the arousal and experience of motivational action states; that *Feelings* refer to ongoing activated behavioural states; that *Moods* refer to unactivated motivational responsive states; that *Emotions* refer to blocked activated behavioural states; and that *Sentiments* refer to cognitive constructs of feelings, moods, and emotions (McDougall, 1936).

THE TASS ANALYSIS OF EMOTIONAL BEHAVIOUR

This analysis arises from the view that if we wish to understand the essential nature of emotion we must use the comparative approach and examine the equivalent phenomena in related vertebrate animals. Human emotion must have evolved by modification of behavioural systems common to our fellow primates and be present, in more basic forms, in homiothermic amniotes, i.e., birds and mammals, and possibly even in all vertebrates. The behavioural phenomena comparable with human

TABLE 2
Terminology of Affect

Affect.

From the Latin *affectus* meaning "disposition." A generic term applicable to the activation and experience of motivational states.

Feelings (hedonic).

Sensori-motor states of beneception or nociception and appetite or aversion associated with the activation, performance, and consummation of motivated behaviour, e.g., of tasting, of being hungry, of eating, of being satiated.

Moods.

Enduring metabolic and hormonal motivational states operating through both general (e.g., mania and depression) and specific (e.g., parental, sexual) activation systems.

Emotions.

Acute feeling and action states associated with the thwarting or end-of-thwarting of activated motivated behaviour, e.g., anger, fear, joy. Chronic emotional states result from reminiscence or anticipation of thwarting or end-of-thwarting (e.g., anxiety and hope, love and hate).

Sentiments.

Cognitive constructs and attitudes of an affective content based on past experience of feelings, emotions, and moods, e.g., patriotic, religious, moral and aesthetic attitudes and beliefs.

emotional behaviour are recognised even by the layman as the displays given by birds and mammals in escape and flight, in aggression, in courtship and mating, in parenting, and in affiliation. These displays have been well analysed by ethologists who have shown that a wide range of such "expressive" patterns can be understood as intention movements and postures (Daanje, 1951), or combinations of such elements, belonging to actions that are blocked or prevented from completion either by inadequate and inappropriate stimulus circumstances or by conflict between incompatible aroused action tendencies (Baerends, 1975; Eibl-Eibesfeldt, 1975; Hinde, 1970; Smith, 1977; Tinbergen, 1958). This analysis of social signalling in vertebrate animals up to and including primates and humans is firmly based on comparative studies of behaviour and is not in any way dependent on classical ethological motivation theories or analogies (Hinde, 1985).

In an article on the origin of social signals Morris (1956) gave a summary analysis of this social signalling and of its relation to thwarting and conflict. This analysis, with some amendments, is shown in Table 3 as a

TABLE 3
Thwarting and Responses to Thwarting

Thwarting Situations	
I	Absence of indispensable stimuli following intense arousal
II	Simple physical obstruction of aroused activity
III	Simultaneous arousal of two or more incompatible tendencies
Primary Responses to Thwarting	
Somatic	
1	Perseverance—persistent approach and adjustment (I, II)
2	Snap Decision—capricious choice of response (III)
3	Threshold Intention Movements—initial element of response (I, II)
4	Ambivalent Posturing—elements of both responses (III)
5	Alternating Intention Movements—successive initial responses (III)
Autonomic	
1	Alimentary—salivation increase or decrease, urination, defaecation
2	Circulatory—pallor, flushing, genital vasodilation, fainting
3	Respiratory—changes in rate and amplitude, panting, gasps, sighs
4	Thermoregulatory—sweating, feather/hair raising/sleeking
5	Lacrimatory—weeping
Secondary Responses to Thwarting	
1	Displacement Activities—irrelevant behaviour
2	Redirection Activities—response to another stimulus
3	Regressive Activities—immature responses
4	Neurotic Inactivity—loss of responsiveness
5	Aggressive Behaviour—intense approach and adjustment
6	Stereotypic Activities—repetitive movement patterns
7	Visceral Dysfunction—chronic autonomic imbalances

summary of the elements of emotional behaviour according to TASS theory. Thwarting and conflict are clearly defined and the types of somatic motor actions and of visceral actions that form the primary response patterns are presented. In addition, there is a list of secondary

responses to thwarting that Morris suggested could result if the primary responses failed to lead to the end of thwarting. I have added three items, *aggressive behaviour*, *stereotypic activities*, and *visceral dysfunction* to the original list given by Morris. Some explanatory notes on the scheme in Table 3 follow.

i) **Primary somatic responses.** The motor responses to thwarting are essentially the incipient actions of the aroused specific motivated behaviours such as attack, flight, mating, parenting, etc.

In *Perseverance* the activated behaviour is persistently attempted in increasingly intensified form. At lower intensities persistent appetitive actions are interpreted as "interest" and it is not insignificant to note that some theorists include interest as a primary category of emotion (Izard, 1971; Ekman, Friesen, & Ellsworth, 1972). Perseverance involves orientative readjustments in approach behaviour which may remove the thwarting. Clearly it is this type of response that can result in learning, as in trial and error learning. This could account for the common notion that emotional arousal is necessary for learning to occur and that it is emotion that motivates, and the reduction in emotional arousal that reinforces, the learning. TASS theory says that the arousal is of underlying motivational action states and that thwarting provides the necessity and opportunity for the variation in appetitive behaviour that in turn may lead to the consummatory stimulus and act. Thus, emotion may provide the medium for learning but is not the instigating factor. At higher intensity persistent approach responses may be interpreted as "desire" or "love." This is an emotion that is strangely absent in many classifications of the basic emotions but was recognised perhaps by McDougall (1936) as "tender emotion" and by Plutchik (1980) as "acceptance." At high intensity, approach and orientation responses may result in attempts to adjust the position of the object (reorientation) even to the extent of causing its disappearance or destruction. For example, aggression in mating behaviour may derive from excessive actions for copulatory orientation. Such behaviour is seen as emotional or frustrative "aggression" and is consistent with the frustration aggression theory of Dollard et al. (1939). In *Snap decision* performance occurs after some delay but in an unpredictable and irrational way. It is the flustered "emotional" decision.

The remaining types of primary somatic response to thwarting shown in Table 3 are halted initial actions or *intention movements* of the activated behaviour alone (*Threshold intention movements*), in combination (*Ambivalent posturing*), or in succession (*Alternating intention movements*). They are coupled with appetitive orientation movements and postures that are directed toward or away from the stimulus source. Because these movements indicate the nature and direction of the intended or activated behaviour they have signal value that can be selected, enhanced and "ritualized" (Blest, 1961; Huxley, 1914; Tinbergen, 1952)

in evolution. This will occur especially where the response to thwarting induces behaviour in a social partner that removes the source of thwarting. Thus, if the social partner has been behaving inappropriately or ambivalently it may be induced to change to actions that are more appropriate for the aroused but thwarted individual. This type of interaction can explain the evolution of courtship ceremonies, agonistic displays, and parent-offspring affiliative interactions (Eibl-Eibesfeldt, 1975; Hinde, 1970). This social signalling of thwarting is not confined to dyadic interactions. Where thwarting is due to a circumstance, either organismic (e.g., a third species member or another species) or environmental (e.g., physical obstruction), that a social partner can affect by a change of behaviour then responses to thwarting may also evolve to give displays such as alarm, fear, and distress displays, that produce helping behaviour, mobbing, and other cooperative behaviour. A similar selection of responses to thwarting that deter, hinder, or otherwise affect the behaviour of potential predators may lead to the evolution of intra-specific fright and defensive displays, including distraction displays, e.g., the broken wing display of birds such as the killdeer (Deane, 1944; Simmons, 1955). Thus TASS theory applies to "emotional" displays specific not only to social partners, physical objects and circumstances, but also to other species. In all cases the effect is to change the situation by inducing behavioural changes in other organisms so that the original aroused consummatory actions may be performed.

ii) Primary autonomic responses. Table 3 shows the autonomic (visceral) system activities that may occur in primary responses to thwarting. They are essentially the visceral actions that accompany the activated behaviour and the enhanced activities of the appetitive orienting behaviour. Morris has classified them by system, and emphasised those changes that are perceptible (i.e., visible, audible, or olfactory) to the social partner (or other organism) and so serve as signals that could be selected and evolve into distinctive displays. Normally somatic and visceral displays are coupled so that the motor action maximizes the detectability of the visceral display as in "waving the flag." Perhaps it would be more accurate to say "flagging the wave" in that the visceral actions become exaggerated in regions of the somatic motor action that they make more perceptible and where they emphasise the movement. In either event this coupling produces the familiar avian and mammalian emotional feather, hair, and bare swollen skin displays, and scent deposition. Irregular respiratory responses to thwarting are shaped by the bodily movements of specific primary somatic responses and produce specific vocalizations. This has led to two significant developments. First, because signalling vocalizations are perceived by the signaller in almost the same form as those given by social partners there is the possibility of responding to one's own vocalizations as if to another social partner, i.e., to self-signalling, self-awareness, and self-control of emotions. Sec-

ond, modulated thwarting vocalizations at moderate levels of activation form an ideal substrate for the evolution of speech.

A deduction or prediction from TASS theory is that we would not expect covert imperceptible autonomic responses to be distinctive for specific somatic response states, i.e., to be specific to particular emotions. And, indeed, generations of psychophysicists have failed in the search for specific visceral patterning in the emotions. Winton, Putnam, and Krauss (1984) in an excellent study showed a correlation between heart rate and pleasantness and between skin conductance and arousal. They suggest that visceral information reflects the dimensions underlying affects rather than the classes of affects. Even in the sophisticated studies of Ekman, Levenson, and Friesen (1983) the claimed degree of specificity using heart rate and temperature is poor and only separates groups of the common emotion categories. Psychophysiology has been chasing a "will o' the wisp" and such study is warranted only for sub-threshold affective action detection, i.e., to detect activation states that are insufficient to produce perceptible overt motor actions. In this case, EMG measures would still be the sensible approach, since they are the means of detecting the sub-threshold primary somatic responses that are the specific action states of emotion (Cacioppo & Petty, 1981). In this respect work such as that of Schwartz and co-workers (Schwartz, 1982) is clearly more fruitful. In a sense the psychology of the emotions was thrown off course by James and Lange who unlike Darwin emphasised the visceral responses, probably because these seemed to be the key to the experience of emotion. Subsequently few people paid attention to McDougall's attempt to reinstate the primacy of motivated behaviour in emotion.

Elsewhere (Salzen, 1978), on the basis of chick and primate data, I have noted that autonomic responses to thwarting are predominantly of the sympathetic nervous and glandular systems and that end-of-thwarting is characterised by a swing from sympathetic to the parasympathetic dominance characteristic of consummatory actions and stimulation. This is consistent with the ideas of Gellhorn (1957, 1966) on sympathetic/parasympathetic balance and rebound phenomena in his hypothalamic theory of emotion. I would suggest that the more recent Solomon and Corbit (1974) opponent process theory of motivation is dealing with the same phenomena, i.e., thwarting and release from thwarting, and the associated sympathetic/parasympathetic discharges, and with the well known physiological phenomena of rebound that Gellhorn has exploited to considerable effect.

iii) Secondary responses to thwarting. These are the responses, both somatic and visceral, that may replace the primary responses if thwarting is persistent and unrelieved. Table 3 lists the classes of response. What is significant about all these secondary responses to thwarting is that they have the appearance of pathological behaviour and are the stuff of psychiatry. Furthermore they have lost the intention movement elements

of the activated but thwarted motivation and/or the goal stimulus orientation and so have lost their specific signalling values. This is what makes their psychiatric diagnosis so difficult; the existence of thwarting or conflict is evident but its precise nature is not, even to the patient. Yet, as will be indicated, secondary responses to thwarting may still have either some signalling value or some other adaptive value and if so may have been selected for in evolution. The first four derive from Morris's analysis and need little explanation.

1. *Displacement activities* (Armstrong, 1947, 1950) include behaviour such as eating, drinking, and grooming inappropriate to the situation; all are well described in conflict situations in the ethological literature and reported in humans (Eibl-Eibesfeldt, 1971). They may act by redirecting the attention and/or switching the motivation of the social partner in a way that makes further social interaction more likely. They may also form the basis of evolutionarily specialized agonistic and courtship displays, as suggested by Schenkel (1958) in discussing the origin of the peacock display from displacement feeding.

2. *Redirection activities* of attack, sexual, and parental behaviour to alternative stimuli when responding to the appropriate stimulus is not possible occur in animals and humans (Eibl-Eibesfeldt, 1975). Redirection is a discharge of primary responses that at least warns others of the individual's state and allows both the individual and the group to resume other ongoing activities.

3. *Regressive activities* include infantile food begging in courtship in birds and mammals, suckling behaviour in distress in mammals, loss of sphincter control in fear in mammals, and infantile temper tantrums in thwarted desires in primates. All occur in humans. Regressive behaviour tends to elicit parenting and caring responses from the social partner and helping responses from the group.

4. *Neurotic inactivity* is a Morris innovation and may correspond with the flaccid condition that can develop after prolonged tense states typical of fearful freezing and immobility responses (Ratner, 1975). It can lead into sleep. Sleep can occur in conflict states in animals and humans when it can be classed as a displacement activity (Armstrong, 1947). Delius (1967) has suggested that displacement sleep might result from an "overshoot" (rebound?) in arousal regulation and this could be the basis of neurotic inactivity. Neurotic apathy and depression can occur in chronic separation in monkeys and humans (Kaufman & Rosenblum, 1967a,b; Scott & Senay, 1973; Bowlby, 1969, 1973). Neurotic inactivity can be the least damaging response for the individual where alternatives are equally disadvantageous. In chronic separation in infants it can be energy conserving (Kaufman & Rosenblum, 1967b). In fear responses, freezing and immobility can lessen detectability to a predator or even serve as a false signal, e.g., death feigning (Ratner, 1975).

5. *Aggressive behaviour* is my first addition to the list of possible

secondary responses to thwarting because it could be a specially evolved secondary response to thwarting derived as already described from the primary somatic response of *Perseverance*, i.e., enhanced approach and orientation responses to the arousing but thwarting stimulus object. Offensive aggression and fighting behaviour employing species patterns of fighting such as biting, striking, and stomping in apes and humans may represent a specially evolved motivational action system (agonistic behaviour for social and reproductive advantage and possibly predatory aggression in hunting). This would support the distinction between agonistic fighting and frustration aggression (Moyer, 1976). The question then is to what extent agonistic fighting has become independent of thwarting and is intrinsically motivated or autochthonous (Lorenz, 1966). This is a subject that is of wide concern for humans (Hinde, 1967). If offensive aggression is autochthonous, then full confident attack may be unemotional, i.e. it can occur without thwarting, and be carried out quite "coolly" while threat behaviour in the form of intention movements is the "heated" emotional display resulting from thwarting of the attack.

6. *Stereotypic activities* is the second of my additions. It, too, could be derived from *Perseverance* with a breakdown of repeated appetitive orientation behaviour into fragmented motor elements. This would result in repeated but apparently aimless sequences of locomotory movements. Similarly, motor actions such as scratching, rubbing, grooming, and biting directed to body parts could be a combination of *Stereotypy* with *Displacement activity* or (in the case of biting) with *Redirection*. Stereotypies do seem to be a breakdown in behaviour and are probably only seen in extreme circumstances as in captive animals and human pathology. But stereotypic movement involving constancy of form and repetition of action is an important element in ritualized thwarting displays where it serves the function of signalling the intensity of the aroused action state (Morris, 1957).

7. *Visceral dysfunction*. If thwarting and conflict persist then visceral responses to thwarting will become chronic and the same fragmentation may occur as in the case of stereotypies. These autonomic or visceral dysfunctions are the kinds of response syndromes familiar in stress conditions and in psychosomatic disorders. Perhaps we can say that secondary somatic responses are evident in humans with neurotic complaints while secondary visceral responses are present in psychosomatic disorders. Visceral dysfunction parallels stereotypy in being a breakdown in function and representing pathology. But the enhancement of a specific visceral response, often in a particular location which may well be associated with a repeated and stereotyped movement, is a common feature of ritualized displays (Morris, 1956).

iv) **End-of-thwarting displays**. On release from thwarting and conflict there is a changeover in behaviour in which the responses to thwarting are declining rapidly and being replaced by consummatory behaviour

and the achievement of a consummatory state. This changeover presents a distinctive pattern of behaviour and internal state that is associated with the events or situation that end the thwarting. This transitional behaviour, too, can be selected and developed in evolution to produce distinctive relief or "pleasure" signals, characterized by relaxation of the tension of the responses to thwarting, and specified or "flavoured" by the nature of the ensuing consummatory stimulation and response state. Such signals would indicate both the appropriateness of the social partner's present behaviour in response to the thwarted response display and the onset of consummatory behaviour that may require a corresponding change in this behaviour to continue or end the ongoing interaction sequence.

Andrew (1963) has described an intensity continuum in the character of vocalizations that primates give from low intensity social greeting, contact, and food recognition calls, to high intensity social isolation calls, and "distress" calls given to high stimulus novelty. He noted that there is a basic similarity in monkey, chimpanzee and human infant distress cries with sound spectrograms that have the same basic features, i.e., a vigorous attack, higher pitch composition of long duration and descending tail (see also Wolff, 1969, for human neonate cries). In contrast, their social contact and food recognition calls consist of a brief rise and fall, and are of lower pitch composition. In short, there is cross species evidence that lends credibility to the notion that vocalizations due to decreasing responses to thwarting with declining sympathetic activity occurring at the onset of consummatory behaviour with its parasympathetic dominance may be "seen" or interpreted as "pleasure" calls. Of course, this does not mean that all collapsing thwarting states are interpreted as, or give rise to, pleasure displays. For example, such a relationship might seem unlikely in the case of threat vocalizations. Yet, in rhesus monkeys, Rowell and Hinde (1962) describe, in addition to a threat bark and a less confident growl, "friendly" noises that included a food bark of lower pitch than the ordinary bark, a similar bark given in greeting, and a long growl made up of short elements that was in some cases used in grooming invitations and had some similarity to the "pleasure" or girning sounds that occurred mixed with growls in affiliative and contented animals. There is perhaps the suggestion that an initial arousal of threat or scared-threat quickly relaxes so that there is an indication of a relaxing state that is at least reassuring if not pleasing to the social partner. Relaxing fear and distress displays may be more likely to become distinctive "pleasure" displays where quiescence follows removal of the provoking stimulus, whereas other thwarted states give place to the performance of the hitherto thwarted behaviour which itself is the informative social signal. It should be recalled that smiling and laughter, the prime displays of happiness and joy in humans, may also be derived from

the relaxation of a basic primate protective grimace and of an open-mouth bared-teeth scared threat display respectively (van Hooff, 1962).

According to TASS theory, then, pleasant emotions should be short-lived, relief and relaxation responses and quickly give way to consummatory behaviour or quiescence. This is true of "joy" and "delight," while more prolonged euphoric states can be produced by reminiscence or by anticipation of end-of-thwarting. Furthermore, the theory predicts that the intensity of joy/pleasure will be low if there is no delay or anticipated delay between arousal and gratification of a consummatory act because there will be no thwarted action display to subside. Presenting and then withholding the arousing stimulus will increase this display and hence the changeover at the end-of-thwarting, i.e., the pleasure, will be greater the higher the level of the aroused action tendency because there will be a greater changeover in the somatic and visceral patterns. These are the phenomena involved in teasing, sexual foreplay, and perhaps in the use (both real and metaphorical) of *hors d'oeuvres*. The pleasure will be less the slower the release from thwarting because the rate of changeover will be lower and the display and internal perceptions less intense. If thwarting is prolonged the thwarted action state behaviour may first intensify but ultimately may decline or fatigue. This initial facilitatory effect and subsequent adaptation or fatiguing effect of the performance or attempted performance of motivated behaviour is known but the physiological explanation is in dispute. Whatever the cause, the result is that moderate delay of gratification gives a greater changeover or end-of-thwarting state or "pleasure" while too long a delay with its consequent decline in thwarted action states can then only produce a weak display—the phenomenon of the "let-down" of a too long awaited desire. If release from thwarting is unexpectedly quick and the levels of activation and behaviour are high, then there may be a residual discharge of the thwarted state behaviour before relaxation occurs; this is the redirected attack of the "air-punch" and "shout" in humans or the "trumpet" of geese triumph displays (Eibl-Eibesfeldt, 1975; Fischer, 1965). Triumph displays are a nice example of the possible signal value of end-of-thwarting displays; they can signal to the social group the identity of the successful individual and, in the case of group or team actions, they ensure that team effort is not continued unnecessarily and everyone can relax.

The switch from responding to a partner's thwarted state behaviour to resuming interrupted ongoing sequences or relaxed states is signalled by the end-of-thwarting displays. These displays, therefore, can serve as conditioned or secondary reinforcers and incentive stimuli for the helping responses which have produced the end-of-thwarting. This is an effect of smiling in social interactions, for example. A similar learning effect in the signaller means that the end-of-thwarting state can become the secondary goal of the appetitive behaviour arising from thwarting. There is

a common impression that we strive for happiness and joy rather than for the consummatory behaviour and states themselves. This is not so, and the philosopher Ryle (1949) has made a similar point in respect of pleasurable activities in humans. In fact, there are abnormal conditions in which this may be the case. For example the Don Juan is more concerned with, and gets more pleasure from, his conquests, i.e., the success of his seductive behaviour than the ultimate coital act. Similarly, the miser is more concerned with his money than with the bodily satisfactions it can bring. But for most people secondary reinforcers ultimately fade and extinguish unless accompanied by biological consummation, so that "money alone does not bring happiness." It is possible that the reinforcing and incentive effect of end-of-thwarting is operating in coping behaviour and in competence motivation (White, 1959). The achievement of competence or coping with the environment may be a key feature of childhood play (tickling, peek-a-boo, catch-me) and many adult games of skill. Again, individuals can become trapped with the secondary reinforcement of the end-of-thwarting even to the extent of risking life and limb in mountaineering and similar dangerous but biologically pointless pursuits.

THE APPLICATION OF TASS THEORY

The following two brief accounts show how TASS theory can be used to analyse complexes of emotional behaviour.

i) **Attachment, separation and reunion.** I first applied a TASS analysis to the behaviour seen in social attachment in nonhuman primates and humans (Salzen, 1978). On the basis of a neuronal modelling theory of imprinting (Salzen, 1962, 1970), I treated attachment behaviour as a sensory homeostatic response pattern which serves to maintain contact or the close presence of the familiar attachment object, somewhat in the manner of the goal-steered model used by Bowlby (1969). Separation represents a disturbance of this state and there is appetitive orientation behaviour to restore the object presence. This behaviour becomes emotional when restoration is blocked and the thwarted responses of persistent and enhanced seeking and approaching occur (primary somatic responses of *perseverance*). They are accompanied by distress vocalizations (a primary visceral *respiratory* response to thwarting). This is the pattern of "separation protest" (Bowlby, 1969, 1973).

In older children learned anticipation of chronic separation (Bowlby's "working models of the mother") might be expected to give responses to anticipated thwarting in the form of persistent approach and clinging (*perseverance*) or at least "glancing looks" (*intention movements* of approach) even in the presence of the mother, and this corresponds with Bowlby's "anxious attachment." If separation continues despite the primary orienting responses to thwarting, then secondary responses to thwarting develop. These include "temper tantrums" in the form of

TABLE 4
Facial Actions, Motivational Action States, and Emotions

<i>Motivational Action State</i>	<i>Description of Facial Actions</i>	<i>Emotional States</i>
Attention	Focal stare, slight frown and mouth tension. Head forward.	Interest, curiosity.
	Phasic, open eyes and mouth, raise eyebrows, head back, gasp.	Surprise, astonishment wonder, awe.
Appetence	Lip and tongue protrude, open mouth and attention for oral intake.	Desire, want, longing, love, devotion.
Aggression	Attention with tight or open mouth of intention bite and shout.	Anger, annoyance, hate, fury, rage.
Rejection	Dilate nostril, raise upper and evert lower lip, depress mouth corners with eject action of tongue. Avert head. Lacrimation.	Disgust, disdain, dislike, contempt. Weeping, crying.
Aversion	Eye aversion, head turning and abduction. Eyes close (cut-off), hide. May be initial attention.	Fear, horror, panic, terror, dread.
Protection/ Effort	Close eyes, clench teeth, retract lips (grimace) and hold breath or grunt/scream.	Distress, anguish, suffering, tension.
Fatigue	Eyelid droop, jaw drop, open mouth for inhalation. Residual effort in oblique brow and clenched teeth.	Sadness, grief, despair, dejection, despondency.

TABLE 4
Continued

<i>Motivational Action State</i>	<i>Description of Facial Actions</i>	<i>Emotional States</i>
Acceptance/ Relief	Relaxation of other facial actions. Smiling from protection grimace. Laughing from open-mouth scream of attack/protect or surprise.	Happiness, joy, delight, elation, ecstasy, bliss.

neonatal undifferentiated repeated extensor movements (*regression*) and thumb sucking (*displacement feeding*), self-rocking (*stereotypy*), and striking others (*aggression*). Subsequently, there may be clinging to a toy or other familiar object providing contact, and this may alternate with rejection of, and aggression towards, the object. Or there may be self-clinging and contacting. The objects are substitutes that provide contact stimulation and to which approach and consummatory clinging behaviours are redirected (*redirection*). There may also be loss of sphincter control (*regression*). Finally "despair" behaviour in the form of apathy and inactivity may set in representing secondary responses to persistent thwarting (*neurotic inactivity*).

The behaviour at "reunion" is normally like that of "anxious attachment," i.e., an enhancement of appetitive approach and consummatory contact responses, although of limited duration. But if the child has become "detached" (Bowlby, 1969, 1973) it may show a blank stare, turning away, distress crying, or apathy, alternating with approach and clinging. The approach may also be aggressive. It is as though the attachment figure is reactivating the attachment behaviour of approach and clinging but also the responses to thwarting that became associated with memory of the attachment figure during the chronic separation period. In any event this is clearly an example of *alternating intention movements* as a primary response to thwarting and *aggression* as a secondary response to thwarting resulting from a conflict state. The original account (Salzen, 1978) of this analysis of attachment behaviour in non-human primates and humans should be consulted for a full assessment of the potential of TASS theory and for a full literature review.

ii) **Facial expression of emotion.** In an application of TASS theory to the analysis of human facial expressions of emotion (Salzen, 1981) I identified eight possible classes of action pattern (Table 4) that seemed to encompass the descriptions of facial expressions of human and non-

human primates available in the literature. These actions were then looked for in the still photographs of the Froois-Wittman series of facial expressions for which corresponding emotion judgments were available (Hulin & Katz, 1935). These eight action patterns appeared to form the predominant elements of eight types of facial expression that are commonly assigned to eight fundamental categories of emotion (also shown in Table 4). An empirical study (Salzen, Kostek, & Beavan, 1986) of the perception by adults and children of these basic action classes and emotion classes in two series of still photographs gave some confirmation of this correspondence, especially for the children. A study by Kirouac, Bouchard, and St-Pierre (1986) did not find a good correspondence between the recognition of classes of behaviour and emotion but their categories differed significantly from those in Table 4 and they did not test children. Tests with video-recordings should prove more interesting because the actions will be more evident. Some of the ambiguities in identifying responses to thwarting or emotional states in photographs of faces lie in the absence of information as to the whole body orientation movements and also in the absence of vocalizations. The significance of whole body orientation and the nature of the eliciting stimuli will be made clear in the next section.

Some supplementary comments especially with respect to vocalizations may be helpful in appreciating Table 4 although the full descriptions and review of relevant literature in the original papers will need to be read.

In the case of *Attention* (Table 4) it is arguable whether interest and surprise are "really" emotions or simply the precursors to emotions once the source of novelty has been identified. Both attentive behaviours can serve as social signals of an interrupted action state and so are included in the present emotion concept. I suggest that the full phasic surprise response is an alarm reaction, because it is normally accompanied by a scream or at the very least an unvoiced gasp, and seems to have many of the characteristics of alarm calls in other primates. Sustained attention (interest) can be an affectively neutral cognitive state but also forms part of most motivated action patterns.

Appetence, with its associated emotional state of want, need or desire, is distinguished in Table 4 from attention although it usually involves sustained attention. In an empirical study of recognition of face photographs with free labelling (Salzen, Kostek, & Beavan, 1986) people used the category of interest for both attention and appetence expressions. In common usage, interest is often a euphemism for want or desire, perhaps because intense attention is almost invariably part of appetence behaviour.

Thwarted attack or *Aggression* (Table 4) involves not only threat postures and expressions but also the low pitched voiced expiration of the angry shout. This may rise in pitch content as it merges with the

scream of the protection/effort state to form an ambivalent open-mouth scream or scared threat display (van Hooff, 1962).

In the case of *Rejection* (Table 4) the typical disgust pattern may give place to crying (weeping), and the incipient cry face is very similar to an incipient disgust expression. This cry face and crying may be a ritualized infantile care-soliciting signal evolved from rejection responses. It can easily merge with open-mouth screaming when the rejection responses are without effect and mixed protective/effort and aggressive responses are recruited.

In *Aversion*, in addition to the thwarted intention movements of withdrawal described in Table 4, there may be tension and screams characteristic of the protective response given in anticipation of contact with the aversive stimulus. The social communication of fear occurs either through the incidental signalling, i.e., through seeing the actual non-thwarted withdrawal responses of a social partner, or through the thwarted state signalling of the alarm and protective vocalizations (see Morris, 1956 for the distinction between signalling in non-thwarting and thwarting situations). There may not have been selection for a specific facial expression of fear, for we do not normally look at our social partner's face in order to learn of the existence of environmental dangers (although we may look to see the direction of their attention and hence the locus of danger). In fact the recognition of "fear" faces in photographs is poor and they are often confused with surprise, anger or distress.

In the *Protection/Effort* display described in Table 4 the accompanying vocalization is distress screaming which can signal for parental and social help. The protect face is similar to the startle expression described by Landis and Hunt (1939). The startle response is a phasic reflex which may be quickly followed by orienting, protective and flight responses. Strauss (1929) called these "secondary responses" and it is these that may be said to be "emotional." This, perhaps, answers the question "Is the startle reaction an emotion?" raised by Ekman, Friesen, and Simons (1985). As in the case of flight a successful protective response need not be "emotional" but may become so when it fails to protect. The adjustive actions and vocalizations to remove the stimulus represent responses to thwarting and constitute distress displays that are "emotional."

In *Fatigue* or exhaustion the actions and vocalizations are the residual elements, or recurrences, of the specific responses that have been chronically thwarted. Thus in grief and mourning there may be residual or recurrent rejection responses of crying and weeping, i.e., in rejection of the unwanted noxious knowledge or thought of the loss of the loved object.

In the case of *Acceptance/Relief* (Table 4) the facial expressions of smiling and laughing are probably ritualized relief/relaxation responses. Smiling or the "grin face" can be understood as the relaxation of an

incipient protect or scream face. Laughing or the "play face" can be understood as oscillatory relaxations of the scared-threat or open-mouth scream face, itself an ambivalent posture combining open-mouth threat and scream face (van Hooff, 1962; Salzen, 1981). A case could be also be made for laughter as relaxation oscillations of the alarm reaction, surprise, which it often follows.

In conclusion, it is possible to analyse facial expressions of emotion in terms of eight classes of action pattern interacting with the degree of arousal and the presence of thwarting. Dyadic and higher combinations of these action patterns could account for a wide range of "mixed" or "blended" emotional expressions. Table 5 illustrates possible emotional interpretations of dyads of the eight action patterns. This analysis will now be compared with the traditional analyses of facial expression which have been used to examine the nature of emotion.

CATEGORIES, DIMENSIONS, AND THEORIES OF EMOTION

It is clear from a number of reviews (Izard, 1971, 1977; Dittman, 1972; Ekman, Friesen, & Ellsworth, 1972; Salzen, 1981) that studies of facial expression of emotion result in two different inferences about the nature of emotion. In one type of study the data seem to show that there are a number of discrete classes of expression which correspond with subjective and traditionally recognised discrete emotional states or categories of emotion. In the other type of study the data suggest that there are a limited number of inferred underlying states or dimensions of emotion rather than discrete categories.

The "category" approach has been critically reviewed by Ekman, Friesen, and Ellsworth (1972). It seems to produce six to nine categories according to each author's notions of what can be regarded as a basic or primary emotion. Ekman et al. themselves settled for six emotion category terms plus interest, although more recently (Ekman & Friesen, 1986) a new category of contempt has been proposed. In TASS analysis, contempt could be derived from a blend of rejection with ambivalent attack and turning away in withdrawal and so would not be regarded as representing a primary emotion category. Table 6 shows the categories recognised in several major reviews of facial expression studies. It seems reasonable to say that there appear to be no more than eight commonly recognised basic or primary categories of emotion.

Dimensional analyses have been well reviewed by Dittman (1972) and Ekman, Friesen, and Ellsworth (1972) and consistently appear to identify four or five dimensions, of which three account for the major data variance. These three dimensions are commonly identified as i) pleasantness-unpleasantness, ii) activation level, and iii) interest or attention-rejection. Dittman points out that these are not too different from the original proposal of Wundt (1907) that there are three dimensions of emotion:

TABLE 5
Possible Emotional Interpretations of Dyadic Combinations of the Eight Thwarted Action States

	<i>Attention</i>	<i>Appetence</i>	<i>Aggression</i>	<i>Aversion</i>	<i>Rejection</i>	<i>Protection</i>	<i>Fatigue</i>	<i>Acceptance</i>
<i>Attention</i>	Interest							
<i>Appetence</i>	Love/Hope	Desire						
<i>Aggression</i>	Threat	Love-hate	Anger					
<i>Aversion</i>	Fascination	Coyness	Fear-threat	Fear				
<i>Rejection</i>	Revulsion	Addiction	Contempt	Horror	Disgust			
<i>Protection</i>	Anxiety	Shyness	Resistance	Shame/Hide	Distress	Pain		
<i>Fatigue</i>	Boredom	Longing	Resentment	Despair	Sadness	Suffering	Weariness	
<i>Acceptance</i>	Enjoyment	Delight	Triumph	Reassurance	Sulk	Resignation	Relief	Happiness

TABLE 6
Categories of Emotion Based on Facial Expression

<i>Salzen</i> (1981)	<i>Ekman et al.</i> (1972)	<i>Tomkins (1962)</i> <i>Izard (1971)</i>	<i>Allport (1924)</i>
Happiness	Happiness		Pleasure
Surprise	Surprise	Enjoyment/Joy	—
Fear	Fear	Surprise/Startle Fear/Terror	Surprise/ Fear
Sadness	Sadness		—
Distress	—	—	Pain/Grief
Anger	Anger	Distress/Anguish	Anger
Disgust	Disgust/ Contempt	Anger/Rage Contempt/Disgust	Disgust
Interest/ Desire	Interest	Interest/Excitement Shame/Humiliation	Attitude

pleasurable-unpleasurable, arousing-subduing, and strain-relaxation. Analyses of the language of experienced emotion (Osgood, 1962; Davitz, 1969; Russell & Mehrabian, 1977) seem to result in three major dimensions comparable with those derived from facial expression/impression studies.

The category and dimension hypotheses are not mutually exclusive and a number of workers have combined them into unified models (Schlosberg, 1952, 1954; Russell, 1980). It seems reasonable to conclude that both the category and dimension interpretations reflect real characteristics of emotional expression, perception, and experience, and that any theory of emotion must account for both.

i) **Categories of emotion.** In principle, TASS theory implies that there could be as many emotions as there are specific thwarted action states. However, it will be evident that differently motivated behaviours share orienting and appetitive actions (seeking, orienting to, and adjusting the goal stimulus). So, differently motivated responses to thwarting may have common appetitive orienting elements. If these appetitive orientation movements form a large part of the thwarted aroused action patterns, they will be responsible for the perceived general category of emotion. Intention movements of the specific motivated consummatory behaviour may also be present and it is these that will qualify the nature of the perceived category and give the specificity or flavour of the emotion (cupboard love, sexual love, motherly love, brotherly love, etc.). Without such specific consummatory intention movements the perceiver must rely on the nature of the arousing stimulus or situation to judge the

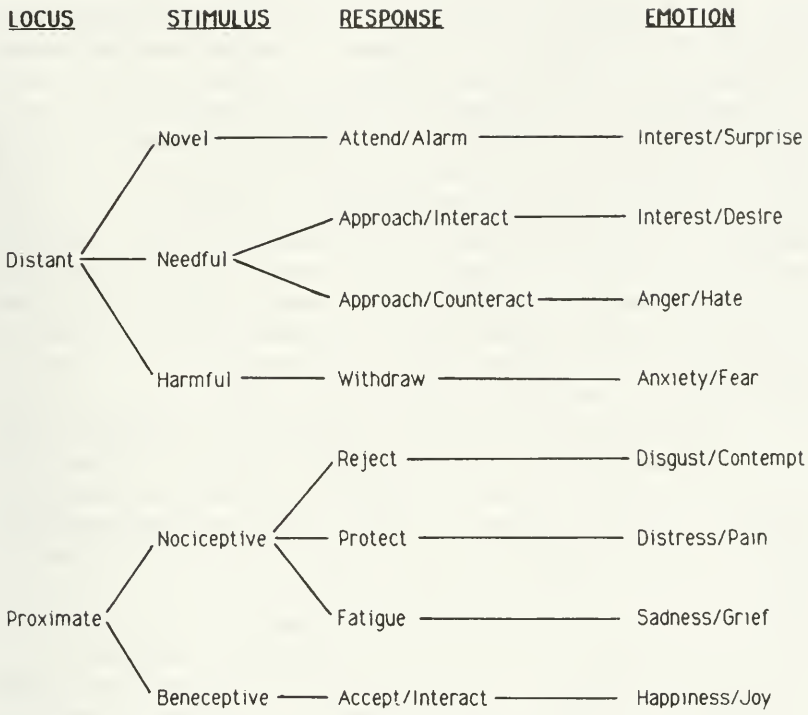


FIGURE 1. Stimulus-Response Classes and Categories of Emotion.

specific goal and motivation, and hence the likely specific quality of the emotion.

If this is true, then the general category of emotion should be specified by the general nature of the arousing stimulus and the appetitive orientation responses or intention movements that such a stimulus arouses. The possible stimulus-response classes are quite limited and are presented in Figure 1, along with the categories of emotion for which they can account. The possibilities are explained as follows.

The arousing stimulus may be either at a distance (distant) or more or less in contact with the body (proximate), and different response patterns must result. If the distant stimulus fails to arouse a specific motivated action state it can be said to be unidentified or “novel” and it evokes general patterns of arrest and attention labelled “attend” in Figure 1. If the stimulation is sudden or at high intensity this attention response may become an “alarm” display. These responses correspond with the emotion category of interest/surprise.

If the distant stimulus arouses motivated action states that require close proximity or contact for their performance then the appetitive orientation will be approach behaviour and the stimulus may be said to be “needful.” This appetitive approach will be to interact in a positive

manner, i.e., to perform consummatory behaviour, and is labelled "approach/interact" in Figure 1. It corresponds with an emotion category that I have called interest/desire in Figure 1. However, approach may lead to actions that forcibly alter the arousing stimulus, either by reorienting it or changing its behaviour or its characteristics even to the point of its destruction or disappearance. This is called "approach/counteract" in Figure 1. When coupled with intention movements of the forcible counteraction (attacking, striking, biting, shaking, pushing, etc.) it is clearly seen as corresponding with the emotion category of anger/hate. This conception of anger and aggression as reorientation, readjustment, alteration, or removal of the arousing stimulus can, as previously discussed, apply to both defensive and offensive aggression.

If the distant stimulus arouses anticipatory actions of defensive, protective or pain responses, then the orientation behaviour will be aversive in the form of withdrawal from the stimulus as unwanted or potentially noxious. The stimulus is accordingly labelled "harmful" in Figure 1 and the aversive response "withdraw" includes avoidance, flight, escape and hiding. The emotion category of anxiety/fear then corresponds with the thwarting or anticipated thwarting of these withdrawal responses. As already stated there may also be tension, screams, and other protective responses in anticipation of contact with the aversive stimulus.

If the arousing stimulus is close or in contact (proximate) then it will be appropriate to either nociceptor or beneceptor systems, i.e., the stimulus may be labelled "nociceptive" or "beneceptive" (Figure 1). Nociceptor responses may initially be actions that serve to remove the noxious stimulus from the body surface and vicinity and may include visceral responses of salivation and lacrimation. These actions are labelled "reject" in Figure 1 and correspond behaviourally and perceptually with the emotion category of disgust/contempt. Strong or persistent nociception may lead to intense flexor and protective reflexes characteristic of pain. I have labelled these "protect" responses and they correspond behaviourally and perceptually with the emotion category of distress/pain. Distress screaming is the accompanying expiratory vocalization and it may have been selected and ritualized for social signalling. If nociception persists despite the reject and protect responses, then physical fatigue may become evident in a response pattern which I have labelled "fatigue" in Figure 1. Signs of physical fatigue combine with the residual thwarted specific nociceptive response patterns to give the appearance that corresponds with our perception of the emotion category of sadness/grief. Persistent failure of distant stimulus-response orientations may also lead to fatigue and the resulting hybrid patterns of loss and despair are also interpreted as sadness and grief. However, persistent proximate noxious stimulation, which can be in the form of images and thoughts, is most likely to lead to fatigue and the concomitant patterns of sadness and grief.

Finally, if the proximate stimulus operates on beneceptors, the resulting behaviour will be the cessation of appetitive or aversive orientation responses and the onset of consummatory responses and interactions. I have labelled this pattern "accept/interact" in Figure 1. It represents a transition from thwarted appetitive/aversive behaviour with high arousal, tension, and predominance of sympathetic nervous activity, to consummatory actions or quiescent resting states with declining arousal, relaxation or relief from tension, and predominance of parasympathetic nervous activity. It corresponds behaviourally and perceptually with the emotion category of happiness/joy. The explanation of the expressions of smiling and laughing as ritualized relief and relaxation responses has already been presented. The state of transition at the end of thwarting is short lived, unless re-evoked in memory, and gives place to the feelings of the consummatory actions, the consummatory stimulation and the consummated motivational state, and it is these that give specific qualities to happiness and joy and the longer lasting feelings of pleasure.

ii) Dimensions of emotion. The three "affective dimensions" of emotion commonly identified in facial expression studies are i) unpleasant/pleasant, ii) activation level, and iii) attention/rejection. There are three properties or factors of the "Thwarted Action State" that are operative according to TASS theory and that could account directly for the three dimensions of emotion as follows.

1) Thwarting/End-of-thwarting. TASS theory states that thwarting or conflict, or their cessation, must be a present or an anticipated factor in all emotional states. Obviously, therefore, thwarting and conflict correspond with the unpleasant pole and release from thwarting or resolution of conflict correspond with the pleasant pole of the "unpleasant/pleasant" dimension. The precise value along this dimension will depend on the degree and duration of thwarting, and the probability and rate of release or resolution of the thwarting as already described.

2) Level of Arousal of Action State. TASS theory requires the initial arousal or release of appetitive or aversive action states belonging to specific motivational systems. The intensity of the thwarted appetitive or aversive response patterns will be related directly to the strength of the arousing stimulus and the level of the motivational state, and so corresponds with the "activation level" dimension.

3) Stimulus-Response Valency. TASS theory suggests that responses to thwarting involve either approach to distant needful stimuli and acceptance of proximal beneceptive stimuli or withdrawal from distant harmful stimuli and rejection of proximal nociceptive stimuli. These, when combined as approach-accept and withdraw-reject tendencies, represent positive and negative response classes or a stimulus-response valency which corresponds with the emotion dimension of "attention/rejection." This affective dimension is rather less well defined in empirical studies of expression, perhaps because attention may be given to stimuli

that are being rejected as well as to stimuli that elicit approach and acceptance.

This analysis of the possible patterns of appetitive and aversive orientation and intention movements and postures in response to distant and proximal stimulation, summarised in Figure 1, when combined with thwarting and end-of-thwarting and their potential social signalling function, can indeed account for the specific eight categories and three dimensions of emotion commonly identified in studies of human facial expression.

iii) Theories of emotion. Most theories accept the existence of fundamental categories and dimensions of emotion and do not attempt to explain why they exist and why they are as they appear. Both McDougall (1936) and Plutchik (1980) account for the conventional specific categories of emotion by equating them with specific classes of instinctive or motivated behaviour, e.g., sex, parenting. Yet what is distinctive (and odd) about categories of emotion is that they apply across motivational classes. Thus, desire or love are terms that are applied to food, comfort, sex, parenting, safety, curiosity, etc. However, this apparent paradox is resolved in TASS theory by their common or shared appetitive orientation elements.

The TASS explanation of categories summarised in Figure 1 may seem comparable with Fig 11.2 in Plutchik (1980) in which, using an idea from Arnold (1960), Plutchik places his eight classes of emotional adaptive behaviours into two groups which are labelled as "approach" and "avoid" reactions to "good" or "bad" "evaluations" of a "stimulus event." The similarity is superficial. Plutchik's eight emotional response classes are ongoing, evolved directly, adaptive behaviours, while TASS theory regards them as social signalling behaviour derived from the blocking of aroused action states with general and specific information carried respectively by the appetitive and consummatory incipient actions. Nor does Plutchik make the important distinction between distant and proximate stimulus location. Furthermore, Plutchik refers to an intervening evaluation of the stimulus event by a hypothetical cognitive appraisal system, which gives rise to a subjective emotional reaction, which in turn produces the emotional behavioural reaction (cf. Fig 11.1 in Plutchik, 1980). In the present account stimuli have been distinguished according to the type of receptor/perceptual system that they trigger and the type of consummatory response that they release, so that there need be no reference to an intervening cognitive appraisal system giving a subjective emotional reaction. Instead there is a direct release by perceptual or by associative and mnemonic processes, of specific classes of motivated action systems. Finally, it is clear that according to Plutchik, emotion serves as adaptive behaviour for the individual itself. According to TASS theory, emotion serves to signal the existence and nature of thwarting in the individual so as to induce social partners to adapt their behaviour and remove the

source of thwarting, i.e., to elicit adaptive behaviour from the social partner.

The differences with other well known theories of emotion should be apparent from this comparison with Plutchik's theory. In general TASS theory differs from traditional theories that see the prime function of emotion as motivating, amplifying, directing or reinforcing the behaviour of the individual itself. TASS theory implies that only secondarily, through self-perception and the development of self-awareness, does it become possible for the individual to respond to its own emotional signals by attempting to make the behavioural changes required to achieve a resolution of the thwarting situation and hence of the emotion. This self-motivating and self-controlling function of emotion will be discussed in more detail later.

Elements of TASS theory form parts of a number of existing theories but they are assembled and employed here in a distinctive and radical manner. Perhaps the most comparable treatments of affective feelings and emotion were given by Allen (1930) and especially Paulhan (1930). The significance of incipient actions was recognised by Bekhterev (1928) who regarded emotions as "somato-mimetic reflexes." They are implicit in the "attitude theory" of Bull (1951) and in an analysis of the basis of emotional action patterns given earlier by Crile (1915). The central role of thwarting and conflict in emotion has been recognised by many theorists including Dewey (1894, 1895), Drever (1921), Howard (1928), Luria (1932), Mandler (1962, 1964, 1975) and Nunnally (1972). Leyhausen (1967) and especially Baerends (1975, 1976) have presented ethological analyses of expressive behaviour in terms of conflict states that are consistent with TASS theory. The significance of emotional behaviour for signalling and social communication is now widely recognised but not accepted as the original and primary function of emotion. In fact Darwin (1872) did not seem to recognise this (Montgomery, 1985) and Wallace Craig (1921) commented specifically on this surprising fact in a paper putting forward the signalling function. Bekhterev (1928) also noted that the somato-mimetic reflexes became "the mimical language of the animal kingdom, facilitating the exchange of reactions among various individuals." But, a theory that combines thwarting, incipient somatic actions, and social signalling requiring a social response, to provide a full biological explanation of emotion, is new. However, to complete the answers to all the questions demanded for a biological explanation (Table 1) TASS theory has to be applied to the development and experience of emotion.

THE DEVELOPMENT OF EMOTION

What are the implications of TASS theory for the development of emotion? Some illustrative answers will be attempted in the hope that specialists in developmental psychology will be encouraged to apply the

theory to the wealth of data at their disposal. In general, TASS theory implies that the range of emotional displays will increase with the development of motor patterns, motivational systems, and sources of motivational action including, of course, cognitive appraisal. Subject to motor ability, highly ritualized displays should be evident before the acquisition of cultural modulations and modifications. As coping responses to the environment and to other people's emotional displays develop, so the importance of self-signalling and self-control of thwarting circumstances and responses (i.e., emotion) should increase. The following comments may serve to indicate how TASS theory might be applied to developmental data.

i) The development of the expression of emotion. If emotional behaviour is the pattern of thwarted appetitive and consummatory actions as TASS theory asserts, then distinctive bodily emotional expressions can only be present where distinctive differentiated appetitive and consummatory behaviours have developed. Studies of whole body reactions suggest initial general excitement (Bridges, 1932) or pleasure, attention, or distress (Sroufe, 1984, Ch. 5). The neonate can show strong extensor struggling and screaming (excitement), protective flexion (distress) and relaxation and cooing (delight). With control of eye convergence, gaze, and head turning, come attention (interest and desire) and wariness/aversion (fear). Struggling develops into temper tantrums (anger). Some evidence for the role of thwarting in infant bodily expressions of emotion is provided by an old study by Blatz and Millichamp (1935) who observed infants from one month to two years of age and reported on the nature and frequency of emotional episodes which were essentially agitated states. Blatz and Millichamp drew three conclusions: i) that emotional behaviour became differentiated as different approach-withdrawal behaviour patterns developed with age; ii) that the frequency of emotional episodes decreased with age as appropriate adjustment patterns of behaviour were learned; and iii) that the causes of emotional behaviour were the thwarting of aroused approach and withdrawal states. All three conclusions are consistent with the TASS theory of emotion.

Although appetitive behaviour involving the whole body is limited in the infant, "on the face of it" the infant would seem motorically capable of fully differentiated facial actions and hence expressions. In fact there is disagreement as to the development of facial expressions in infants. There seem to be three schools of thought. i) There is a differentiation from happy and unhappy expressions in early months into fear, anger, joy, and disgust within two years, a pattern consistent with Bridges (1932) schema (Ekman & Oster, 1979; Emde, 1984). ii) Virtually all emotional expressions are recognisable in neonates or within the first few months (Field, 1982; Field & Walden, 1982). However Gaensbauer and Hiatt (1984) say that these neonate expressions are fleeting and are not reliably linked to the infant's state or behaviour. iii) Adult expression categories

are not appropriate to infant expression but specific action patterns can be reliably seen. These include the actions of crying, smiling, head aversion, pursing of lips, grimacing to taste, attention, yawning, brow knitting, laughing, flushing, panting, and weeping (Emde, Kligman, Reich, & Wade, 1978; Ekman & Oster, 1979; Charlesworth & Kreutzer, 1973).

Infant expression has previously been analysed by Peiper (1961) in terms of action patterns of regions specific to the stimulus but which tend to spread to other face regions. His response patterns include an attention response with eye opening action, a defensive grimace to taste (disgust), and respiratory responses of laughing and crying (screaming), with crying beginning as a defensive distaste grimace. Studies of children born deaf-blind (Eibl-Eibesfeldt, 1973) also describe action patterns rather than emotional categories. The actions include smiling, laughing, crying, frowning, panting, refusal head shake, clenched teeth, strong exhaling, and jerking head back. Thus, in both infants and deaf-blind children the emotional displays seen to conform with the types of action that might be expected from an application of TASS theory to the development of expression (Salzen, 1981). But by two years of age children have developed the typical adult patterns of facial expression, and by five years they have learned the associations that make possible complex affective states such as shame, anxiety, elation and hope (Ekman & Oster, 1979; Charlesworth & Kreutzer, 1973; Izard, 1971, 1979).

ii) The development of perception of emotion. It is during the period of two to five years of age that accurate recognition of facial expressions in still photographs develops (Lewis & Michalson, 1985; Bullock & Russell, 1984, 1985; Russell & Bullock, 1986). But it may take longer to learn to interpret accurately the full range of adult emotional categories (Salzen, 1981). Salzen, Kostek, and Beavan (1986) compared the responses of 4–5 year old children and adults when asked to name the action and then the emotion shown in selected photographs of facial expressions. Unlike adults, children found naming the action easier than naming the emotion. Both gave action terms that fitted some of the actions hypothesised for these expressions by TASS theory. We concluded that there was some support for the view that in childhood facial action patterns are perceived and that emotional categories are attached to these patterns through learning the cultural norms. Obviously the recognition in still photographs of facial expressions is a special skill. A living model making vocalizations as well as faces is clearly going to elicit appropriate responding earlier than a silent static face photograph (Haviland & Lelwica, 1987).

In a commentary (Salzen, 1989) on a review by Oster, Daily, and Goldenthal (1989) of the processing of facial affect I suggested that in studying the development of the impression or cognitive processing of emotion the distinctions between *perception*, *recognition*, and *comprehension* may be useful. Correspondingly, three levels or stages of re-

sponsiveness to affective displays might be seen in the neonate, the infant, and the child respectively. Responses to affective displays in others that occur in neonates may be *innate perceptuo-motor coordinations*, while *empathy* develops in the infant and *sympathy* in children.

Perception of affect can be said to be present in the infant when different emotional expressions elicit specific motor responses or perceptuo-motor coordinations that are either innate or the result of procedural learning and memory processes (Hirsh, 1974; Cohen & Squire, 1980). An innate response might be for example distress or protective responses produced by alarm calls. The evidence of Martin and Clark (1982) that newborns respond differently to recordings of their own cries than to those of other infants suggests an innate perceptuo-motor response system of remarkable specificity. Neonatal imitation of certain parental facial contortions such as tongue protrusion (Meltzoff & Moore, 1977; Field, 1982; Field, Woodson, Greenberg, & Cohen, 1982) may also be an example of intrinsic perceptuo-motor coordination. If they included copying specific emotional facial expressions then it would be difficult to distinguish from later appearing empathic responses involving learned stimulus recognition. There is evidence that imitative tongue protrusion is lost at three months and reappears at the end of the year (Butterworth, 1990, citing a study by Vinter). This looks very like developmental shifts in behaviour such as the well known loss of the neonatal grasping reflex and the emergence of voluntary grasping, suggesting a shift from one type of neural process (often subcortical) to a neurologically "higher" one (often cortical). A similar shift in infant responses to cries from innate perceptuo-motor coordinated responses to recognition induced or empathic responding is possible.

This distinction between intrinsic matching responses and acquired recognition induced empathy is speculative but potentially useful. Recognition of affect can be said to be present when a specific stimulus expression can produce the same affective state, perhaps requiring episodic or knowledge memory processes (Tulving, 1972; Cohen & Squire, 1980) which may be associated with an experienced feeling of familiarity. Empathy, then, is the occurrence of the same emotional state as that shown by the social partner because of previous experience of the situations associated with the affective display. Comprehension can be said to exist when there are organized relationships of affective expression, situation, and consequence which together form concepts in semantic memory processes (Tulving, 1972; Warrington, 1975). Sympathy, then, is the arousal of an associated but not identical affective state through cognitive understanding of the observed affective display and a conscious act of identifying with the other person. The definitions of empathy and sympathy are given here because although they follow contemporary usage (Aronfreed, 1970; Hoffman, 1984; Miller & Eisenberg, 1988) they are the reverse of the traditional and literal meanings.

In development both empathy and sympathy can be acquired by interaction with the immediate caregivers, normally the parents, siblings and close relatives in a family-based society. Through stimulus generalization they may also occur in others of different developmental stage, mental condition, creed, or culture in an "expanding circle" (Singer, 1981). They are later generalized to neighbourhood, region, nation state and beyond. Presumably there is survival value and genetic advantage in the acquisition and application of empathy and sympathy within the family, the local group, or the state. Where this is the case it will be a factor in the development and evolution of altruism (Hoffman, 1978; Barash, 1982).

THE EXPERIENCE OF EMOTION, SELF-CONTROL AND SELF-AWARENESS

TASS theory is essentially a biological theory of the nature and evolution of emotional behaviour. If the theory represents biological reality, it should have implications for the nature, evolution, and development of the experience of emotion. The following section explores the consequences of TASS theory, especially of the signalling function, for the experience of emotion. It is recognised that this extension of the theory to cover the experience of emotion is essentially speculative and suggestive and is intended to be provocative rather than definitive.

i) Emotional experience. If TASS theory fully describes the process involved in emotional behaviour then the experience of emotion must arise from the cerebral activities associated with thwarting and end-of-thwarting states. For unpleasant emotion (thwarting) these will include i) the specific motivational state, ii) the releasing or goal stimulus, iii) the released action state, iv) the thwarting stimulus, v) the response to thwarting, and vi) the memory of previous associations of activities i-v. For pleasant emotion (end-of-thwarting) there will be activities i-iii with the addition of vii) the stimulus effecting release of thwarting, viii) the waning of the response to thwarting(v), ix) the onset of the consummatory response and stimulus, and x) memories of previous associations of activities vii-ix. Rich and unique though these processes may be, and although they represent the emotional state itself, they cannot in themselves account for the *experience* of emotion because experience implies awareness of that emotional state. The crucial question is: what is the difference between brain processes of which we are aware and ones of which we are not aware?

The simplest explanation both in neural and behavioural terms would seem to be through "feedback" mechanisms. Neural feedback occurs at all levels, from the single neuron level to the complexes of neural activity involved in thinking, and from simple muscle feedback to interoceptive feedback of one's total behaviour. Behavioural feedback occurs through

exteroceptive perception of one's own behaviour in the same manner as the perception of the behaviour of other people. In addition there is the perception of the consequences of one's own behaviour, i.e., the "reafference" of von Holst and Mittelstaedt (1973). The integrated totality of this internal and external feedback represents the self and, in a social context, the social self. The creation of the self as an externally perceived self (which we call "me") could be through the establishment of neuronal assemblies comparable with the neuronal assemblies that represent our perceptions of other individuals so that the rest of the brain system (the "I") can interact with the "me" assemblies in the same way as it does with the representations of other individuals. It could be these interactive processes that constitute self-awareness, self-consciousness and subjective feeling. This view is consistent with the theory of the social construction of the self argued in beautiful detail by Mead (1934).

The immediate concern here is with the emotional self and with the feedback of emotional behaviour so that it is perceived (i.e., seen and heard) and processed in the brain *in the same way as the emotional displays of a social partner*. But this perception of the emotional self will be unique because it will include the interoceptive feedback which is lacking in emotional "social partner" percepts. But, if an individual responds to the affective displays of its social partners, and can perceive its own affective displays as virtually the same, then it can come to respond to its own affective displays *as it might to those of another person*. This affective self, besides being part of the development of the total self, enables the development of self-control. Both self-control and self-awareness are especially dependent upon, and facilitated by, vocal displays since *these are most clearly perceived as virtually the same* in the affective displays of both self and social partners. The evolution of speech and language from such vocal displays in humans has facilitated the development of the self and the consequent possibilities for self-communication and self-control of thwarting and conflict states. This facilitation is achieved through the use of symbols for the perceived self ("me") as an object comparable with other people and other objects and for the "I" as the perceiving and acting system operating on objects, people, and myself as a person ("me").

If this picture of the self and of self-awareness of emotion is correct then we can say that *suffering* is the state aroused in us by the perception of our own unpleasant affective (thwarted action state) displays and *enjoyment* is the equivalent state for pleasant affective (end of thwarting) displays. Self-awareness, then, is not a requirement of emotion and we have no need to posit self-awareness in animals showing affective behaviour that in ourselves would involve subjective feelings or self-awareness. We can also say that such self-awareness, with its suffering and enjoyment, will occur in humans and other animals to a degree that is dependent on *the extent to which they can perceive and respond to*

their own affective displays as to those of others. This gives us an empirical and experimental approach to determining the degree of self-awareness and of suffering of which an organism is capable. Mirrors, photographs, videofilm and recorded vocalizations have been used with some success to study self-awareness in human infants and in animals. In animals there is some evidence of self-awareness of affective displays in primates and birds (Gallup, 1982; Gallup & Suarez, 1986; McArthur, 1986, 1987; Suarez & Gallup, 1987). In humans such self-awareness develops in infancy with awareness of emotional states emerging later than awareness of bodily appearance and actions (Lewis & Brooks, 1978; Lewis & Michalson, 1983).

Displays of social partners that are perceived as the same, although lacking the accompanying patterns of internal perception of our own displays, can come to evoke a comparable awareness with comparable suffering and enjoyment and this is the basis of *empathy*. In the case of *sympathy* the awareness is evoked by similarity rather than identity of the social partner's situation and affective response. A greater degree of learned cognitive processing is involved for that similarity to produce an affective response in the perceiver. The experienced affect of the perceiver reflects this and could account for the somewhat different character of the experienced affect in sympathy compared with empathy, and for the more flexible nature of the helping behaviour that may result.

ii) Self-control of emotion. Self-control of states of thwarting and conflict, and so control over one's emotional state and potentially motivational action states, becomes possible after experience of responding to the emotional behaviour and states of other people. Thus it becomes possible to respond to one's own thwarted state and behave as one might to another individual, with the possibility of doing so with acquired knowledge and experience, i.e., consciously and intelligently. In the words of Mead (1934), "The conversation of gestures is the beginning of communication. The individual comes to carry on a conversation of gestures with himself. He says something, and that calls out a certain reply in himself which makes him change what he was going to say." In this way our emotion can motivate us into coping behaviour and so control the emotion. It may, of course, simply evoke the unlearned responses so that fear evokes fear giving the runaway positive feedback of the *panic attack*.

It is the "stimulus to action" effect of "experienced emotion" that has given rise to the universal belief that emotion makes us do things, so that emotions have the function of self-motivation rather than motivation of others. Most current theories of emotion take this view. TASS theory states that the prime evolutionary function of emotional expression is to motivate and direct the actions of *social partners and not those of the individual itself*, who is already highly aroused and motivated. The thwarted action state displays of other people clearly incite us to particular types of responses, as they have evolved to do. When we perceive

our own thwarted action states they can stimulate us to make the same responses, i.e., behaviour that may remove thwarting. But the underlying motivation must be present. This point is dramatically illustrated by an account given by Oliver Sacks (1982, p. 213) of the effect of l-Dopa treatment on a post-encephalitic patient who two years previously had had a glass of water poured over her by a hostile demented fellow patient. When brought into activity by l-Dopa she wrote hostile tirades against the dement. Finally she went and threw a jug of water at the offending patient. Sacks writes "When I asked her whether she had been brooding over the matter for the entire two years, she said: 'No, of course not. I didn't care at the time. I didn't give it a thought till I started l-Dopa. And then I got mad, and couldn't stop thinking about it.'" This fits the suggestion that when there is no aroused action there is no emotion. The stimulus was there but no action to be blocked. When l-Dopa restored the "go" motor action system the remembered stimulus could produce the impulse to action and the emotion.

iii) Self-awareness. However, this external feedback or re-entry process applies to all behaviours, not just to affective displays, so there must be a continuum of self-perception and self-awareness from simple bodily actions to complex language behaviour. For heuristic purposes discrete levels of awareness of increasing complexity can be postulated as in Table 7 representing the self-perception and self-awareness of actions, feelings, emotions, and thoughts. The implication is that adult self-awareness in its global sense is a compound of these levels of self which might be expected to follow a developmental sequence beginning with the bodily self; Butterworth (1990) describes the first stage in this process. Thus the development of self-awareness of affect in infancy could pass through the stages or levels of self shown in Table 7.

This process begins with the integration and association of internal perceptions (proprio- and interoception) with external perceptions of the infant's own bodily actions in distinction from other external events, giving *motor awareness*. Since perceived comparable motor actions of social partners are not accompanied by the same internal feelings (hedonic) there arise the distinctions that comprise the *feeling self*. The same process occurs with responses to thwarting, i.e., with emotional behaviour, where the earliest and most effective external perceptual feedback comes from the infant's vocalizations (Ploog, 1979). Further cognitive development, which is greatly facilitated by but not dependent on speech, makes possible the full development of the *emotional self* capable of appreciating and responding with understanding and sympathy rather than empathy not only to the emotional states of others but also to itself. Language development facilitates the process of creating a self-concept by the labelling of oneself just as one labels others in the manner previously described and makes possible the employment of "rational" cognitive responses to the emotional displays of both other people and

TABLE 7
Levels of Self-Awareness

Level 1. Motor self.

Perception of own actions through exteroceptors creates a neural representation of the self as a real world object similar to the representations of other people and objects but distinguished by the concurrent proprioception.

Level 2. Feeling self.

Perception of motivationally significant stimuli and actions and concurrent interoception adds hedonic tone to the neural representation of the self.

Level 3. Emotional self.

Perception of own emotional behaviour patterns as similar to those of other people but with added concurrent internal states adds emotional content to the neural representation of the self.

Level 4. Cognitive self.

Perception of own speech and language as similar to those of other people facilitates cognitive interaction with the neural representation of the perceived self or "me" which may be addressed in speech and language both by other people and by the "real self" which is the whole perceiving, thinking, cognitive brain system.

oneself. This is the level of the *cognitive self* or what might be called the semantic self since it is maximal when the relationships can be mediated through language. This sequence for the development of the self parallels, and may be the basis of, the development of moral behaviour and the acquisition of socio-cultural moral attitudes (Kohlberg, 1969; Leahy & Shirk, 1985).

SUMMARY

This paper has set out to give a unified account of the phenomena of emotion and a biological explanation in terms of the thwarting and signalling of aroused action states in a "thwarted action state signalling" (TASS) theory. The behavioural phenomena are summarized in Tables 3 and 4 and Figure 1; the experiential phenomena are dealt with in Table 7. The relation between emotion and other affective processes is given in Table 2 and Table 1 shows how answers to all the questions demanded of a biological explanation have been attempted in this account of TASS theory.

An ethological analysis of social signalling is used in a comparative

approach to the nature of emotion. The somatic actions are incipient appetitive and consummatory acts that have been blocked by inadequate or inappropriate stimulus situations or by conflicting motivated action states. The locus and nature of the arousing stimulus determine the general nature of the appetitive/aversive orientation movements and give rise to the eight categories of emotion that are conventionally identified. The states of thwarting and end-of-thwarting correspond with the unpleasant/pleasant dimension of emotion; the level of the activated motivational state corresponds with the level of activation dimension of emotion; and the character of the appetitive/aversive orientation behaviour corresponds with the attention/rejection dimension commonly identified in emotion.

The thwarted somatic actions and their perceptible autonomic support actions signal the existence and nature of the thwarted motivation and serve to elicit changes in the behaviour of social partners that may alter the situation and give release from thwarting. Emotional displays have evolved for this purpose. End-of-thwarting states can become secondarily reinforcing leading to the pursuit of happiness. Other affective processes can be conceived to consist of feelings of motivationally significant sensori-motor activity, moods as states of motivational responsiveness, and sentiments as cognitive constructs with an affective content. Some indications of how the theory can be applied are given for attachment and loss, facial expression, and the development of emotional expression and perception.

The experience of emotion is derived from the external perception of one's own emotional displays as if they were those of a social partner together with the concurrent internal perceptions, which add emotional content to the self construct that has been formed by external perception of bodily action in the physical and social world. It is suggested that emotional self-perception develops in infancy and makes it possible to respond to one's own emotional states as one might to those of another person, i.e., to alter one's own thwarting and conflict situations, giving a motivating effect and the potential to exercise self-control of the emotions.

ACKNOWLEDGEMENT

I am grateful to my friend and colleague Dr. Norman Wetherick for his careful reading of repeated versions of this extensive manuscript and for his helpful corrections and comments which encouraged me to produce further versions for him to read.

REFERENCES

- Allen, A. H. B. (1930). *Pleasure and instinct. A study in the psychology of human action.* London: Kegan Paul.

- Allport, F. H. (1924). *Social psychology*. Boston: Houghton Mifflin Co.
- Andrew, R. J. (1963). The origin and evolution of the calls and facial expressions of the primates. *Behaviour* 20:1-109.
- Armstrong, E. A. (1947). *Bird display and behaviour*. London: Lindsay Drummond.
- Armstrong, E. A. (1950). The nature and function of displacement activities. *Symposium of the Society for Experimental Biology* 4:361-384.
- Arnold, M. B. (1960). *Emotion and personality*. 2 vols. New York: Columbia Press.
- Aronfreed, J. (1970). The socialization of altruistic and sympathetic behavior: some theoretical and experimental analyses. In: *Altruism and helping behavior*, p. 103-126, ed. J. Macaulay & L. Berkowitz. New York: Academic Press.
- Baerends, G. P. (1975). An evaluation of the conflict hypothesis as an explanatory principle for the evolution of displays. In: *Functional and evolution in behaviour. Essays in honour of Professor Niko Tinbergen*, p. 187-227, ed. G. Baerends, C. Beer, & A. Manning. Oxford: Clarendon Press.
- Baerends, G. P. (1976). A tentative model for the causation of neuroses. In: *Research in neurosis*, p. 183-191, ed. H. M. van Praag. Utrecht: Bohn, Scheltema & Holkema.
- Barash, D. P. (1982). *Sociobiology and behavior*. 2nd ed. London: Hodder & Stoughton.
- Bekhterev, V. M. (1928). Emotions as somato-mimetic reflexes. In: *Feelings and emotions. The Wittenberg Symposium*, p. 270-283, ed. M. L. Reymert. Worcester, Mass.: Clark Univ. Press.
- Bentley, M. (1928). Is "Emotion" more than a chapter heading? In: *Feelings and emotions. The Wittenberg Symposium*, p. 17-23, ed. M. L. Reymert. Worcester, Mass.: Clark Univ. Press.
- Blatz, W. E., & Millichamp, D. A. (1935). The development of emotion in the infant. *University of Toronto Studies, Child Development Series No. 4*, p. 5-44.
- Blest, A. D. (1961). The concept of ritualisation. In: *Current problems in animal behaviour* p. 102-124, ed. W. H. Thorpe & O. L. Zangwill. London: Cambridge Univ. Press.
- Bowlby, J. (1969). *Attachment and loss, Vol. 1 Attachment*. London: Hogarth Press.
- Bowlby, J. (1973). *Attachment and loss, Vol. 2 Separation: anxiety and anger*. London: Hogarth Press.
- Bridges, K. M. B. (1932). Emotional development in early infancy. *Child Development* 3:324-341.
- Brown, J. S., & Farber, I. E. (1951). Emotions conceptualized as intervening variables with suggestions toward a theory of frustration. *Psychological Bulletin* 48:465-495.
- Bull, N. (1951). The attitude theory of emotion. In: *Nervous and Mental Diseases Monographs, No. 81*. New York: Coolidge Foundation.
- Bullock, M., & Russell, J. A. (1984). Preschool children's interpretations of facial expressions of emotion. *International Journal of Behavioural Development* 7:193-214.
- Bullock, M., & Russell, J. A. (1985). Further evidence on preschoolers' interpretation of facial expressions. *International Journal of Behavioural Development* 8:15-38.
- Butterworth, G. (1990). Self-perception in infancy. In: *The self in transition. Infancy to childhood*, p. 209-244, ed. D. Cicchetti & M. Beeghly. Chicago: Chicago Univ. Press.
- Cacioppo, J. T., & Petty, R. E. (1981). Electromyograms as measures of extent and affectivity of information processing. *American Psychologist* 36:441-456.
- Cannon, W. B. (1927). The James-Lange theory of emotion: a critical examination and an alternative theory. *American Journal of Psychology* 39:106-124.
- Charlesworth, W. R., & Kreutzer, M. A. (1973). Facial expressions of infants and children. In: *Darwin and facial expression. A century of research in review*, p. 91-168, ed. P. Ekman. New York: Academic Press.
- Cohen, N. J., & Squire, L. R. (1980). Preserved learning and retention of pattern-analyzing skill in amnesia: dissociation of knowing how and knowing that. *Science* 210:207-209.
- Craig, W. (1921). A note on Darwin's work on the expression of the emotions in man and animals. *Journal of Abnormal & Social Psychology* 16:356-366.
- Crile, G. W. (1915). *The origin and nature of the emotions*. London: W. B. Saunders.
- Daanje, A. (1951). On locomotory movements in birds and the intention movements derived from them. *Behaviour* 3:48-98.
- Darwin, C. (1872). *The expression of the emotions in man and animals*. 2nd ed. 1889. London: John Murray.
- Davitz, J. R. (1969). *The language of emotion*. New York: Academic Press.
- Deane, C. D. (1944). The broken-wing behavior of the killdeer. *Auk* 61:243-247.

- Delius, J. D. (1967). Displacement activities and arousal. *Nature, London* 214:1259-1260.
- Dewey, J. (1894). The theory of emotion. (I.) Emotional attitudes. *Psychological Review* 1:553-569.
- Dewey, J. (1895). The theory of emotion. (II.) The significance of emotions. *Psychological Review* 2:13-32.
- Dittman, A. T. (1972). *Interpersonal messages of emotion*. New York: Springer.
- Dollard, J., Doob, L. W., Miller, N. E., Mowrer, O. H., & Sears, R. R. (1939). *Frustration and aggression*. New Haven, Conn.: Yale Univ. Press.
- Drever, J. (1921). *Instinct in man*. 2nd ed. Cambridge: Cambridge Univ. Press.
- Duffy, E. (1941). An explanation of "emotional" phenomena without the use of the concept "emotion." *Journal of General Psychology* 25:283-293.
- Eibl-Eibesfeldt, I. (1971). *Love and hate*. London: Methuen.
- Eibl-Eibesfeldt, I. (1973). The expressive behaviour of the deaf-and-blind-born. In: *Social communication and movement*, p. 163-194, ed. M. von Cranach & I. Vine. New York: Academic Press.
- Eibl-Eibesfeldt, I. (1975). *Ethology: the biology of behavior*. 2nd ed. New York: Holt, Rinehart & Winston.
- Ekman, P., & Friesen, W. V. (1986). A new pan-cultural facial expression of emotion. *Motivation and Emotion* 10:159-168.
- Ekman, P., Friesen, W. V., & Ellsworth, P. (1972). *Emotion in the human face: guidelines for research and an integration of findings*. New York: Pergamon Press.
- Ekman, P., Friesen, W., & Simons, R. C. (1985). Is the startle reaction an emotion? *Journal of Personality and Social Psychology* 49:1416-1426.
- Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science* 221:1208-1210.
- Ekman, P., & Oster, H. (1979). Facial expressions of emotion. *Annual Review of Psychology* 30:527-554.
- Emde, R. N. (1984). Levels of meaning for infant emotions: a biosocial view. In: *Approaches to emotion*, p. 77-107, ed. K. R. Scherer & P. Ekman. Hillsdale, N.J.: Lawrence Erlbaum.
- Emde, R. N., Kligman, D. H., Reich, J. H., & Wade, T. D. (1978). Emotional expression in infancy: I. Initial studies of social signaling and an emergent model. In: *The development of affect*, p. 125-148, ed. M. Lewis & L. A. Rosenblum. New York: Plenum Press.
- Field, T. (1982). Individual differences in the expressivity of neonates and young infants. In: *Development of non-verbal behavior in children*, p. 279-298, ed. R. S. Feldman. New York: Springer.
- Field, T. M., & Walden, T. A. (1982). Production and perception of facial expressions in infancy and early childhood. *Advances in Child Development and Behavior* 16:169-211.
- Field, T., Woodson, R., Greenberg, R., & Cohen, D. (1982). Discrimination and imitation of facial expressions by neonates. *Science* 218:179-181.
- Fischer, H. (1965). Das Triumphgeschrei der Graugans (*Anser anser*). *Zeitschrift für Tierpsychologie* 22:247-304.
- Gaensbauer, T. J., & Hiatt, S. (1984). Facial communication in early infancy. In: *The psychobiology of affective development*, p. 207-229, ed. N. A. Fox & R. J. Davidson. Hillsdale, N.J.: Lawrence Erlbaum.
- Gallup, C. G. (1982). Self-awareness and the emergence of mind in primates. *American Journal of Primatology* 2:237-248.
- Gallup, G. G., & Suarez, S. D. (1986). Self-awareness and the emergence of mind in humans and other primates. In: *Psychological perspectives on the self*, Vol. 3, p. 3-26, eds. J. Suls & A. Greenwald. Hillsdale, N.J.: Lawrence Erlbaum.
- Gardiner, H. M., Metcalfe, R. C., & Beebe-Center, J. G. (1937). *Feeling and emotion. A history of theories*. New York: American Book Co.
- Gellhorn, E. (1957). *Autonomic imbalance and the hypothalamus*. Minneapolis: Univ. Minnesota Press.
- Gellhorn, E. (1966). The neurophysiological basis of anxiety: a hypothesis. *Perspectives in Biology and Medicine* 8:488-515.
- Haviland, J. M., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotion expressions. *Developmental Psychology* 23:97-104.

- Hillman, J. (1960). *Emotion. A comprehensive phenomenology of theories and their meaning for therapy*. London: Routledge & Kegan Paul.
- Hinde, R. A. (1967). The nature of aggression. *New Society* 9:302-304.
- Hinde, R. A. (1970). *Animal behaviour*. New York: McGraw-Hill.
- Hinde, R. A. (1985). Ethology in relation to psychiatry. In: *The scientific foundations of psychiatry. Handbook of psychiatry, Vol. 5*, p. 119-133, ed.
- Hirsh, R. (1974). The hippocampus and contextual retrieval of information from memory: a theory. *Behavioral Biology* 12:421-444.
- Hoffman, M. L. (1978). Toward a theory of emphatic arousal and development. In: *The development of affect*, p. 227-256, ed. M. Lewis & L. A. Rosenblum. New York: Plenum Press.
- Hoffman, M. L. (1984). Interaction of affect and cognition in empathy. In: *Emotions, cognition, and behavior*, p. 103-131, ed. C. E. Izard, J. Kagan, & R. J. Zajonc. New York: Cambridge Univ. Press.
- Howard, D. T. (1928). A functional theory of the emotions. In: *Feelings and emotions. The Wittenberg symposium*, p. 140-149, ed. M. L. Reymert. Worcester, Mass.: Clark Univ. Press.
- Hulin, W. S., & Katz, D. (1935). The Frois-Wittmann pictures of facial affect. *Journal of Experimental Psychology* 18:482-498.
- Huxley, J. S. (1914). The courtship-habits of the Great Crested Grebe (*Podiceps cristatus*); with an addition to the theory of natural selection. *Proceedings of the Zoological Society of London* 2:491-562.
- Izard, C. E. (1971). *The face of emotion*. New York: Appleton-Century-Crofts.
- Izard, C. E. (1977). *Human emotions*. New York: Plenum Press.
- James, W. (1890). *The principles of psychology*. Reprinted 1950, New York: Dover.
- Kaufman, I. C., & Rosenblum, L. A. (1967a). Depression in infant monkeys separated from their mothers. *Science* 155:1030-1031.
- Kaufman, I. C., & Rosenblum, L. A. (1967b.) The reaction to separation in infant monkeys: anaclitic depression and conservation-withdrawal. *Psychosomatic Medicine* 29:648-675.
- Kirouac, G., Bouchard, M., & St-Pierre, A. (1986). Facial expressions of emotions and ethological behavioral categories. *Perceptual and Motor Skills* 62:419-423.
- Kohlberg, L. (1969). Stage and sequence: the cognitive developmental approach to socialization. In: *Handbook of socialization research*, p. 347-480, ed. D. A. Goslin. Chicago: Rand McNally.
- Landis, C., & Hunt, W. A. (1939). *The startle pattern*. New York: Farrow & Rinehart.
- Leahy, R. L., & Shirk, S. R. (1985). Social cognition and the development of the self. In: *The development of the self*, p. 123-150, ed. R. L. Leahy. New York: Academic Press.
- Lewis, M., & Brooks, J. (1978). Self-knowledge and emotional development. In: *The development of affect*, p. 205-226, ed. M. Lewis & L. A. Rosenblum. New York: Plenum Press.
- Lewis, M., & Michalson, L. (1983). *Children's emotions and moods: developmental theory and measurement*. New York: Plenum Press.
- Lewis, M., & Michalson, L. (1985). Faces as signs and symbols. In: *The development of expressive behavior*, p. 153-182, ed. G. Zivin. New York: Academic Press.
- Leyhausen, P. (1973). The biology of expression and impression. In: *Motivation of human and animal behavior*, p. 272-380, ed. K. Lorenz & P. Leyhausen. New York: Van Nostrand Reinhold.
- Lindsley, D. B. (1951). Emotion. In: *Handbook of experimental psychology*, p. 473-516, ed. S. S. Stevens. New York: Wiley.
- Lorenz, K. (1966). *On aggression*. London: Methuen.
- Luria, A. (1932). *The nature of human conflicts, or emotion, conflict, and will*. Translated by W. H. Gantt. New York: Liveright.
- Mandler, G. (1962). Emotion. In: *New directions in psychology, Vol. 1*, p. 267-343, ed. R. W. Brown, E. Galanter, E. H. Hess, & G. Mandler. New York: Holt, Rinehart & Winston.
- Mandler, G. (1964). The interruption of behavior. In: *Nebraska Symposium on Motivation 1964*, p. 163-219, ed. D. Levine. Lincoln, Neb.: Univ. Nebraska Press.
- Mandler, G. (1975). *Mind and emotion*. New York: Wiley.

- Martin, G. B., & Clark, R. D. (1982). Distress crying in neonates: species and peer specificity. *Developmental Psychology* 18:3-9.
- McArthur, P. D. (1986). Similarity of playback songs to selfsong as a determinant of response strength in song sparrows (*Melospiza melodia*). *Animal Behaviour* 34:199-207.
- McArthur, P. D. (1987). Auditory self-perception: a reply to Suarez & Gallup. *Animal Behaviour* 35:612-613.
- McDougall, W. (1936). *An introduction to social psychology*. 23rd ed. London: Methuen.
- Mead, G. H. (1934). *Mind, self and society*. Edited by C. W. Morris. Chicago: Chicago Univ. Press.
- Meltzoff, A., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science* 198:75-78.
- Miller, P. A., & Eisenberg, N. (1988). The relation of empathy to aggressive and externalizing/antisocial behavior. *Psychological Bulletin* 103:324-344.
- Montgomery, W. Charles Darwin's thoughts on expressive mechanisms in evolution. In: *The development of expressive behavior: biology-environment interactions*, p. 27-50, ed. G. Zivin. New York: Academic Press.
- Morris, D. (1956). The feather postures of birds and the problem of the origin of social signals. *Behaviour* 9:75-113.
- Morris, D. (1957). 'Typical intensity' and its relation to the problem of ritualization. *Behaviour* 11:1-12.
- Moyer, K. E. (1976). *The psychobiology of aggression*. New York: Harper & Row.
- Nunnally, J. C. (1972). A human tropism. In: *Science, psychology and communication*, p. 255-277, ed. S. R. Brown & D. J. Brenner. New York: Teachers College Press.
- Osgood, C. E. (1962). Studies on the generality of affective meaning systems. *American Psychologist* 17:10-28.
- Oster, H., Daily, L., & Goldenthal, P. (1989). Processing facial affect. In: *Handbook of research on face processing*, p. 107-161, ed. A. W. Young & H. D. Ellis. Amsterdam: North Holland.
- Panksepp, J. (1982). Toward a general psychobiological theory of emotions. *Behavioral and Brain Sciences* 5:407-467.
- Papez, J. W. (1937). A proposed mechanism of emotion. *Archives of Neurology and Psychiatry* 38:725-744.
- Paulhan, F. (1930). *The laws of feeling*. Translated from 4th ed. 1926 by C. K. Ogden. London: Kegan Paul.
- Peiper, A. (1961). *Cerebral function in infancy and childhood*. 3rd ed. Translated by B. Nagler & H. Nagler. London: Pitman.
- Ploog, D. (1979). Phonation, emotion, cognition, with reference to the brain mechanisms involved. In: *Brain and mind, CIBA Foundation series 69 (new series)*, p. 79-98. Amsterdam: North-Holland.
- Plutchik, R. (1980). *Emotion. A psychoevolutionary synthesis*. New York: Harper & Row.
- Plutchik, R., & Kellerman, H., eds. (1980). *Emotion. Theory, research, and experience, Vol. 1 Theories of emotion*. New York: Academic Press.
- Raines, L. (1929). Emotion: a classified bibliography. *Bulletin of Bibliography* 13:153-155, 180-182.
- Raines, L. (1930). Emotion: a classified bibliography. *Bulletin of Bibliography* 14:9-11, 53.
- Raines, L. (1931). Emotion: a classified bibliography. *Bulletin of Bibliography* 14:82-83, 103-108.
- Ratner, S. C. (1975). Animal's defenses: fighting in predator-prey relations. In: *Advances in the study of communication and affect, Vol. 2 Nonverbal communication of aggression*, p. 175-190, ed. P. Pliner, L. Krames, & T. Alloway. New York: Plenum Press.
- Rorty, A. O. (1980). *Explaining emotions*. Berkeley, Calif.: Univ. California Press.
- Rowell, T. E., & Hinde, R. A. (1962). Vocal communication by the rhesus monkey (*Macaca mulatta*). *Proceedings of the Zoological Society of London* 138:279-294.
- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology* 6:1161-1178.
- Russell, J. A., & Bullock, M. (1986). On the dimensions preschoolers use to interpret facial expressions of emotion. *Developmental Psychology* 22:97-102.

- Russell, J. A., & Mehrabian, A. (1977). Evidence for a three-factor theory of emotions. *Journal of Research in Personality* 11:273-294.
- Ryle, G. (1949). *The concept of mind*. London: Hutchinson.
- Sacks, O. (1982). *Awakenings*. Revised ed. London: Pan Books.
- Salzen, E. A. (1962). Imprinting and fear. *Symposium of the Zoological Society of London* 8:199-217.
- Salzen, E. A. (1970). Imprinting and environmental learning. In: *Development and evolution of behavior*, Vol. 1, p. 158-178, ed. L. R. Aronson, E. Tobach, J. S. Rosenblatt, & D. S. Lehrman. San Francisco: Freeman.
- Salzen, E. A. (1978). Social attachment and a sense of security—a review. *Social Science Information* 17:555-627.
- Salzen, E. A. (1979). The ontogeny of fear in animals. In: *Fear in animals and man*, p. 125-163, ed. W. Sluckin. New York: Van Nostrand Reinhold.
- Salzen, E. A. (1981). Perception of emotion in faces. In: *Perceiving and remembering faces*, p. 133-169, ed. G. Davies, H. Ellis, & J. Shepherd. London: Academic Press.
- Salzen, E. A. (1989). The construction of emotion from facial action. In: *Handbook of research on face processing*, p. 177-186, ed. A. W. Young & H. D. Ellis. Amsterdam: North-Holland.
- Salzen, E. A., Kostek, E. A., & Beavan, D. J. (1986). The perception of action versus feeling in facial expression. In: *Aspects of face processing*, p. 326-339, ed. H. D. Ellis, M. A. Jeeves, F. Newcombe, & A. Young. Dordrecht: Martinus Nijhoff.
- Schenkel, R. (1958). Zur Deutung der Balzleistungen einiger Phasianiden und Tetraoniden. *Ornithologische Beobachtung* 55:65-95.
- Schlosberg, H. (1952). The description of facial expressions in terms of two dimensions. *Journal of Experimental Psychology* 44:229-237.
- Schlosberg, H. (1954). Three dimensions of emotion. *Psychological Review* 61:81-88.
- Schwartz, G. E. (1982). Psychological patterning and emotion revisited: a systems perspective. In: *Measuring emotions in infants and children*, p. 67-93, ed. C. E. Izard. Cambridge: Cambridge Univ. Press.
- Scott, J. P., & Senay, E., eds. (1973). *Separation and depression*. Washington, D.C.: American Association for the Advancement of Science.
- Sherman, P. W. (1988). The levels of analysis. *Animal Behaviour* 36:616-619.
- Simmons, K. E. L. (1955). The nature of the predator-reactions of waders towards humans: with special reference to the role of the aggressive, escape- and brooding-drives. *Behaviour* 8:130-173.
- Singer, P. (1981). *The expanding circle*. Oxford: Clarendon Press.
- Smith, W. J. (1977). *The behavior of communicating. An ethological approach*. Cambridge, Mass.: Harvard Univ. Press.
- Solomon, R. L., & Corbit, J. D. (1974). An opponent-process theory of motivation: I. Temporal dynamics of affect. *Psychological Review* 81:119-145.
- Sroufe, L. A. (1984). The organization of emotional development. In: *Approaches to emotion*, p. 109-128, ed. K. R. Scherer & P. Ekman. Hillsdale, N.J.: Lawrence Erlbaum.
- Strauss, H. (1929). Das Zusammenschrecken. *Journal für Psychologie und Neurologie, Leipzig* 39:111-231.
- Strongman, K. (1973). *The psychology of emotion*. 1st ed. New York: Wiley.
- Suarez, S. D., & Gallup, G. G. (1987). The question of an auditory self-concept in song sparrows, *Melospiza melodia*. *Animal Behaviour* 35:610-612.
- Tinbergen, N. (1952). 'Derived' activities, their causation, biological significance, origin and emancipation during evolution. *Quarterly Review of Biology* 27:1-32.
- Tinbergen, N. (1958). The origin and evolution of courtship and threat display. In: *Evolution as a process*, 2nd ed., p. 233-250, ed. J. Huxley, A. C. Hardy, & E. B. Ford. London: George Allen & Unwin.
- Tinbergen, N. (1963). On aims and methods of ethology. *Zeitschrift für Tierpsychologie* 20:410-433.
- Tomkins, S. S. (1962). *Affect, imagery, and consciousness, Vol. 1 The positive affects*. New York: Springer.
- Tulving, E. (1972). Episodic and semantic memory. In: *Organization of memory*, p. 381-403, ed. E. Tulving & W. Donaldson. New York: Academic Press.
- van Hooff, J. A. R. A. M. (1962). Facial expressions in higher primates. *Symposium of the Zoological Society of London* 8:97-125.

- von Holst, E., & Mittelstaedt, H. (1973). The reafference principle (Interaction between the central nervous system and the periphery) In: *The behavioural physiology of animals and man*, p. 139-173, translated by R. Martin. London: Methuen.
- Warrington, E. K. (1975). The selective impairment of semantic memory. *Quarterly Journal of Experimental Psychology* 27:635-657.
- White, R. W. (1959). Motivation reconsidered: the concept of competence. *Psychological Review* 66:297-333.
- Winton, W. M., Putnam, L. E., & Krauss, R. M. (1984). Facial and autonomic manifestations of the dimensional structure of emotion. *Journal of Experimental Social Psychology* 20:195-216.
- Wolff, P. H. (1969). The natural history of crying and other vocalizations in early infancy. In: *Determinants of infant behaviour, Vol. 4*, p. 81-109, ed. B. M. Foss. London: Methuen.
- Wundt, W. (1907). *Outlines of psychology*. 7th ed. Translated by C. H. Judd. Leipzig: Wilhelm Engelmann.
- Young, P. T. (1943). *Emotion in man and animal*. New York: Wiley.
- Young, P. T. (1961) *Motivation and emotion*. New York: Wiley.