A Dual Process Model of Emotion

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Abstract

The thesis brings together philosophical, psychological and neuroscientific theories of affect in developing a dual process account of emotion.

Philosophers and psychologists who take a cognitivist view claim that emotions in humans and other mammalian species require intentionality, arising as the product of evaluations which bear upon our survival or wellbeing, whereas neuroscientists conclude from their research that emotion has its foundations in subcortical affect mechanisms by which behaviours may arise as spontaneous responses to valuable stimuli. Parts I and II of the thesis examine these two accounts, which are construed as cognitive-evaluative and primitive emotional processes respectively. It is further proposed that both these manifestations of emotion are to be found in mammalian species.

Given that cognitive-evaluative and primitive emotional states can be demonstrated to coexist and function separately in mammalian species, how do we explain cases in which the two processes seem to be non-accidentally associated? To exemplify: how does it come about that an appraisal that I have been unfairly treated is accompanied by aggressive feelings and impulses towards the object of my anger?

Cognitivists accept that the somatic changes accompanying emotions are associated with appraisals but argue that such changes play no role in emotion as an evaluative process other than that of marking the appraisal as significant for our wellbeing. In contrast, a dual process model of emotion is proposed for the interaction of primitive emotions and emotional appraisals whereby the appraisal process arouses a primitive emotion through the detection of patterns within complex external contexts which have a significance for an individual's wellbeing. The neurophysiological changes associated with the primitive emotion when so aroused, will in turn, invest the appraisal with *feelings*, sensations characteristic of those neurophysiologies. These feelings influence evaluation in ways which are fundamental to the successful performance of everyday mental functions.

INTRODUCTION

A few years ago, I attended a symposium for philosophers, psychologists and neuroscientists intended to promote interaction on matters of common concern. At one of the seminars a professor of psychology presented the conclusions of a programme of research into episodic memory. The gist of his findings was that any episodic memory must contain some spatial or temporal reference.

In the subsequent question and answer session, a professor of philosophy insisted repeatedly that he could have episodic memories which contained no such reference. His objection, which may have been mischievous, occasioned some amusement in the audience. The professor of philosophy did not fully clarify his motives for making this statement: he did not identify these memories; nor did he seem to be arguing with the findings or their general applicability; rather, he seemed to be asserting that it would be possible for humans to construct and retain episodic memories without a spatial or temporal reference *intentionally*, despite the existence of psychological principles relating to the spatial and temporal 'tagging' of episodic memory.

The professor of psychology declared that what his opponent was asserting was impossible; and there the matter rested.

I am unable to visualize how an episodic memory could be intentionally constructed and retained in the manner proposed. Yet this encounter has remained with me because it highlighted a problem for any theory of mind: if there are principles which motivate and inform our mental processes, to what extent do our conscious cognitions allow us to overwrite or alter them?

This question is relevant to the study of emotion. The range and complexity of the emotions which humans claim to experience is so great that any study of them as separately occurring entities must necessarily be extensive and, as William James observed, potentially tedious. But while emotions as experienced seem to be extremely diverse in both nature and function, some shared aspect of their phenomenology invites us to acknowledge them as inhabiting, at some level, a common dimension of the human psyche. And such an acknowledgement invites us to speculate that emotion could be a coherent category of mental processes subject to principled motives.

Amelie Rorty counsels against any such notion; she visualises the emotional whole as composed of three elements of explanation: individual, social and genetic, but observes:

"what goes without saying may need to be said: we should not be misled by talk of interaction, layers or strands, to suppose that we are dealing with direct variables whose causal interaction can be traced. What is independently variable in theory need not be independently variable in fact." (1978 p.157).

Rorty is asserting that the experience of emotion is so rich and complex and so bound up with our thoughts, that any attempt to unravel it into interacting components or principles, even if it were possible, would fail to account for it as a totality. According to this view, we need not search for principles which govern emotion because even if we were to find them, what they are attempting to explain must perforce be beyond the ability of any interaction of such principles *to* explain.

I am not persuaded by Rorty's assertion; and this is not because I have no regard for the importance of human emotion: it is just because I believe that emotion is a core aspect of human cognition that I also believe that any account of mind will be impoverished by the absence of the sort of explanation which Rorty resists. If we are to have a philosophy of mind, we must be prepared to consider the possibility that emotion functions in a manner which can be expressed in terms of philosophical theories or psychological processes, rather than analysed as an abundance of distinct yet inextricably complex experiences.

And I am not alone in taking this view. Behavioural scientists and neuroscientists specialising in affect, treat emotion in animals – particularly mammals – as arising in response to certain types of stimulus. They believe that emotional states in animals are instantiated by neural systems originating in the subcortex and proximate brain locations, sometimes characterized as the limbic system, and they provide a good deal of evidence to substantiate this claim. Neuroscientists and some psychologists working in the field of human emotion believe that these same subcortical systems, (whilst still occasionally responsive to unconditioned stimuli) are elaborated in higher brain functions and express themselves as agents in mental activities such as complex decision-making (Damasio 1994) Many of these manifestations of emotion do not act at a level of mentality which could be described as conscious and indeed, psychologists such as Kahneman (2012) take the view that many of the day-to-day choices we make are informed by emotionally-driven judgments acting rapidly and processed nonconsciously.

In contrast to the neuroscientific and psychological views of emotion, an important field of emotional philosophy is represented by advocates of *cognitivism*. Cognitivists make a broad claim that emotion is caused by judgments or evaluations of objects, events or circumstances as having significance for the wellbeing of the subject. There is good evidence for this view; for example, human emotions such as embarrassment or guilt cannot arise without the subject's having some understanding of the social context within which he/she exists. However, the claim that emotion arises solely as the outcome of appraisal is challenged by psychologists who claim that certain emotions may arise spontaneously in the presence of certain exciting objects.

The proponents of both these views accept that the idea of emotion as the product of evaluation cannot easily be reconciled with a claim that an emotional state is automatically triggered in the presence of an exciting object.

This thesis accepts the cognitivist view that emotions may arise from appraisals of value in humans and other mammals. But whilst accepting the cognitivist claim, it provides an explanation for the spontaneous arousal of emotions by introducing a separate category of *primitive emotions* in which emotional behaviours arise spontaneously as responses to stimuli of homeostatic value, and it is argued that both cognitive-evaluative emotional states and primitive emotions occur in mammalian species.

In order to achieve a better understanding of the respective nature and function of cognitivist and primitive emotional processes, both accounts must stand upon an equivalent philosophical footing. However, in contrast to the extensive body of work provided by cognitivists for the explanation of emotions as appraisals, the notion of affect as a set of automatically-arising subcortical processes is not well represented as a philosophical concept, and accordingly, the first two parts of this thesis are allocated to the exposition and analysis of cognitivist and neurobiological theories of emotion:

Part I explains, then explores, the cognitivist position that emotion is the outcome of evaluation or appraisal. It discusses disputes concerning emotional episodes in which affective states appear to manifest without evaluation and concludes that there is a strong case to be made for a distinct class of 'non-evaluative' emotions.

The cognitivist view of feelings is examined separately. The cognitivist claim that the feelings associated with emotional evaluation are explicable as the products of evaluative or judgmental processes is challenged, as is the concomitant claim that physiological changes, whilst co-occurring with emotional experiences, play no role in emotional evaluations.

Part II pulls together the results of scientific research into the causes and effects of emotions as both neurobiological states and behavioural phenomena with the object of translating these explanations into a model for the action of primitive emotions which can be usefully compared with cognitivist accounts. To do this, a methodology is employed in which research into the action of affect in mammals is progressively expanded from a description of a set of subcortical neural systems into an account of primitive emotions as autonomous functions, able both to access and co-opt perceptive, memory and motor centres. The collective action of these states is argued to constitute a core primitive emotional architecture common to all mammalian species, and the systematicity of these mental phenomena is contrasted with cognitivist accounts of emotion as requiring intentionality.

But this leaves a question unanswered. If cognitivist and primitive emotional states represent two coexisting emotional systems acting independently, both in humans and other mammals, why is it that there appear to be cases in which they are non-accidentally coordinated? If emotional thoughts may be explained as the products of evaluation, why is it, for example, that when my child is arbitrarily denied a merited opportunity, even as I judge that she has been unfairly treated by the administrative process, these thoughts are bound up with feelings of anger directed against some individual or group as being responsible for that inequity?

Cognitivist accounts do not deny that the feelings which accompany emotional evaluations mark that mental state as emotional, but in **Part III** of the thesis I will advance the hypothesis that primitive emotional systems are triggered by patterns of appraisals and exert an influence upon those appraisals when aroused. According to this account, the feelings which accompany an emotional appraisal are the effects of an underlying primitive emotional state. Over the past two decades, several psychological theories of this type – designated 'dual-process' theories - have been proposed for mental activities as diverse as social cognition, reasoning and memory. The claim underpinning the dual process concept is that these faculties may be broadly differentiated into two modes of cognition: processes which act autonomously and processes which are commonly described as reflective or deliberative.

To my knowledge, whilst proponents of dual process explanation have offered emotion as a candidate for this form of explanation, no detailed dual process model of emotion has previously been advanced.

PART I – Cognitive Evaluative Theories of Emotion

The first part of this thesis will be devoted to an account of the cognitivist view of emotion. However, for reasons which will become apparent, I will use the term 'cognitive-evaluative' to describe philosophers who argue that emotions are aroused by appraisals or evaluations of external entities as they concern the self. The term 'cognitive-evaluative' is awkward but it provides the most appropriate description of this account of emotion.

- Chapter 1 will offer a representative view of the various proposals and theories which have been offered in support of emotion as a cognitive-evaluative phenomenon.

The subsequent chapters will consider two separate challenges to the cognitive-evaluative theory:

- Chapter 2 will examine claims that emotion may arise in the absence of evaluation and will describe the responses of cognitive-evaluative advocates to such claims.
- Chapter 3 will consider the claim that, in its treatment of feelings, the cognitive-evaluative explanation of emotion provides an incomplete account of emotion as experienced.

Throughout this thesis, I will – in common with many philosophers and psychologists working in this field - use the terms 'evaluation' and 'appraisal' interchangeably.

Chapter 1: The Cognitive-Evaluative Account of Emotion

1.1 *A Brief Overview and History*

Over the past two centuries the concept of emotion has been the subject of a wide range of philosophical treatments: in the late nineteenth century James and Lange identified emotion with the experience of feelings which occurred as characteristic bodily states caused by the detection of some exciting object, but these views were challenged in the early to mid-twentieth century by behaviourists who argued that those bodily states were merely elements of a process by which an animal responded to a stimulus and were in consequence eliminable by behaviourist theory. By the 1970's and 1980's the failure of researchers and behaviourist philosophers to produce explanations of animal behaviours as predictable responses to stimuli caused many philosophers to adopt a *cognitivist* approach to emotion.

Describing the general reaction to the unravelling of the behaviourist position, Martha Nussbaum writes: *"Simple models of behaviour [ ], kept proving to be inadequate as explanatory and predictive accounts: it came to be recognised that S-R models would have to be replaced by S-O-R (Stimulus/Organism/Response) models of a far more complicated sort. This recognition was prompted by experimental results in the area of learning where it became clear that the animal's view of its own situation, and the stimuli to which it was subjected, were crucial explanatory factors."* (2001 p.94)

The view expressed here is 'cognitive'. It takes the position that mental states in humans and animals cannot be understood simply as expeditors of invariant responses to stimuli. Cognitive advocates argue that the brain is able to instantiate a range of processes subsequent to the detection of stimuli - such as remembering, thinking and learning – and that behaviours occur as the outcome of these processes, functioning separately or collectively, in response to stimuli. Treating the brain in this way enables cognitive scientists and philosophers to work from a shared perspective with regard to the role of mental states, allowing the term 'cognitive' to be claimed uncontroversially by either of these groups.

The cognitive-evaluative account which I will examine takes as its premise the notion that certain animals, including humans, in making an emotional evaluation behave intentionally towards the emotional object, by selecting objects, events or circumstances in the external world which have value for themselves, and acting towards those objects in a manner which supports the wellbeing or survival of the individual.

Nussbaum compares this view to much earlier cognitivist theories of emotion. Chrysippus, a Stoic, (c280-207) argued that only creatures capable of forming proposition-like entities (*lekta*) could exhibit emotions. He concluded that non-human animals, having no linguistic ability, are incapable of emotion. Other Stoic philosophers disputed this, arguing from observation that animals display emotionally-driven behaviours. They accepted Chrysippus' proposal that animals were incapable of learning and judgment exhibited by species with language, and concluded that in consequence, emotions must constitute some separate nonreasoning element of the soul.

Nussbaum responds: "*they share a false premise: that animals are incapable of intentionality, selective attention and appraisal"* (2001 p.91)

Nussbaum's account of emotion as appraisal provides a separate explanation of emotion as felt; she accepts the co-occurrence of bodily feelings as a characteristic of the emotional experience but denies any *role* for those feelings in her account of the intentional processes which generate emotions:

"Do we get further by recognizing qualia, and saying it's not boiling or trembling we're after, but the sui generis feeling of anger, which has a constancy across subjects, in something like the way that seeing red has constancy? I don't feel that much is contributed by this move. So far as we can see, what has constancy across subjects is a pattern of thought, which is of course a type of experience. If we are to be convinced that there is anything further that has constancy across subjects, we need to be told something about what this might be." (2001 p.61)

Nussbaum is asserting that if I am experiencing an emotion, such a state is explained from an appraisal of the circumstances obtaining at the time, rather than the bodily accompaniments to the emotion as appraised. She argues that if these physiological effects have some role in emotion, we need first to have an account of how some pattern of physiological arousal is correlated with an emotion which we believe we are experiencing.

But, for Nussbaum, even if a physiological state were to co-occur consistently with an emotion, this would not be sufficient in itself to allow us to postulate that those bodily changes play some role in the co-occurring emotion. In the absence of such an explanation, even if a characteristic physiological change were to be identified, it remains superfluous to the cognitive-evaluative account.

1.2 The Philosophical Explanation of Emotion as a 'Cognitive' Phenomenon

The term *cognitive* is not one which is readily accepted by all philosophers to whom this view is attributed and before embarking upon any further discussion, I will attempt to explain what will be understood to constitute a cognitive theory for the purposes of this thesis.

Robert Solomon (2004), who is widely cited as one of the earliest advocates of emotion as 'judgmental evaluations' makes this observation: *"what exactly is a 'cognitive' theory of emotions? The label 'cognitive theory' is not mine, and I fought it for years not just because it was misleading but because "cognition" is so variously or ill-defined."* (2004 p.78). Solomon's argument here is with the notion of cognitions as being descriptive of the judgmental processes which he believes form the basis of emotion. I concur with Solomon that the term 'cognition' is ill-defined. But I shall not adopt Solomon's view that cognitive theories are defined by the presence or action of 'cognitions'. Rather, I shall take the description 'cognitive' to refer to a theory of any mental process, which, acting independently of its stimulus or its outcome, explains the way in which a stimulus generates a response, be that a behaviour, or a disposition in the form of a propensity to act, or an internalised mental outcome, such as a decision[1].

This account of the 'cognitive' view is the one proposed earlier by Nussbaum in which a stimulus does not directly predict a response, as it would in a reflex such as

[1] See p.29 for a more complete account.

an eye-blink in response to a puff of air (i.e. stimulus→response); rather it refers to mental events interposed between stimulus and response so that the response can be suppressed or modified by some internal process instantiated by the organism (i.e. stimulus→organism→response) which is independently explicable. On this reading, Solomon's explanation of emotions as 'subjective engagements with the world', whatever their form, is a 'cognitive' view. In a cognitive relationship, the relationship between stimulus and response is mediated by some intervening process, allowing the interpretation of stimulus to be varied independently of the evoked response. In this account the relationship between stimulus and response is explicable as some function of the mediating process, whereas in a reflex response the intervening neural processes may be treated as invariant mechanisms for expediting a response from a stimulus.

At first sight, this appears to be setting the boundaries of cognitive processes loosely, but Solomon is not alone amongst cognitive-evaluative advocates in calling for latitude in terms of the evaluative mental processes which constitute the broad spectrum of observed mental processes with which affect is associated. Despite this, my interpretation of 'cognitive' is constraining inasmuch as it *does* require that the intervening mental processes described are separately explicable, with the result that any explanation Solomon wishes to provide for the action of emotion, independent of stimulus or response, becomes 'cognitive'.

1.3 The Scope of Cognitive-Evaluative Theories of Emotion

Emotion is commonly held to have a wide-ranging and heterogeneous role in our mental lives. We can be sad or depressed without particular reason. These could be regarded as 'stimulus-free' emotions and hence do not obviously conform to my requirements as 'cognitive', since no role for mediation is evident. Or we can have personalities which are 'cheerful' or 'irascible'; but again, these are qualities attaching to the character of a subject's day-to-day interactions, which colour his/her relationships without reference to any particular stimulus or response. So once again, the prospects for explaining such qualities cognitively are poor because they are constantly present, apparently requiring no stimulus, whilst colouring our responses.

Solomon has outlined the kind of phenomena he claims as candidates for his account of emotion:

"*Carroll Izard begins by defining* [emotions] *as "brief responses". In recent work by Joe LeDoux and Jaak Panksepp, and Antonio Damasio, an emotion is sometimes presented as if it is more or less over and done in 120 milliseconds, the rest being mere aftermath of cerebral embellishment. An emotion, so understood, is a brief, preconscious, precognitive, more or less automatic excitation of an affect program. [ ] I am more interested in substantial processes that last a long time – lifelong love, for instance. I am interested, in other words, not in these brief "irruptive" reactions or responses but in the long-term narratives of Othello [ ]. I am interested in the meanings of life, not short-term neurological arousal."* (2004 p.78)

In this respect, the field of interest of this thesis is more modest than Solomon's. My earlier characterisation of cognitive evaluation restricts me to occurrences of emotion with origins which may be identified and outcomes which may be explicated. This view of emotion must take into account the sort of short term 'neurological arousals' dismissed by Solomon, to the extent that they are triggered by stimuli and evoke intelligible responses; it will also include the concept of emotion as the product of appraisal, where the object of appraisal is identifiable and the outcome is manifest. But the type of extended emotional experiences which interest Solomon, such as lifelong love, are much less apt for interpretation as evaluative mechanisms for mediating the relationship between stimulus and response. The greater part of this thesis will concentrate on relatively brief emotional events in which the role of emotional processes in mediating stimulus and response may be examined. However, in Chapter 21 I will consider Nussbaum's account of grief, in the light of theories I have proposed as a result of my investigations of more compressed emotional episodes.

Moving to Solomon's disinterest in Izard's 'brief responses', I will explain presently how cognitive science has demonstrated that emotions may indeed *arise* as rapidly as Solomon describes, but to suggest that an entire emotional episode may occur with such brevity is to misrepresent LeDoux's and Panksepp's work. Neither does it reflect Izard's more general account of emotion (2009). And even a cursory reading of

Damasio's work will demonstrate that he is describing emotional conditions – or more accurately, deficiencies – which are active throughout the lifetimes of his subjects[2].

While Solomon expresses little interest in these 'more or less automatic' manifestations of affect, Lazarus has argued at some length that such events may be dismissed as simple reflexes which are non-cognitive (Chapter 2); and Nussbaum takes the more nuanced view that a behavioural state, having some of the characteristics of an emotion, may arise automatically in a human or an animal. But she argues that such states are not emotions themselves, rather they are transformed into emotions by some apprehension of the value of the emotional object – a mental act requiring intentionality.

1.4 The Constituents of Emotional Evaluation

The philosophical view that an evaluation of circumstances as they relate to oneself can cause an emotion is widely held, but it is less clear what an evaluation ought to consist of. Solomon observes *"Several philosophers join me in defending the theory that emotions are evaluative judgments, a view that can be traced back to the Stoics."* (2004 p.79). I have described how Solomon has questioned the notion that emotions can result from short-term neurological arousal. But his account of emotions as the outcome of evaluative judgments reveals that he is unwilling to accommodate his concept of emotion entirely within more formal theories of mind:

"I have long argued that emotions as judgments should not be confused with singular summary judgments (such as might be used to briefly define them or distinguish one emotion from another), nor should a judgment be thought of something deliberative, articulate or fully conscious [ ] To say that emotions are intelligent is not to say that an emotion is an aspect of intellect, and to insist that emotions are judgments is not to say that emotions are what some philosophers call 'propositional attitudes'" (2004 p.77)

and:

[2] An extract from Damasio's work is provided in the Appendix.

"I now want to stress even more than I have done before that a judgment is not a detached intellectual act but a way of cognitively grappling with the world. It has as its very basis and as a background a complex set of aspirations, expectations, evaluations ("appraisals"), needs, demands and desires (which says something about why the reigning "belief-desire" analysis of emotions and intentions is so hopelessly impoverished)" (2004 p.77)

Solomon argues that emotions are judgments, and the product of such judgments manifest as some intelligible attempt to address the emotional object. But the candidate mental processes which subserve evaluative judgments need not be propositional attitudes, representing the outcomes of explicit beliefs, nor need their arousal be the product of consciously-held desires and intentions.

But this is not sufficient to justify the central role of evaluation in emotion. If appraisals are the mental processes which cause emotions, and if cognitive-evaluative advocates are unwilling to describe appraisals in terms of any particular theory of mind, they must offer some other criterion, or set of criteria, by which the role of emotional appraisals may be characterized.

Smith and Lazarus offer a possible way forward: they observe that *"for an emotion to occur, the "facts" as construed by the individual, must further be* ***appraised*** *for their implications for personal well-being.[ ]. We suggest that this [ ] type of evaluation provides the emotional 'heat' in an encounter, and we refer to it as* ***appraisal*** *to distinguish it from colder cognitions that play a more indirect role in emotion generation"* (1993 p.917).

They propose (in accordance with their own psychological research) that the attributions I make, when they pertain to circumstances concerning myself, arise as emotions because they are assessed as relevant to my goals - either challenging or supporting them - and are further appraised, *inter alia,* with respect to my potential to cope, and the need for me to act. Smith and Lazarus, through research, have discovered from a collective analysis of these factors that certain patterns of appraisals which they call *core relational themes* have emotional potency.

We sense from our own experience that the appraisal criteria which Lazarus describes are the right sort to identify the presence of attributes which have implications for the interests and goals of the experiencing subject. On the face of it, the circumstance that appraisals refer to matters of subjective well-being rests upon a full account - a model - of what constitutes wellbeing and, more specifically, what constitutes an assault upon - or an enhancement of - that wellbeing.

But this need not be the case: Lazarus describes the relationship between appraisal and wellbeing in this way:

"Cognitive activity is a necessary precondition of emotion because to experience an emotion, people must comprehend – whether in the form of an evaluated perception or a highly differentiated symbolic process – that their well-being is implicated for better or worse." (1984 p.124)

and Nussbaum expresses a similar view:

"I shall argue that emotions always involve the thought of an object combined with a thought of that object's salience or importance; in that sense, they always involve appraisal or evaluation. I shall therefore refer to my view as the cognitive-evaluative view [ ] But by "cognitive" I mean nothing more than "concerned with receiving and processing information." I do not mean to imply the presence of elaborate calculation, of computation, or even reflexive self-awareness," (2001 p.22).

Nussbaum attaches a particular precondition for emotional appraisals which is implied in her description of appraisals as 'thoughts':

"By now nearly all major investigators in the area grant that emotions can and should be studied by psychologists and that emotions are richly cognitive phenomena, closely connected with the animal's way of perceiving and interpreting the world [ ] *a position in which intentionality is taken seriously and regarded as part of what any good theory must include."* (2001 p.94)

According to this account, the requirement for a general theory, or model, of wellbeing I proposed above is rendered unnecessary for humans and other animals, because each individual - as Lazarus puts it - is able to *comprehend* the significance of externalities for its own wellbeing. This ‘comprehension’ need not be rational, it is only necessary that the subject is able to adopt some response towards the object of the emotion, a response which may be construed as serving its wellbeing, and in so doing, the subject may be said to display intentionality.

1.5 The Cognitive-Evaluative Treatment of Feelings

The full experience of emotion is described by Lazarus as normally consisting of three fused components *“thoughts, action impulses and somatic disturbances. When these components are dissociated we are left with something other than what we mean by a true emotional state.”* (1982 p.1019). It will be noted that the cognitive-evaluative view as described thus far accounts for only one of these components - the thoughts which comprise our evaluation of the emotion-inducing object.

Joel Marks addresses the ‘widely-held view’ that emotions are feelings. The feelings he describes are bodily states such as the tenseness associated with anger or the relaxation which accompanies relief or joy, and he asserts that if we have no experience of these things, we have not emoted. But the nature of emotion - its identity - raises problems. Emotions may take us unawares as the sudden apprehension of feelings of which we have previously been unconscious: the concept of ‘unfelt feeling’ is a contradiction; though he speculates that such spontaneous events might be explained by feelings acting subliminally or subconsciously through our senses alone.

His response is to separate the feelings we experience during emotions from the cognitions which generate them: *“It is not clear how to deal with arguments like these. I would simply persist in maintaining that there seem to be clear cases where, for example, a person experiences a genuine revelation with regard to his own emotion. However that issue goes, there is a second point against the feeling thesis which seems to me to be decisive: emotions are intentional phenomena or states (‘intentions’ for short), feelings are not. ‘Intentional’ here is being used in a particularly philosophical sense; it has to do with the ‘aboutness or ‘directedness’ of certain mental states, e.g., A’s worrying* ***about*** *his financial situation.”* (1982 p.228)

In arguing that emotions are mental process directed towards the objects of emotion, Marks, like Nussbaum, proposes that for a state to be emotional, some manifestation of intentionality upon the part of the experiencing subject must be present. Marks is expressing the cognitive-evaluative view; he accepts that feelings accompany emotional states, but he claims that emotions are intentional states, whereas feelings are not.

The other feature of emotional experience is what Lazarus has described as an 'action impulse' – say, the impulse to lash out, or flee. A brief consideration of emotions such as fear and anger will confirm that although these impulses are present, we are normally able to control them. The physiology of the suppressed emotional impulse could be bundled in with, say, a raised pulse, trembling and blushing, as 'somatic disturbances'. But though we rarely carry through the actions which these impulses prompt us to perform, Lazarus's characterisation of action impulses as a core component of emotion nonetheless seems to bear only one interpretation: that the arousal of emotion may be associated with an impulse for action which often constitutes a response to the arousing stimulus other than that offered by appraisal. Such impulses represent a comprehensible response to certain classes of stimulus - that is, the sort of response which I would often resort to as a child, before I was *able to control* my emotions, or the sort of responses which other species would evoke routinely in response to certain opportunities, threats or provocations.

Lazarus has explained this transition away from early emotional impulses: *"* [They] *seem to disappear or at least go underground with an ontogenetic shift to higher mental processes, just as they seem to disappear or go underground with the phylogenetic accretions of the neocortex that only suppress and regulate but do not banish lower functions"* (1982 p1021).

For Nussbaum, bodily feelings mark the presence of emotion but play no part in the thoughts and actions which shape an emotional event, but she accounts for the *mental* perturbations which are commonly associated with feelings by arguing that it is the appraisals themselves which cause these disturbances, just because they relate to matters of direct concern to ourselves, promoting them to the head of the queue of our thoughts and pushing our everyday concerns and reflections into a subsidiary position. The extent to which they occupy our thoughts, their *urgency*, is a function of the importance and salience which the emotion-arousing circumstances hold for our goals and wellbeing. So, Nussbaum, whilst accepting that somatic states co-occur with emotions, assigns no role to them.

Summary

My aim in this chapter has been to provide a brief account of emotion as represented by a set of claims which are common to philosophers who take the view that emotions arise from mental processes entailing evaluation – a view which I have described as cognitive-evaluative.

They argue first, that emotions are the outcome of intentional mental processes which entail evaluations or judgments in humans and other species, by which certain entities are revealed to have value. Valued entities may be objects, events, or circumstances which are appraised to have relevance for the subject, because they have the potential to promote or impair its wellbeing, or threaten its survival. The value in such objects may arise because they are desired, as, say, goals, expectations or needs, or because they pose threats. To hold such things as valuable, some subjective awareness is postulated in which the implications of the perceived value for the subject's wellbeing are apprehended, allowing the subject to act towards the object of value in a manner appropriate for the maintenance or enhancement of its wellbeing.

Cognitive-evaluative advocates propose that when an object of value is detected, an emotion arises in which thoughts directed towards the object of emotion are accompanied by physiological alterations and action impulses. In explaining the physiological changes which accompany emotion, a common view is expressed that whilst such states mark the evaluation as emotional, they play no role in the evaluative process. However, at this point, some divergence occurs. Nussbaum argues that the feelings we experience in the emotional event are bound up with the process of appraisal and that the physiological changes accompanying the emotion are incoherent, bearing no relationship to the experiential quality of the emotion, whereas Lazarus argues that the somatic disturbances accompanying emotions may be responses to the pattern of appraisal issues detected, which occur as reflex mechanisms retained from an earlier period of our evolutionary development.

1.6. Challenging the Cognitive-Evaluative Explanation

In Chapters 2 and 3, I will challenge aspects of cognitive-evaluative theory. However, the arguments I put forward, are not to be understood as attempting to disprove the entire theory; my intention rather, will be to investigate claims that aspects of emotion are not explained by the theory, specifically:

- *Chapter 2*. That certain manifestations of emotion in humans and other mammals appear to arise in the absence of evaluation.
- *Chapter 3*. That the arousal of bodily feelings and states of action preparedness associated with emotion may play a role in the emotional process, and that the evidence which cognitive-evaluative advocates offer against such a role is inconclusive.

The evidence to be considered is taken principally from the results of psychological or behavioural research which have been selected as supporting or refuting the claims made by the contesting parties. In consequence, the discussion must, in part, be steered by the examples which have been selected by cognitive-evaluative advocates and their opponents - evidence advanced in disputes which have arisen intermittently over the past forty years.

In adopting this approach, my intention will be to prepare the ground for a separate category of emotion as a set of spontaneously-aroused primitive states common to all mammals which I shall develop in Part II.

Chapter 2 – Comparing Evaluative and Non-Evaluative Theories of Emotion

Introduction

In this chapter, I shall examine the claims of psychologists and behavioural scientists who argue that emotional states can arise in the absence of evaluation, and I shall consider the objections of cognitive-evaluative philosophers who oppose this view. The psychological accounts I shall cite as evidence for the non-evaluative view do not require that *all* instances of emotion are non-evaluative: I shall propose that emotions may occur as both evaluative *and* non-evaluative states.

In making such a proposal, I do not assert that the non-evaluative states of emotion are differently structured to the *stimulus-organism-response* formation advanced by Nussbaum, only that, whilst entailing a mediating process, which meets Nussbaum's requirement as 'cognitive', they operate in the absence of evaluation and hence, in the absence of intentionality.

To test such a claim, it will initially be necessary to create a conceptual model of emotion which embraces the important elements of the emotional process without appeal to the view that emotion is the product of evaluation. I have been unable to discover a model of this kind, and so the account I offer below adopts important elements of the cognitive-evaluative account, without requiring that evaluation constitutes a necessary precondition for emotion. My intention is to discover whether the non-evaluative accounts of emotion offered by psychologists and behavioural scientists are consistent with these less stringent requirements.

In constructing this conceptual model, the explanatory elements I shall adopt are first, the overarching concept of emotion as *cognitive*, i.e. that it is explicable as a separate mediating process, in which objects of *value* are identified, implying some process for *detecting* value. But value detection is not sufficient for an emotional occurrence. Once detected, the organism must generate a *response* to such value.

As I have described it, the occurrence of an emotion rests upon a number of distinct but interrelated claims which I will elaborate and analyse separately, and it is only when these claims are presented as an ensemble that the concept of emotion which I intend to investigate can be understood:

1) At the core of any emotion is one of a class of mental events/processes by which the relationship between the subject and the external world is mediated.

2) The mediating event or process characterising an emotion has two interrelated components:

> *2i) first, value detection, in which the environment is scanned for objects*[3] *of value for the subject.*
>
> *2ii) second, a 'rendering of value' in which detection of a valuable object causes a mental state, directed towards the object, which is characteristic of an emotion. The emotion has the function of causing the subject to act towards the object in a manner appropriate for the maintenance of its wellbeing.*

In the following paragraphs, I will consider the constituent elements of my model separately in order to determine whether some 'non-evaluative' explanation can be established which could meet the framework requirements for emotion as a cognitive phenomenon.

2.1 Emotion is Cognitive

For the purpose of this thesis, the term *cognitive*, denotes Nussbaum's use of the word rather than Solomon's. Solomon argues that if 'cognitive' is referring to 'cognitions' generally, then it does little to describe his particular view of emotion. Nussbaum is using it in a different sense: she is using it as a descriptive term in which an emotion arises as a particular chain of mental events, *stimulus>organism>response.*

[3] I use the term 'object' in a broad sense to encompass objects, events and circumstances or states of affairs arising in the external world.

This sequence of events does not have the conformation of either a reflex, (*stimulus>response*) or that offered by James and Lange (*stimulus-response-organism)*[4] rather, the response to a stimulus is determined by some intervening, separately explicable, process. In Nussbaum's account this intervening process is one of evaluation, in which the subject's view of its own circumstances serves to mediate between stimulus and response, entailing some manifestation of intentionality upon the part of the subject.

Whilst adopting Nussbaum's 'cognitive' view as it pertains to both the sequence in which an emotion arises and the existence of some mediating role between stimulus and response, I shall argue that such a mediating role need not be exclusively evaluative, and will provide evidence to support my arguments.

In sum, in using the word 'cognitive', I am adopting Nussbaum's account of emotion as a sequential process in which the detection of a stimulus is succeeded by a mediating process by means of which some response to the stimulus is evoked. The response evoked is not invariant but occurs as some separately explicable outcome of the mediating process.

In employing the term 'cognitive', therefore, I am denoting a category of processes for mediating between stimulus and response. Nussbaum's account of emotion as entailing evaluation is one example of this category of mediating processes, and I have used the term *cognitive-evaluative*, a term which Nussbaum herself employs, to distinguish her view of emotion.

2.2 The Mediating Process has Two Components

The framework account of the mediating process I have provided might be resisted by cognitive-evaluative advocates because it creates an undue distinction between processes of 'value detection' and 'value rendering' in the mediating process.

[4] The sequence I offer is based upon James and Lange's claim that an emotionally-exciting object arouses a physiological condition which the subject (*organism)* subsequently interprets as an emotional experience.

To better illustrate my proposal, I will provide two examples. First, if a tiger walks into the room, I will experience a strong disposition to leave the room, either as the effect of some inherited response to the presence of big cats, or as the result of a belief that tigers are a threat to my survival. In this type of emotional event, object detection and impulse arise rapidly and are experienced as co-occurring elements.

The previous account may serve for simple object-directed perceptions but seems less cogent when emotions are generated from complex events. Some years ago, I was stopped by police and accused of speeding. When the officer explained his reasons, I became angry. I had just dropped my son off at his school a few yards down the road, well after the speed trap, and in any case, I could not have accelerated to the legal limit before I was stopped. My thoughts were successively, a curiosity as to why I had been stopped, followed by bewilderment as I heard the account of the policeman, who stated that I was speeding on a stretch of road on which I had not driven, succeeded by anger when the policemen said I would be prosecuted. Initially, I was not angry; my anger arose only when I had been fully informed. It had its origins in my belief that I had been wrongly, hence unfairly, charged – a charge which I said I would challenge in court.

In this example, the identification of unfairness caused me to experience anger, but the detection of that unfairness constituted the more complex and lengthy process. It arose at the conclusion of a chain of reasoning which had as its outcome the belief that I was being unfairly treated. It may also be understood as a process of two parts: the deliberation leading to my belief that the police were treating me unfairly, succeeded by expressions of anger as a response to that belief.

In an emotional process, the detection of an exciting stimulus may be addressed separately from the behaviour which is evoked as a response to that stimulus. Even if these two elements of emotion are experienced synchronously, they may be treated as conceptually distinct, if not numerically distinct. For this reason, I have separated processes by which value is detected (interpretation) from those in which value is rendered (response-forming).

2.3 Value

The notion of emotion as the outcome of evaluation cannot exist separately from the concept that there are entities which the evaluator holds as valuable. The value of an entity is not something which can be determined by the senses alone. If some object is said to be of value to *x,* then this statement implies some relationship between *x* and that object.

Value may be a *sui generis* property such as intense heat or high places, both of which can pose a survival threat for a wide range of species. In these cases, the value of an entity can be explained independently of subjective experience. But the value attached to an entity need not arise in consequence of some property or a generally held belief or opinion that the entity is valuable. Something may be valuable to me because I am accustomed to it. On this second account, the attribution of value is a mental construct of the experiencing subject. For instance, I may have a sentimental value for an old jacket. These sentiments would not be shared by others. But whether the attribution of value is a shared or subjectively-derived construct, both concepts of value can act as sources of emotion: if I find myself in a forest fire, I will be afraid; if you throw away my old jacket, I will be angry.

To summarise, it is a necessary precondition for the arousal of emotion that subjects treat certain objects as valuable. If this account is correct and no object, event or set of external conditions can, of itself, be understood as possessing intrinsic or universal value, then for an animal to hold something to be valuable, that animal must first possess the ability to bring about some mental process, or processes, by which objects having value for a subject are discriminated.

The foregoing account describes aspects of the relationship between the evaluator and what is valued. It does not explain how an object comes to have value. In my earlier account, valuable entities are described by cognitive-evaluative advocates as promoting our wellbeing or posing threats to our survival. Value for us might take the form of goals, aspirations, threats or expectations, food, desired objects or partners. All these things may advance our wellbeing or promote our survival but they have a diversity which invites further explanation. In the course of this thesis, I intend to develop a concept of value which will bring together these diverse elements as collectively supporting a state of homeostasis.

2.4 Value Detection

Introduction

Philosophers who advocate the concept of emotion as the outcome of evaluation argue that the mental processes entailed in evaluation are intentional, but cognitive scientists such as LeDoux (1996) and Murphy & Zajonc (1993, 1995)) provide experimental evidence that certain emotional responses are triggered automatically by the detection of value. This value is not revealed by evaluation; it is rather the outcome of some inborn process whereby the value of an entity has been affirmed phylogenetically by the success of a particular response towards that entity in assuring the survival of the species.

In this, and following chapters, I intend to develop a claim that there exists a wide range of stimuli capable of generating automatic emotion-like responses of this type. To exemplify: opposite sexes of the same species attract during mating; flames are avoided, as are snakes. Whatever inherited mechanisms cause these emotional behaviours, I shall argue that they may be understood principally as neurological systems without recourse to considerations of awareness or intention upon the part of the subject.

Contrasting with this claim, I will propose, in accordance with cognitive-evaluative theories, that in mammalian species, value may also be revealed by the appraisal of an object as having implications for the subject's wellbeing. If value is revealed through appraisal, implicit in this view is the possibility that humans may respond to values which are intentional constructs as disparate as justice, art and status – either learned, socially inculcated or self-conceived – which Nussbaum describes as supporting *"the idea of one's own flourishing or one's important goals and projects."* (2001 p.4).

In sum, I will propose that there are objects of value which animals, including humans, possess the capacity to acquire intentionally but there are also objects of value to which animals, including humans, respond automatically by means of inherited mechanisms and I will discuss the evidence presented for this latter category below.

Emotions Manifested Spontaneously in Response to the Detection of Value

I intend to demonstrate that in order to detect a valuable object, it is not invariably the case that an animal should have some comprehension of the value of an object.

Robert Zajonc has offered a number of examples of emotion which he claimed could not be the outcome of evaluation and Lazarus, as an advocate of the cognitive-evaluative view, opposes this view. The dispute between the two culminated in two papers in *The American Psychologist* (1984) termed respectively 'On the Primacy of Cognition' and 'On the Primacy of Affect'. The titles of the papers, which imply that the dispute relates to the *primacy* of cognition or affect, are misleading: Zajonc is attempting to establish that affect, as a mental phenomenon, can be distinguished from - and may occur independently of - evaluation, and Lazarus opposes this view. Both agree that in humans, affective states often have intentional explanations, but Zajonc's attack produced the effect of drawing a response from Lazarus on the issue I am interested in – his treatment of 'primitive evaluations'.

Zajonc expresses his challenge thus:

"*For Lazarus, cognitive appraisal (of meaning and significance) underlies and is an integral feature of all emotional states.* [ ] *Thus all three aspects of an emotional reaction – bodily processes, overt behavioural expression, and subjective experience – need cognitive appraisal as a necessary precondition. I believe that this is not so, and I shall try to show why not."* (1984 p.118)

Zajonc believes that certain emotionally-associated behaviours arise as automatic responses to stimuli and he maintains that his claim is supported by experimental evidence that simple emotional responses are instantiated in dedicated subcortical neural pathways. These pathways transmit sensory information *directly* from the sensory input to the hypothalamus, a neural location which has been demonstrated to be active during emotional episodes in a number of species. He claims further that: "*Since the hypothalamus plays a central role in the arousal and expression of emotion, the retinohypothalamic tract allows the organism to generate an emotional reaction from a purely* ***sensory*** *input."* (1984 p.119). On this account, the emotion generated is aroused spontaneously by means of a neurological system. I employ the term *system* in this sense: that the emotional process can be described as a system, in which a neurological function, separate from stimulus or response, is able to generate a common behaviour (output) in response to multiple stimuli (input).

Examples of emotional mechanisms of the sort Zajonc describes are rare in adult humans (less rare in other mammals) but Lazarus (1982) understands the potential challenge such processes would pose for his theory:

"The only doubts I have are in the area of phylogenetically based triggers or releasers of fear in humans such as those postulated by Hebb" (1982 p.1021).

Hebb proposed from research that fear in humans could arise automatically in response to the sight of spiders, snakes or strangeness.

Lazarus, whilst accepting that such phenomena might exist, argued that they *"seem to disappear or at least go underground with an ontogenetic shift to higher mental processes, just as they seem to disappear or go underground with the phylogenetic accretions of the neocortex that only* ***suppress or regulate but do not banish lower functions.*** (my emphasis)***"*** (1982 p.1021).

Lazarus is asserting that these effects occasionally exist but may be suppressed or overwritten by higher mental processes.

Lazarus's explanation of emotion, offered in a 1991 paper which he co-wrote with Craig Smith, is that it developed by means of an evolutionary process in which:

"innate reflexes were once the simplest solutions to the adaptational problem of getting along in the world, but in more complex creatures these evolved into emotional patterns." (1991 p.612).

In offering this explanation, Lazarus is proposing that emotional behaviours emerged from reflexes and the distinction he makes is this:

"Probably all mammals meet the minimum cognitive requirements of emotion if one permits the concept of appraisal to include the type of process described by ethologists in ***which a fairly rigid, built-in response to stimulus arrays differentiates danger from no-danger****.* (my emphasis)*"* (1982 p.1023)

On the face of it, Lazarus's *built-in response to stimulus arrays* has the characteristics of an automatically-generated emotional mechanism of the type I have proposed. He attempts to clarify his position in an argument against the 'startle' response:

"Emotion results from an evaluative perception of a relationship [ ]between a person (or animal) and the environment. Startle is best regarded as a primitive neural reflex process. It signals that something has happened, and although it could precipitate a "true" emotional response, it is in itself merely a physiological response to an unanticipated change in stimulation". (1982 p.1023)

Lazarus offers no account here of how startle, which he claims to be a reflex, fails to meet his minimal cognitive requirements for evaluative processes as 'fairly rigid built-in responses to stimulus arrays'. Startle could be argued to conform to Lazarus's minimal cognitive requirement because it can be characterised independently of its arousing stimuli – i.e. as an independent cognitively explicable process capable of generating a response to any one of a number (an array) of stimuli. To clarify: Lazarus argues that startle is a reflex, yet it is a reflex which can arise in response to a potentially unlimited array of stimuli, such as a sudden noise or movement, a rapidly approaching object or the unexpected presence of a person. Anyone who has been badly startled will know that this condition involves a raised heartbeat; we flinch and close our eyes. These responses – eye-closing to protect the eyes, flinching to brace the body, raised heartbeat to facilitate escape – are all appropriate for protecting the subject from injury and preparing it for escape.

According to this account, many diverse and novel types of event may cause startle behaviours and each of these events may be separately interpreted as threatening. If we accept this account, then some mediating process must exist whereby any one of an array of startle stimuli may be identified and subsequently addressed by the startle behaviour and I have argued that the existence of such a process marks the mental state as cognitive rather than reflexive. If this is the case, the distinction Lazarus is drawing between a reflex and an emotion is difficult to understand, unless it represents some unstated level of interpretative complexity.

In sum, an array of potentially fear-inducing stimuli are observed to generate a common fearful behaviour, and yet both Zajonc and Lazarus appear to accept that no evaluation can have taken place. But whereas Zajonc argues that startle has the attributes of an emotion arising in the absence of evaluation, Lazarus, in finding an absence of evaluation, treats startle as a reflex.

This is not a discussion about language: Lazarus, in calling the startle response a 'reflex', is ruling out the possibility that startle occurs as a result of evaluation. In so doing, he seems to be arguing against his earlier 'minimal cognitive requirement' for emotion, that a mental process must evoke a fixed response to a diverse array of stimuli, a cognitive requirement which the startle response appears to meet.

In charity, Lazarus has stated a second minimum requirement for emotion which 'startle' fails: his precondition that, for a 'startle' emotion to occur, a subject, in reacting to any one of the 'startle' stimuli, must have some comprehension of their importance for its well-being; and it is this condition which Lazarus believes has not been met. Lazarus takes the view, in common with Nussbaum, that for a mental state to be an emotion, some display of intentionality must first occur in which the subject is able to grasp the significance of an exciting object or state of affairs. I will now consider this view in the light of further evidence that emotional states can arise in the absence of intentionality.

The Detection of Value by Intentional Processes

Lazarus describes the full experience of emotion as consisting of thoughts, action impulses and somatic disturbances. His mention of 'thoughts' suggests that evaluations involve intentionality. Moreover, his descriptions of the causes of emotion require that the subject is able, albeit in a minimal sense, to have some comprehension of the value of the stimulus object. The relation between the object and subject on this account, is intentional.

Nussbaum is more forthright on the subject:

"By now nearly all major investigators in the area grant that emotions can and should be studied by psychologists and that emotions are richly cognitive phenomena, closely connected with the animal's way of perceiving and interpreting the world [ ] a position in which intentionality is taken seriously and regarded as part of what any good theory must include." (2001 p.94).

Nussbaum shares Lazarus's view that emotion-like behaviours which have a nonintentional explanation cannot be emotions. Nussbaum cites the work of LeDoux who has characterised the conditioning of rats to neutral cues. Le Doux has outlined the mechanism by which stimuli such as electric shock can cause a rat rapidly to memorise and anticipate shock-associated stimuli. A neutral cue (such as a tone) when it co-occurs with the shock will subsequently cause the rat to exhibit fear-like behaviours in the absence of shock. If LeDoux's account is correct (see p.160), the acquisition of neutral stimuli able to trigger fear-like behaviours is explicable as a nonintentional process. Nussbaum explains LeDoux's findings in this manner:

"*LeDoux claims only to have uncovered some phenomena involved in fright behaviour, not to have illuminated the subjective experience of the emotion of fear, either in rats or humans. LeDoux writes that he considers fear to be a "subjective state of awareness" involving reaction of the organism to danger, and that what he studies is therefore not that emotion."* (2001 p.115)

I will set aside for the moment the question of how Nussbaum is able to adduce 'the subjective experience of fear' as supporting her view of emotion as the product of appraisal.

In the absence of such support, Nussbaum interprets LeDoux's account as demonstrating that even if rats may be conditioned to anticipate shocks and exhibit fear-like behaviours towards shock-associated (but previously neutral) stimuli, they must also have some awareness of the events in progress and it is this awareness which transforms what may be a spontaneous process of threat detection into an emotion. This view is supported by behavioural observation. Tolman's (1948) account of an earlier experiment by Hudson is illuminating: when a rat had been shocked by a food bowl mounted on a patterned panel, the rat's subsequent behaviour, apart from staying well away from the panel most of the time, included heaping sawdust against the panel, presumably in an attempt to hide it. Although we cannot enter the rat's mind, its motive in heaping the sawdust is strongly suggestive of a conscious aversion to the panel, in addition to a conditioned aversion.

Such observations tend to confirm Nussbaum's view of evaluation as entailing intentionality. But I will provide a second example: a rat, which has never encountered or smelled a cat or a ferret, will reliably detect a cloth impregnated with cat or ferret odour and will avoid it in subsequent experimental sessions, even when the cloth has been cleaned so that the odour is absent (Munoz-Abellan). From this we may conclude that, in a single session, the rat not only avoids the cloth (impregnated with cat odour) but has been conditioned to avoid the cloth in future sessions when the cloth is free of cat odour. Supporting this account, when the cloth was present, the researchers identified hormones in the rat's bloodstream typical of 'fear' states. In a control experiment, these same hormones were measured in the animal's bloodstream for another fear-inducing activity but were not present when the animal was in a non-threatening environment.

From this experiment, we may conclude that a cloth which was not previously feared, when impregnated with cat odour, causes the rat to act fearfully on this and subsequent exposures to the cloth, even when the cat odour has been removed. And because the rats had not previously experienced cat odours or cats, the observed behaviours may only be explained as 1) the product of an inborn detection mechanism in rats causing fear-like behaviours and 2) neural processes which automatically generate a subsequent avoidance behaviour towards the cloth.

Nussbaum's claim that an emotional state entails evaluation does not explain this behaviour. The rat has been rapidly conditioned to act fearfully in the presence of the cloth and this state has been assessed as conforming to a neurobiological state characteristic of fear responses to other threats. But what evaluation could cause the rat to treat that object as a fear stimulus? The rat would ordinarily treat the cloth as a neutral object and has never encountered a cat, and hence can have no beliefs about cats or cat odour. The notion that the cloth induces neurophysiological changes which cause the fear response will not serve for Nussbaum because she has excluded any role for such changes, arguing that only the evaluation of an object as threatening will induce emotion. Nussbaum's rejection of the proposal that the physiological states co-occurring with emotion are indicative of the nature of the emotion expressed, or play some role in the emotional episode, coupled with her claim that: '*emotions are forms of intense attention and engagement in which the world is appraised in its relation to the self.*' (2001 p.106), rules out the possibility for Nussbaum that what the rats are experiencing in response to the cloth is fear.

In LeDoux's example of conditioning by footshock, the rat could be argued to appraise shock-associated objects as frightening, based upon a memory of a previous shock. But in the Munoz-Abellan experiment the odourless cloth is devoid of information which would cause the rat to evaluate it as a threat.

In sum, the presence of either cat or ferret odour will cause a rat which has never encountered these species to act fearfully. Not only this, the stimulus associated with the cat odour will cause the rat to condition to associated neutral objects. Both these changes occur in the absence of information which would permit cognitive evaluation.

Under these circumstances, Nussbaum may resort to the argument she employed in response to Lazarus's conditioning experiments - that because the subject is not aware of the threat an object poses, the mental states associated with the spontaneous fear-like behaviours exhibited are not those of a rat which has comprehended the significance of the stimulus as a threat to its wellbeing and hence, do not meet the conditions necessary for an emotion, but she adds:

"We should certainly not eliminate the intentional account, and we should not at this time include a particular physiological process as a necessary element in a definition of a particular emotion type – although we should not rule out the possibility that such a move will in future be supported by evidence, at least for some simpler emotions such as fear and surprise." (2001 p.114)

Here Nussbaum could be interpreted as conceding that-cognitive evaluative theory may be unable to explain some of the evidence I have offered for the arousal of fear behaviours and associated conditioning processes. This challenge to the concept of emotion as an intentional phenomenon causes Nussbaum to advance the possibility of a limited role for spontaneously induced 'fear-like' behaviours, both as responses to inborn stimulus detection mechanisms and in the conditioning process itself - one in which a neurophysiological process, inducing fear-like behaviours, also acts as a catalyst for new stimulus acquisition. And my account thus far has only included *fear*-like behaviours; Panksepp (1998) has described other neurophysiological processes in which the detection of a valuable stimulus will automatically induce characteristic emotion-like behaviours such as rage, nurture and play, which he calls *basic emotions*. The core functions of these emotions are describable as mediating processes acting independently of stimulus and response and are, in consequence, cognitive according to my earlier description. Despite this, I will argue that such systems function – and may be explained – as nonintentional phenomena (see Chapters 6 to 14)

Summary: Stimulus Detection

Nussbaum, in requiring that emotion necessitates evaluation on the part of the subject, offers the prospect of explaining emotions as the products of thought or experience, but this account does not explain the examples of spontaneous stimulus detection and response I have offered. Her argument against these examples is that although certain emotion-like behaviours appear to arise spontaneously as the effects of neurobiological processes, such processes do not meet her requirements for emotions, unless the animal is able to effect some process of mediation between stimulus and response which entails a degree of comprehension on the part of the subject regarding the significance of the stimulus object for its well-being - some expression of intentionality.

The position at this point is summarized as follows:

1. I have provided evidence and offered arguments in support of a claim that in some cases emotion-like behaviours may be caused by the detection of value in the absence of evaluation and I have described the cognitive-evaluative arguments against this claim.
2. If the evidence I have offered in (1) is correct, then Nussbaum's cognitive-evaluative explanation must constitute a second, separate class of stimulus detection in which the subject has some comprehension of the significance of the entity towards which an emotion is directed.
3. Lazarus, arguing against (2) maintains that the separate class of non-evaluative processes I have described have the characteristics of reflexes and, in consequence, the distinction I am making should lie between reflexes as 'non-cognitive', and emotional evaluations as 'cognitive'.

I will now develop my argument for a separate cognitive class of emotions in an investigation of the final component of the emotional model described on page 29 which proposes that emotional states, upon detecting value in an object, will generate an appropriate response to that value.

2.5 Value Rendering

Introduction

I have described a second stage of the mediating process in which:

> *a 'rendering of value'* [occurs] *in which detection of a valuable object causes a mental state, directed towards the object, which is characteristic of*

an emotion. The emotion has the function of causing the subject to act towards the object in a manner appropriate for the maintenance of its wellbeing.

The processes required to generate appropriate motivations and cognitions from the identification of valuable stimuli are claimed by cognitive-evaluative advocates to constitute a core element of evaluation. These processes are attributed by both Nussbaum and Lazarus to appraisals or judgments regarding the significance of some object or state of affairs as it relates to the wellbeing of the subject. According to Nussbaum's account, notions of appraisal, because they originate in beliefs or judgments with respect to that state of affairs, must entail intentionality.

In previous paragraphs, I have proposed that a separate class of mental processes exists whereby an animal *detects* external entities of relevance for its wellbeing and that such processes may be cognitive, without being intentional. To complete such an account of the processes which mediate stimulus and response, for any given animal, there must exist, not only a set of entities which are of value, together with mechanisms for detecting those entities, but also some nonintentional mechanism which, for each category of value detected, may render that value into some act - mental or behavioural – which is supportive of the animal's wellbeing; because without such mechanisms, value may be detected, but nothing follows from this. The mental state disposing the animal to act therefore, constitutes the second element of the emotional process, whereby the behaviour observed is triggered by the nature of the value detected.

My use of the term 'rendering of value' can be understood in the same way that we speak of rendering a desired element from an ore – that we apply to an ore some process appropriate for extracting that element. To exemplify, whether I am a rat or a human, if I am confronted with a wildfire, my detection of this object as having value does not, of itself, cause me to treat the object as a threat or create the notion of flight away from the fire; the cognitive-evaluative account requires that I comprehend that the wildfire is a threat and that I act in a manner appropriate for avoiding that threat, whereas a non-evaluative account would require only that in detecting the fire, flight behaviour is aroused automatically.

The cognitive- evaluative view is challenged by psychologists and neuroscientists who provide accounts of emotion in which emotional behaviours may arise in the absence of beliefs or judgments on the part of the subject. My intention will be to present some of these claims and I will subsequently consider Lazarus's objection that such stimulus-response mechanisms are reflexes. In addressing this objection, I intend to demonstrate that Lazarus's view of emotion fails to account for more recent scientific discoveries regarding spontaneously arising (non-evaluative) manifestations of emotion, which meet the requirements for emotional processes which I have provided on page 29.

Panksepp's account of basic emotions

Jaak Panksepp, a neuroscientist specialising in affect, has identified a set of brain mechanisms which cause a mammal to respond automatically to particular stimulus types. He describes such processes as 'basic emotions' and to illustrate this approach, I shall briefly outline his account of the neural pathway involved in the generation of rage or rage-like behaviour in cats.

"The core of the RAGE system runs from medial amygdaloid areas downward, largely via the striae terminalis to the medial hypothalamus and from there to specific locations within the periacqueductal gray of the midbrain. The system is organised hierarchically, meaning that aggression evoked from the highest areas of the amygdala is critically dependent upon the lower regions, while aggression from lower sites does not depend critically upon higher areas" (1998 p.196).

What Panksepp is describing here is a neural mechanism by which information regarding some external event or circumstance, when identified by the animal as a stimulus for rage, will automatically trigger a rage-like behaviour. The action of the system described, once such a stimulus has been detected, is automatic; it is as if the animal has a 'rage' button and once that button has been pressed, a state of rage will inevitably occur.

In demonstrating this hypothesis, Panksepp stimulated the neural 'rage' pathway of a cat via an electrode located in the medial hypothalamus. In response, the cat attacked, displaying all the attributes of rage, hair erect, spitting and clawing with its fangs bared. Very rapidly after the electrical stimulation was removed, the aggression ceased. Panksepp cites similar research using humans, generally employing electrical stimulus to specific locations of the amygdala, in which subjects experienced states of intense anger.

According to Panksepp, a state of rage can arise from nothing more than the administration of a current to a brain location. His findings demonstrate that an emotional behaviour, of the sort which cognitive-evaluative proponents take to be the outcome of an evaluation in the form of a response appropriate for the cat's well-being, need be no more than an automatic process once the 'rage' circuit is triggered. This tells us nothing about the neural processes which cause the rage behaviour circuit to activate. Panksepp mentions a number of stimulus types which trigger aggression, *inter alia*, 'inter-male', 'maternal', 'territorial' and 'sexual'. The taxonomy of cues which trigger rage, such as a large approaching male, a threat to offspring, or territorial incursion, are postulated by Panksepp to be detected by inborn neural encoding, in a process by which each of those stimuli is addressed by the single rage behaviour. Such mechanisms - by which a number of stimuli are detected and addressed in a single response - acting separately from stimulus or response, are characteristic of a cognitive process and I have already cited examples of similar inborn stimulus interpretation mechanisms for fear behaviours.

My aim here is to prepare the ground for a claim that a number of different emotions can occur as mechanisms in which both detection and response can occur without the subject holding any beliefs about the objects of emotion, or carrying out any behaviours towards those objects which have arisen as a consequence of evaluations or judgments on the part of the subject. I will describe these mechanisms as *primitive emotions*. The evidence I have presented thus far is sufficient to outline a challenge to the claim that the cognitive-evaluative view of emotion embraces all manifestations of emotion. A good deal more evidence is required to support this claim and I shall present this in Part II.

Lazarus's objection to the class of 'nonintentional' emotions I have proposed – that such phenomena are reflexes - remains.

Lazarus's view: the distinction between evaluations and reflexes

Lazarus, like Panksepp, believes that emotions are the outcome of adaptation. He argues that evolutionary processes have generated three different types of survival-promoting activities: reflexes, physiological drives and emotions. Lazarus's notion of physiological drives extends to desires such as thirst and hunger, which I shall discuss in Part II (Chapter 8); what I wish to investigate here is the distinction which Lazarus makes between reflexes and emotions.

Smith and Lazarus (S&L) propose that reflexes arise to cope with circumstances in which *"a need is reliably signalled by a very specific cue or set of cues and can be met by performing a specific behaviour."* (1991 p.612). Such stimulus-response mechanisms are inherited, allowing organisms to interact successfully with their environments in a stereotypical manner. For S&L, the adaptational disadvantage of such mechanisms is that if survival depends upon a successful response to valuable cues, then in the presence of a multiplicity of cues with value for the organism, survival chances can only be improved via a phylogenetic process in which each new stimulus is matched by a dedicated response. However, an evolutionary process by which an organism becomes capable of reacting to even a modest range of stimuli with a reflexive response, is, according to S&L, 'disadvantageous' with the result that:

"with increasing complexity there is an increasing selective pressure to surmount the behavioural rigidity inherent in reflexes and to decouple specific stimuli from specific responses." (1991 p.612)

I will accept S&L's argument from complexity here, although they have not sufficiently demonstrated it. They simply assert that reflexes, in pairing a specific stimulus to a single dedicated response 'have a high cost'. They do not state what that cost is or how it increases with complexity in such a way that it exceeds the adaptational 'cost' of decoupling stimulus from response.

The argument S&L are preparing is one in which emotion-like behaviours which arise spontaneously in response to exciting stimuli are reflexes. According to this view, reflexes because they directly connect a stimulus to a response, are non-cognitive, whereas emotions: *"developed in ways that differentiate them from reflexes in flexibility, variability, richness, and dependence upon intelligence."* (1991 p.614). Such mental phenomena are cognitive because the processes which mediate between stimulus and response are separately explicable as evaluations, and evaluations – in requiring some awareness by the subject of the significance of the emotional object for the its wellbeing - can be understood to exhibit intentionality.

More particularly, S&L believe that emotions are mental states which expand both the flexibility of response of an animal to a stimulus *and* the ability of an animal to detect stimuli of value, moving away from stimulus specificity towards a much wider characterisation of stimuli as, say, threatening or frustrating so that: *"in place of the unwieldy adaptational solution of developing a different reflex in response to every signal of every significant event in all contexts, more complicated species have to stake all their security on their capacity to evaluate the significance of what is happening."* (1991 p.614)

Such an account of emotion excludes the type of emotions which are enacted spontaneously as responses to stimuli of value – cases in which, say, the detection of a wildfire will automatically cause flight. For S&L, the subject will evaluate the wildfire as a threat, in response to which the animal will take some action appropriate to avoiding the wildfire. For this reason, S&L argue that the action taken is the result of some thought (or more primitive judgment) directed towards the object of emotion by which the value of the stimulus is apprehended in such a way that the subject is able to behave towards the stimulus in a manner appropriate for the promotion or preservation of its wellbeing.

Lazarus explains his view of meaning in emotion in his 1982 paper *Thoughts on the Relations between Emotion and Cognition.* His view is summarised in his response to Zajonc's claim that emotions can arise free of evaluation:

"it is entirely possible that the very first stage of the organism's reaction to stimuli and the very first elements in retrieval are affective. It is further possible that we can like something or be afraid of it before we know precisely what it is and perhaps even without ***knowing*** *what it is."* (1982 p.1020).

Lazarus argues that Zajonc has failed to understand his view of the cognitive process by mistakenly assuming that Lazarus's concept of mind is analogous to that of a computer in which cognitions, involving meanings, are created by information processing from short or long-term memories containing information which has previously been received, registered and encoded in preparation for processing. He concludes that if Zajonc believes an organism generates meaning in such a tortuous fashion, it is understandable that he has doubts as to its ability to evaluate a stimulus with the rapidity which characterises many emotional responses.

He provides this counter-argument:

"Zajonc is therefore correct in asserting that meanings are immediately inherent in emotionally-laden transactions but for the wrong reasons. In my view the concept of meaning defined by the traditional information processing approach subscribed to by Zajonc has a perfectly reasonable – and better – alternative. We do not always have to await revelation from information processing to unravel the environmental code. [ ] in perception, personal factors such as beliefs, expectations, and motives or commitments influence attention and appraisal at the very outset of any encounter." (1982 p1020).

To test Lazarus's argument, Murphy & Zajonc carried out experiments in which subjects were shown meaningless ideographs, paired with flashed images of friendly or angry faces known as 'affective primes', occurring too rapidly for the subject to have any awareness of them[5], (1993,1995). When subsequently exposed to these ideographs, the subjects reported liking or disliking the ideographs in a pattern which correlated with the nature of the associated affective primes (for further details see Chapter 16).

[5] Each affective prime was exposed for four milliseconds

Lazarus's explanation of such phenomena is that because the information acted upon is incomplete or degraded, the meaning derived from such information will be imprecise and that such imprecision characterises the meaning we take from many ordinary transactions. For this reason, he argues that his theory should allow for such imprecise renderings of meaning alongside more clearly articulated and thoroughly processed meaning.

Murphy & Zajonc's experimental evidence appears to contradict this view; a Chinese ideograph, verified as having no affective content, when associated with a subliminally detected angry face image, is reliably reported as disliked rather than liked. The subjects seemed to be rather efficient at associating subliminally detected affective images with meaningless ideographs. The problem is therefore not one of vagueness of attribution, rather it lies in explaining how an individual would display aversion as the result of an evaluation of meaningless ideographs – how it came about that these ideographs were judged to be of significance for the subject's wellbeing. If the aversive ideographs had been paired optimally[6] with an affective image, such images could be said to predict the affective image. However, in Murphy & Zajonc's experiment, the subjects were unaware that they had been exposed to the affective image. This creates a difficulty for Lazarus's account, because if the subjects' cognitive evaluations had been made in response to the ideographs alone, they would be uniformly appraised as neutral i.e. non-affective.

LeDoux would attribute the observed behaviours to a process of fear conditioning in which the affective prime – say, the angry face – acts as an unconditioned stimulus for humans and its brevity of exposure, whilst excluding cognitive appraisal, has the ability directly to access the subcortical pathways which evoke fear-like behaviours. When the subject is in a state of fear, associated neutral images are acquired and stored in such a way that these images will act as a proxy for the unconditioned stimulus upon future exposure.

LeDoux's account (1992) can be understood in this way: that previously neutral stimuli, offering no particular threat to the organism, when they are associated with

[6] For a period sufficient for conscious evaluation.

some unconditioned fear-inducing stimulus are ‘welded’ directly to the primitive emotional circuits associated with the arousal of fear, so that in subsequent encounters the organism reacts to the conditioned stimulus in the same manner as it would to the unconditioned stimulus.

Fear conditioning offers a cognitive – but non-evaluative - explanation to the evolutionary problem of matching a beneficial response to multiple disparate stimuli. Conditioned fear-associated stimuli are acquired throughout the lifetime of any animal in response to threats which may be particular to the environment of that animal. However, such conditioned stimuli act, not through any comprehension of meaning or value, but rather by directly triggering a fearful behaviour. This has the effect of allowing the animal to expand the range of stimuli to which it can respond, but in doing so, it need not employ even the rudimentary processes of ‘beliefs, expectations or motives’ described by Lazarus. Conditioning is more accurately described as a system in which a stimulus triggers a response in the absence of evaluation.

On the basis of the evidence and arguments I have presented, I advance the following proposals:

1. that a class of emotion exists whereby emotional behaviours may be directly aroused by unconditioned stimuli *and* by conditioned (affect-neutral) stimuli.
2. that these processes are cognitive because a single behavioural response is mediated from diverse stimuli by processes acting independently of stimulus or response.
3. that such mechanisms act in the absence of evaluation.

Lazarus, expresses the view that a clear distinction is to be made between evaluations - being cognitive/emotional - and reflexes - being non-cognitive/non-emotional. My counter-claim has been that indeed there are physical processes which, as Lazarus asserts, are reflexive and non-cognitive but, in forcing the distinction between the emotional and the reflexive, he overlooks the existence of a separate but important class of emotions - neurological mechanisms mediating between stimulus and emotion-like behaviours which, while functioning nonintentionally, are nonetheless cognitive.

My proposals, if accepted, require a more comprehensive account of the manner by which this separate class of emotions are to be reliably distinguished from reflexes. I will consider this question more fully in Part II of this thesis.

2.6. Summary: Two cognitive accounts of emotion

I have accepted the cognitive-evaluative proposal that emotion may occur as the outcome of evaluation but, in order to test the limits of the evaluative theory, I have cited a number of experiments, employing humans and other animals, in which rapidly-arising emotion-like behaviours occur under experimental conditions which are constructed in such a manner that the results obtained cannot straightforwardly be explained as the products of evaluation.

In pursuing this course, I hope to have provided sufficient evidence to provide the outline of a second proposal: that there exists a class of emotions which arise either from the activation of inborn responses to unconditioned stimuli or from the effects of conditioning - both processes being explicable as the spontaneous action of neurophysiological mechanisms, rather than as the outcome of evaluation.

I have not discussed Nussbaum's response to Zajonc because she defends her cognitive-evaluative view of emotion against Zajonc by citing Lazarus's arguments (2001 pp. 106-126). She draws from Lazarus the view that the goals which motivate an animal:

"may be the objects of conscious reflection, or they may be deeply internalized without being conscious" and that emotions *"need not be 'rational' in the sense of being, in every case, explicit or verbal. But in another, normative sense they are profoundly normal: for they are ways of taking in important views of the world."* (2001 p.109).

Nussbaum, like Lazarus, is arguing that appraisal is a necessary element of emotion and, like Lazarus, she does not require that such emotions are rationally constructed or derive from beliefs which are consciously-held. Nonetheless, in claiming that emotions are intentional phenomena, she is arguing for a relationship between the subject and the significant object, in which the subject plays an active role – as Lazarus proposes:

"cognitive appraisal means that the way one interprets one's plight at any given moment is crucial to the emotional response" (1982 p.1019).

My claim that certain emotions arise as the outcome of spontaneously arising neurophysiological mechanisms challenges Nussbaum's assertion that evaluation is *necessary* for emotion. However, I do not intend to challenge the cognitive-evaluative view that appraisal constitutes a necessary element of emotion in cases when intentionality can be demonstrated, because in these cases, the class of nonintentionally arising emotion of the sort I have proposed is often unable to account for either the thought processes or behaviours of the experiencing subjects.

My introduction of a second 'primitive' class of cognitive emotions allows me to modify my earlier framework account of a cognitive emotion in order to characterize each process more fully.

For primitive emotional systems, my original model may be modified to describe the action of a neurobiological process:

1) At the core of any emotion is one of a class of mental processes by which the relationship between the subject and the external world is mediated.

2) An emotion is caused by a mediating process acting in two stages:

> *2i) first, detection, in which the environment is scanned for objects of value for the subject;*

2ii) second, a 'rendering of value' in which the detection of a valuable object arouses a mental state, which is characteristic of an emotion, having the function of disposing the subject to act towards the object in a manner appropriate for the maintenance of its wellbeing.

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The cognitive-evaluative account may now be described more extensively as an intentional phenomenon:

1) *At the core of any emotion is a mental event by which the relationship between the subject and the external world is mediated.*
2) *The mental event is an evaluation requiring intentionality, in which some process, employing explicit or implicit beliefs, event or circumstance reveals it as having significance for the wellbeing of the subject.*
3) *The type of emotion aroused may be characterised as a particular configuration of thoughts directed towards the external object of emotion which will cause the subject to act - or be disposed to act - in a manner which is appropriate to the achievement of some goal, implicitly or explicitly held by the subject, or to exploit some value which promotes the survival of the subject or its species.*

This second description provides a view of emotion which would be recognised by cognitive-evaluative philosophers. As a philosophical theory, it casts its net wide: its subjects may be humans or other animals and in consequence, it takes both the appraisals which may be formed by and expressed as language, together with the evaluations and judgments of non-linguistic species, to be sources of emotion. These processes may deploy explicit or implicit beliefs directly or represent the products of deliberation which employ such beliefs. The beliefs themselves may be intentionally acquired, socially-inculcated, or the accidental products of experience.

But even if we accept that any or all of these elements may be constituents of the evaluative account, an anterior question remains unanswered: how does it come about that the evaluations which reveal external entities as being of significance to *ourselves* have the mental and physiological characteristics of emotions?

I will illustrate my problem by means of an earlier example: I have previously described the thoughts which caused me to experience anger when I was wrongly accused of speeding. Imagine now that I hear this account from some other person; he could extensively detail the same events and the same outcome but having shared those thoughts and concurred with his evaluation, I would be unlikely to experience the same anger. At most, my thoughts might contain sympathy for the narrator and his minor misfortune, or, more likely, I might experience nothing more than a mild interest. This would be true even if I shared the narrator's beliefs and his ideas of fairness.

The view that we can regard the emotion-arousing evaluations of others with relative equanimity is one that is generally shared. The extent to which we are able to take a dispassionate stance seems to bear some relationship to acquaintance: we might not take the same view of the misfortunes of our friends and family. But this is explained by evaluative theory; because if a friend or family member is concerned, then that person's misfortune – or fortune – is often a matter of direct importance for me and hence a cause of emotion.

To summarize: the cognitive-evaluative assertion that I experience emotions only on those occasions when externalities arise which I appraise to have significance for myself, or when my reflections cause me to infer that circumstances have arisen which are of importance for myself, seems to be verified empirically by the relative absence of emotional feelings[7] when I hear the accounts of the emotional evaluations of others. But the empirical evidence for this phenomenon is not explained by cognitive-evaluative theory as I have described it thus far. Cognitive-evaluative theory takes as its premise the occurrence of an emotion as being conditional upon an appraisal of some state of affairs as carrying implications for the wellbeing of the subject. But how does it come about that a particular emotion is associated with some concatenation, say, of my caring about x, or thinking that x is good/bad for me, or whether I can cope with x?

[7] I accept that humans can experience empathy towards those in the extremes of suffering, but for most other animals, expressions of empathy are difficult to verify.

Assume now that A and B, have identical cognitive abilities and life experiences, so that a state of affairs x, when explained to A, would have the same goal-associated significance for B, causing an evaluation in which each would respond to x with a thought y. In this case if A and B share similar goals and make – towards significant entities - the same appraisals, then evaluative theory is satisfied. Nothing more is explained by introducing the notion that when A, as a participant, evaluates event x as significant for his wellbeing, he experiences an 'emotion' which would not be experienced by B evaluating x as hypothetical. Indeed, to a being who had never experienced an emotion, the idea would seem incomprehensible.

I will provide an example. In the absence of emotional feelings in humans, assume I were to ask A & B to imagine their wives had died and to predict their subsequent responses. They would, as the products of a process of appraisal, prioritize certain necessary actions, such as informing relatives and the authorities, arranging the burial and considering future living arrangements. Assume now that I inform A that his wife has actually died: then my investigation of cognitive-evaluative theory at this point predicts that A will simply carry through the actions he has imagined, whereas B will not. Nothing in this appraisal would predict how A would feel and act upon such feelings if his wife had died, which, if such a state of affairs were to occur, would constitute for most of us, the critical manifestation of the event as experienced, and - revealingly - as others would expect it to be experienced.

My description of the cognitive-evaluative account thus far accepts that its proponents offer a great deal of evidence to demonstrate that the mental states associated with appraisals of significance for the self, have effects – often far-reaching effects – which are not explained by the appraisal itself but I have offered no explanation as to why this should be so. In Chapter 3, I will present the cognitive-evaluative explanations for the turbulence of the mental states associated with emotion and I will offer a number of objections to these accounts.

Chapter 3: Reviewing Cognitive-Evaluative Explanations for the Turbulence of Emotional States

3.1 Introduction

My exploration of the cognitive-evaluative theory of emotion thus far has led me to conclude that although an emotion may be caused by my appraisal of a state of affairs as having significance for my goals, the association of such appraisals with states of mind and body, generally described as 'feelings', has not been explained.

Nussbaum recognises that appraisal alone is insufficient to account for these aspects of emotion:

"We see several features of the emotions that it will be the business of my argument to try to explain: their urgency and heat; their tendency to take over the personality and move it to action with overwhelming force; their connection with important attachments, in terms of which a person defines her life" (2001 p.22)

Nussbaum's subsequent account of the qualitative aspects of emotional appraisals and their effects upon our mental landscape - which she describes as 'upheavals of thought' - are extensive. By carefully detailing these effects from her own experience, and from observation of the emotional behaviours of other species, she demonstrates that the thoughts associated with emotion have a character and salience which can distort or overset the routine thoughts and actions which we employ in going about our day-to-day business.

It will not be my purpose to dispute this. What I am interested in is *how it comes about* that emotional appraisals differ from 'routine' appraisals.

3.2. Does eudaimonia explain the particular urgency of emotional thoughts?

Nussbaum believes she can provide the kind of explanation I am seeking and that it lies in the special nature of emotional thoughts: that they have 'heat' and 'urgency' as they pertain to the interests of the self. More particularly, she argues that these qualities attach to emotional thoughts because they concern the subject's conception of *eudaimonia.* I think there is no exact translation for this word, which for each individual encompasses "*all to which the agent ascribes intrinsic value."* (2001 p.190); so what is valued, is not valued simply because it bears some instrumental relation to the subject's wellbeing, it may also apply to personal relationships or, say, aspects of society, such as fairness or community spirit, which are valued for their own sake. For this reason, these things have value only as they constitute elements of my mental life, rather than someone else's.

The notion of *eudaimonia* expresses an aspect of our mental life which is not immediately evident in cognitive evaluations of objects, events or circumstances as having significance for the subject: it is that the things which we value, taken collectively, represent a model of what (to use Nussbaum's term) our *flourishing* would consist of, so that any threat to these values must be interpreted as a loss - a withering of our prospects. Nussbaum also asserts that our values form a framework - a self-woven fabric - such that any evaluation which challenges or undermines a component of this framework, is potentially disruptive of the whole; and anything which extends or confirms these values will strengthen *eudaimonia* as a whole, and is to be prized.

Nussbaum explains the effects of emotion upon our conception of *eudaimonia* in this way:

"This, it seems, is what emotions are like, and this is why, in negative cases, they are felt as tearing the self apart; because they have to do with damage to me and to my own, to my plans and goals, to what is most urgent in my conception of what it is for me to live well." (2004 p.190)

For Nussbaum what is at stake, separately from the instrumental effects of a threat, is my idea of *the way things ought to be for me,* and the more potent the emotional circumstance, the greater the potential effects upon the framework of my beliefs.

I will illustrate this effect by providing different responses to the loss of £5: I lose £5 accidentally; I would feel a mild frustration at the small loss of cash. In treating the loss of cash in this way, I am taking an instrumental view of my loss. Suppose now that I buy something for £1 in a shop and pay with a £10 note. The woman at the till gives me £4 in change. When I point this out, the woman refuses to give me the correct change.

Since both examples involve me losing £5, it would seem reasonable that I treat both losses in the same manner. However, my level of emotion at the till woman's refusal to return my money would be of a different order altogether. It finds its source in my belief that the till woman is cheating me. My evaluations differ; but what is it that makes the thought 'this is an attempt to cheat me' *qualitatively* different from 'this is annoying'? The answer is intuitively obvious: in the second case, I am very angry because I believe I have been cheated. But this is begging the question.

Nussbaum's explanation would be that the evaluation caused by my belief that I am being deliberately cheated is the effect of a much broader assault upon my values than the instrumental effect of a loss of £5; it represents a challenge to my notion of how the world ought to function. It is this more general assault which, for Nussbaum, undermines the construct which constitutes my notion of *eudaimonia*, introducing an urgency into my thoughts. My sense of grievance following that event would be of some duration and would draw me into other considerations of value which pertain to the arousing event. I might think "This woman stole money from me whilst I was in her presence."; "I'll never use cash again."; "I'll never go to that store again."; "I will warn my friends about that store." These thoughts would echo on and finally subside. But it is undoubtedly true that if such thoughts had occurred, I would have willingly given more than £5 to be free of them, because they represent a much broader assault upon my peace of mind than that of the actual loss incurred.

Nussbaum argues that the phenomenological states we experience during an emotional event are attributable to the effects of the appraisal itself. Emotions arise when external circumstances are appraised to have significance for oneself (or that part of the self which constitutes our beliefs and values) and it is the process in which this structure of beliefs and values are reappraised – the mental upheavals involved in such processes and the urgency with which we enter into the emotional evaluative process – which explain the feelings which accompany emotion, rather than any associated physiological changes.

I offer two broad objections to Nussbaum's view:

- The eudaimonistic concept of emotions as the outcome of thoughts arising from the evaluations of entities with importance for the self, entails a requirement for a concept of a self as affected by these thoughts – a self, represented as a network of values. I will argue that the appeal to a self in which our values and goals constitute an interconnected whole seems to bear little relationship to a reality in which individual values and goals are formed haphazardly and locally, often having no discernible relationship to one another.

- But even if -for any individual - *eudaimonia* exists, my original question remains unanswered, why should the thoughts that refer to ourselves have the experiential character of emotions? Simply to raise the stakes so that the object of significance is an 'entire network' of values explains why emotional thoughts may have priority but does not explain why emotions have a *sense* of urgency.

I will expand each objection separately: central to the identity of cognitive-evaluative emotions is their basis in belief-like cognitions and their relationship with evaluation. To use my earlier example: the transaction between myself and the woman at the till is driven by the implicit beliefs that she will deduct the price of an item from the amount I give her and return to me the correct change. The day-to-day ability to enact monetary transactions efficiently is valuable to me. And it connects to many other beliefs: *inter alia,* that there exist written codes with which commercial enterprises must comply regarding such matters and that such transactions constitute an expression of fellow-feeling between members of a community. If the woman at the till refuses to return the correct change, all these beliefs are potentially challenged. To this extent, what Nussbaum is saying is correct, but this does not demonstrate that all the values I hold have been, to some extent, impaired; it has nothing to do, say, with my value for liberal as preferable to populist politics. Nor need it be the case that even the rather narrow set of beliefs I have regarding the sanctity of unwritten contracts all occur to me during or after my encounter with the till woman.

However, if, as per my second objection, I nonetheless assume that our values are connected in a manner such that a challenge to one constitutes a challenge to all, I can think of no cognitive-evaluative explanation for a claim that emotional appraisals, even if they were to have such wide-ranging effects upon this network of values, need in consequence be imbued with any particular *quality* of 'urgency'. To prioritize a thought is simply to assign to that thought a preference above others. In this sense the thought may be described as urgent. But to give a thought preference is not to assign a particular quality to that thought; it is simply to ascribe to it a position in our sequence of thoughts. This is best understood by example: imagine you are walking in the countryside and find yourself in a field with an angry bull. An appraisal of these circumstances as they concern your wellbeing would cause you to interrupt your plans for the walk and leave the field as rapidly as possible. Your wellbeing would not be better served by Nussbaum's idea of urgency as giving preference, since preference has been awarded as a consequence of the appraisal process itself. The urgency which attaches to this cognitive process – if we agree that the encounter would arouse a *sense* of urgency - is no more (in fact less) a part of our appraisal than the bodily feelings we undergo and behavioural responses we enact when we see the bull.

In summary, I accept Nussbaum's proposal that certain events in our lives have widespread implications for our values and goals, compelling us to access and reappraise those values and goals, a process in which each appraisal arouses some new emotion, but this, of itself, provides no evidence that some particular quality attaches to appraisals made under these circumstances. Nothing has been offered to persuade us that the appraisal processes associated with emotion have an experiential quality which separates them from other sorts of appraisal.

Nussbaum's assertion that there exists some overarching system of values, acting in the manner of, say, a spider's web so that any disturbance at one location may set up a vibration which is detectable in the whole, and to which the whole (in response to the threat of 'tearing the self apart') reacts by imbuing that response with an urgency, which provides emotional appraisals with their characteristic quality (or qualities), is not verified by the arguments she offers.

3.3 Lazarus and 'hot cognitions'

The idea that emotions have 'heat' carries an intuitive appeal; Nussbaum and Lazarus both employ the term and Lazarus took the notion from Abelson (1963). In a 1993 paper Smith & Lazarus clarify what is entailed in the concept of 'hot cognition':

"We propose that for emotion to occur, the "facts," as construed by the individual, must be further appraised for their implications for personal well-being. Relevant issues include, Do I care about what is happening? Is it good or bad for me? Can I do anything about it? Can I accept it? Will it get better or worse? We suggest that this latter type of evaluation provides the emotional "heat" in an encounter [ ], and we refer to it as appraisal to distinguish it from colder cognitions that play a more indirect role in emotion generation. Thus, of the many attributions, inferences, and evaluations that one might make during an encounter, appraisal represents a constrained subset that, we propose, bears a special relationship to emotion." (1993 p.917)

Lazarus is concerned to demonstrate that appraisals conforming to cognitive-evaluative theory have a special character – that they *are* 'hot' cognitions – but he has not explained how this comes about. Rather, Lazarus cites his psychological research to support his assertion that, although emotions result from causal attributions (inferences concerning the perceived causes of an event), it is only those attributions concerned with 'adaptational significance' - being connected with deeper biological effects associated with our survival - which can be described as 'hot cognitions'. Other considerations of external events, when they result in causal attributions without adaptational significance, play out unemotionally.

Thus far, Lazarus's description of emotions as 'hot' seems to carry no clear implications for the subjective experience of emotion, but when Lazarus describes the emotional experience as normally including three fused components: "*thoughts, action impulses and somatic disturbances"* (1982 p.1019) he seems to be preparing the ground for the explanation of a phenomenology of emotion; because, if, in response to some stimulus, we undergo bodily changes and impulses to act towards that stimulus, independently of any appraisal we might make, it would be interesting to understand how such physiological changes and action impulses might affect the appraisal process. However, I cannot find that Lazarus, whilst frequently mentioning that somatic disturbances and action impulses co-occur with appraisals, ever clearly states how such phenomena, whilst being fused with emotionally-generating appraisals, act in any role. His approach to feeling can be summarised thus:

"emotion or feeling is never totally independent of cognition, even when the emotional response is instantaneous and nonreflective [ ]*This is the real import of the expression "hot cognition". The thoughts and feelings are simultaneous.* (1984 p.1021)

Lazarus's mention of 'emotion *or* feeling' here is noteworthy. For both Nussbaum and Lazarus, emotion, being fused with bodily feelings, *is* a cognition. Lazarus is asserting that emotional feelings cannot exist separately from emotional cognitions, but he also claims that feelings imbue emotional cognitions with 'heat'. However, he does not make this claim as a first step to providing some distinct role for feeling in his cognitive-evaluative account of emotion but rather to bind feeling into that account.

What emerges from both these accounts is that cognitive-evaluative advocates, in their concept of emotion as the outcome of appraisals or evaluations, claim that such appraisals, whilst being associated with physiological changes and action impulses, are not importantly affected by them. The emphasis of cognitive-evaluative philosophers upon the role of appraisals, and their relegation of associated physiological changes to the status of associated phenomena is challenged by alternative views in which emotion finds its origins in feelings. The best known of these is the James-Lange theory and I will briefly describe this, together with Nussbaum's response.

3.4 Objections to the Cognitive-Evaluative Account of the Role of Bodily Feelings

3.4.1 Introduction

James and Lange advanced the notion that the bodily changes which arise when we perceive some emotion-inducing stimulus act as a trigger for our subsequent cognitive states of emotion. So, if I find that my heart is beating rapidly, I am trembling and my face is flushed, I judge that I am angry, or if I am crying and cowering, I am afraid. Hence, the cognitive processes which occur in emotions arise as a consequence of the initial perception that I feel, say, afraid or angry.

Nussbaum's argument against emotion as the perception of bodily feeling is that the physiological sensations which we experience in the course of an emotion are not characteristic of that emotion. In support of her argument, Nussbaum challenges the theories of James and Lange, employing evidence provided by Cannon (1929) and a widely-cited work by Schachter and Singer (1962)[8], which I shall now investigate.

3..4.2 Schachter and Singer

Introduction: Nussbaum cites Schachter and Singer's work as supporting her claim that it is the evaluations which subjects make of their circumstances, rather than the physiological alterations associated with an emotion, which comprise the necessary condition for the arousal of an emotional state, enabling the subject to discriminate one emotion from another. She maintains that that Schachter and Singer's experiment demonstrates that:

"Given **one and the same induced physical condition** [my italics], *subjects will identify their emotion as anger if placed in a situation where they are given reasons to be angry [ ]; they will identify their emotion as happiness if put in a situation where they are given reasons to think the world is great [ ], and so on."* (2001 p.98).

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[8] Commenting on experimental programmes in the 1970's to demonstrate that subjects' reports of feeling emotions correlate with their introspection as regards the emotion they were encountering, Nussbaum states "*This program was inspired not only by the general atmosphere but also by the still pervasive inference of the James-Lange theory of emotions which had led researchers to expect a correlation between an emotion and a discernible state."* (2001 p.96)

Clearly, if two quite different emotions are attributed by the experiencing subjects to the same co-occurring physiological state, then this is a strong argument for abandoning the notion of bodily feelings as indicative of – and hence, as playing an active role in - an emotional state.

I will argue that a closer examination of Schachter and Singer's experiment reveals a number of problems of methodology, some of which were raised by the experimenters themselves. I hope that the extent of the problems I raise will demonstrate that they are not mere hair-splitting; they create a complexity that makes a definitive interpretation impossible and provide no basis for the argument that bodily feelings *do not* comprise an active constituent of the emotional state.

Experimental Procedure and Results*:* In 1962 Schachter and Singer carried out an experiment to ascertain whether the nature of the emotion reported by the experiencing individual could be determined by the 'cognitive' aspects of the emotional state rather than its physiological characteristics. In order to make this determination, an experiment was devised whereby one group of subjects were injected with epinephrine[9] and another was injected with a placebo. The epinephrine-injected group was further subdivided: one group was advised of the physiological effects of epinephrine (Informed) which include hand tremor, raised heartbeat and flushing of the face. A second group was misinformed (Misinformed), that is, given a false account of the effects. A third group was told nothing about the potential side-effects; this group included all Placebo subjects (Ignorant).

Subjects who were injected with epinephrine prior to the emotion-inducing experience were monitored for the occurrence of characteristic symptoms as compared to those injected with a placebo. If these symptoms were not observed, the subjects were excluded from the experiment.

All subjects were advised that the experiment was intended to test the effects of the injection upon vision. When awaiting the vision test, a part of each group (Informed,

[9] Epinephrine is more generally known as *adrenalin*

Misinformed, Ignorant and Placebo) was subjected to one of two experiences (designed to appear accidental) which were described as either *euphoric* or *anger* inducing.

The results of the 'euphoric' group are described below:

- The subjects who were informed of the effects of epinephrine upon their bodily states were less likely to attribute their feelings to euphoria than those who had been given no information (Ignorant) or those who had been misinformed. Schachter and Singer in interpreting the similar reactions of Misinformed and Ignorant subjects observe that:
  "*Comparisons between Misinformed and Informed conditions makes it immediately clear that the experimental differences are not due to artifacts resulting from the informed instructions." (*1962 p.389)
- Subjects who were given a placebo were likely to report marginally less euphoria than those who had been injected and Misinformed or Ignorant but reported significantly more euphoria than those who had been Informed.
- The subjects' behaviours were also observed during the 'euphoric experiences'. In these sessions a 'stooge' accidentally wandered into the room and began to fool about (in a controlled routine). The extent to which the subject participated was observed. Again, it was found that the 'Placebo' subjects were marginally less likely than the Misinformed and Ignorant to join in the stooge's activity, whereas the Informed group were significantly less likely than all other groups to participate.

In the second set of experiments, which tested anger, Schacter and Singer point out a potential flaw in the design of the experiment. Subjects had volunteered for the experiment in order to gain points for their final examinations; the 'stooge' in the anger experiment aroused irritation in the subjects by selecting aspects of the questionnaire design which were intrusive or pointless, and subjects, when subsequently reporting their motivations, said that they were (according to Schacter and Singer) unwilling to risk their final results by revealing their dissatisfaction as regards the questionnaire design, making their reporting of the experiment potentially unreliable.

Before the experiment, one group of epinephrine-injected subjects were advised of the possible effects (Informed) and one group, including Placebo, was not (Ignorant). No Misinformed subjects were used in this experiment.

- Despite the experimental difficulties, Informed subjects reported less irritation than Ignorant subjects with Placebo subjects showing more irritation than Informed and less than Ignorant.
- Behavioural observations of irritation (based upon the tendency of the subject to agree, disagree or ignore the stooge's remarks about the questionnaire) showed that Placebo subjects and Informed subjects displayed markedly less irritation than Ignorant subjects.

***Schachter and Singer's Interpretation of the Results**:* The results indicate that informing the subject of the effects of epinephrine had an effect upon his/her judgment that the bodily feelings experienced were the result of emotion and caused subjects not only to report their feelings differently but to *behave* differently during the experiment.

However, Schachter and Singer, in analysing the outcomes state that:

"for a perfect test for these hypotheses, it should be anticipated that in the euphoria conditions the degree of experimentally produced euphoria should vary in the following fashion: Misinformed ≥ Ignorant > Informed = Placebo. And that in the anger conditions anger should conform to the following pattern: Ignorant > Informed = Placebo." (1962 p.393)

However, in neither case did this prove to be true

"The results for the Placebo subjects fall between the Ignorant and Informed subjects. This is a particularly troubling pattern for it makes it impossible to evaluate unequivocally the effects of the state of the physiological arousal and indeed raises serious questions about our entire theoretical structure." (1962 p.393)

In order to investigate the troubling nature of the results, Schachter and Singer re-analysed post-experimental interviews of the 'Ignorant' and 'Misinformed' subjects

(N.B. *not* the Placebo subjects) and arrived at the view that a proportion (13% Anger/Ignorant; 32% Euphoria/Ignorant; 20% Euphoria/Misinformed) had drawn for themselves the conclusion that the injection was causing their feelings and hence were dubbed 'self-informed'. By eliminating these subjects, the experimenters were able to create a greater distinction between Ignorant/Misinformed and Placebo subjects (.03 significance).

The researchers then move to discuss the unexpected difference between Informed and Placebo subjects. Importantly they note

"This expectation should hold if there is no sympathetic activation in the Placebo conditions. This assumption is completely unrealistic for the injection of a placebo does not prevent sympathetic activation. The experimental situations were fairly dramatic and certainly some of the placebo subjects gave indications of physiological arousal." (1962 p.394).

Subsequent measurement of pulse levels demonstrate indeed that subjects were physiologically aroused but provide no further indication as to the nature of the physiological arousal in Placebo subjects.

Having made these adjustments and qualifying statements Schachter and Singer observe:

"It has been suggested that given constant cognitive circumstances an individual will react emotionally only to the extent that he experiences a state of physiological arousal. Without taking account of experimental artifacts, the evidence in support of this proposition is consistent but tentative. When the effects of 'self-informing' tendencies in epinephrine subjects and 'self-arousing' tendencies in placebo subjects are partialled out, the evidence strongly supports the proposition." (1962 p.396).

Discussion of Results

- *Experimental Method:* Panksepp, in his brief description of the Schacter and Singer experiments comments: *"The most famous series of studies, which have proved quite difficult to replicate, were conducted by Schacter & Singer"*

(Panksepp p346), an observation confirmed by Nussbaum herself. This is not unexpected. The results must have been heavily dependent upon the degree to which the performance of the two 'stooges' was convincing and how forceful or charismatic each performance was. Schacter and Singer also reported differences in subject behaviour between each session as the stooge worked through a set routine which was designed to produce interaction with the subject. As the level of interaction evidently varied, the exchanges between the stooge and the subject must have been modified to accommodate more or less interaction. This does not necessarily invalidate the research but makes it difficult to repeat.

- *The use of Epinephrine*: Epinephrine is a neurotransmitter found in the body and brain during 'fight or flight' (rage and fear) episodes, which, as a minimum, causes some of the physical conditions which are found during *bona fide* episodes of fear and anger. Schacter and Singer note "*Latane and Schachter (1962) demonstrated that rats injected with epinephrine were notably more capable of avoidance learning than were rats injected with a placebo.*" This finding both anticipates the work of LeDoux and supports the action of epinephrine as the outcome of mental and physiological mechanisms causing fear. As both Panksepp and Cannon note, rage and fear are closely associated states and so it is unsurprising that epinephrine occurs in both. Hence by injecting the subjects with epinephrine, the experimenters may be generating complex neurochemical *and* physiological states associated with anger. Consequently, when subjects were induced by the stooge into irritation or anger, the physiological changes induced by epinephrine may have corresponded to *bone fide* feelings of anger, or at least some part of them.
- *Potential complexities of induced physiological states:* Schachter and Singer, in attempting to establish the lack of coherence between reported emotions and bodily states make a critical and, I will argue, unjustified assumption in the design of their experiment: they assume that the physiological state which the subject experiences in response to each emotional event is caused by the injection of epinephrine. In the first set of sessions they set out to induce a state of euphoria in the subject by exposing him/her to playful or irritating circumstances. Assume now that some *bona fide* physiological state exists which is generated by play

(P). Similarly, assume that when the subject is angry, a physiological state (A) arises. When Schachter and Singer inject the subjects with epinephrine they create a third physiological condition (E). However in constructing the experiment Schachter and Singer must at least allow for the possibility that the induced emotional states of anger and euphoria may be accompanied by physiological feelings A and P as per Table 3(i) below:

TABLE 3(i) Research Parameters employed in Schachter & Singer's Experiments with possible Physiological States Aroused

Epinephrine injected	*Epinephrine Advised*	*Anger Induced*	*Play Induced*	*Physiological State*
Yes	Misinformed		Yes	P+E
Yes	Informed		Yes	P+E
Yes	Ignorant		Yes	P+E
No (Placebo)	Ignorant		Yes	P
Yes	Informed	Yes		A(E)*
Yes	Ignorant	Yes		A(E)*
No (Placebo)	Ignorant	Yes		A

*The bodily feelings associated with anger and epinephrine injection are represented as A(E) to indicate that bodily states (E) as a minimum comprise a part of the feelings associated with anger.

According to this account, if emotions anger and play generate physiological states A and P respectively, we cannot know whether the epinephrine subjects, when attributing their behaviour to feelings of euphoria (playfulness), are referring to P or E. And it may well be that in the anger scenario, subjects are making genuine attributions of angry feelings when referring to either A *or* E.

- *Treatment of Placebo Subjects:* In the initial 'euphoria' results Placebo subjects report and exhibit both feelings and behaviours which correspond loosely to those of the epinephrine injected but ignorant subjects. If both groups were experiencing physiological states associated with 'play', rather than the epinephrine-induced physiology, this would be explained. But Schacter and Singer adjust the ‘epinephrine ignorant’ numbers by removing those subjects who ‘self-informed’ regarding the effects of the injection. However, the Placebo subjects were also injected and ignorant of the effects of the injection and so potentially there is a second adjustment to be made for ‘self-informed’ Placebo subjects who believe their emotionally-induced feelings are caused by the injection. Such an adjustment might have restored the responses of Placebo subjects to equivalence with Ignorant subjects; despite this, I can find no evidence that such an assessment was made.

Schachter and Singer - Summary

Schachter and Singer wish to test the hypothesis that if an individual is unable to explain a state of physiological arousal, he will describe his feelings in terms of the cognitions available to him.

It will be noted here that the experimenters make no reference to ‘appropriate physiological feelings’ because their aim is to demonstrate that any set of accompanying (e.g. epinephrine-like) feelings will suffice to satisfy the subject’s need for a cognitive condition to be described as ‘emotional’.

To test this theory, the researchers induce two very different emotional states and aim to create a single set of physiological conditions. This, it is proposed, will enable them to ascertain whether subjects attribute both emotional states to the same physiological conditions. But, if, as Lazarus claims, emotions are *fusions* of thoughts, physiologies and action impulses, the researchers have set themselves an impossible task. If you induce in me the emotion ‘play’ by using a stooge, then the ‘fused’ physiological state I experience in association may have characteristics corresponding to the ‘play’ emotion. The injection of epinephrine would ensure that at the same time, I have hand tremblings, a raised pulse, and flushing which are not appropriate to the emotion ‘play’. But if the physiological feelings associated with play are distinctive, then they ought to be discriminable by the subject from other physiological conditions. The reactions and reports of the Placebo subjects strongly indicate that they are undergoing play-induced feelings – feelings which have not been induced by an epinephrine-induced physiological state - and so the possibility that they are experiencing *bona fide* physiological states caused by play seems real.

I conclude therefore, that Schacter and Singer have not demonstrated that the physiology of an emotion is not indicative of the emotion experienced. Nor, in default of such evidence, does their experiment demonstrate that physiological configurations characteristic of particular emotions *do* exist. In consequence of this, Nussbaum's claim that Schacter and Singer have demonstrated that 'one and the same physical condition' will be claimed by experimental subjects as accompanying different emotions is not confirmed.

3.4.2 Cannon's Emotional Research

Cannon's work *Bodily Changes in Pain, Hunger, Fear, and Rage* is also cited by Nussbaum as an example of the incoherence of physiological feelings. It was the outcome of a programme of biological and behavioural research carried out in the early years of the 20th Century. It finds its origins in work carried out by Pavlov and a number of other researchers in the late 19th Century. His study of the physiological changes which happen during rage, fear, fatigue and hunger led him to conclude that although noticeable visceral and physical changes occurred, there was no reliable correlation between the two emotions studied and the characteristics of the associated physiological state.

Cannon also discovered that when the viscera[10] were separated from the brain by lesions to the spinal cord, emotional behaviour in humans and animals was not noticeably impaired. Since sensory information is transmitted from the body to the brain via neural pathways in the spinal column, this tends to confirm the view that the bodily changes we undergo during an emotion do not cause the emotional event.

[10] When Cannon refers to the 'viscera', he is specifically referring to the stomach and the alimentary tract and the changes which occur to those organs during anger and fear

Interestingly, Cannon noted that visceral changes occur too slowly to trigger emotions. His counter theory was that emotions were brain-based and that particular neural pathways, especially those related to the thalamus, were responsible for the arousal of emotions. So, whilst Cannon's work tends to confirm that physiological changes do not initiate emotions, he attributes the origins of emotion to the thalamus, located in the limbic system, rather than to the action of higher cognitive processes.

To summarise, Cannon's physiological and behavioural studies confirm Nussbaum's view that bodily sensations do not initiate emotions. He provides three reasons:

1. Humans who are unable to sense visceral or other bodily functions are still able to experience emotions.
2. There is no reliable correlation between the bodily sensations experienced during the course of an emotion and the nature of the emotion which the subject believed he/she was experiencing.
3. The bodily states experienced during an emotion occurred too slowly to account for those states being the arousers of an emotion.

Cannon's observations were based upon the best scientific evidence of the time but Panksepp separately addresses each of these findings with later discoveries in the fields of behavioural science and neuroscience (1998 p.57):

- *Visceral separation*. Whilst confirming that the intensity of emotions is lessened by lesions of the spinal cord, he observes *"We now know that the viscera secrete many chemicals (especially hormones and neuropeptides) that may feed important information back to the brain indirectly.* (that is, independently of the spinal cord)
- *Similar visceral changes occur in very distinct emotional states. "More recent evidence suggests that the patterning of many visceral changes is modestly different among different emotions*
- *Bodily response too slow to cause emotion.* Panksepp does not dispute this general finding but observes *"injections of certain gastric peptides can rapidly produce emotional episodes".*

In summary, none of the claims which Nussbaum makes from Cannon's research can be confirmed by more recent research, with the single exception of the sequence of emotional arousal. Bodily changes are initiated by affective neural processes which co-occur with cognitions and hence cannot be the cause of emotional cognitions as James and Lange propose.

3.5 Summary of the Cognitive-Evaluative Treatment of Bodily Feelings

Two claims are made by cognitive-evaluative philosophers regarding the role of bodily feelings: first, that such feelings do not cause the emotion and second that bodily feelings are not characteristic of the emotion type. I will discuss a third claim, that bodily changes act as signifiers of emotion, in 3.6 and subsequent sections.

Regarding the first claim, the evidence from more recent neuroscientific research (See Chapters 7 to 9) supports the cognitive-evaluative claim that the bodily sensations associated with emotions do not trigger emotions. But this does not demonstrate that the bodily effects of emotion play no role in the unfolding of emotions once those states are aroused: they may provide a reason for believing that an emotional event is occurring, or act as a mechanism in the physical realisation of that event without constituting its entirety.

As to the second claim, Nussbaum interprets Cannon's research as reducing the feelings associated with emotions to a collection of incoherent bodily sensations and cites the work of Schachter and Singer as demonstrating that similar physiological sensations will be accepted by subjects as signalling emotion even when they accompany different emotion types. In the case of Schachter and Singer, the evidence she has cited does not confirm her claim and I have argued that the experiment is conceived in such a way that it never could.

Cannon however, in claiming that different emotions evoke indistinguishable bodily changes, adopts a more promising methodology, but in limiting his measurement of bodily changes to a few basic physiological processes, he might be unable to identify such changes even if they existed. More recent research indicates that, as a minimum, the physiologies which accompany emotions have complex presentations, associated with the generation of particular neurochemicals in addition to changes in physiology. If this is the case, it makes little sense to think of the effects of such processes simply as bodily changes to be measured by heart rates, temperature, skin conductivity, or the generation/non-generation of gastric juices. We may experience effects associated with the chemical state of the brain, combined with tensing or relaxation of certain muscles, cold sweats, a tendency to cry or blush. All these changes and many others are known to be associated with emotions - and if we add to these considerations the possibility that mixed emotions aroused by multiple stimuli may induce combinations of these effects, it seems possible that if characteristic patterns of feelings were to exist, we would be hard put to discriminate them experimentally even using the measurement techniques currently available.

But before investigating the nature or function of emotional feelings, it is important to acknowledge them as a phenomenon: what is remarkable about emotional feelings is that these effects exist and manifest as they do. For humans and other animals, it has somehow come about that we are not only able to discriminate those things in the world which are of value to ourselves, but our psyche is so constructed, that bound up with our evaluations of objects as having value, we *feel* the importance of that value for ourselves. As Goldie puts it, we have feelings *toward* those things.

The evidence that cognitive-evaluative advocates offer against a role for bodily feelings in emotional processes fails to support their contention, but neither does it support an alternative assertion that the feelings associated with emotions in some way invest those objects with phenomenological characteristics which are indicative of the implications for the self as it relates to the object detected. I will now consider further arguments for this latter claim – specifically that emotional feelings are sensations: and that they constitute a separate mode of identifying the implications of external events as they pertain to the self which may influence the cognitive-evaluative process.

3.6 Feelings as signifiers of emotion

In summarising my earlier discussion of bodily feelings as sources of emotion, I accepted that bodily feelings developed too slowly to trigger emotions but I concluded that bodily feelings might play a role in the unfolding of emotional states once aroused, and that the experience of such feelings could cause us to believe that a particular emotion was occurring.

Goldie shares this view, but he offers this *caveat*: "*It is only a prima facie reason because one can be mistaken about whether the feeling is part of an emotional experience. You might, for example, feel red and think that this is because you are embarrassed (that you have blushed in embarrassment) while in fact you have just come into a room on a frosty day."* (2004 p.93)

In proposing that bodily changes might cause us to apprehend that we are experiencing an emotion, Goldie is introducing the view of physiological changes as signifiers of emotion without claiming that such physiological changes generate characteristic emotional phenomenologies. I believe that this constitutes a useful first step towards understanding the role of feelings in emotion. But in his 'frosty day' example, he is asserting that certain bodily changes could 'trick' us into believing that we are experiencing an emotion. This seems unlikely. I can remember no occasion when I have confused 'feeling red' with being embarrassed. There are at least two conditions which entail reddening of the skin: the first is 'blushing' which is normally confined to the face and upper chest and the second is 'flushing' which can occur more widely on the body. Flushing is a physiological condition which may respond to medical treatment, whereas blushing will only respond to *psychological* treatment of a mental state which arises from the evaluation of a set of social circumstances in which one of my responses would be to blush. But blushing would be unlikely to be my only response to an embarrassing situation: I might have a raised heartbeat, a disposition to be elsewhere, an inability to collect my thoughts. It is only when the stimulating circumstances are present *and* that some or all of these associated physiological and psychological conditions arise that I will acknowledge that I am embarrassed.

If my description of the symptoms of embarrassment finds resonance in the experience of others, then Goldie's 'frosty day' example, rather than disproving the argument that there is a complex physiology of emotion, tends to support such a view by demonstrating that the occurrence of a single bodily sensation can never be mistaken for an emotion. In charity, it may be that upon entering the room, if we were to assume that the appropriate 'embarrassing' circumstances were also present, then it may well be that we could mistake 'feeling red' for a physical sign of embarrassment, but Goldie, in framing his example, seems to be intent upon excluding that possibility.

Goldie might overcome my objection by accepting that the feelings associated with embarrassment manifest in a considerably more complex form than he describes. However, such an acceptance takes us an important step away from the cognitive-evaluative view of such physiological states as incoherent; inviting us to consider the view that emotional feelings are explicable separately from appraisals.

3.7 Cases of Non-identity between Appraisal and Feeling

Lazarus claims that emotional feelings are "bound up" with cognitive evaluation and signify to the subject that an emotion is occurring. This view is supported by Nussbaum's claim that the emotional feelings we experience are a constituent of the appraisal process itself, rather than its physiological accompaniments.

I will now offer two states of affairs in which emotional states arise or disappear independently of appraisals.

The first concerns cases of the sort described by Marks (p.24) in which emotions may take us unawares. Such emotions might arise in response to places, smells or sounds or random memories, causing us to experience feelings for which we can find no reason.

In the second case, the subject becomes inured to emotionally potent circumstances in such a way that he/she is able to reflect that a state of affairs which was once an emotional cue is no longer emotionally arousing. I will provide an example: shortly after leaving university I was employed in a human resources department. My work entailed interviewing several job applicants per week. Initially I was anxious but excited by the prospect of interviewing people who might be a good deal older and more experienced than myself. However, after a few weeks the work became routine and unemotional, causing me to have no feelings of anxiety or anticipation.

The evaluation of a set of circumstances which initially caused me to experience emotion, would later cause no emotion; and in determining whether the experience was – or was not - emotional, the criterion I employ for emotion is the presence or absence of feelings.

Smith and Lazarus would argue that in the intervening period, I have come to understand that I can cope with the situation so that it no longer constitutes a threat. Intuitively this seems obvious. But the relationship between the appraisal of some situation (I remained young and inexperienced) and the construal of that appraisal as constituting more or less of a threat, based upon some inverse function of my ability to cope, does not immediately explain the presence or absence of emotional feelings as accompaniments to the appraisal.

In sum, if my appraisals of a set of circumstances as occasioning emotion can change over time, then appraisal alone cannot be the mark of the emotional. What does appear to be characteristic of all emotional experience, is the arousal of feelings. But if feelings are necessary for emotion, the attributes and effects of feelings discovered thus far provide no further clarification of the nature or function of those feelings. I have observed that feelings may arise spontaneously, or they may fade with cue repetition or, as Schachter and Singer's experiment demonstrates, feelings may be subdued or eliminated by evaluation; but all these are matters requiring explanation, they are not explanations in themselves.

3.7 The Commonsense View of Emotional Feelings

I will now describe a view of emotion which is not explained by emotion as the outcome of an evaluation, or as a spontaneous neurological response to the detection of certain stimuli. To illustrate: my friend may observe to me that “A feels angry.” or “B feels afraid.” When I am told this, I am able - even without knowing what A feels angry about or why B feels afraid - to apprehend the state to which my friend is referring; so that there is some aspect of the experience of anger which distinguishes it from fear, existing independently of the circumstances occasioning those emotions in A and B. This interpretation of emotional feeling, which I shall call the Commonsense View, is sufficiently prevalent in everyday accounts of emotion to invite further consideration.

Before proceeding further, there is a potential cognitive-evaluative objection to the view I am about to develop: that on hearing that B is afraid, it can be assumed that there is some state of affairs he is afraid of, having the attributes of a threat. I certainly do not discount this view; it will be important to the theory I will presently propose, but I am hoping to establish, separately from this, that there is a commonly shared view that, separate from the notion that fear arises in response to a threat, that there is something it is like to be afraid.

Viewed from the perspective of commonsense explanation, the cognitive-evaluative account constitutes a radical reinterpretation of emotion. To illustrate, here are two statements involving emotion: the first is a well-known piece of advice given to individuals who are observed to be angry:

- Don’t make important decisions while you are angry.

The second is a quote from a speech given by Roosevelt at his first inauguration in 1933 regarding the challenges faced by the nation which, again, is generally accepted as providing an insight into the nature of fear:

- The only thing we have to fear is fear itself.

Taking the first example: the decision to be taken is understood to be a decision concerning the object of one’s anger. The Commonsense View is that anger constitutes a state of mind and body, an ill-humour, centred around some source of frustration, so that judgments made in anger, rather than leading to beneficial outcomes, may cause the subject to take overly-aggressive and self-destructive measures against the object of his/her anger.

The inference to be drawn is that the decisions taken when one is angry are not decisions which would normally be regarded as optimal, where an optimal appraisal of the circumstances would be one taken in an unemotional state which would produce outcomes more conducive to the wellbeing of the subject. In saying this, I am not requiring that appraisals are conscious or rational, only that they produce behaviours beneficial to the subject.

Roosevelt's example describes the Commonsense view of emotion more completely. The cognitive-evaluative view is that when an object or state of affairs is appraised as a threat, the appraisal will conform to a pattern of issues consistent with the arousal of fear. Interpreted in this cognitive-evaluative sense, the statement can be restated as "The only thing which should cause us to fear are the thoughts caused by events, circumstances or objects which have been appraised as threats to our wellbeing." The banality of this interpretation makes it unlikely that this was the message which Roosevelt was attempting to convey. His following sentence immediately clarifies his meaning: fear is a "*nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert retreat into advance*".

A cognitive-evaluative advocate might focus on Roosevelt's use of the term 'unjustified' as an indication that emotional appraisals may be biased - based upon a misreading of circumstances - and that, in consequence, our fears of some events may be exaggerated[11]. But Roosevelt is not exhorting American citizens to prioritize their appraisals of threats more rationally. In speaking of a 'nameless, unreasoning terror', he is speaking of that which cannot be put into words - he is asserting that there comes to exist amongst individuals, in communities which perceive themselves as

[11] To exemplify: no people have been killed in terrorist attacks in the UK in the past two years, whereas over 3,000 were killed in road accidents. Viewed from this perspective the level of public anxiety aroused by terrorism seems to be disproportionate.

being exposed to incalculable threats, a quality attached to thought, existing separately from any particular appraisal, which is inimical to a settled, rational pursuit of our day-to-day goals and hence, the best interests of those individuals.

That Roosevelt could send such a message and that its content should be accepted by the public indicates that fear is not construed simply in the cognitive-evaluative sense - as an emotion arising in response to an apprehension of danger caused by the appraisal of some state of affairs. The Commonsense View of emotion contains – in part - elements which are phenomenological, maintaining that states such as fear, anger or shame each have a characteristic quality which is particular to the emotion itself. The best cognitivist response is this: assume that in a lifetime an individual will make numerous appraisals of objects or circumstances as emotion-inducing, then we will progressively come to associate patterns of circumstances which are potentially good or bad for the subject. So, for example, if some set of circumstances has similarities to previous circumstances in which the pattern of appraisal caused us to view those circumstances as dangerous, we could describe the thoughts we experienced in response to that set of circumstances as negatively-valenced, just as pleasant thoughts generally arise in response to conformations of circumstances involving individuals who we find attractive.

But the diversity of emotional qualities which are commonly thought to exist extends well beyond their being ‘good or bad’ for the subject. There seems to be some aspect of being afraid which does not attach to anger, so that even if I desired it, I cannot find in my anger at a four-year-old child any sense of fear, though both these things are ‘negatively valenced’; and the pleasures of love are not the pleasures of play: my pleasure at playing chess has a different quality to the pleasure I take from a romantic attachment. On this account, there is a quality particular to each emotion as experienced which is distinguishable from other emotions. Taking Thomas Nagel’s idea, there seems to be something ‘it is like’, to be afraid, distressed, playful, loving etc.. which is more than a sense of valency.

The Commonsense View of emotion requires that when I feel emotional, I am literally ‘in a state’ - a condition of mind and body. To exemplify: if I am embarrassed, it may be that I am blushing or that my heartbeat increases, but it is not these things alone – or even primarily - which cause my discomfort, rather it is a quality which attaches to the thought itself; so that if, say, I am embarrassed, this quality is embedded in such a way that even if I wished to be free of it, the sentiment is entrenched. I cannot view my embarrassment *dispassionately*.

3.8 Emotional Feelings – Summary

Cognitive-evaluative advocates justify their theory of emotion on the basis of its explanatory power, maintaining that any associated bodily feelings play no demonstrable role in the emotional event, except that of signalling the presence of emotion. As Kenny puts it:

“a bodily state is not qua bodily state an emotional state; for it is only if it occurs in the appropriate circumstances that we can call it an emotional state at all [ ] *The occasion on which an emotion is elicited is part of the criterion for the emotion.”* (1963 pp.48-49).

For cognitive-evaluative philosophers, it is the nature of the occasion - the context – and its relevance for the self, which will determine the type of emotion experienced.

Nussbaum attributes the turbulent character of emotional experiences to their *urgency* - the pressing need to prioritize emotionally-potent appraisals according to their significance for the wellbeing of the subject. She claims that this significance is augmented by the role of any value revealed by appraisal as a component of a network of values – a network which constitutes, for any given individual, her/his concept of *eudaimonia*. According to this account, any challenge to – or confirmation of – a single value will be experienced as challenging or confirming, to a greater or lesser degree, the subject’s broader conception of value.

Responding to this view, I have accepted that our beliefs and values tend to be interconnected and that an appraisal of a change in some external state of affairs as it relates to myself, may cause me to embark upon a process in which other beliefs and values as they relate to that state of affairs are reappraised, but such reappraisals themselves will not necessarily involve some broader assault upon the entirety of the beliefs and values which I may hold. Nor do I accept that the urgency with which emotional appraisals are addressed in our thoughts is the cause of the mental turbulence attending emotion. I have argued that the urgency of an appraisal is restricted to the assignment of priority, a mental rearrangement of thoughts according to preference and that such prioritisations are insufficient to account for experiential quality of the mental upheavals which Nussbaum ascribes to emotion.

Lazarus asserts that emotions are 'hot' cognitions, and although he observes that emotional states produce somatic changes and states of action preparedness which differentiate them from non-emotional states, he does not ascribe the 'heat' of emotion solely to physiological change: rather it is understood to arise as a consequence of the apprehension that some external entity has adaptive significance for the subject, signalling a convergence of emotional appraisals with ancient neurobiological responses arising in circumstances which affect the subject's wellbeing.

Both Nussbaum's and Lazarus's accounts conflict with claims advanced by James and Lange who propose that experienced emotions find their origins in the physiological changes arising in response to some "exciting fact". More recent scientific evidence by researchers such as LeDoux and Panksepp indicates that physiological arousal is triggered by mediating processes which follow the detection of an exciting object, tending to disprove the James-Lange hypothesis.

Nussbaum further proposes - and offers evidence to demonstrate - that the physiological changes co-occurring with an emotion exhibit no pattern characteristic of the emotion being expressed and, in consequence, play no discernible role in the arousal of a particular emotion type.

I have investigated the evidence provided by Nussbaum, which she claims has demonstrated that the physiological changes observed to co-occur with emotion bear no relationship to the emotion reported, and I have concluded that while the evidence fails to support her claim, neither does it support the James-Lange hypothesis that somatovisceral changes act as *initiators* of an emotional event.

In attempting to introduce a role for feelings into cognitive evaluative explanations of emotion, Goldie proposes that the sensations associated with emotion, even if they conform to no discernible pattern relating to the emotion experienced, could be understood as introducing an experiential quality into what would otherwise be a purely cognitive process of appraisal. Our feelings might offer a prima facie reason for believing that the emotion we are experiencing is of a certain type, and that even when they mislead us, their presence serves to authenticate a mental state as emotional.

In the absence of experimental evidence to verify either the existence or absence of patterns of physiological states associated with emotional appraisals, Goldie's view offers a useful step towards a recognition of a function for emotionally-associated feelings, without committing us to the view that feelings necessarily complement or play any role in appraisals, or that feelings exhibit characteristic phenomenologies.

This latter interpretation is developed in my account of a Commonsense View of emotion in which Goldie's account is expanded to encompass the notion of feelings as possessing qualities which are characteristic of the type of emotion experienced. The Commonsense View, whilst accepting that emotional states may find their origins in events, objects or circumstances of significance to the self, treats the feelings which accompany those states as comprehensible independently of the appraisals which occasion them. Yet, on the basis of the evidence provided, the Commonsense View is no more verifiable than the cognitive-evaluative ascription of the mental turbulence of emotion to their urgency or adaptive significance.

In sum, unless some brain mechanism can be identified which would explain the arousal of the feelings co-occurring with emotional appraisals as having a function and an experiential quality which can be understood separately from those appraisals, the cognitive-evaluative view offers the better theory of emotion by virtue of its explanatory power.

My intention now will be to pursue the notion that the neurophysiological changes which co-occur with emotion have function. I intend to demonstrate that the feelings we experience during an emotion are the products of subcortical brain processes, having characteristic neurological and neurochemical elements, which generate attitudes, bodily effects and action impulses.

In the course of my previous account, a number of aspects of emotion have been identified which my proposed account must satisfy:

1. It must explain the co-occurrence of action impulses and changes in bodily states.
2. It must explain how our emotional thoughts come to have characteristic experiential qualities.
3. It must describe some mechanism whereby these effects may be suppressed or ‘overwritten’ by appraisals.

The mental processes which I will offer as candidates for the generation of emotional feelings are *primitive emotions*. I will argue that primitive emotions are inherited mechanisms, capable of autonomous function, with the ability to generate a spectrum of behaviours in response to valuable stimuli. I will propose that primitive emotions provide the source of physiological sensations and action impulses, existing alongside the cognitions which form emotional appraisals. My explanation will be presented in two stages:

- First, I will provide a more comprehensive account of the nature of primitive emotions and their function. The existence of subcortical affect mechanisms is acknowledged by some philosophers working in the field of emotion, but the full implications of the existence and function of such mechanisms are less well understood. Neuroscientists and behavioural scientists have been able to outline the action of core affect systems as neural processes which, taken collectively, describe an extensive mental architecture, providing a rudimentary survival programme for both humans and other mammalian species which is able to function in the absence of the intentional processes required for appraisal. The challenge in presenting the findings of these researchers is to achieve an adequate presentation in the space available.

- Having provided an overview of the action of primitive emotional systems, I shall argue that the arousal of primitive emotion is a necessary condition for any emotion, in contrast to the view of cognitive-evaluative advocates who argue for the necessity of appraisal or judgment. However, I intend to demonstrate that although a primitive emotion is a necessary component of an emotional occurrence, this does not conflict with the cognitive-evaluative view that certain emotional occurrences require intentionality.

PART II - PRIMITIVE EMOTIONS

Introduction

The concept of primitive emotion I intend to develop in Part II will have as its focus, not some primitive subset of human emotion, but rather an account of primitive emotional mechanisms as mediating between stimulus and response in mammals.

I shall treat the mental processes which bring about this mediation as *nonintentional*. Such processes are often described by cognitive scientists as being *pre-programmed* or *automatic,* arising spontaneously in the presence of particular stimuli. They are also described as arising and acting without the subject's being conscious of their functioning, driven by mechanisms which may act autonomously. Each of the terms used denotes some aspect of the processes I shall describe as nonintentional, but none describes the mental states so completely, except perhaps 'nonconscious'. However, the use of this term would entail first, a model of consciousness with which nonconscious states may be contrasted, and I can provide no such model.

For any animal species, a nonintentional account of emotion must explain the role of emotion in generating behaviours without recourse to the notion that the subject is acting with intention, that is, employing implicit or explicit beliefs towards either the exciting stimulus, or in forming the actions deployed in response to that stimulus. Moreover, such an account as a very minimum, must explain how, in the absence of an ability to identify a stimulus intentionally, the animal is able to detect emotionally stimulating objects and behave appropriately towards them.

In the following paragraphs, I outline the approach I shall adopt in developing a theory of primitive emotions:

- Chapter 4 will examine a number of theories concerning the nature and action of emotion in animals. A key issue is identified when attempting to distinguish behaviours which entail emotional processes from those which do not: in making this distinction, the behaviourist argument - that many of the ethologies displayed by animal species may be interpreted as reflexes, without recourse to the notion of affect - is contrasted with the view that primitive emotions play some role in the aetiology of more complex behaviours.

As a first clarifying step in responding to the behaviourist challenge, the concept of homeostatic value is introduced and it is proposed that all animal species respond to objects of homeostatic value, hence eliminating the notion of value as discriminating what is emotional from what is reflexive. Accordingly, it is proposed that some other boundary criteria are required to distinguish those responses which entail emotional processes from purely reflexive responses.

- Chapter 5 considers stimulus-response mechanisms lying below the emotional boundary in which an animal exhibits predatory and flight behaviours as a reflex. To demonstrate this effect, research into the ethology of toads is described, in which the behaviours exhibited may be expressed as the action of neurological mechanisms without recourse to the view that emotional processes play a role in the systems described.

- In Chapter 6, two approaches for expanding the toad's ability to detect and respond to valuable stimuli are considered: the first assumes that the animal, as it evolves, is able straightforwardly to add reflex mechanisms in which each new stimulus is addressed directly by an appropriate response. This approach encounters difficulty in the increasing complexity inherent in selecting an optimal response to multiple stimuli. A second approach, in which some mediating process enables multiple stimuli to be addressed by a single response, is found to simplify the prioritization of responses in multi-stimulus environments.

- Chapter 7 offers Panksepp's account of basic emotions as candidate mechanisms for the mediating role proposed in Chapter 6. Panksepp claims that a number of emotions are common to all mammals, and that they find their origins in a set of subcortical mechanisms for mediating stimulus and response which are, by and large, both anatomically and functionally homologous in mammalian species. However, he claims that these basic emotional mechanisms are extensively connected with higher cortical mechanisms entailing conscious processes; and because cortical development varies markedly across mammalian species, these underlying emotional mechanisms, after processing by higher cortical processes, will exhibit broad variations between species, both in terms of the range of emotionally motivated behaviours observed and the objects detected as valuable.

In response to these findings, I have differentiated those aspects of Panksepp's basic emotions which can be understood as spontaneous responses to external cues, arousing characteristic neurochemical and neurophysiological states (*E-states*), functioning nonintentionally, as distinct from higher level mental processes associated with emotion which Panksepp often describes as conscious. Each E-state consists of a brain mode, an impulse to behave and a set of musculoskeletal and visceral conditions supportive of that behaviour. In order to arrive at an understanding of the role of these states in motivating the behaviours of mammalian species, I have advanced the notion of a *primitive mammal* with behaviours governed only by the action of E-states. My intention will be to demonstrate that a primitive mammal, motivated by E-states, will perform those functions necessary to achieve homeostasis.

- In Chapters 8 and 9, a set of E-states are described, corresponding to Panksepp's basic emotions. Chapter 8 is dedicated to the description of SEEKING. The concept of SEEKING - an emotion associated with the act of searching or foraging - is not one which would be generally acknowledged, and Panksepp's description of SEEKING, both in terms of its sources of stimulus and its outcomes, requires separate explanation.

  In Chapter 9, six more E-states are described. Each description consists of a brain mode, having neurodynamic and neurochemical constituents, an account of the physiologies characteristic of the E-state, and a description of the action impulses evoked.

- Chapter 10 considers the role of unconditioned stimuli in triggering E-states. For each E-state it is proposed that several characteristic stimulus classes may exist which will directly activate a single E-state.

- Chapter 11 reviews the role of conditioning in the acquisition of stimuli as a function of E-states, and in particular, fear. Cognitive scientists propose that the stimuli acquired by conditioning are not selected randomly but as a function of their attentional salience, introducing into the primitive emotional process the concept that for an object to be conditioned, it must, first, be subject to some process requiring attention.

- The function of attention in conditioning is reviewed in Chapter 12. A series of experiments are described in which a mammal is observed to attend preferentially to and retain certain aspects of its environment, such as shape and movement[12], in the absence of emotion.

  Additional evidence is put forward in support of the view that the process of attending and retaining object information is accelerated when the animal is in a state of SEEKING. I have designated such object information, when acquired, as *passive* rather than conditioned.

  From these observations I conclude that attention constitutes a separate function for acquiring and retaining object information in mammalian species which is accessed by the emotional process during conditioning. This information is further supported by research I shall cite in Chapter 17.

[12] That is, as a function of an object's salience

- In Chapter 13, the relationship between E-states and their activating stimuli is interpreted as one in which an E-state, together with its stimulus objects, constitutes a realisation of a set of motivating principles, each of which may be expressed as a strategy for the achievement of homeostasis in mammalian species – a *homeostatic imperative*. According to this account, an object acquires its emotion-arousing status by virtue of its membership of one of a set of stimulus objects, which are collectively described as a *metastimulus*. Each metastimulus is one of a class of metastimuli, each of which represents some generic challenge or opportunity for the wellbeing of the subject. To illustrate the role of a metastimulus, I offer an outline schematic demonstrating the respective functions of unconditioned and conditioned stimuli, metastimuli, E-states and attention in primitive emotional processes.

- Chapter 14 gives an account of mammalian behaviours in the presence of multiple stimuli, which I attribute to the competitive action of E-state brain modes. This model is compared with the account of Panksepp, who proposes that multiple basic emotional states interact in a mutually inhibitory or excitatory relationship.

Chapter 4: Philosophical and Naturalist Theories of Primitive Emotion

In his paper *The Expression of the Emotions in Man and Animals*, Darwin proposes that emotions have arisen as the result of an evolutionary process. Darwin and his later followers were interested in expressions of emotion in men and other animals in which an exciting object will automatically generate the physical conformations and behaviours characteristic of an emotion[13]. For Darwin, the nature of emotions, which he regarded as characteristic physiologies, conformations and behaviours as opposed to thoughts, was not of primary interest; his goal was to extend his evolutionary theory to emotional adaptation. Darwin was concerned with the existence of apparently emotional responses to certain types of stimuli, occurring both within and between species, which could be explained as common adaptive strategies for responding to those stimuli.

This treatment of primitive emotions – as a set of inherited, predictable, species-wide responses to certain types of stimulus – exposes the Darwinist view of primitive emotions to a behaviourist objection. M.F. Meyer predicted:

"Why introduce into science an unneeded term? [ ] I predict: the "will" has virtually passed out of scientific psychology today; the "emotion" will do the same" (1933 p.300).

Behaviourists reasoned that if an 'emotional' response was evoked predictably by a stimulus, the concept that an emotion plays some role in instantiating that response becomes unnecessary. On this account, if rats respond predictably to foot shock by freezing, then that behaviour can (or will eventually) be explained as the outcome of some invariant neural mechanism connecting the detection of the stimulus to the motor outputs required for the response. The introduction of an additional concept 'fear' is unnecessary and potentially misleading, inviting us to seek for some neurobiological state causing the emotion 'fear' where none exists.

[13] Such as a facial expressions denoting disgust, surprise or anger.

To avoid the behaviourist objection, more is required of primitive emotions as a special class of mental states than that they generate invariant responses to certain types of stimulus. William James (1884) and Carl Lange (1885) proposed that emotional cognitions are evoked by 'feelings' - sensations which are caused as a consequence of the arousal of the physical (i.e. visceral and musculoskeletal) responses when a stimulus object is detected. The sequence of events as James and Lange describe them is disproved by later neuroscientific evidence, but a less specific contention that emotion may be determined by characteristic physiological changes can, in some respects be reconciled with Darwin's view: both accept that emotions are associated with feelings but Darwin does not treat feelings as predictive of emotion in the manner of James and Lange. Taking these two approaches into account, I offer this minimally controversial statement about primitive emotions:

Primitive emotions are inherited states of men and animals, arising automatically in response to certain classes of external stimuli. These states are associated with neurophysiological alterations and behavioural impulses directed towards those objects.

There are difficulties with this account. It seems reasonable to assume that humans associate the experiential quality of an emotion with certain types of musculoskeletal and visceral alterations in addition to the arousal of behavioural impulses, but, as humans, we have no warrant for attributing this correspondence to other species, leaving us dependent upon observation of behaviour alone for our attribution of emotion to those species.

The difficulty of attribution of emotion in other species remains unresolved in more recent texts. In his essay *Primitive Emotions* (2004) John Deigh proposes that a theory of emotion should cover the fact that emotions are common both to humans and beasts. He does not propose that humans and beasts share the same set of emotions; rather he asserts that there exists a subset of emotions common to men and beasts which he names primitive emotions *"liability to which is instinctive"* (2004 p.10).

In claiming that some emotions may be distinctively human, he cites shame as an emotion to which men are liable and beasts are not, but asserts that fear, anger and delight all have primitive forms found in other species. His view of the unique status of certain human emotions finds support in the views of modern Darwinists such as Ekman. They claim that facial expressions indicative of the emotions disgust or surprise are found in humans, but while many other species appear to be surprised by unexpected stimuli, none appear to exhibit disgust.

Deigh's view is difficult to verify: if I am constrained to the observation of behaviour alone for the detection of emotion in other species, then it may be that there are species for which observation will not reliably detect the presence of emotion. To exemplify, Deigh claims that the emotion 'delight' has a primitive form (2004 p.10) in both men and beasts but I do not believe I have ever observed a delighted fish. Now, this apparent conflict may have arisen from one of two sources:

1. Deigh might have identified some outward expression of the emotion 'delight' in species such as fish which I have not, and hence feels able to attribute this emotion to all animals.

2. The taxonomy of species which Deigh describes as 'beasts' does not extend to fish and, by implication, any other species which cannot express delight in a manner which he or I would recognise. (accepting that certain species appear to express delight).

In proposing the existence of primitive emotions which are common to men and beasts, Deigh provides no evidence that the taxonomy of primitive emotions he has provided comprises the full spectrum of emotions which fall into this category, nor does he specify the set of species (excluding humans) to which these emotions can be reliably attributed, unless by the term 'beasts' he is referring to all animal species. But if this is the case, then the behaviourist objection pertains: if we are to think of all animals - even fish, insects and molluscs – as having primitive emotions, then it becomes increasingly difficult to assert with confidence that the behaviours of the more ancient species such as molluscs or insects are the products of emotions rather than reflexes.

This behaviourist objection is important for any theory of primitive emotions. If as Deigh proposes, there exists some boundary between the ‘higher’ emotions which are exclusively human and the primitive emotions which are shared by men and beasts, then to avoid the behaviourist objection, there must exist a second lower boundary between those beasts whose behaviours are attributable to the action of primitive emotions and those which exhibit only reflexive responses to stimuli.

The higher boundary which Deigh proposes to lie between primitive emotions and exclusively human emotion is described by Deigh as ‘cognitive’. Deigh’s use of the word in this case denotes the existence of theories of emotion as experienced mental states, employing propositional attitudes. In previous chapters I have described how cognitive-evaluative philosophers such as Nussbaum and Lazarus argue that for both men and animals, emotion entails evaluation, requiring some manifestation of intentionality towards the object of emotion, but Deigh, whilst concurring that cognitive emotional states are intentional, further claims that there exists a special ‘human’ category of intentional states of emotion which require that the subject has language.

I do not intend to pursue this distinction; rather I wish to acknowledge the existence of a concept of emotion as a mental phenomenon requiring intentionality, which I have described as cognitive-evaluative, and to argue that primitive emotions comprise a different class of emotion which arise in the absence of intentionality. This distinction between the intentional and the nonintentional states represents the higher boundary of primitive emotion.

My immediate purpose however, will be to establish the existence of a second lower boundary between behaviours which are evoked by primitive emotions, and behaviours which may be characterized as reflexive responses to stimuli. Such a boundary is required for just the same reason as the higher boundary between primitive emotions and cognitive-evaluative emotions is required; the distinction between these two processes cannot be established without a clear understanding of the particular nature and role of primitive emotions as contrasted with those which constitute evaluative processes. Similarly, the action of primitive emotions cannot be fully explicated without identifying the differences between their nature and function and those of the reflexive stimulus-response mechanisms which can be explained straightforwardly by behaviourist theory.

My goal of establishing a lower boundary for primitive emotion in this manner might feasibly produce an outcome in which both primitive emotions and reflex behaviours are present in a single species - just as Deigh is able to attribute both intentional and primitive emotions to humans. Even if this were the case, the establishment of some criterion to distinguish between the emotionally-driven and the reflexive would not be fundamentally affected by my discovering that the distinction I am aiming to achieve lies between processes rather than between species.

Defining this lower boundary therefore, could help me to identify a set of species which are subject (partially or wholly) to the action of primitive emotions, and to assign a role for primitive emotion together with a taxonomy of primitive emotions to which those species are subject. This in turn should place me in a position to explore the extent to which primitive emotions can complement or inform more complex human emotions.

The project as described is ambitious. I have already outlined the difficulties in assigning the action of emotion to animals by the observation of behaviour alone. It is only by examining the neural processes which drive these behaviours that there can be any prospect of distinguishing neurophysiological states which are emotional from those which are not. And even here a problem is apparent: given two neurobiologically defined processes for explaining the action of stimulus and response, it is not obvious how the emotional is to be distinguished from the reflexive.

The argument which I shall provide for the existence and role of primitive emotions will rest heavily upon the notion that they provide a particular mode of response to clusters of valuable stimuli. In order to develop this argument, it will be initially necessary to introduce a concept of exciting stimuli as sources of *homeostatic value* for the responding animal. And having established homeostatic value as a common motivator for all animal species, I intend to investigate differences in the neurological mechanisms by which the detection of a homeostatically valuable object generates a response in amphibians as opposed to mammals.

In elaborating these processes my intention will be first, to demonstrate that for an amphibian, the entire process by which a stimulus causes a response can be explained as a neurological algorithm, without recourse to the concept of emotion. I shall contrast this account with that of stimulus-response processes in mammalian species, in which a set of intermediate neurobiological processes intervene to enable an animal to cope with an increasing complexity of stimulus and response and I shall argue that these processes, which I describe as primitive emotional systems, engender brain states, physiological alterations and behaviours having attributes characteristic of the physiological states of action preparedness which occur during emotional events.

As a first step in the process I have described, I will propose that all animals are able to respond to objects of homeostatic value.

4.1 The Concept of Homeostatic Value

The sea hare, *Aplysia Californica* has a simple nervous system containing around 20,000 neurons[14]. As Panksepp puts it: *"In its journey from rock to rock, it uses an intrinsic behavioural strategy of reaching out and swinging from side to side in search of a new anchor point. In so doing, it exhibits a photoactic preference for darker rather than lighter environments."* (1998 p.37)

We can view the sea hare's behaviour as a causal chain:

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[14] An adult human central nervous system contains approximately 100,000 million neurons.

$\pm\delta$(Light Intensity) → Neural Impulse → Swing Modification.

I use arrows here to indicate the causal relationship between the elements described. For the sea hare, once some variation of light intensity is detected, the animal has no control over its subsequent behaviour.

The sea hare undergoes a sequence of events by which a stimulus is identified, generating a state of the nervous system which causes a behaviour; it possesses two characteristics:

- Each element of the chain is caused by the preceding element. No other order can occur.
- Once the entire chain has been activated, all the elements act together.

The sea hare's response is the result of a connection between the identification of a stimulus (some gradient in light intensity) and a neural impulse which alters its movement, generating a single state of the organism. The consequence of the sea hare's behaviour is that in moving towards dark places it will improve its chances of survival. The behaviour of the sea hare is automatic, but its effects are likely to be beneficial for its wellbeing.

As observers of the sea hare's behaviour, we might reasonably conclude that it carries a high risk. Undersea predators lurk in dark places and the sea hare's flight from light places might often end badly. But the sea hare is an ancient creature and its survival as a species must, in part, be attributable to this behaviour, despite its occasional failures, and so taken on aggregate across the entire species, the behaviour must have been beneficial – it must have had a value for the species. I would further propose that the behaviour constitutes an *appropriate response* to the light stimulus, but this raises an objection, I have already observed that fleeing to a dark place can be a dangerous strategy, in which case it would not be appropriate.

Compare the sea hare's behaviour to that of an octopus, which exists in a similar environment and hides in dark places: in its search for concealment it will deploy its eyes and tentacles, supported by a nervous system comprised of 500 million neurons to select less hazardous locations as compared to the sea hare's simple preference for dark places. The octopus's more discriminating approach is achieved by the deployment of a vastly more extensive array of sensory and processing resources. The sea hare cannot choose where it hides with the same rate of success because it does not possess the same cognitive and motor resources as the octopus but the sea hare's response is effective when viewed in terms of its more limited resources and its persistence as a species.

To summarise: by 'appropriate' behaviour I am referring to some inherited species-wide response which is, on aggregate, effective when viewed in terms of the perceptual, cognitive and motor resources available to individuals of that species. But, if an animal's response can be understood as appropriate to the stimulus presented, the stimulus itself must address some goal or need of the organism which would render the response appropriate, and I propose that for all species, that goal is the achievement of homeostasis.

Homeostasis is the persistence of some steady, balanced state of an organism; it may also be understood as the goal towards which its actions are directed. This drive to homeostasis has been taken by Neu from a description by Spinoza:

"*Each particular thing, interacting with other particular things within the common order of Nature, exhibits a characteristic tendency to cohesion and to the preservation of its identity, a striving (conatus), so far as it lies in itself to do so, to persist in its own being*" (1977 p.72).

I amend this by adding "*or to promote the propagation of its species.*"

As a result of its drive to maintain homeostasis, an animal will act when it detects an object of homeostatic value. By 'homeostatic value', I am referring to some property of an external object which might prove valuable for the well-being of the organism if it were to respond to its detection by an appropriate behaviour.

My concept of value here is limited to those objects in an animal's environment which, if identified, are likely to promote or preserve the homeostasis of the subject or the persistence of its species. In this sense, it is valuable for a rat to be able to identify a cat and it is valuable for a cat to identify a potential mate. Viewed in this way, an object can be understood to have a value irrespective of whether that object offers a threat or an opportunity for the detecting organism.

The theory of homeostatic value predicts that for any species there exists a set of objects having homeostatic value (HVOs). The configuration of sensory information generated by the HVO to which an animal is responsive is a stimulus, and if the animal displays an inborn response pattern to an HVO, the stimulus generated is described by behavioural scientists and psychologists as 'unconditioned'.

Although I have described the activating stimuli as homeostatically valuable 'objects', the term may apply equally to an object, a relationship between objects (a context), or an event (entailing changes in relationships between objects), any of which might promote the well-being or survival of that animal.

Chapter 5 - Setting the Lower Boundary of Primitive Emotion

Introduction

In offering a concept of homeostatic value which is common to all animals, I have generated a potential difficulty for both cognitive-evaluative and primitive models of emotion. An ant exhibits a wide range of responses to objects of homeostatic value: *inter alia,* in nurturing its progeny, it ensures the survival of its species and in defending its nest and its territory, it deters the threats of predators or competitors. If emotion consists simply of detecting and responding to stimuli with value for the subject's (or its species') wellbeing, the ant may be argued to undergo the emotions associated with nurturing and aggressive behaviours.

Hence, the concept of emotion, if it is predicated only upon detection and response to value, potentially extends to all animals. Cognitive-evaluative advocates escape this challenge by requiring that emotion entails some apprehension on the part of the subject of an object's value – some display of intentionality.

The precondition of intentionality therefore, establishes a key criterion for cognitive-evaluative emotion. But no such escape is available for a concept of primitive emotion which I will argue is both cognitive *and* nonintentional - so that primitive emotions arise in response to stimuli but in the absence of evaluation.

In addressing this challenge, I will propose that primitive emotions, whilst arising nonintentionally, may be treated as cognitive because they are elaborated as a set of separate intermediary mental processes, allowing an organism both to acquire new stimuli and to respond flexibly to multiple stimuli. Such processes conform to the cognitivist condition I have stated previously, i.e.: *"a class of mental processes by which the relationship between the subject and the external world is mediated."* (p. 52)

The difficulty with this project lies in identifying the boundary between primitive emotion and reflex. If an organism displays behaviours in response to stimuli, it is unclear how an emotional behaviour is to be differentiated from a reflex. It may be argued, as I have, that emotional behaviours can be distinguished from reflexes by the complexity and unpredictability of responses and the abundance of stimuli detected, but observations from complexity or behavioural unpredictability alone will not suffice to create the distinction I am seeking; it must lie in the mental process itself. For a reflex, the response generated must derive from the stimulus by means of some invariant neural mechanism, whereas for a primitive emotion, the neural pathway between stimulus and response must contain some mediating process (or processes) whereby the stimulus-response behaviour may be varied or expanded.

In establishing the boundary between the emotional and the reflex, my first step will be to provide an example falling below that boundary. I will later contrast this simple set of stimulus-response behaviours with the operation of 'basic emotions' which Panksepp ascribes to the action of neural mechanisms in the mammalian subcortex.

5.1 The Neuroethology of the Toad

Jörg-Peter Ewert (1993) has carried out an extensive range of research into the neurophysiological basis of stimulus-response mechanisms in amphibians. In the experiments described here, toads were selected because they displayed low levels of habituation and hence would display naturally-occurring behaviours for extended periods.

5.1.1 Stimulus-Response Characterisation

A toad was placed in the centre of a circular platform. Cut-outs of various shapes and sizes could be attached to the platform periphery and rotated, traversing the visual field of the toad at a variety of speeds, or even in a stop/go motion. Under these conditions it was observed:

i) The toad would strike consistently at a horizontal bar moving parallel to its axis
ii) The toad would ignore the same bar moving perpendicularly to its axis.

iii) The toad would retreat from a square shape moving horizontally.

From this, it was concluded that to stimulate behaviour:

1. The object must have a certain visual configuration; it must occupy a certain proportion of the toad's visual field and be within a certain distance.

2. The object must move within a range of speeds.

3. The direction of movement – either horizontal or vertical to the toad's visual orientation - was relevant but only when taken into consideration with (4) below.

4. The object is assessed for its horizontal or perpendicular extension relative to the direction of movement.

5.1.2 Neurobiological Explanation

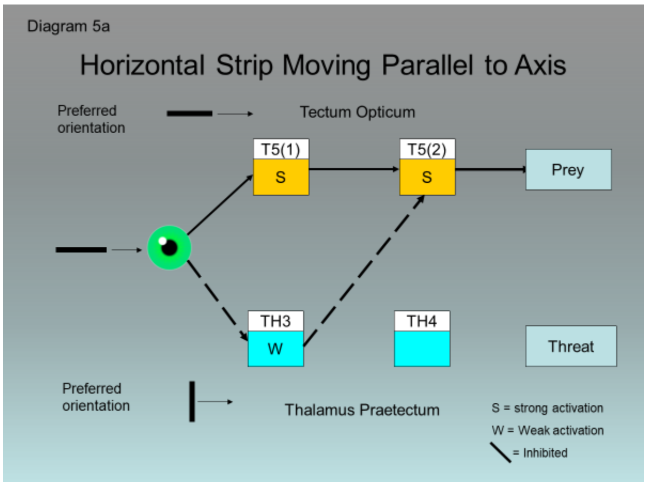
In attempting to understand the neurobiological processes which were driving the toad's behaviour, the researchers monitored the electrical activity of separate clusters of neurons in the midbrain and diencephalon which are activated simultaneously, following pre-filtering by retinal neurons.

Each of the brain centres activated are sensitive to different combinations of configuration and movement: certain neurons in the Optic Tectum (T5) register movement of objects extended parallel to the direction of travel (i.e. the orientation and the motion of the bar are the same). Conversely the neurons in the thalamus (TH) are sensitive to movements of objects extended perpendicularly to the direction of travel. Both these modes of activation have been confirmed using EEG measurements of the brain centres under study.

The neurons in the brain centres characterised can operate in one of four modes:

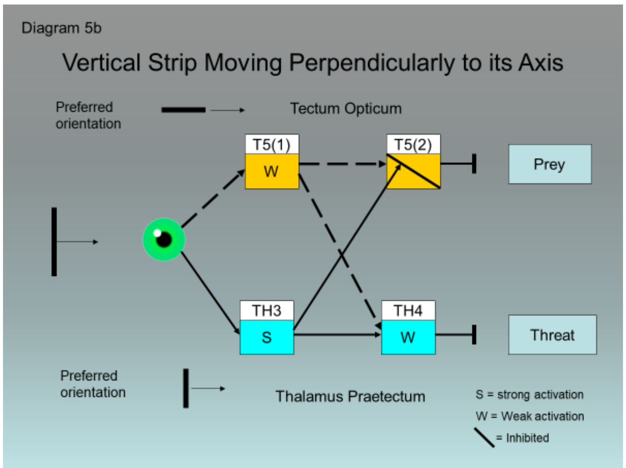
1. Strong activation
2. Weak activation
3. No activation
4. Inhibitory (i.e they may inhibit the activity of other neurons)

A horizontal bar-shaped object moving horizontally (see Diagram 5a. below) will be accepted by T5(1), and hence T5(2) receives excitatory information from T5(1). T5(2) may also receive inhibitory information from TH3 neurons if TH3 is also activated[15]. However, if TH3 is weakly activated, prey catching is released. This process is shown schematically below. In the diagram a visual signal 'prey' (horizontal bar moving horizontally), does not sufficiently activate TH3 and hence the prey capture behaviour is not inhibited.

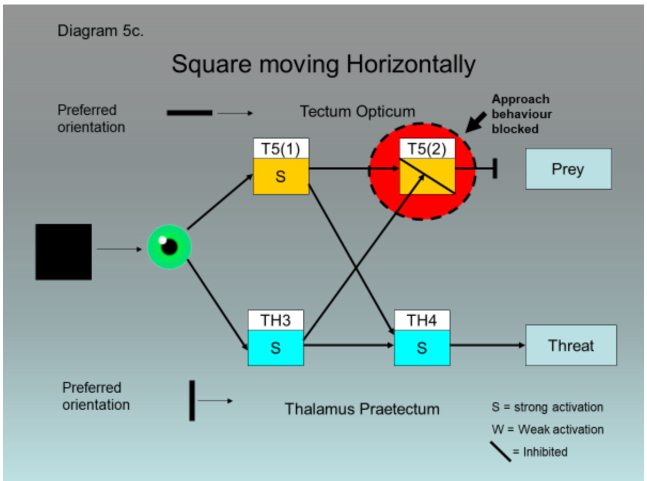


When the toad encounters an object extended perpendicularly to the direction of movement (Diagram 5b.), TH3 is strongly activated, transmitting an excitatory signal to TH4. However, in order to activate strongly, TH4 requires a second excitatory signal from T5(1) but because the object observed has minimal horizontal extension, TH4 is not activated beyond the threshold necessary to induce the toad to flee. Hence, for a moving vertical bar-shaped object, the toad displays no behaviour.

[15] This stimulus route is weakly activated because any real horizontal object as well as being horizontally extended, must have some extension vertically. So the more a horizontal object is vertically extended, the stronger the 'vertical' inhibitory signal will become.



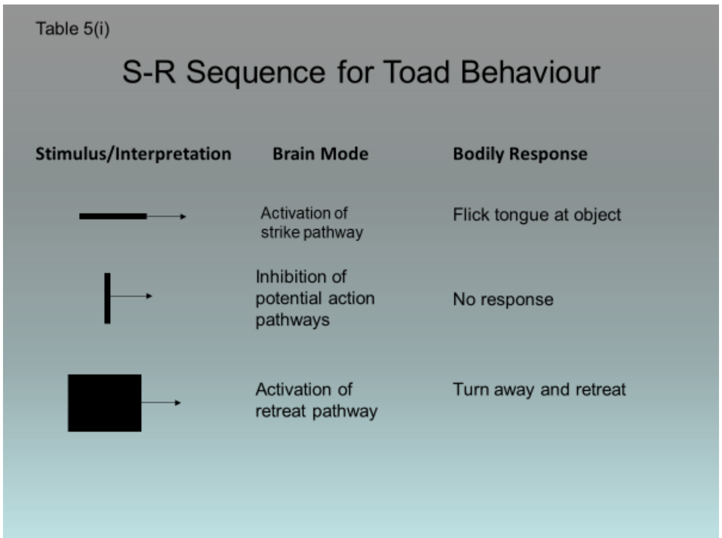
In the final case (Diagram 5c.), the cue object is extended both horizontally and vertically sufficiently to represent a predator, both T5(1) and TH3 are activated. TH3 inhibits T5(1) whereas T5(1) excites TH4 and this signal, together with a signal from TH3 are sufficient to activate escape behaviour



5.1.3 Summary of Findings

This account of the toad's behaviour can be described in terms of a neurobiological process in which a stimulus is captured and interpreted, initiating a neural circuit which triggers a response.

Taking this last notion first; the three explanations of behaviour in response to different object shapes are automatic. The toad does not have to choose between predator and prey related behaviours, each option automatically excludes the others and all options are products of an integrated analytical process. But the process also carries a ‘failsafe’ mechanism: whenever the shape is vertically extended relative to motion, approach is inhibited so that a toad is prevented from striking at a prey [T5(2)] when a predator shape is present. (Table 5(i))



5.1.4 Discussion

Ewert’s experiments provide insights into a toad’s stimulus-response mechanisms.

- First, for all toads, common responses to controlled stimuli at the same brain locations were recorded, providing support for the assumption that the toad’s system for processing visual information has arisen phylogenetically.

- Second, the stimulus interpretation function is a single process occurring in two interlocked stages i.e. retinal pre-filtering, followed by analysis. It is the first stage of this two-stage process which has the function, (by selectively admitting movement/shape-related visual data) of discriminating the HVO, whereas the analytical network described by Ewert has the function of selecting an appropriate neural response.

- Third, the toad's visual system is directed towards the normative characterisation of HVOs in order to enable subsequent analysis and selection of behaviours in response to those objects. To be identified as an HVO, an entity must have movement and extension, both of which must fall within certain parameters in order to generate behaviour. Objects falling outside these parameters, even if they display movement, do not access the system.

- Finally, the toad's visual system (at least insofar as I have described it) seems to provide a straightforward answer to the problem of object discrimination. For the toad, valuable objects in the world are picked out by movement, proximity and extension; these are further sorted into particular combinations of motion and extension, triggering responses which are appropriate for the movement and shape detected.

The foregoing account has been created without reference to the concept of emotion. We may, in observing the toad's behaviour, conclude that it is displaying aggression toward a worm-like configuration and fear towards a predator-like shape but in attributing characteristic feelings to these behaviours, we are introducing unnecessary entities into Ewert's explanation by anticipating neurobiological mechanisms or phenomenologies which have no experimentally verifiable foundation.

In sum, in the case of the toad, the behaviourist objection is confirmed.

The toad's stimulus-response mechanism is fixed and its structure embodies a stimulus-driven algorithm enabling it to extract three homeostatically valuable stimulus types from its visual field and respond appropriately to each. Extension and movement yield approximations of 'predator' versus 'food' - shadows of the world as we perceive it - and it is difficult to imagine how such a characterization could yield much more information.

But I believe that the simplicity and rigour of the mechanism which the toad employs to register a stimulus and select a response is signalling an important aspect in the development of neural systems: for nonintentional mental states, an ability to pick out multiple stimuli having homeostatic value will inevitably necessitate an ability to *choose automatically* between those stimuli. Any animal able to respond involuntarily to more than one HVO with more than one behaviour must also possess the ability to select the correct response in the presence of any combination of those HVOs. And the necessity for some involuntary mechanism for choosing between competing stimuli is often an existential requirement.

The toad is employing a retinal pre-filtering mechanism for stimulus characterization which is further analysed into one of three responses. Not only this, for a toad to choose to strike at a worm when a predator is present constitutes an incorrect survival choice and the animal is 'pre-programmed' to prevent this option (Diagram 5c.). Hence the toad's interpretative mechanism can be understood as a computational algorithm with two functions:

I. To provide homeostatically appropriate responses to three shape/movement combinations.

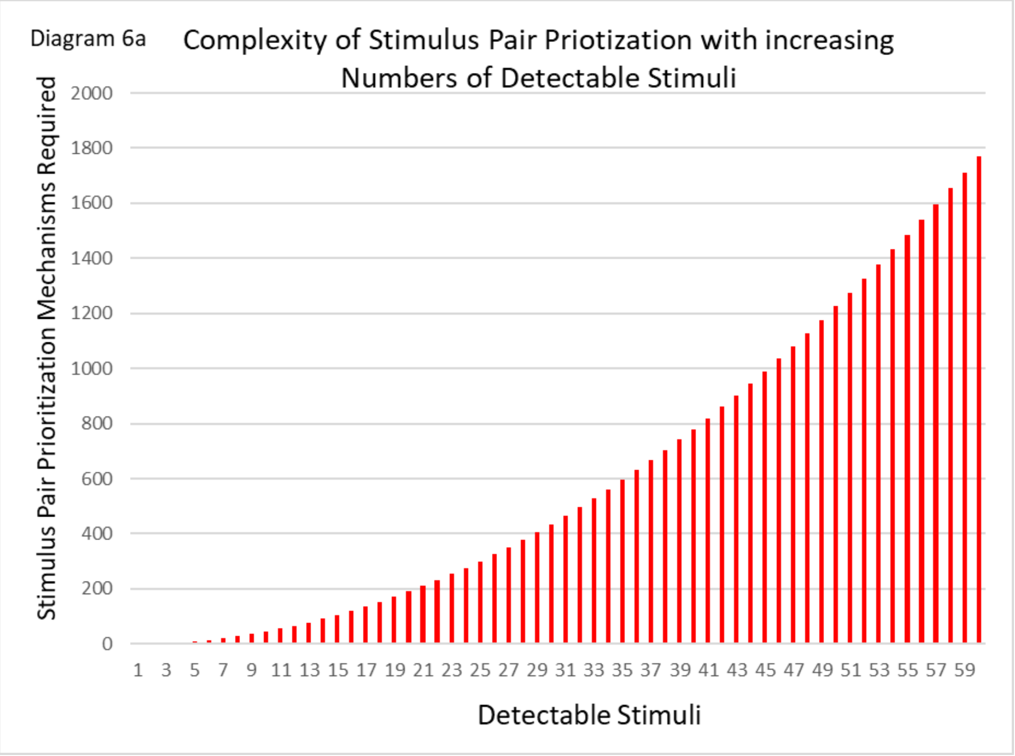
II. To select the most appropriate response when competing stimuli are present.

Understood in this way, the limitations of an algorithmic 'stimulus-response' mechanism become apparent: a 'toad-type' mechanism in which HVOs are selected simply on the basis of movement and extension does not allow for a precise characterisation either of predator threats or of prey selection and hence carries a high probability of failure, favouring evolutionary innovations which provide the ability to discriminate a greater range of HVO's. But the more stimuli an animal is able to respond to, the greater the likelihood that an animal will be confronted at any given moment by multiple stimuli, requiring increasingly more complex neural processes for selecting an appropriate response.

Chapter 6: Contrasting Reflexive and Primitive Emotional Models

I have proposed that the toad's chances of survival would be improved by its having an ability to respond to many more stimuli with an appropriate behaviour. But the task of generating dedicated responses to a broader range of stimuli than those addressed by the toad's neural mechanism presents challenges. In particular, those challenges arise in selecting the optimum response when confronted by combinations of stimuli.

Imagine an amphibian with a neural structure similar to that of a toad which, rather than having an ability to respond to three stimulus types with three behaviours, could in responding to *n* stimuli, generate *n* dedicated behaviours, and when confronted by any combination of two of these stimuli simultaneously, would select and prioritize the most appropriate response. On this assumption then *n* stimulus-response pairs would require the ability to prioritize (n-1)(0.5n) combinations. It may be noted here that by opting for pairs of stimuli, I am adopting the simplest option. I have not considered the much more complex algorithms which would result from a prioritization of three or more co-occurring stimuli. (Diagram 6a.)



As the amphibian evolves, it acquires new stimulus-response mechanisms but to accommodate this expansion, the animal's ability to prioritize between pairs of stimuli must increase geometrically so that, say, for sixty stimulus-response mechanisms, the animal must be able to prioritize between c.1800 stimulus-response pairs.

The 'enhanced amphibian' project faces additional obstacles: the ability to pick out more HVOs may well require a corresponding enhancement of any or all of its perceptual faculties. Toads do not appear to discriminate objects[16]: rather, they appear able to identify a moving shape as a two-dimensional form within certain parameter sets, and once that shape has been picked out, the response appears uniform. In order to distinguish more objects, some perceptual enhancement would be required whereby features of a moving shape could be selected which would enable the toad to achieve greater differentiation between shapes,

In summary: it would be valuable for the toad to discriminate large numbers of stimuli – particularly predators and prey – but the ability to identify stimulus A, as well as demanding enhanced perception, critically requires the animal to respond appropriately to that stimulus in the presence of other stimuli, and this might entail responses which are not those prompted by stimulus A. To achieve an optimum response, each stimulus-response entity must be integrated into neural excitatory/inhibitory networks with other stimulus-response entities in order to achieve the appropriate prioritization for homeostasis.

The evolutionary project I have described is challenging but not impossibly so. It may well be that animals exist with the ability to identify and respond spontaneously to many more stimuli than the toad and to prioritize those stimuli effectively, even at the cost of increasing complexity of prioritization; but a possible simplification of

[16] I do not take this as an assumption, but rather as the best explanation of Ewert's experimental evidence

this programme exists: observation of core mammalian behaviours[17] suggests that relatively few response classes will suffice to accommodate a much broader diversity of stimulus type. Behaviours are constrained in this way because the existence of land-based animals is conditional upon their compliance with a number of criteria imposed upon species by the natural environment afforded by this planet:

- to persist beyond a single generation, they *must reproduce* successfully and in sufficient numbers to guarantee replacement.
- as water-based organisms, they *must consume water*.
- to grow and move, they *must find and consume nutrients.*
- to survive adverse climates, they *must find shelter*.
- in carrying out these activities, they *must avoid threats*.
- to pursue these activities successfully, they *must resist constraints upon these behaviours.*

The taxonomy of behaviours I have emphasised above need not be comprehensive, my intention is only to demonstrate that for any behaviour there may be many more valuable stimuli in an environment than there are behaviours required to address those stimuli appropriately[18].

I return now to the enhanced stimulus response model based upon an amphibian: assume that, for the amphibian, behaviour R_1 is appropriate for detection of odours of predators A and B; assume further that some other behaviour R_2 is appropriate for food stimuli C and D, then the optimum behaviour may only be selected by means of a neural mechanism by which A, B, C and D are paired with their responses in a computational network, permitting only the optimum response to occur. On this account, if the enhanced amphibian is assumed to be driven by reflexes, the neural

[17] I have taken these behaviour types from Panksepp's *Affective Neuroscience.* They represent a number of basic responses to stimuli in mammalian species which are inborn and can be understood separately from behaviours acquired throughout the lifetime of the animal by means of operant conditioning or learning.
[18] To exemplify: for any number of nutrients, there need only be one consummatory behaviour and for any number predators, there need only be one flight behaviour.

structures required to select the optimum response between multiple stimulus-response pairings would not be simplified by its responding to multiple stimuli with a limited set of behaviours. (See Diagram 6b. below)

In view of the limitation of response types, a natural step for reducing the complexity associated with the process of prioritizing multiple stimuli would be to permit diverse stimuli to trigger a single response, a behaviour which is appropriate to that stimulus group. But to gain advantage from this step, something important must occur: *the process which allows the subject to prioritize the most appropriate behaviour can no longer be an invariant mechanism in which a stimulus evokes a fixed response;* rather that stimulus must activate an intermediate neural entity. It is this intermediate entity which will both evoke the designated behaviour for that stimulus group and represent the stimulus when arising in competition with alternative intermediate entities supporting different behaviours which provide optimum responses for other stimulus groups.

To exemplify: an animal will evoke response R_1 in the presence of the odour of predators A or B. But the simplification implicit in this development entails a loss of ability to discriminate behaviourally between these stimuli[19], so that if the animal were confronted simultaneously by A and B, it would be unable to prioritize its response to these two stimuli. In effect, this is of secondary importance for the animal's wellbeing; what is important is that the animal should flee upon the detection of either stimulus.

I will assume now – just as in the example previously offered for the amphibian - the mammal is also offered two food stimuli, C and D inviting the consummatory response R_2. I will now assume that for the mammal, there exists some intermediate neural entity, E_2, capable, not of comparing stimulus-response mechanisms, as per

[19] In making this distinction, I am assuming that the paired stimuli have equal intensities. I will demonstrate in chapter 14 that in the case of the presentation of multiple stimuli at different intensities evoking the same behaviour, the animal's response will be calibrated to the most intense stimulus.

the amphibian, but rather acting as a comparator of behaviours – and that for A and B there exists a similar neural entity, E_1. The determination of the optimal response to four stimuli is achieved by a single comparison $E_2 \leftrightarrow E_1$ in which E_1 is dominant, suppressing E_2 and inhibiting behaviour R_2. (Diagram 6c.)

Diagram 6b

'Amphibian' model for selection of optimal response with four stimuli-response pairs

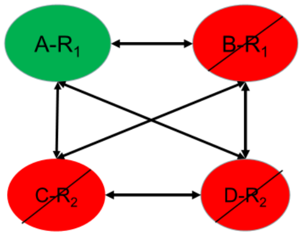
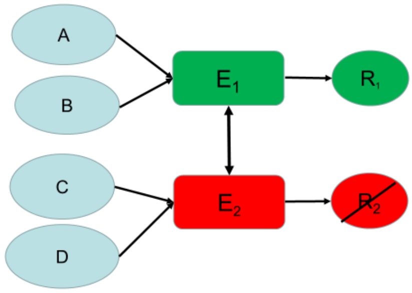


Diagram 6c

'Mammalian' model for selection of optimal response to four stimuli



Summary: The Lower Boundary of Emotion - Reflexive and Primitive Emotional Models

The contrast I have drawn above constitutes the basis for a claim that the 'enhanced amphibian' model is one in which a stimulus will automatically trigger a response and hence would conform closely to Lazarus's description of a behavioural process as 'reflexive', whereas I have proposed that the mammal is able to activate some intermediate neural entity which is able both to generate a behaviour and prioritize behaviours in the presence of multiple stimuli. Such a mental entity, acting independently of the stimulus, could provisionally be described as conforming to my earlier definition of 'cognitive'.

I intend to argue that the intermediate mental states characterised by E_1, E_2 are brain modes corresponding to primitive emotions and that the lower boundary of emotion can be understood as existing between those behaviours which follow reflexively from a single stimulus type and those behaviours which are the outcome of a brain mode which may arise in response to multiple stimuli. The evidence I have presented thus far is insufficient to support this claim. On the face of it, the 'brain modes' I have presented as primitive emotions might be components of a more elaborate and extensive stimulus-response mechanism.

To establish the intermediate brain modes represented by E_1, E_2 as cognitive, a much richer range of function must be attributable to these conditions than the ability to prioritise responses. The evidence I will present will draw upon the research of neuroscientists and ethologists into the behaviour of mammalian species. I will demonstrate that primitive emotional states, *inter alia,* promote the acquisition of valuable stimuli throughout the lifetime of the animal and are able to represent the salience of emotional stimuli in the strength of response instantiated.

My intention is to present the functions of primitive emotion as *nonintentional and cognitive,* so that in responding to existing stimuli and acquiring new stimuli, the animal may do so nonintentionally. In introducing this possibility, I shall not challenge the cognitive-evaluative argument that animals may also evoke emotional states through intentional processes. But even in the absence of intention I will argue that primitive emotional systems provide viable and complex mechanisms for the detection and rendering of value

Chapter 7: The Neurobiological Foundations of Primitive Emotional Systems

7.1 Introduction

In his work, *Affective Neuroscience,* Jaak Panksepp provides evidence that some species possess a set of neurobiological mechanisms which will evoke characteristic responses to the identification of valuable objects. He claims that these mechanisms - neural systems originating in the subcortex or proximate brain locations, sometimes characterized as the limbic system – are basic emotions, common to all mammalian species. He offers this explanation for the existence of the feelings associated with these states:

"Feeling states may have been a neurosymbolic way for the brain to encode, in relatively simple fashion, intrinsic values for the various behavioural options that are open to an organism in a specific situation" (1998 p.183)

By restricting my account to the emotional states of mammals, I do not assert that similar subcortical affective states are not found in other species - there is good evidence that birds also exhibit affective neurologies. However, as my purpose is to examine the role of emotion in human thought processes, Panksepp's claim that subcortical affective systems exhibit homologies in mammalian cerebral anatomy allows me to review the action of emotions at this shared mammalian level in the light of the expression of human emotional states as described by psychologists and philosophers.

Research available from neuroscience and behavioural science supports a view of primitive emotion as providing a core mental architecture for mammals; it provides a set of elementary responses to objects or events of importance for the wellbeing of the subject, whilst enabling the animal to adapt during its lifetime, both in terms of the range of stimuli it is able to discriminate and the responses it is able to generate.

The action of these core affect systems requires a good deal of explanation. In response to this challenge, Chapters 8 to 14 pull together the results of scientific research into the causes and effects of subcortical affect systems, expressed as both neurobiological states and behaviours, with the object of incorporating these accounts into a model for the action of primitive emotions which can usefully be compared with the cognitive-evaluative accounts described previously. To do this, a methodology is employed in which scientific research into the action of affect in mammals is progressively expanded from a description of a set of subcortical neural systems into an account of primitive emotions as brain states able both to access and direct perceptive, memory and motor centres.

It could be argued that the account I am about to present strays too far into the realms of cognitive science and that my purpose might be equally served by challenging the philosophical theories of emotion previously discussed using individual counterexamples from primitive emotional theory. This approach could be effective in contesting the view that emotion is exclusively evaluative. However, my aim here will be to create an account of primitive emotion from the findings of cognitive science which is internally consistent and can serve not only as a tool to challenge some of the views of philosophers working in the field of emotion but, more importantly, may be understood as a separate account of emotion, functioning in parallel with - and interacting with - emotion as a cognitive-evaluative phenomenon.

My approach to presenting this research will be as follows:

1. It will initially be necessary to pick out from Panksepp's account of basic emotions those aspects which represent primitive emotional states. Panksepp uses the term 'basic emotions' to indicate the class of affective states he has identified. But, in addition to describing the action of basic emotions as automatic responses to environmental stimuli, Panksepp's account incorporates claims regarding the action of these affective states in higher processes of cognition, and I shall argue that these higher cognitions can be treated separately from the action of basic emotions at a subcortical level.

2. I will propose that these subcortical mechanisms conform to the outline requirements contained in my earlier description of the role of primitive emotions as neural states which mediate between stimulus and response, and I shall offer a much fuller account of their action.
3. A range of primitive emotions will be elaborated in which a number of discrete neurobiological systems - acting and interacting automatically to instantiate a number of physiological states and behaviours - can be understood as accounting for *primitive mammalian* behaviours without appeal to the notion that the subject animal is acting intentionally.

The requirement for the notion of a primitive mammal is driven by neurobiological and psychological accounts of mammalian ethology which indicate that for mammalian species, primitive emotional states may be subject to regulation by later-evolving mental processes. These higher functions tend to mask – to a greater or lesser extent – the action of emotions at the subcortical level. The concept of a primitive mammal, therefore, provides a theoretical construct for revealing the collective action of primitive emotions independently of these controlling brain functions. It takes as its premise the notion that each emotion is activated by its own range of characteristic stimuli in which stimulus, brain mode and response comprise a 'primitive emotional system'. The collective action of the full range of primitive emotional systems, when conceived as operating independently of other mental states, provides a framework of basic responses to environmental threats and opportunities which enable a mammal to survive and flourish.

*7.2 The Existence of Subcortical Homologies between Mammalian Species***.**

In Paul MacLean's 'triune brain' theory (Kral 1973), the brain is viewed as a layered structure, progressively established by an evolutionary process whereby the earliest stratum, consisting of the spinal column and basal ganglia (which still constitute the entire executive function of the reptilian brain), is succeeded by the elements of the limbic system (emotional type systems) arising in 'paleomammalians' with the more recent development of the cortex to be found in 'neomammalians'.[20]

Commenting upon MacLean's theory, Panksepp observes: *"Considerable evolutionary diversity has been added by species-typical specialisation in the higher brain areas as well as lower sensory motor systems [ ], but [ ] the basic affective value systems deep within ancient recesses of the brain appear to be reasonably well conserved across mammalian species."* (1998 p.303).

Panksepp provides evidence that the cortex does not have an executive function in more primitive mammalian species; these key functions are provided by sub-cortical systems. According to this account, the primary behavioural functions of mammalian brains are emotionally-driven and located at a subcortical level, and it is this level of function which I attribute to a primitive mammal. Higher brain functions regulate the effects of emotional systems, hence protecting the animal from the potentially dangerous extremes of behaviours induced by primitive emotional drives.

7.3 Basic Emotions and E-states

Panksepp provides extensive neurobiological evidence for the existence of a number of basic emotional mechanisms in causing mammalian behaviours as diverse as foraging, rage-induced, fear-induced, sexual, caring (maternal), distress, play and predatory aggression, but Panksepp makes additional claims for the interaction of these subcortical systems with neocortical emotional processes, which I will exclude from my explanation of emotion as 'primitive'.

In choosing to treat basic emotions at the subcortical level, I am aware that I have chosen to by-pass a very important element of Panksepp's conception: that is, I am ignoring for the moment the existence of an extensive network of neural circuitry for

[20] Deacon (1990) has provided a more extensive and nuanced commentary.

exchanging information between these subcortical mechanisms and higher brain functions. Panksepp has a good deal to say with respect to the action of basic emotions in higher cerebral processes which he argues are often evoked as conscious expressions of emotion. I do not dismiss these observations; rather, I am hoping presently to develop a more structured model of the relationship between subcortical emotions and the cognitive-evaluative accounts of emotions as appraisals – accounts which are recognised in Panksepp's text.

In order to clarify the distinction between Panksepp's basic emotions and the set of subcortical states which I intend to characterize, I will designate these core emotional states using the term of art 'E-state' and I list below Panksepp's description of the properties of basic emotions (1998 p.49) each presented with my own observations either contrasting or comparing those properties with that of the corresponding E-state.

1. *"The underlying* [emotive] *circuits are genetically predetermined and designed to respond unconditionally to stimuli arising from major life-challenging circumstances."*

    - The term 'life challenging' is potentially misleading, perhaps implying that basic emotions arise only in response to threats or situations of peril. A study of Panksepp's text shows that this was not his sole intention[21]. I believe my definition of a homeostatically valuable object provides a better fit with his concept of a stimulus. Other than this, Panksepp's description accords with that of an E-state.

2. *"These circuits organise diverse behaviours by activating or inhibiting motor subroutines and concurrent autonomic-hormonal changes that have proved*

[21]For example, Panksepp's account of the action of hunger as a homeostatic regulator (1998 p.170-177) demonstrates that a rat may forage and eat, well before its wellbeing is threatened by loss of bodyweight.

adaptive in the face of such life-challenging circumstances during the evolutionary history of the species.”

- My notion of an E-state extends beyond Panksepp’s concept of a basic emotion inasmuch as it encompasses the characteristic brain mode and its associated physiological and behavioural manifestations.

3. *“Emotive circuits change the sensitivities of sensory systems that are relevant for the behavioural systems aroused.”*

   - Here Panksepp is describing an aspect of the neurophysiological response of the organism to an emotional stimulus. (See also Mackintosh, Tolman, Vuilleumier and Driver)

4. *“Neural activity of emotive systems outlasts the precipitating circumstances.”*

   - My interpretation here is simply that E-states arise as a chain of neural events, but once aroused, each link continues to function, creating a state of the entire animal. Panksepp does not clarify here that withdrawal of the HVO will lead to the abatement of a basic emotion. But while the sequence in which the S-O-R chain arises is predetermined, withdrawal of the HVO may cause behaviour to cease, while physiological arousal often persists.

5. *“Emotive circuits have reciprocal interactions with the brain mechanisms that elaborate higher decision-making processes and consciousness.”*

   - Panksepp makes many allusions to the interaction between ‘emotive circuits’ and brain mechanisms which regulate the action of those circuits. I accept that such mechanisms exist, but my purpose here will be to establish the extent to which Panksepp's emotive circuits (which I call brain modes) together with the behaviours and visceral states which they arouse, are able to account for much of the behaviour of simpler mammalian species – those with less cortical development.

The difference between our explanations reduces, more or less, to this: Panksepp views the subcortical affect mechanisms he has identified as a component of a much wider range of mental activity which he describes as basic emotions - processes entailing high levels of 'reciprocal interaction' with higher brain function - whereas I am attempting to identify the nonintentional elements of basic emotions which I will argue are realised in the operation of these subcortical mechanisms.

By adopting this approach, my intention is to investigate the extent to which E-states are able to account for the ability of primitive mammals to address a wide range of cues with appropriate behaviours, without resorting to the action of Panksepp's 'higher decision-making processes and consciousness' as explanation.

My model of an E-state, therefore, is a subcortical system in which a stimulus has aroused a characteristic state of the animal, consisting of a brain mode, a set of visceral, sensory organ and musculoskeletal conditions, supporting a disposition[22] to behave in a particular manner – all acting together so that they collectively describe the entire condition of that animal. My concept of a *primitive mammal* takes as its premise the notion of a mammal, driven only by the action of E-states, being the physiological and neurobiological states of the animal necessary to deliver an appropriate response to the stimulus detected. This state will persist as long as the stimulus is

[22] Rather than 'a disposition to behave' it would have been simpler to use the word 'behaviour' here, but my explanation will demonstrate that although a primitive mammal upon entering an E-state will normally instantiate a behaviour automatically, that behaviour is sometimes withheld as a result of competing subcortical affect processes (Chapter 14).

present, and a primitive mammal is completely dependent upon the action of these states for the determination of its behaviour.

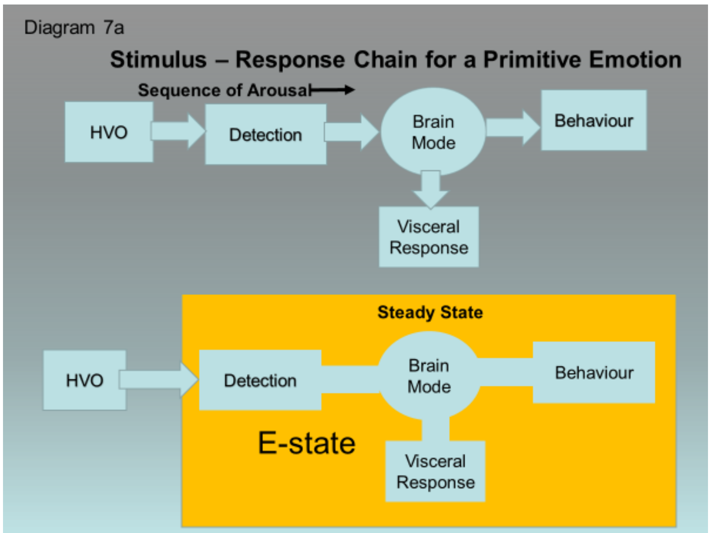
The notion of a primitive mammal may be closer to reality for some mammalian species than might be imagined: much of the ‘higher level’ regulation of emotional behaviour in mammals is controlled by the cortex. In order to test the effect of cortical function, Panksepp allowed his students to observe the behaviour of two rats, one of which had had its cortex removed:

“asked to observe two animals one normal and one decorticate, [the students] *typically mistook one for the other. This arises from the fact that decorticates are more active, while the normal animals appear more timid [ ] The ability of such decorticate animals to compete effectively with normal animals during bouts of rough-and-tumble play is further testimony to the likelihood that internal self-coherence is subcortically organized”* (1998 p.308)

None of the actions of a primitive mammal is intentional: an animal enters into an E-state without possessing any mental apparatus to intimate that it might, at some other time, have been in some other state.

A primitive mammal in any one of these states conforms to the requirements of Putnam’s probabilistic automaton (1975) in which the description of the automaton’s operating system can apply to the realisation of any one of a range of discrete states (in this case E-states). Putnam’s automaton is able to shift between states in response to changes in sensory inputs, and each state, when active, will generate a characteristic motor output, so that, for example, a primitive mammal stimulated by the presence of its offspring *x* into caring behaviour, ‘**a’,** is in a different neurophysiological state A, to state B, when that same animal exhibits stalking behaviour, ‘**b’,** towards its prey *y*.

An E-state arises as the result of a brain process in which a stimulus generates a behavioural response. In Diagram 7a. ‘Stimulus-Response Chain’ presents a fixed sequence of mental and physical events in which a homeostatically valuable object is detected, giving rise to a characteristic brain mode which in turn instantiates behavioural and physiological responses appropriate to the homeostatically valuable object. This diagram depicts the order in which each element activates the subsequent ‘linked’ element. A good way to think of this is as a train with carriages, each linked to the next by a length of chain. As the engine begins to move, a certain length of time is required for each chain to tension. This period constitutes a transitional state but once each chain is under tension, the train and the carriages move synchronously. When all elements are operating synchronously, the resultant state of the system is an E-state. This phase of arousal will take much less than a second to work through.



An animal which is in the throes of stimulus/response arousal cannot be understood to be in any state[23]; rather it is undergoing a process of transition between E-states.

The lower Diagram in 7a. represents, not a chain of causality, but a neurophysiological state of the animal in which all elements of the stimulus-response chain are acting

[23] One way to understand this condition is by the term ‘reaction time’ – the time it takes for a human to perceive a threat and act upon it. In this period, it is difficult to characterise our thoughts and behaviour as being in any particular state because they are in transition; our brain processes have not worked through to selecting the action appropriate to the external threat.

collectively. The interaction of all these elements is an E-state. This state will persist as long as the stimulus is present.

7.4 E-states and Primitive Emotional Systems

E-states have a much broader role than that of effecting a response to an unconditioned stimulus. As will be demonstrated, the findings of researchers such as LeDoux (1996, 2000), Mackintosh (1975, 1976), Dickinson (1980) and Olds (1977) – all of whom have analysed mammalian behaviour in response to an array of stimuli - confirm that the outputs of an E-state are not limited to the triggering of visceral and motor functions; they may extend *inter alia* to the acquisition of stimuli by conditioning and the modification of behaviours by operant conditioning. These effects are complex for any particular E-state but in Chapters 10-13 I intend to provide evidence that the relationship between E-states and their activating stimuli can be expressed as a set of general principles:

1. An E-state can be understood as acting as a proxy for any one of its initiating stimuli so that the stimulus will evoke some E-state, having a nature and an intensity which represent an appropriate behavioural expression towards that stimulus as it is presented.
2. An E-state, when activated by some inborn process of stimulus identification in response to an unconditioned stimulus, may cause the subject to discriminate and retain associated, but previously affect-neutral, cues as conditioned stimuli, with the effect that the neutral cue will subsequently activate that same E-state in the absence of the unconditioned stimulus. By this process a single E-state may become activated by an increasing array of unconditioned and conditioned stimuli.
3. In the presence of multiple stimuli, the different E-states aroused will each tend to displace the other in a bid to control the behavioural outcome, and it is both the nature and the intensity of each E-state which will determine the likelihood of a particular E-state-induced behaviour occurring[24].

[24] Although the ability of any given E-state to 'out-compete' another will, in part, be a function of its intensity, the competitive process is biased as to the nature of the E-state aroused. In general, aversive E-states will prevail over pleasurable ones, so that, for example, a rat subjected to even mild

The evidence I will provide will demonstrate that E-states may cause an animal to detect and respond to stimuli in a complex and unpredictable manner. An E-state, when aroused by an unconditioned stimulus, will act as the core mechanism for the capture of associated neutral stimuli (conditioning) or compete with other E-states in the presence of multiple stimuli. Seen from this perspective, any treatment of E-states which discusses these states independently of their arousing stimuli is likely to have a limited explanatory power. In consequence, my approach to investigating the action of individual E-states will first be to describe the neurobiological evidence for a particular state and subsequently to furnish that description with an account of the relationship between the E-state and its arousing stimuli, the entirety of which I shall term a *primitive emotional system*.

7.5 Primitive Mammalian Ethology as a Product of the Action of E-states

Chapters 8 and 9 will explain the ethology of a primitive mammal as the product of primitive emotions acting separately and collectively. Following this account, I will extend my description to include the categories of stimuli which will activate a characteristic E-state, in which the response to a stimulus is mediated by the E-state brain mode.

It might be objected that primitive emotional systems as I will describe them carry little significance for philosophical theories of affect, but I hope to demonstrate that the range and action of these emotional processes, in conjunction with their associated stimuli, provide a rich and diverse explanatory substrate of affect systems which motivate and influence emotional appraisals.

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foot shock will immediately cease playing or eating. These relationships are not fixed: a hungry rat will eat rather than play and if the foot shock intensity is low enough, it will endure a shock rather than starve.

In his taxonomy of basic emotions, Panksepp uses upper case lettering to indicate each emotion (e.g. RAGE). This measure is intended to encourage us not to take too narrow a view of the word by regarding it as a simple behaviour or as any single intermediary process which might cause that behaviour, but rather as the combination of neurological and physiological states that precede and accompany rage-induced behaviour. I will continue to use this method of indicating the separate subcortical affect mechanisms when referring to corresponding E-states

A closer examination of each class of emotion reveals that they may contain some important sub-classes. For example, Panksepp provisionally includes ‘predatory aggression’ as a sub-class of RAGE, whereas it appears to be a neurobiologically distinct class of affect. Again, some emotions such as CARE appear to be comparatively late evolutionary arrivals, tending to find their origins in earlier emotional processes such as LUST.

Chapter 8: SEEKING – Panksepp's 'Goad without a Goal'

Panksepp's identification of SEEKING as an emotional state alongside more generally accepted forms such as FEAR and RAGE is controversial and in view of some unique aspects of this primitive emotion and its effects, it will open my explanation of primitive emotional types.

The emotion SEEKING is associated with two very different stimulus types: first, it is aroused by homeostatic imbalances such as hunger and thirst which I describe as *urges*. Second, and more controversially, SEEKING is associated with the detection and passive acquisition of unfamiliar objects.

In the following paragraphs, I will describe the stimulating effects of the onset of physical urges in the arousal of the SEEKING emotion.

8.1 Urges

Urges as I shall describe them here are not E-states, rather they describe a fairly narrow class of neurobiological states of the organism which arise unbidden and increase in intensity if the homeostatic imbalances they signal remain unaddressed.

Other words have been used to describe these phenomena: I have not used 'desires' because desires may be generated intentionally; 'impulse' is, I think, not quite right: it carries too much of a sense of the actions required to correct the homeostatic imbalances which these conditions signal. The sort of things I have in mind here are internally-arising stimuli such as hunger, thirst, a need for warmth and the urge to reproduce. My intention here is to describe how these urges arise and to explain the roles they play in triggering SEEKING.

In selecting hunger, thirst and thermal balance as a class of stimulants for an organism[25] Panksepp is able to locate the circuits and neurochemical processes which generate these conditions. He details the neurological processes which register the presence of homeostatic imbalances (locating their function primarily in neural pathways found in the hypothalamus).

Much of the evidence provided by Panksepp in his account of urges relates to the ability of specific brain processes which act to control energy supplies in the body both in the long and short term, and the behaviour which issues from these processes - the seeking and consumption of nutrients; I will briefly describe these processes as paradigmatic for the action of urges more generally.

From this research, Panksepp concludes that there exist mechanisms in the brain which normalise fat reserves by the generation or suppression of the urge to eat. He identifies the joint action of these two mechanisms by investigating the comparative neurologies of normal rats with that of rats which are genetically disposed to obesity - cases where appetite suppression does not occur.

From this evidence, he argues that the mechanisms which control feeding behaviour fall into one of two types:

1. The brain detects circulating nutrients and correlated substances in the blood and adjusts feeding accordingly.

2. The brain itself sustains an ongoing energy-dependent integrative process that simulates bodily processes and adjusts feeding in response to its own local energy transaction mechanisms.

Panksepp believes that both these mechanisms are continuously active.

[25] Panksepp also identifies LUST (i.e. the sexual drive) as an urge causing the subject to seek a mate (SEEKING) but treats it separately. He further speculates that sexual drives and behaviours are the evolutionary precursors of maternal behaviour (CARE)

The critical (but not the only) location in the brain for controlling weight is the ventromedial hypothalamus (VMH). The VMH has metabolic properties which distinguish it from other brain systems. It is the only system to have insulin sensitivity, enabling it to monitor and control a long-term signal of body energy status, whilst local measurement of VMH energy levels may generate a signal to suppress feeding during repletion states. These VMH signals have a small sustained effect on eating behaviour, rather than acting summarily to terminate any single meal. This means that a rat may indulge in short bouts of opportunistic gluttony without impairing its long-term optimum metabolic function.

Taken as a whole, this complex system of hunger-inducing/inhibiting states challenges the assumption that in the presence of food, a rat will always eat; or that it will eat the same amount of food whenever the opportunity presents itself. And Panksepp argues that there are cases in which a rat would not eat at all[26].

The act of eating therefore does not occur predictably in response to the presence of food, or its associated stimuli, but is the outcome of a number of complex long-term and short-term brain processes which make the animal more or less responsive to food-related stimuli. Despite this complexity, the urge to eat is expressed as a single impulse; it is as if all the factors involved in causing hunger have come together to operate a single dial, which can be turned up or down in response to an amalgamation of short-term and long-term requirements.

8.2 SEEKING

In identifying hunger, thirst and thermal balance as motivating drives, Panksepp locates the ‘circuits’ or neurochemical processes which generate these states. He outlines the interaction between bodily imbalances and the neurological processes which register their presence and describes how such neurobiological imbalances act upon other motivational brain systems (Diagram 8a.).

[26] Apart from longer-term VMH controls and short-term satiety controls, a rat that has experienced illness as a result, say, of eating cheese will refuse cheese and a rat in a state of fear will not eat.

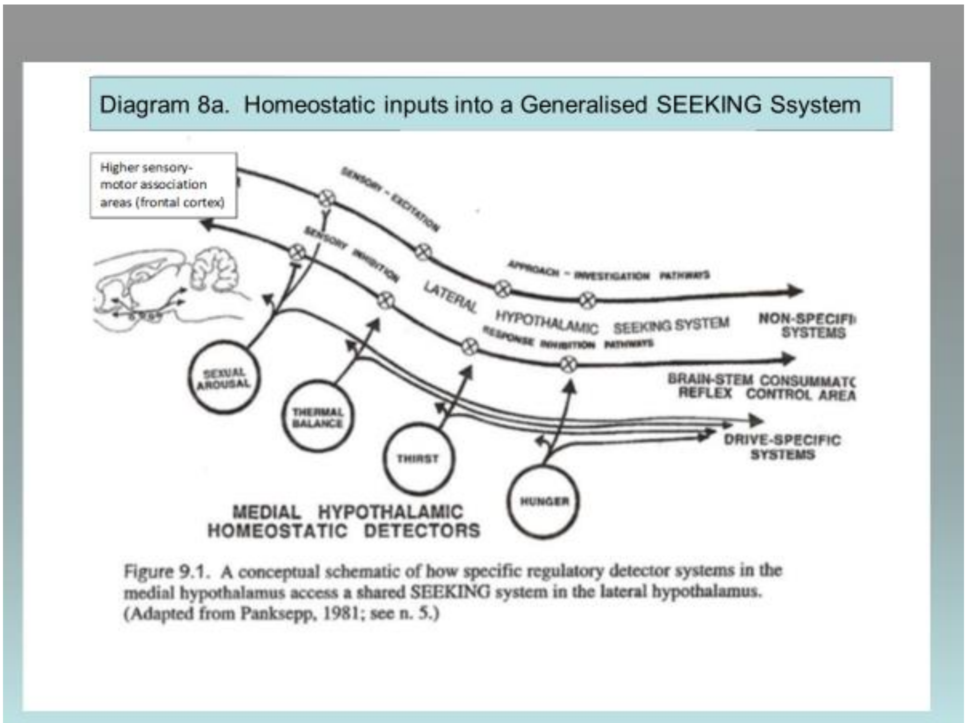


Figure 9.1. A conceptual schematic of how specific regulatory detector systems in the medial hypothalamus access a shared SEEKING system in the lateral hypothalamus. (Adapted from Panksepp, 1981; see n. 5.)

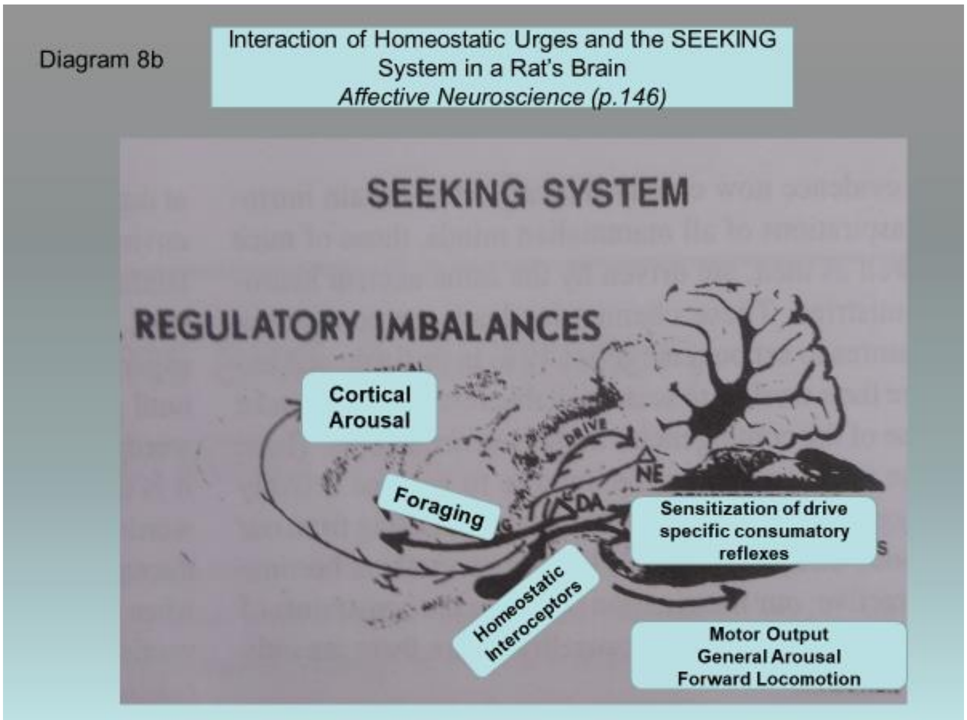
According to Panksepp's account, the drive to satisfy our bodily needs cannot be understood as a response to external stimuli but arises as a consequence of homeostatic imbalances. If urges arise as the result of the detection of internal homeostatic imbalances, then this creates a potential argument against my concept of a primitive mammal able to function without access to intentional cognitive processes: if, in Panksepp's account, an animal is driven by urges to eat/drink/find shelter, the valuable objects necessary to satisfy those urges (nutrients, water or shelter) need not be present; and for a primitive mammal, there is no necessary relationship between the fact that, say, it is hungry now and the fact that there are sources of nutrition elsewhere in this world which could satisfy that hunger.

And even if we were to assume that for each primitive mammal, some inborn mental faculty existed with the function of representing the goal object for each urge, it would serve no obvious purpose in assisting the animal to locate that object in its absence. However, Panksepp has identified a basic emotion which prompts an animal to forage in response to urges: so, if I am thirsty, my thirst acts as a general foraging stimulus and SEEKING is the E-state supporting this foraging behaviour; so that - as it were – the foraging animal carries its thirst around with it, with the effect that when it encounters water, a separate consummatory behaviour is initiated in which the animal will detect and consume water and receive a reward - the pleasurable sensation of consuming water when one is thirsty. In this way the emotional state 'SEEKING' can be understood as bridging the spatiotemporal gap between having an urge and satisfying that urge. In this manner, an urge is carried into the presence of those objects which will satisfy it.

8.3 Panksepp's Evidence for a SEEKING E-state

8.3.1 The location and action of the LHSS neural pathway

The brain locus of the SEEKING system consists of a bundle of transhypothalamic circuits arising in the ventral tegmental area (VTA) and extending forwards to the nucleus accumbens. Panksepp notes that electrical stimulation of this area evokes an energized forward motion and sensory arousal. He characterises this pathway as the Lateral Hypothalamic SEEKING System, or LHSS (See diagram 8a. above).



The LHSS pathway (originating at point DA in Diagram 8b. to indicate that this core system is dopamine activated) is able to instantiate purposeful responses to homeostatic imbalances. In the simplest case, the LHSS tract acts as an engine which can be activated by a range of urges, thereby sustaining the organism in foraging[27] activity in the absence of the 'goal' object. Viewed more extensively, Panksepp offers the LHSS as the brain's core motivational system, functioning independently of the urge-satisfying objects which it serves to locate. Such a concept constitutes an important hypothesis, not just for cognitive science but for any exploration of mental function.

8.3.2 Neurochemical effects associated with the arousal of SEEKING

The core LHSS system is associated with the action of dopaminergic[28] neural systems in the core (subcortical/limbic brain systems) including the amygdala and can extend to areas of the frontal cortex. Panksepp notes that norepinephrine and epinephrine also play a modest facilitatory role. These neurochemical effects cause the characteristic sensory arousal associated with the SEEKING state, and if the sought-after object is located, they trigger the release of neurotransmitters involved in consummatory behaviours.

8.3.3 Electrical Stimulation of the SEEKING Response: Two Experiments into the action of the LHSS

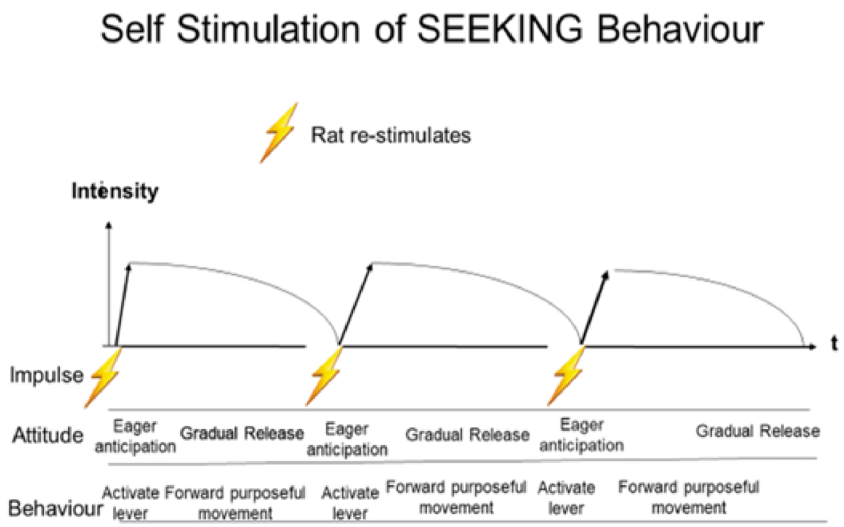
i) The Effect of Electrical Self Stimulation of the LHSS pathway

Taking LHSS activation in its most basic form, Panksepp describes an experiment in which the LHSS may be electrically stimulated to activate the SEEKING behaviour: *"If one presents the animal with a manipulandum, a lever that controls the onset of brain stimulation* (by electrical stimulation of the LHSS), *it* (the rat) *will readily learn to press the lever and will eagerly continue to 'self stimulate' for extended periods, or until physical exhaustion and collapse set in. The outward behaviour of the animal commonly appears as if it is trying to get something behind the lever. This is not the kind of behaviour one sees when animals are either pressing levers to obtain*

[27] I will explain subsequently how the foraging activity is shaped to locate specific goal objects.
[28] Dopamine specific or dopamine-related mechanisms

conventional rewards or when they are actually engaged in consuming them. (1998 p.145)

Diagram 8c.



It will be noted that the only reward the rat receives for self-stimulation of the LHSS is a further spate of forward, eager movement. The urgency of the rat's movement is combined with an arousal of the senses. In Diagram 8c. above, I have attempted to represent the operation of the self-stimulation process. The onset of stimulation is characterised by the increase in dopamine levels along the LHSS pathway. As the level of this neurochemical diminishes, the animal will self-stimulate by pulling a lever, suggesting that this activity is preferred to a passive state.

ii) *External Electrical Stimulation of the LHSS Pathway*

Panksepp's concept of an undifferentiated LHSS process is founded in the failure of attempts of other experimenters such as Valenstein (1973) [29] to discover discrete circuits in the lateral hypothalamus for specific homeostatically valuable goal objects;

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[29] Valenstein's experiments in the 1970's were prompted by the behaviourist notion that each urge-related behaviour (e.g. eating, drinking, thermal balance) could be tracked backwards via a dedicated brain system to the satisfaction of a particular stimulus type

to exemplify: according to Valenstein's hypothesis, a particular neural strand of the lateral hypothalamic pathway would be concerned with the sensing and consumption of water, with another guiding the location and consumption of food. This did not prove to be the case: *" what these researchers did, quite simply, was to study 'stimulus bound' eaters, drinkers and gnawers* **after** *they took away each animal's preferred goal objects, while leaving two other goal objects available throughout prolonged periods of intermittent electrical stimulation of the brain* [that is, at the same hypothalamic location]. *By morning, most animals had shifted to another behaviour."* (1998 p.153)

In summary he notes:

"The experiments indicated that the hypothalamic motivational system that was activated when animals exhibited distinct behaviours was non-specific. The lateral hypothalamus apparently mediated some process other than the specific behaviours observed." (1998 p.153).

In Valenstein's experiments, electrical brain stimulation (ESB), in which the lateral hypothalamic pathway was stimulated remotely, caused animals to 'latch on' to any goal object available, and the stronger the ESB signal, the more rapid and vigorous the switch between goal-directed behaviours became, causing Panksepp's rebuttal of the behaviourist argument for separate motivational pathways directed toward specific homeostatic goals.[30]

8.4 Discussion

This evidence supports the hypothesis that the LHSS is a multi-purpose motivational mechanism rather than a bundle of neural circuits, each dedicated to instantiating separate HVO-directed behaviours (i.e. for hunger, thirst etc..).

[30] *"if there were many systems coursing through the LH, one would have predicted that a movable electrode could be repositioned into different sites to yield different motivational behaviour as it passed through different neural systems. In fact, a single animal tended to show a single behaviour in such experiments."* (Panksepp p 154).

If the onset of SEEKING is occasioned by a homeostatic imbalance, its conclusion is signalled by what Panksepp describes as 'consummatory behaviours'. These behaviours commence when the SEEKING behaviour – the eager anticipatory forward movement, and sensory arousal - brings the animal into the proximity of an urge-satisfying object. When such an object is detected, behaviour will normally change[31]. For a predator, it may entail stalking and predatory aggression, and for rats, the discovery of food will be preceded by a different, more leisurely approach behaviour, licking and/or manipulating the food prior to eating, which are accompanied by neurochemical changes in the brain which reward the subject for its achievement and terminate the SEEKING state.

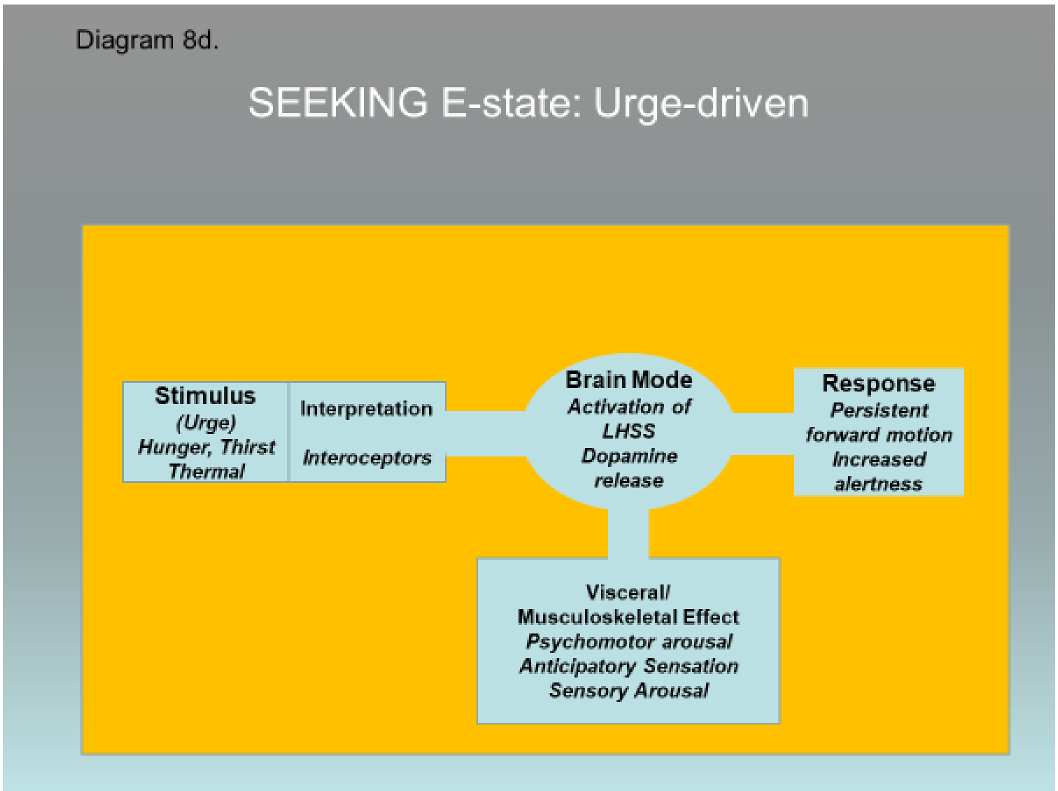
Panksepp acknowledges that SEEKING has characteristics which distinguish it from other emotions. SEEKING acts as the core motivational system for any primitive mammal – 'a goad without a goal'- explaining the apparently objectless but purposefully directed activity which we associate with foraging in many species. He observes that most emotions arise and subside quickly, whilst SEEKING is 'tonically engaged' – that is, an animal will persist with SEEKING behaviours for extended periods, whereas the other animal emotions appear to be relatively short-lived.

In sum, the SEEKING E-state has as its stimuli a number of urges, signalling homeostatic imbalances which are detected and transmitted to the LHSS via a network of interoceptors (sensory receptors which transmit information within the body). The neurodynamic action of the LHSS, when activated, will cause sensory and psychomotor arousal and bring the animal into a purposeful forward motion, whilst the release of dopamine, epinephrine and norepinephrine will generate a feeling of anticipation which is associated with this activity.

Panksepp's account of SEEKING as an emotion is one of a set of commonly occurring stimulus/response mechanisms observed in mammalian species which he as-

[31] Brain neurochemistry is also altered.

cribes to the action of basic emotional mechanisms, collectively forming a neurological architecture which will support its wellbeing or promote its survival (Diagram 8d).



Chapter 9 - Non-SEEKING Primitive Emotions

Introduction

Panksepp describes SEEKING, RAGE, FEAR and PANIC as the "major 'Blue Ribbon, Grade A' emotional systems of the mammalian brain." (Panksepp p52).
Of these systems, I have dedicated a good deal of space to the explanation of SEEKING because it describes an important emotional process which would not be immediately recognisable to most readers. It connects our physiological urges to the behaviours which satisfy those urges and I will demonstrate (Chapter 12) that its occurrence is associated with the passive acquisition of information, as opposed to the acquisition of cues by classic conditioning. In these respects, SEEKING differs from Panksepp's other basic emotions.

FEAR and RAGE are emotions which are comparatively straightforward to characterize as neural mechanisms and have causes and effects which are commonly observed and understood. However, Panksepp's inclusion of PANIC as a 'blue ribbon' emotion is less easy to accept. According to Panksepp's account, PANIC is one of a cluster of later-evolving emotions, including maternal care and play, which find their origins in the neural circuitry and neurochemistry of early reptilian sexual behaviour. These later-evolving states drive various aspects of socialisation amongst mammalian species.

Panksepp devotes a substantial part of *Affective Neuroscience* to elaborating these emotional mechanisms and it is the very quantity of this information which presents a dilemma for the writer of a thesis such as this: I intend to argue that the primitive emotions which Panksepp describes are not peripheral to our everyday experience of emotion, but central to it. I also intend to argue that primitive emotions act - and can be understood as acting - in the absence of intentionality. My dilemma is this: if I simply assert that such neuroscientific explanations of emotion exist and share the general characteristics of E-states, I am open to the very reasonable objection that I have not explained how, say, FEAR, RAGE and LUST are realised in separately explicable neural mechanisms which conform to those characteristics. However, if, in responding to this challenge, I embark upon a full explanation of the differences between E-states, I am committed to providing a precis of Panksepp's lengthy account, which perforce must be one of neuroscience, being neither appropriate for this thesis nor necessarily of interest to philosophers.

The approach I have determined upon therefore, will steer a course between these alternatives. In the following pages, I intend to compress and tabulate Panksepp's evidence for the existence and action of the basic emotions in terms of their neural circuitries (neurodynamics), their neurochemical constituents and the somatovisceral and behavioural effects evoked, and I will present these components in the form of a particular E-state, supported by sufficient reference for the reader to explore the neuroscience more extensively if necessary.

I am conscious that in providing this highly abridged version of Panksepp's work, I am omitting many of the important details of his explanation, particularly in the field of neurochemistry. Here is Panksepp's description of one of the effects of oxytocin:

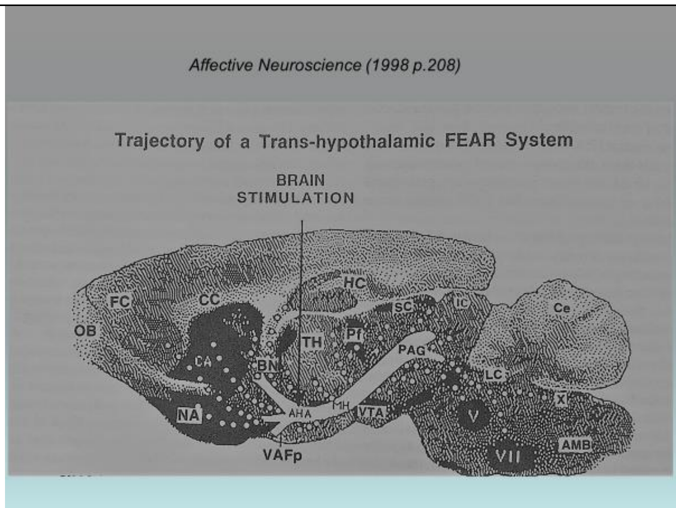
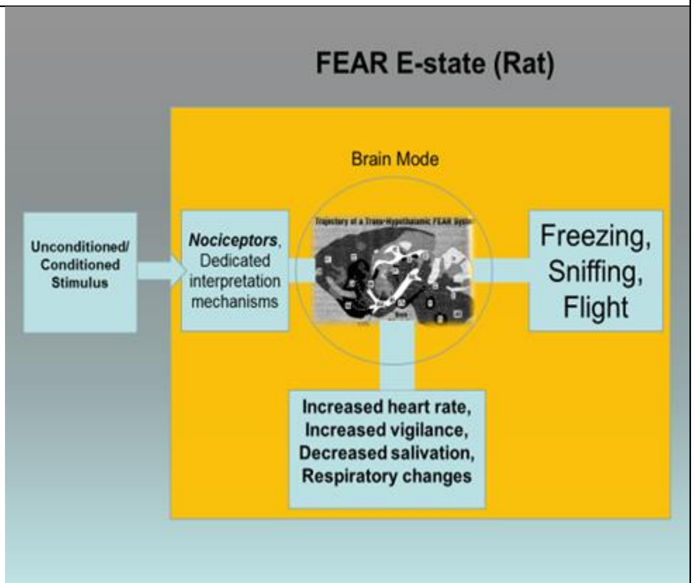
"at modest levels, brain oxytocin appears to help cement social bonds that may be the foundations for future reciprocities and 'friendships' while excessive activity may lead to social aloofness. One thing modern neuroscience has revealed is that the brain is full of apparent puzzles and paradoxes, and that logic is not as good a guide to knowledge in the natural sciences as careful observation!" (1998 p.231).

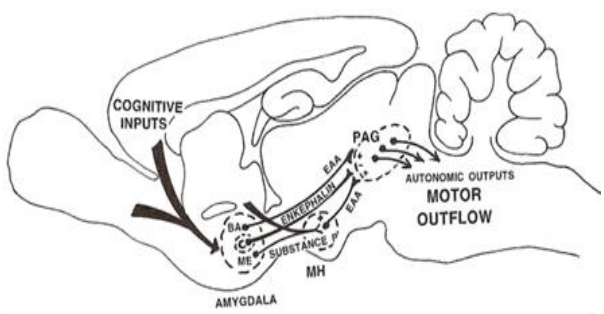
Any close examination of Panksepp's text will leave no doubt that brain chemistry can be complex and sometimes rationally perverse, but it is equally apparent from his account that emotional pathologies can be treated successfully or ameliorated by inducing alterations to brain chemistry by the selective employment of the neurochemicals which Panksepp identifies as being associated with states of emotion; to exemplify: if I suffer from chronic anxiety, it is possible by the administration of Diazepam to modify, not only my anxious state of mind, but also the things I tend to think about.

In sum, while there is little doubt that any primitive emotion is associated with the complex but incompletely understood action of characteristic arrays of neurochemicals which promote the functioning of certain neural pathways and inhibit the action of others, there is equally little doubt that such neurochemistries are central to the direction and tone of our emotional activity.

But this evidence alone is insufficient for understanding primitive emotions as processes. Just as I have proposed that physiological urges are specific stimuli for SEEKING, hence completing my account of SEEKING as a primitive emotion, I will propose that each E-state is evoked by a certain class of stimulus, employing evidence from cognitive and behavioural sciences. It is this combination of stimulating phenomena, together with their characteristic E-states, which explains the role of emotion as mediating the relationship between the animal and its environment.

In this way, I hope to demonstrate that E-states act in a manner which would allow a primitive mammal to acquire and behave appropriately towards an array of external cues which may expand throughout the animal's lifetime.

<table>
<tr><td colspan="2">Table 9(i) FEAR</td></tr>
<tr><td>Neural Pathway</td><td>Neural Schematic</td></tr>
<tr><td>“These are in the lateral and central zones of the amygdala, the anterior and medial hypothalamus and, most clearly (and at the lowest current levels) within highly specific PAG areas of the midbrain. Of course this highly connected network interacts with many other emotional [ ] especially RAGE circuits, as well as the behaviourally nonspecific chemistries of the brain such as norepinephrine and serotonin.” (1998 p.208)</td><td>
</td></tr>
<tr><td>Characteristic Neurochemistry</td><td>E-state Schematic</td></tr>
<tr><td>The action of neurochemicals which inhibit the transmission of fear signals are better understood than those which promote them. Panksepp identifies the presence of Benzodiazepine (BZ) receptors along the FEAR pathway described above. These receptors promote GABA binding, hence inhibiting the transmission of FEAR impulses along the pathway. However, it has been demonstrated that in the absence of these inhibitory neurochemicals, the FEAR system is not ‘tonically’ (continuously) engaged. And the search for neurochemicals which arouse FEAR has produced a number of candidates such as kainic acid, CRF, α-MSH, ACTH and CCK – all of which will generate specific FEAR-associated responses – has as yet produced no all-purpose FEAR generating agent, of the type provided by Diazepam in reducing FEAR symptoms. (1998 p.217-219)</td><td>
</td></tr>
<tr><td>Behavioural Manifestation</td><td>Physiology</td></tr>
<tr><td>Flight, ‘freezing’, elimination, startle, vigilance</td><td>Rapid heartbeat, sweating, respiratory changes, gastro-intestinal symptoms, increased muscle tension, decreased salivation</td></tr>
</table>

<table>
<tr><td colspan="2">Table 9(ii) RAGE</td></tr>
<tr><th>Neural Pathway</th><th>Neural Schematic</th></tr>
<tr><td>The core brain circuitry for the RAGE E-state originates in the medial amygdaloid areas and runs downward through the stria terminalis to certain locations in the periaqueductal gray (PAG). The system has an organisation in which aggressive ‘higher brain’ impulses evoked from the amygdala are critically dependent upon the involvement of lower brain functions for their effectiveness, whereas the lower regions are able to instantiate RAGE states without the involvement of the amygdala. (1998 pp.193-198)</td><td>

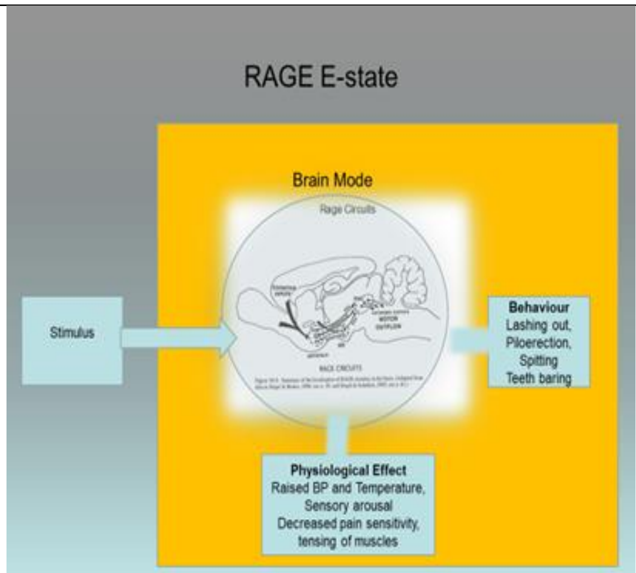
Summary of the localisation of RAGE Circuitry in the brain. Adapted from data in Siegel and Brutus, 1990; see n.39 and Siegel and Schubert, 1995; see n.81</td></tr>
<tr><th>Characteristic Neurochemistry</th><th>E-state Schematic</th></tr>
<tr><td>The neurochemistries associated with RAGE are not well understood currently, although Substance P, a neuropeptide, is thought to be a regulator of states associated with RAGE-type states. Despite this limited understanding of the states which promote RAGE, a wide variety of drugs are found to combat aggression by promoting the generation of neurochemicals such as oxytocin, oestrogen and progesterone, GABA, stimulating the opioid systems of the brain. All these neurochemicals are associated with non-aggressive emotional activity and hence compete with or suppress RAGE-like states. (1998 pp.201-203)</td><td>
</td></tr>
<tr><th>Behavioural Manifestation</th><th>Physiology</th></tr>
<tr><td>RAGE-induced behaviours vary between species; in humans RAGE is characterised by a wish to lash out at an aggressor and to raise one’s voice but in cats the state it is more complex, consisting of body arching, piloerection, tail lashing, snarling, spitting and teeth baring.</td><td>Physiological responses involved in RAGE include raised pulse and blood pressure, increased temperature and a general state of sensory arousal together with a decreased sensitivity to pain.</td></tr>
</table>

Table 9(iii) CARE

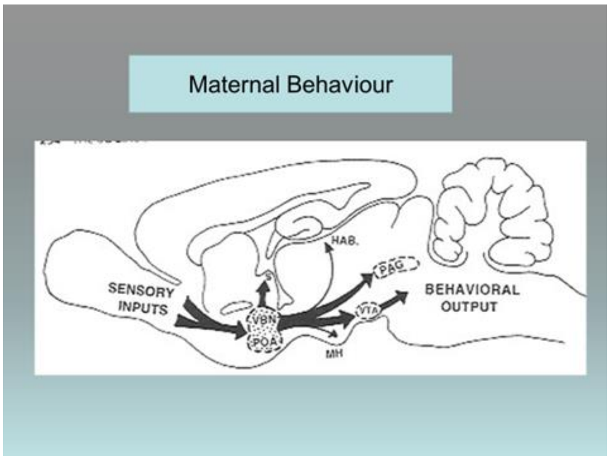
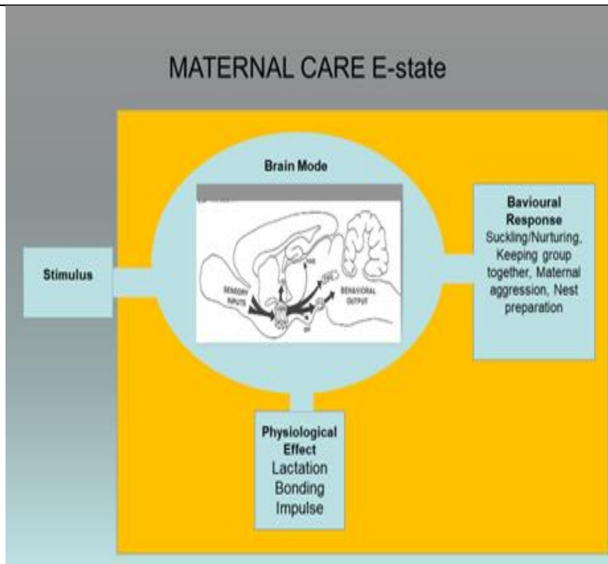
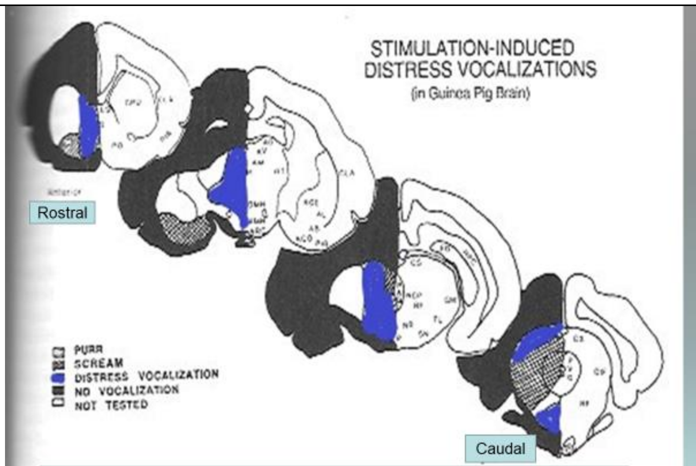
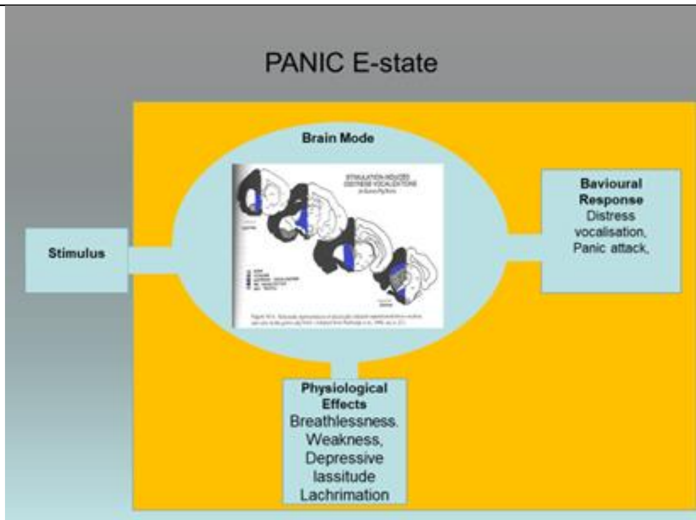
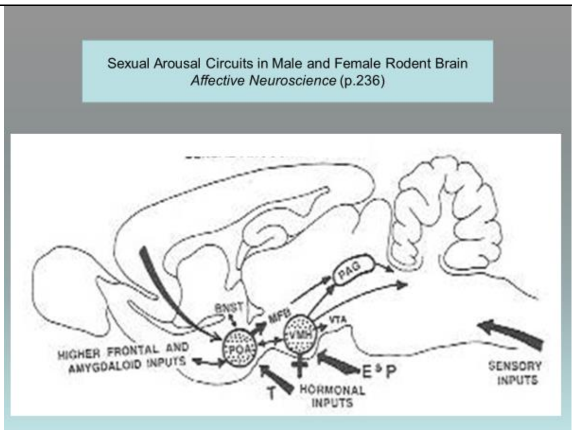
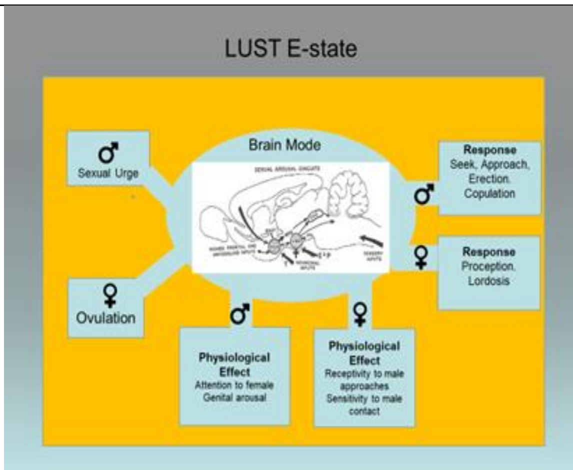
Neural Pathway	**Neural Schematic**
The neural pathways for maternal behaviour are located in the dorsal preoptic area (POA) and the ventral bed nucleus of the stria terminalis (VBN) situated above the location evoking male sexuality. These cells control nurturing behaviour in both females, and to a lesser extent in males. Neural pathways emerge from the POA/VBN into the ventral tegmental area (VTA) which activates maternal behaviour in the presence of oxytocin. Pathways from the POA/VBN also extend into the septal area (S), the periacqueductal gray and the habenula (HAB). (1998 pp.253-254)	*Affective Neuroscience* (p 254) 
Characteristic Neurochemistry	**E-state Schematic**
*"The brain chemistry of female nurturance has been associated with the generation of oxytocin. However, oxytocin alone does not cause maternal behaviour. Early experiments confirmed that "**the elimination of peripheral oxytocin did not eliminate subsequent maternal behaviour**" "* (Panksepp p251) *"To get a robust effect from oxytocin infusions into the brain, females need to be primed with injections of oestrogen [ ] finally and quite perplexingly, oxytocin is only effective if animals have been habituated to test chambers for a few hours but not if they have been habituated for a day or more. [ ] well established maternal behaviour no longer requires brain oxytocin arousal."* (1998 p.252)	
Behavioural Manifestation	**Physiology**
Nest building/preparation; keeping the young together; suckling/nurturing	Lactation

Table 9(iv) PANIC (Separation Distress)	
Neural Pathway	**Neural Schematic**
The PANIC system originates close to the pain response system in the midbrain peri-acqueductal gray (PAG) and may have evolved from that system. It extends from the PAG to the preoptic area via the bed nucleus of the stria terminalis and the dorsomedial thalamus. (p267-268)	 Schematic representation of electrically induced separation-distress vocalisations in guinea pig brain *Affective Neuroscience* (p 267)
Characteristic Neurochemistry	**E-state Schematic**
Neurochemicals which promote distress vocalisation in young animals are CRF (Corticotropin releasing factor) and a number of glutamate receptor stimulants (particularly those acting on kainite and NMDA receptors). (1998 pp.268-271)	
Behavioural Manifestation	**Physiology**
Distress vocalisation, lachrimation, panic attacks. lassitude	Appetite loss, depression, breathlessness. Long term separation causes an inability to interact with other members of the species (estrangement)

<table>
<tr><td colspan="2">Table 9(v) LUST</td></tr>
<tr><td>Neural Pathway</td><td>Neural Schematic</td></tr>
<tr><td>Two major brain locations are involved in the differential control of male and female sexual behaviours, the medial preoptic area (POA) and the ventromedial hypothalamus (VMH). The POA is enlarged in males and promotes sexual competence, whereas the VMH is more influential in promoting female sexual receptivity. The POA is more central to the generation the sexual behaviour than in generating socio sexual activity. For this reason, sexually-experienced male rats with lesions to the POA will seek access to receptive females but will not mate. The systems operate in part by activating the sensory input channels which promote sexual activity. (1998 pp.230-239)</td><td>


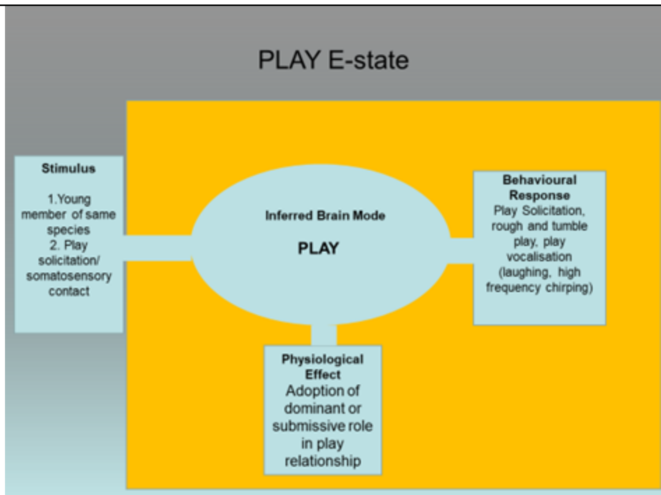
</td></tr>
<tr><td>Characteristic Neurochemistry</td><td>E-state Schematic</td></tr>
<tr><td>Male: The medial preoptic area of male rats contains testosterone receptors, activating sexual activity at maturity. In other species DHT (dihydrotestosterone) receptors are also active in arousal. (1998 pp. 231-236)

Female: hormonal changes associated with egg fertility cause gradual rises in oestrogen, succeeded by a rapid rise in progesterone which prepare the female brain for heightened sexual receptivity. (1998 pp.236-242)</td><td>


</td></tr>
<tr><td>Behavioural Manifestation</td><td>Physiology</td></tr>
<tr><td>Male: Approach, erection, copulation

Female: Proceptive behaviours,: decrease in aggressiveness towards sexually aroused males. Active solicitation of male attention (proception): sensitization of female copulatory reflex ‘lordosis’ (1998 p.239)</td><td>Male: Urge to copulate associated with VMH arousal (causing SEEKING-type behaviour for mate). Genital excitation:
Female: Sensitivity to male contact initiating lordosis.</td></tr>
</table>

<table>
<tr><td colspan="2">Table 9(vi) PLAY</td></tr>
<tr><td>Neural Pathway</td><td>Neural Schematic</td></tr>
<tr><td>The PLAY system is incompletely understood as a neural mechanism. The baseline form of play in mammals is 'rough and tumble' play (RAT) which is initiated via somatosensory contact. In rats, it may be induced by dorsal contact and in human infants by tickling. Panksepp observes that when this somatosensory information enters the thalamic projection areas specific motivational effects are found: "At that level somatosensory information diverges into the specific thalamic projection areas of the ventrobasal nuclei that project discriminative information up to the parietal cortex and into nonspecific reticular nuclei [ ]that seem to elaborate a ludic motivational state within the animal." (1998 p.291)</td><td></td></tr>
<tr><td>Characteristic Neurochemistry</td><td>E-state Schematic</td></tr>
<tr><td>Owing to the limited understanding of the PLAY system, it has been difficult to identify the neurochemistry of that system definitively. A wide variety of neurochemicals will inhibit play including oxytocin, CRF and nicotine agonists - as do high levels of opioids. Conversely, moderate doses of morphine promote playful activity. Many of the inhibitory effects observed may be caused by the neurochemical arousal of competing emotional circuits, which suppress playful motivation. (1998 pp.293-294)</td><td>



</td></tr>
<tr><td>Behavioural Manifestation</td><td>Physiology</td></tr>
<tr><td>Solicitations to play via physical contact followed by rough and tumble play. High frequency chirping (rats), laughter (humans) (1998 pp.287-289)</td><td>Open-mouth displays are a common prelude to play in humans (laughter), chimpanzees and dogs, 50Khz chirping in rats</td></tr>
</table>

Notes regarding the PLAY E-state

In my tabulation of characteristics of the PLAY E-state (p.144), I have specified two stimulus types - somatosensory contact and/or the presence of a young member of the same species. I do this because the neurology associated with PLAY is insufficiently characterised and in its absence Panksepp has employed the robustness of the stimulus-response relationship to infer the existence of a PLAY brain mode. To establish this relationship, Panksepp has studied and measured the incidence of 'rough and tumble play' in rats, normally commencing when the rat is twenty days old (see Chapter 14, Diagram 14b.). In this research, Panksepp has established a clear pattern of response to a particular class of stimulus.

Panksepp's attempts to trace the circuitry of the PLAY brain mode from the somatosensory stimulus to the behavioural impulse fail due to the number and diversity of brain locations aroused in both the subcortex and the cortex. In order to simplify this process Panksepp has also compared the play behaviour of both normal and decorticate rats; he notes: *"even though decortication does not eliminate play, it seems clear that play has powerful effects on the cortex [ ] one of the adaptive functions of juvenile play may involve programming various cortical functions."* (1998 p.291).

In sum, Panksepp has identified a play behaviour which is reliably aroused by a somatosensory stimulus and may be observed to vary reliably without cortical intervention, and he has observed the frequency and content of PLAY behaviour as a function of subject age, social isolation and neurochemical state. He concludes that while such play functions are predictably aroused and entail routine behaviours, rough and tumble play is too complex to be explained as the product of reflexive brain functions, and indeed, even when subjected to detailed examination, the brain circuits engaged are presently too complex to isolate. He nonetheless infers that the robustness of the core stimulus-response relationship must be the result of the action of subcortical circuitry (an E-state brain mode) whilst postulating that this mode may be elaborated in higher brain functions in more advanced mammalian species and humans.

Chapter 10 - Primitive Emotional Stimuli

Introduction

In describing E-state brain modes separately from their arousing stimuli or their behavioural and physiological effects, my aim has been to represent these mental phenomena as mediating the relationship between an object of homeostatic value and the behaviours aroused as responses to that object. In this way, I have prepared the ground for the concept of classes of stimuli, having homeostatic value, each of which arouses a particular E-state. To exemplify: in my explanations of SEEKING and PLAY, I have already introduced two particular stimulus/E-state relationships: SEEKING is aroused by physiological urges, whereas PLAY is aroused by 'same species' somatosensory stimulation.

The combination of stimulus and E-state constitute a primitive emotional system. If the arousing stimulus is unconditioned, then the entirety of the system is encompassed by the stimulus and its E-state, and it is this type of system that I will initially describe. However, cognitive science provides a good deal of evidence to support a further claim that the emotional states aroused by certain classes of unconditioned stimuli promote the acquisition of neutral cues by a separately instantiated but connected neural process, described as *conditioning*.

In my investigation of the conditioning process, my aim will be to demonstrate that a very extensive range of homeostatically valuable cues may be acquired by a primitive mammal during its lifetime, without resorting to the notion that the animal has intentionally acquired that information, or is aware that such a process is occurring. In order to produce this explanation, it will initially be necessary to review the findings of behavioural scientists with regard to the nature and function of unconditioned stimuli.

10.1 Unconditioned Stimuli

10.1.1 RAGE-Inducing Stimuli

Moyer (1976) has identified seven classes of aggressive behaviour in mammals:

1. Fear-induced aggression (the ‘cornered animal’)
2. Maternal aggression (a mother protecting her offspring)
3. Irritable aggression (local irritation not sufficient to induce flight)
4. Sex-related aggression (in the presence of sexual stimuli)
5. Territorial aggression (same-species)
6. Predatory aggression (attacking/killing prey)
7. Inter-male aggression (rutting)

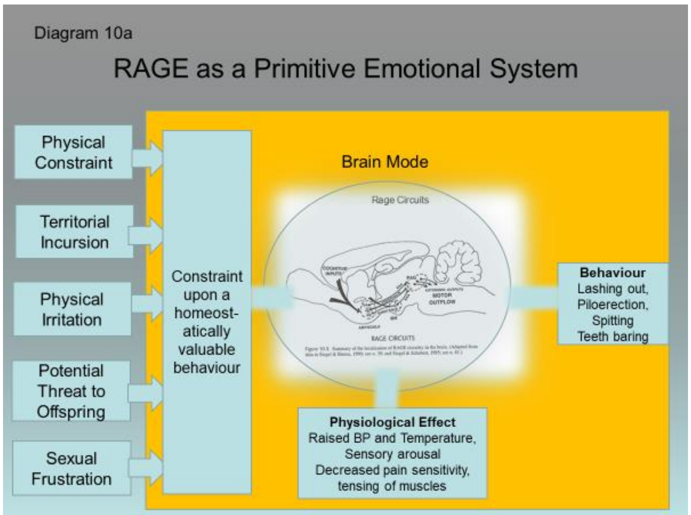
Panksepp’s view of these multiple expressions of mammalian aggression is that they can be simplified further into three classes of response:

a. Classes 1, 2, 3, 4 and 5 evoke the basic emotion RAGE.
b. 6 and 7 are instantiated as brain modes other than RAGE. Predatory aggression appears to derive from an adaptation of the consummatory behaviour which succeeds SEEKING, whereas the circuits which Panksepp attributes to intermale aggression seem to be more closely aligned to male sexual neurodynamics and neurochemistry.

In the first five classes, the circumstances described are unconditioned stimuli inducing RAGE-like behaviours in which the response is evoked spontaneously.

I will provide an example of a RAGE-induced behaviour of this type; a colony of meerkats, when they attack members of a distant but adjoining territory, do so for motives which are resistant to explanation as the outcome of rational processes accessible to the species. To account for such a behaviour as the outcome of an inferential process would entail that members of the defending group were able to judge that the opposing group had committed some territorial incursion. This appraisal would entail a notion of a territorial boundary enclosing an area of land, which would, in turn, be informed by some apprehension of the long-term necessity for the preservation of the limited sources of nutrients within that boundary for the wellbeing of the group. To argue, as Solomon has, that emotions are: "*subjective engagements with the world"* entailing *"complex sets of aspirations, expectations, evaluations, needs, demands and desires"* (2004 p.77), moves us no further forward in this attempt to understand how it comes about that one group of animals will defend a territory against an adjacent group of the same species.

In sum, the RAGE-inducing stimuli which cause resistance to territorial incursions may have homeostatic value, but it is a value which does not appear to be manifested as the outcome of an inferential process. Panksepp believes that the original RAGE motivation was a reaction to physical constraint in which a highly aggressive ('cornered animal') response could be successful[32]. He speculates that through a process of species adaptation, the RAGE behaviour[33] has proved to be an effective response to a wide range of constraints. According to this account, each of the various classes of RAGE-inducing stimuli described by Moyer are detected by some inborn mechanism, as representing potential constraints upon the animal's pursuit of homeostasis (Diagram 10a.).



[32] Panksepp notes that newborn infants will exhibit RAGE behaviours if their arms are held down for a short period.

[33] I have previously described the effects of electrical brain stimulation (ESB) of the RAGE pathway in which electrical activation of RAGE circuits 'downstream' from the mechanisms of stimulus interpretation would evoke a single RAGE physiology and behaviour.

10.1.2 FEAR-Inducing Stimuli

Panksepp believes that there are inborn, fear-inducing stimuli native to each species. For example, humans have an inborn fear of dark places, approaching strangers, sudden movements and (less certainly) snakes and spiders, whereas rats fear well-illuminated areas, open spaces and predator odours. These are what I shall term *targeted stimuli*. Targeted stimuli activate some inborn interpretive process which is able reliably to identify some attribute of an HVO, triggering a FEAR-type behaviour.

But I will advance the notion that there exists a second, general-purpose class of FEAR-arousing stimuli which I shall term *blind stimuli*; the term refers to a stimulus which causes the animal to respond in the absence of stimulus information. I provide a fuller explanation of each class below.

I. Targeted Stimuli

In the case of a blind stimulus, the subject is able to respond without identifying the stimulus object[34], whereas for a targeted stimulus, an animal must possess an inborn mental paradigm of some class of homeostatically valuable objects, which enables it directly to discriminate objects of that class, causing FEAR-associated behaviours. I provide two examples of this stimulus type:

i) A vervet monkey will generate three call types in response to snakes, air-borne raptors or cat-like species, each of which will cause other monkeys to adopt behaviours specific to the avoidance of that particular predator.

ii) If rats are placed in an environment which has been treated in some way with predator odour (either cats or ferrets have a similar effect) they will display a FEAR response equivalent to that displayed for foot shock. Any detected level of odour will evoke high levels of aversive response.

[34] For example, I will withdraw my hand from a hot object without necessarily identifying that object.

II. Blind Stimuli

Contact

The senses, whilst being limited with regard to the nature and bandwidth of cues which they are able to detect, display responses which are a function of the raw intensity of the sensory input within those limits. So that in the case of touch, the skin contains a number of contact-sensitive receptors dedicated variously to the detection of stroking, pressure, stretching or vibration, but the skin also contains a particular set of receptors (nociceptors) able to register intense pressure such as a blow or a bite or pricking – sensations we would describe as painful (Kandel, Schwartz, Jessell) (2000 pp.411-470) tending to induce FEAR or perhaps RAGE (as irritation).

Taking the action of pressure upon the skin as registered by two receptor types[35] we can predict that there will be some very slight pressure at which the organism will register contact and some higher level of pressure (such as a pinprick) at which nociceptors are activated, causing the organism to act aversively. Early behavioural scientists would designate these two phases as thresholds: the lower threshold would be the lowest intensity at which a sensory stimulus is detected and the higher threshold would activate aversive behaviours. But this is an incomplete account: between the initial registering of a contact and the aversive threshold, there may be an increasing tendency to react - and even beyond the aversive threshold, increasing intensity may cause a progressively robust response.

The aversive responses I have described for skin contact apply also for sight and hearing: Both senses, whilst acting as conduits for light- and sound-encoded information, also display a variable response to raw stimulus intensity, so that white noise and white light, being states carrying no information, have 'initial detection' and 'aversive' thresholds corresponding to levels of intensity.

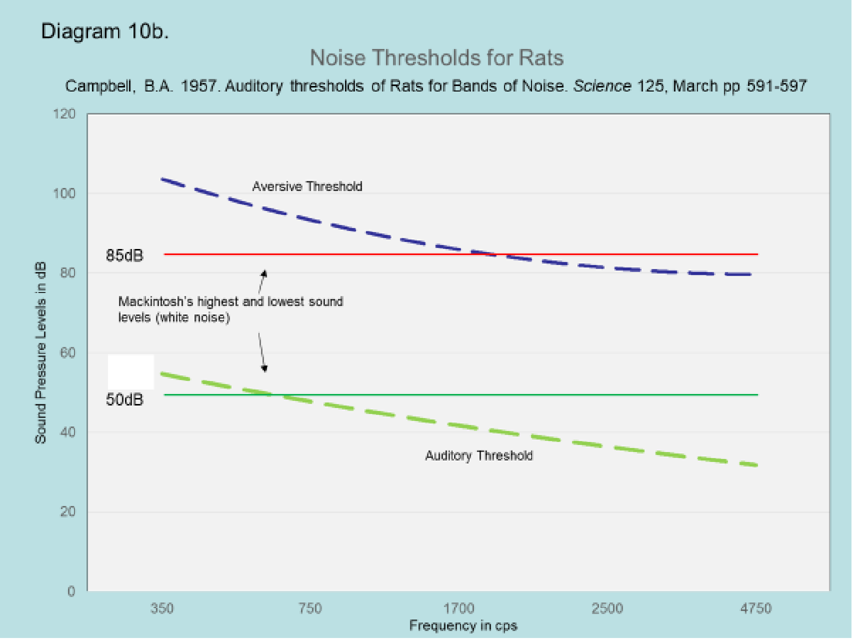
[35] Merkel disc receptors will register lower pressures whereas mechanical nociceptors will register sharp pricking pain

White Light and Noise

I will describe the findings of experiments by Campbell (1957,1969) and Whishaw (1974) to illustrate the effects of white noise and white light upon rats.

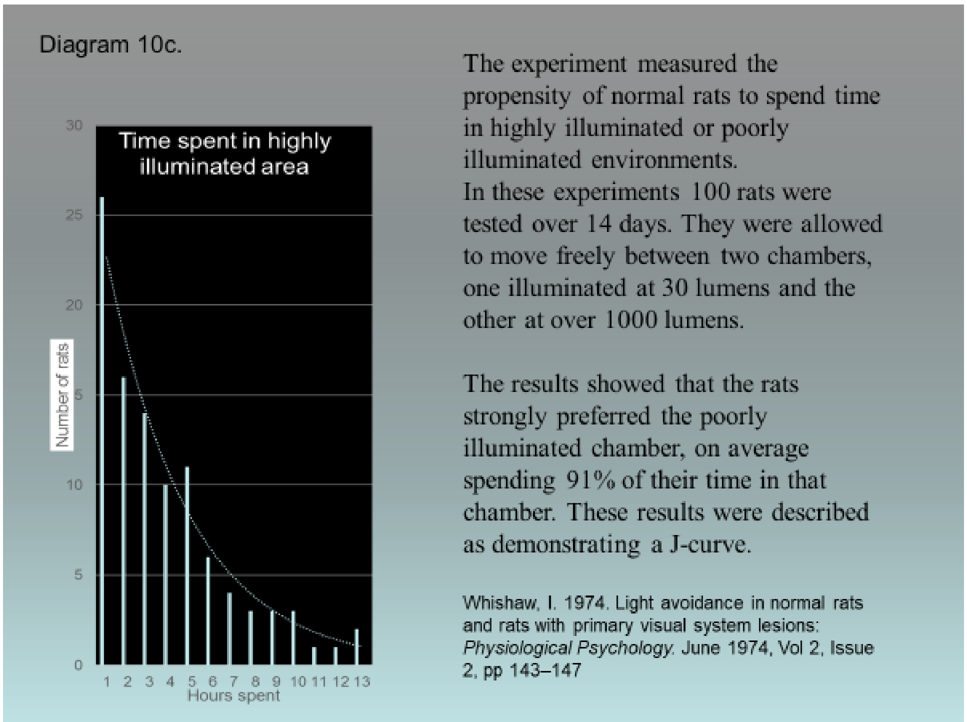
i) Noise

Campbell carried out two sets of experiments; the first designed to determine the lowest threshold at which a rat was able to detect white noise transmitted within narrow bands of frequency, and the second was aimed at determining the level at which the sound induced an aversive drive, causing the rats to move from the noisy chamber to a quiet one. Both thresholds were observed to correlate with frequency level (Diagram 10b.).



ii) Light

Whishaw studied rat's aversion to light (1974). The study began by assessing the behaviour of groups of normal rats when given the choice between a well-lit chamber and a chamber in relative darkness. The group as a whole strongly favoured the poorly-lit chamber. Whishaw subsequently attempted to locate the source of this aversion by testing smaller groups of rats with brain lesions to the cortex. None of these lesions caused any significant change in the 'J curve' structure response to light (below) indicating that the behaviour was rooted in some subcortical region. We could expect that if rats displayed no reaction to light intensity, they would spend 50% of their time in either chamber, whereas in the experiment, they spent 91% of their time in the poorly-lit chamber (Diagram 10c.).



Campbell (1969) had earlier performed a similar set of experiments in which light levels were varied between two chambers and the preferences of Sprague-Dawley rats for each chamber were assessed:

- When both chambers were at minimal but highly differentiated illumination levels (e.g. 0.03 vs 0.46 foot candles - an intensity change of c.15) rats preferred (74%) the lower levels of illumination but the preference was relatively low)
- When light intensities were increased to high but minimally differentiated levels (e.g. 300 vs 450 foot candles, an intensity change of 1.5) preferences were marked with rats strongly preferring the 300 foot candle chamber (97%).

From these two experiments, we can detect a general relationship between behaviour and stimulus intensity: as intensity increases, the rats will display an increasing tendency to escape from the high intensity area, a behaviour characteristic of the E-state FEAR.

Electric Shock

A common blind stimulus employed in conditioning experiments with rats is an electric shock delivered from the cage to the foot of the animal. Mackintosh has carried out a series of tests to determine the response of rats to increasing foot shock intensity. He characterized the strength of response as the length of time rats spent immobile ('frozen') after the shock was delivered.

The chart below maps the rats' response to current in terms of freezing time. It is clear from the data that foot shock is highly aversive, with a rapid increase in aversive response between 0.1 and 0.5 mA but at this point the response levels out. I describe this effect as 'response saturation'. A similar effect has been noted by Rescorla for white noise. He has measured the response of rats to broad spectrum white noise levels of 107dB (generally well above the levels tested by Campbell (see chart above) and Rescorla discovered that rats will display aversive (FEAR-driven) behaviours at high noise intensities, generally corresponding to those exhibited for foot shock.

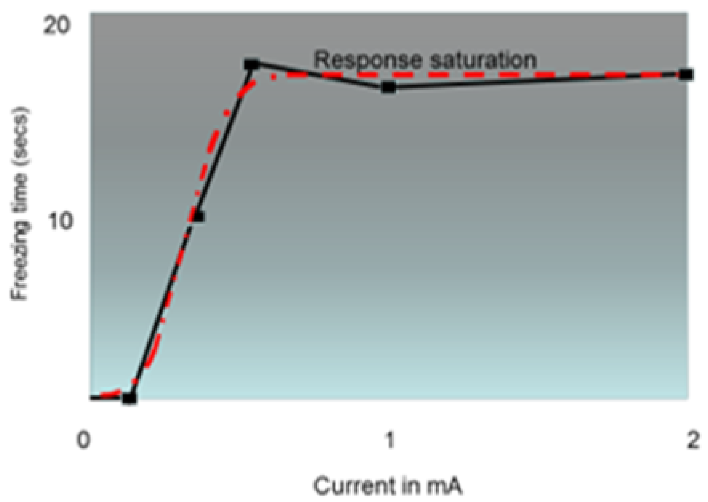
The response curve shown as foot shock intensity increases has three phases (Diagram 10d.):

- at low levels of intensity, at some point, detection will occur
- for a period thereafter aversive response will increase, generally as a function of intensity

- this increase is succeeded by a saturation level at which some maximum level of response is elicited.

Diagram 10d.

Response of rats to increasing foot shock intensity



Data taken from: Mackintosh, N.J. 1975. A theory of attention: variations in the associability of stimuli with reinforcement *Psychological Review* 82, pp 276-298

This 'S'-type curve displayed in the response to electric shock intensity can be interpreted as the layered action of two receptors, the first has the function of detecting and registering sense stimuli at low or moderate intensity, within a range at which sensory content may be effectively processed, whereas the second is responsive to sensory overload. At these higher intensities, the animal will increasingly experience the emotion FEAR causing it to 'freeze' if no escape is offered or to flee if the opportunity presents itself[36].

Summarising the action of Blind Stimuli

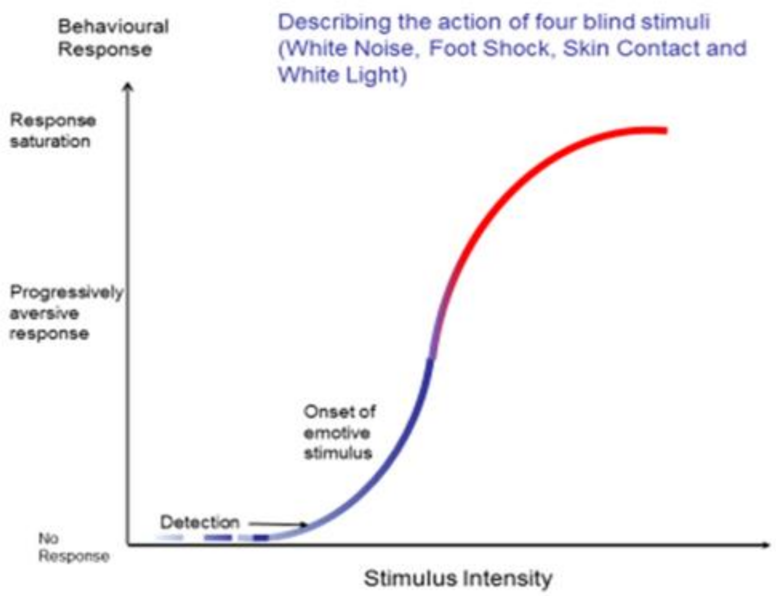
- A blind stimulus when detected by a sensory mechanism, will cause a response, which is a function of its intensity, without carrying information.[37]
- The response to a blind stimulus is automatic.

[36] As per Campbell and Whishaw's experiments when the rat moves to a lower intensity environment.

[37] White light and white noise, if transmitted on a continuous basis (that is, not as some intermittent signal) will each activate its sense without conveying content.

- The response to increasing sensory stimulation is non-uniform: there are threshold levels of sensory stimulus necessary to attract attention as the levels of these sensory stimuli are increased they will cause an increasing intensity of FEAR response.
- As the sensory stimulus continues to increase a saturation level of FEAR response is observed where fear-induced behaviours cease to increase in intensity. (See Diagram 10e.)

Diagram 10e.



Summary: Unconditioned Fear-Inducing Stimuli (Blind and Targeted)

I have proposed that there are two broad classes of unconditioned FEAR stimuli:

Blind Stimuli:

A blind stimulus is a raw sense-activating stimulus causing a response which is a function of the stimulus intensity. At high intensity, a FEAR response is generated, whereas at low intensities, the animal will attend to a blind stimulus without its arousing any emotion or response. I will propose that low intensity stimuli of this sort may act as neutral cues in the conditioning process.

The stimulating role of the senses can be understood separately from any function which those same senses might play in the interpretation of context. It is homeostatically valuable for an animal to flee in response to a loud noise, or intense heat without the objects which are the source of these threats having been identified.

Targeted Stimuli:
In contrast to blind stimuli which leave the issue of the source of the sensory assault unresolved, targeted stimuli can be treated as 'resolved'. Targeted stimuli can only arise if the source HVO is present. To register such stimuli, the animal must have an inborn ability to identify a particular class of objects, automatically initiating a state of FEAR.

By classifying unconditioned fear-inducing stimuli in this manner, a much clearer exposition of the processes entailed in cue acquisition by conditioning can be achieved.

10.3 Unconditioned Stimuli for LUST, CARE, PANIC and PLAY

Panksepp argues that the emotions CARE and PANIC are later-evolving basic emotions, which find their origins in subcortical LUST and pain circuitries respectively. Mammals produce vulnerable offspring with limited survival skills and CARE serves to support these offspring until maturity. Panksepp observes that:

"the nurturance circuits in the mother's brain and care-soliciting circuits in infants are closely intermeshed with those that control sexuality in limbic areas of the brain," (1998 p.247).

Compared to E-states such as RAGE and FEAR, the E-states LUST, CARE, PANIC and PLAY take a much narrower range of external objects for their stimuli – specifically, a fellow species member in a particular conformation. In the case of LUST it is a mature and sexually receptive partner; for CARE, it is a relationship between a mature adult and an offspring; and mirroring this relationship, PANIC describes the responses of an offspring towards parent absence. PLAY behaviour occurs most frequently between young animals at a particular stage of maturity and arises in response to behavioural signals, usually entailing mock aggression. As animals progress beyond this phase of maturity, play behaviour diminishes.

In the presence of an offspring, a parent – usually the mother – will adopt a characteristic nurturing behaviour. But the existence of a nurturing drive in primitive mammalian behaviour generates potential tensions between the urges associated with SEEKING in which the individual is motivated to attend to its own needs, as opposed to the demands of offspring for nurture and protection. In order to counteract the effects of other primitive emotional states in the parent, mammalian offspring generate signals - distress vocalizations - to attract the parent when they are failing to deliver the nurture required. PANIC-driven brain states and distress behaviours are instantiated in neural pathways which may be activated by electrical brain stimulation. Panksepp speculates that these systems emerged from earlier emotional processes:

"the systems that mediate separation distress emerged, in part, from pre-existing pain circuits. Here we will call this neural system the PANIC circuit." (1998 p.261).

The primitive emotional hypothesis excludes the notion of a single maternal instinct which drives both nurturing and defensive behaviours in the presence of offspring. If a primitive emotion describes the entire state of the animal, there can be no state which encompasses both nurturing behaviours towards offspring and aggression towards a potential predator. These states are motivated by CARE and RAGE separately. The two offspring-associated behaviours are explicable as the outcome of mutually supportive evolutionary processes: an evolutionary process which supported the nurture of vulnerable offspring without some defence against predators would fail, as would that of defending offspring in the absence of nurture.

10.4 Unconditioned Stimuli – Summary

In my explanation of the particular types of unconditioned stimuli which arouse primitive emotions, it will be noted, first, that the types divide into two broad classes:

- SEEKING, FEAR and RAGE in which a stimulus type is constituted of multiple stimulus tokens.
- LUST together with CARE, PANIC and PLAY, which Panksepp claims to be later-evolving emotions. These emotions are activated by a much narrower range of stimuli which regulate the behaviours of members of a species towards one another.

These emotions, together with their arousing stimuli are shown in Table 10(i).

Table 10(i)	***Stimulus Types and the E-states they arouse***
E-state	**Stimulus Types and Tokens**
SEEKING	**Internal Urges**: Hunger, Thirst, Body Temperature, Reproductive
FEAR	**Targeted Stimulus:** Inborn species-specific threat detection mechanisms **Blind Stimulus (raw sensory):** E.g. Contact, Heat, Light, Noise, Sting, Electric shock
RAGE	**Constraint:** E.g. Physical restraint, Physical irritation, Sexual rejection, Territorial incursion, Threat to offspring
LUST	**Potential Mate**
CARE	**Offspring**
PANIC	**Parental absence**
PLAY	**Young member of same species**

Perhaps the most striking aspects of the unconditioned stimuli I have categorised are their scope and diversity. These stimuli allow a primitive mammal to evoke a set of behaviours in support of its wellbeing as a response to the detection of a more numerous set of cues. Not only this - in responding to at least some of these cues, the animal will evoke a behaviour which is proportionate to the intensity of the stimulus presented. However, this by no means constitutes the entirety of the capacity of primitive emotions to mediate stimulus and response: to complete the primitive emotional model three more constituents will be proposed.

i) In Chapter 11 I will describe the effects of conditioning - neurological processes by which the subject is able to acquire new stimuli spontaneously in the presence of a primitive emotion.

ii) The process of conditioning is not fully explained as an effect of primitive emotion. Behavioural psychologists who have studied conditioning argue that the objects to be conditioned are attended preferentially, i.e. that objects have attentional salience. In Chapter 12 it is proposed that when undergoing an E-state, the subject may access separate attentional mechanisms which allow the characterization of novel objects, and a number of experiments are described which illustrate the ability of mammalian species to detect and retain object information by attention.

iii) In response to the range of stimuli which a primitive mammal is able to detect, some mechanism is required by which emotions are prioritized in the presence of multiple stimuli. In Chapter 14, I will describe Panksepp's model for the action of multiple emotions as mutually exciting or inhibiting and I shall provide an alternative model for emotions as competitive, albeit in a biased sense.

Chapter 11 - Stimulus acquisition by Classical Conditioning

11.1 Introduction

Rats are routinely used in experiments to assess the effects of conditioning. In these experiments the animal will come to associate previously neutral objects with fear-inducing stimuli. The experimental methodology employs some unconditioned stimulus such as foot shock (US) causing rats to exhibit an unconditioned fear response (UR), such as ‘freezing’. In the conditioning process, neutral objects presented in the presence of the US may be *acquired* so that the rat, upon subsequently encountering the acquired object (CS) in the absence of the US, will exhibit a fear-induced behaviour as a conditioned response (CR). This behaviour is sometimes explained by saying that the animal has *learned* to associate the neutral object with the experience of FEAR. The precise mechanism by which this happens is not known; as Panksepp puts it:

“In classical conditioning of this type it is not certain whether the CS produces the CR directly or indirectly via the activation of the US or UR processes in the brain. Although the most likely connection is directly to the UR system, direct connections could also be made to US representations in the brain, while direct connections to the CR seem less likely” (1998 p.19)

There is no strong evidence for the existence for the conditioning of neutral cues to conditioned stimuli which are presented in the absence of an unconditioned stimulus, an effect which is termed ‘secondary conditioning’.

11.2 Le Doux and Phillips’ Experiments concerning the Nature of Explicit and Contextual Cues associated with FEAR

In their 1992 paper Le Doux and Phillips attempted to characterise the neurology of the conditioned response in rats. Previous research had been successful in associating conditioned responses with activity in the amygdala and the hippocampus but the aim of this research was to assign (if possible) a role to each brain centre

The methodology used was straightforward. A control group of rats (n=4) were placed in an experimental chamber and conditioned to respond to a 20 second tone followed by a foot shock for two sessions on successive days. Following this initial conditioning they displayed the characteristic fearful response, assuming complete immobility or ‘freezing’ upon entering the experimental chamber in the absence of foot shock. This behaviour was described as being the response to a *contextual* stimulus (the experimental chamber). It was followed by a second freezing period when the tone – described as an ‘explicit’ stimulus - was sounded. The length of time ‘frozen’ was measured for both contextual and explicit cues in the absence of foot shock for four further sessions on successive days in order to assess the extinction of the characteristic fear-induced behaviour in the absence of shock reinforcement.

Having established an optimised foot shock level for conditioning, the experimenters operated upon three groups of rats to produce amygdaloid lesions (n=8), hippocampal lesions (n=25) and neocortical lesions (n=11)

Each group was tested under the same set of experimental conditions and the response of each group of rats is presented in Diagram 11a. below:

Diagram 11a. LeDoux J.E., Philips R.G. 1992. Differential contribution of amygdala and hippocampus to cued and contextual fear conditioning. *Behavioural Neuroscience*. Apr;106(2):274-85.

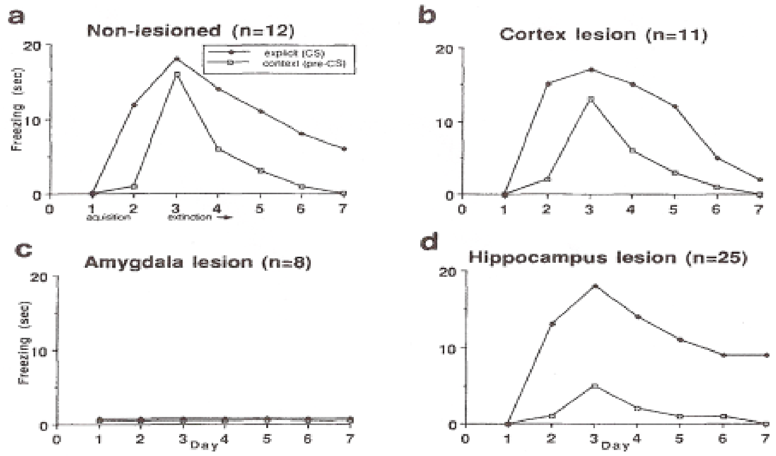


Figure 2. Effects of lesions of the amygdala and hippocampus on the acquisition of conditioned freezing responses to a cued conditioned stimulus (CS) and to contextual stimuli. (Lesions of the amygdala [c] interfere with conditioning to the cued CS and to the context, whereas lesions of the hippocampus [d] only interfere with contextual conditioning, compared with controls [a]. Lesions of the cortex above the hippocampus [b] have no effect on either form of conditioning. Conclusions are based on analysis of variance and post hoc tests.)

- Chart a. shows the effects of conditioning on the control group. The rats take one session longer to condition to the contextual cue (Experimental Chamber CS1) than to the explicit cue (Tone CS2). And after withdrawal of the foot shock on day 3, extinction is more rapid for CS1.

- Chart b. for rats with cortical lesions[38] shows behaviour largely unchanged, suggesting that the cortical area removed proximate to the hippocampus played a minimal role in the conditioning process.

- Chart c. Regions of the amygdala thought to be active in fear-related conditioning were removed[39] (i.e. lateral, basolateral and central nuclei), demonstrating that animals with such lesions showed no conditioning response, either to CS1 or CS2

- Chart d. Hippocampal lesions transected the dorsal hippocampal formation, caused animals to respond normally to CS2 with a significantly suppressed response to CS1 followed by rapid extinction of CS1 following foot shock withdrawal.

The researchers draw the following conclusions from this research:

1. The amygdala is critical to the formation of both simple and complex conditioned aversive responses, receiving inputs from the thalamus, sensory processing areas of the neocortex, and the hippocampus.

2. Regarding the action of the hippocampus, the researchers state:

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[38] Included lesions to the sensorimotor region overlaying the dorsal hippocampus

[39] Plasticity of the lateral amygdala is thought to potentiate the ability of the CS to excite neurons in the central nucleus and hence to generate conditioned fear responses, supporting the view that this brain location is a primary catalyst for initiating cue acquisition.

> *"For the most complex stimuli, particularly those for which spatial organisation is important, the hippocampus and the projection from the subiculum to the amygdala may be required. In this scheme, the hippocampus contributes to fear conditioning not as an associative structure, but much the same as other CS sensory processing channels (sensory thalamus and sensory cortex) that relay sensory information to the amygdala."* (1992 p.283)

The research provides good evidence for the existence of two types of cue, generating two modes of conditioning:

1. The 'explicit' cue, that is, the effect of the 20 second 80dB tone prior to foot shock, has a temporal dimension, a single sensory modality and intensity typical of a low-level blind stimulus[40].

2. The 'contextual' cue (the EC), being continuously present throughout the experiment, is not (as in the case of the tone) predictive of the occurrence of foot shock except in a diffuse sense. Contextual stimuli can be multi-modal and carry complex information, requiring spatial analysis and retention of spatial information.

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[40] Le Doux investigates the neurological process of conditioning (1993) in which a tone is followed by a shock. Analysis of the brain functions activated in response to the tone indicates that sound enters the eighth cranial nerve and after synapsing in the cochlear nucleus, the information moves to the inferior collicus of the midbrain, then to the medial geniculate of the thalamus, and thence to the auditory cortex of the brain's temporal area. Lesions to any area *prior* to the cortex will render the animal unable to generate a conditioned response because the animal is effectively rendered deaf. However if only the auditory cortex is removed, the conditioned response remains intact.

In reviewing Le Doux's work, Panksepp concludes that: *"the highest levels of auditory processing are not necessary for conditioned fears to be exhibited to simple sounds. This implies that a conditional linkage to the FEAR system has emerged at some subcortical location* (Panksepp p215).

This does not mean that the auditory cortex is irrelevant for FEAR learning. Complex auditory conditioning probably does require input from the cortex

11.3 Summary

1. There is a class of stimulus (US) which acts without conditioning to produce characteristic responses.

2. A second class of stimulus is acquired by conditioning (CS). This class of stimulus is dependent upon nuclei of the amygdala for its instantiation. In conditioning two different types of sensory information – 'explicit' and 'contextual' – are acquired at different rates, with the contextual stimulus displaying the greater dependency upon the hippocampus for its retention and subsequent effectiveness as a CS.

3. The conditioning impulse - which might be described as an instruction to those brain functions which specialise in the fixing and retention of a previously neutral cue to create a conditioned stimulus - requires the arousal of an E-state.

4. There is evidence that sound and visual cues are detected and retained via specialised brain functions, each able to characterize and retain sensory information by type.

5. The acquisition of both contextual and explicit stimuli is not critically dependent upon the action of higher cortical intervention for its effect

In the processes described, two types of sensory information (sound, spatial information) are found to trace different paths to the amygdala, which appears to play a critical role in the formation of conditioned stimuli.

This casts doubt upon a view of the conditioning process which requires that each CS will induce FEAR by activation of its corresponding US pathway[41]. Unconditioned stimuli as diverse as cat odour, white noise and foot shock are detected via different sensory pathways, yet each is able to induce CS acquisition by FEAR conditioning, making it improbable that a conditioned stimulus is subsequently able to induce an E-state by means of the sensory circuits activated by the originating US. If this were the case, each sense would have to generate its own fear conditioning process (e.g. noise, footshock, cat odour). And these by no means represent the full extent of fear-inducing US mechanisms available. It is more probable that the conditioning process allows a previously neutral object to activate the FEAR E-state directly, tending to confirm the concept of an E-state functioning independently of its activating stimuli.

LeDoux's work supports the notion of two classes of 'neutral' stimulus:

- Explicit stimuli are simple in content and modality, with a temporal dimension – that is, they can be presented synchronously with a US in order to reinforce the relationship between the two stimuli.

- Contextual stimuli tend to have complex presentations and may be continuously at hand throughout the experimental procedure. In order to respond to these stimuli, the organism is likely to require the ability to process and retain complex, and perhaps multi-modal, sensory information.

In contrasting the rates of acquisition of explicit and contextual cues Le Doux has demonstrated a variance in the speed of acquisition of otherwise affectively neutral cues. Since the unconditioned stimulus employed (i.e. electric foot shock) is common for both stimulus types, we may infer that some property of what I have described as a 'neutral' stimulus plays a role in its acquisition. The property which

[41] In using the word 'pathway', I am referring to a sequence of neural connections.

causes one neutral object to be acquired in preference to another is often described as 'salience'.

Chapter 12. The Role of Attentional Salience in Conditioning

12.1 Introduction

In the opening paragraph to his 1976 paper 'Overshadowing and Stimulus Intensity' Mackintosh states:

"*Pavlov* [ ] *used the term "overshadowing" to describe the observation that conditioning to a relatively weak stimulus might be severely attenuated if it was always presented in conjunction with a more intense stimulus. The stronger or more* ***salient*** *component of a compound conditioned stimulus (CS) was said to overshadow conditioning to the weaker or less salient component*". (1976 p.186)

Mackintosh continues:

"*This finding has usually been attributed to some sort of competition between stimuli. According to theories of selective attention (Sutherland & Mackintosh, 1971), conditioning requires that the subject attend to the* [stimulus], *and there is an inverse relationship between the probabilities or strengths of attention to different stimuli*" (1976 p.186)

In my account of the action of unconditioned stimuli it is not required that an organism has previously attended to a stimulus in order for the organism to respond to it. I have described two types of unconditioned FEAR stimuli, 'blind' and 'targeted'. Blind stimuli such as white light, noise, or heat, cause a subject to respond to a stimulus directly from sensation. Targeted stimuli, such as early facial detection in neonates, rely upon an inborn ability to detect a particular stimulus conformation. These faculties, whilst requiring an adaptational investment in some dedicated interpretative mechanism, do not require that a subject has previously attended to and retained the stimulus for that stimulus to arouse an emotion.

Conversely, conditioning must entail that I select and retain information regarding some proximate object which will subsequently act as a stimulus in the conditioning process – a stimulus which was previously not emotionally arousing. What Mackintosh is asserting therefore, is that in order to condition to such a cue, the subject must attend to that (affect-neutral) cue object, either before or after experiencing a fear-inducing unconditioned stimulus.

My aim now will be to elaborate Mackintosh's notion of attention as the mental process of discriminating and retaining information regarding the external world in the form of discrete entities – objects, which (as per the toad) might be detected in a form quite different to that employed by humans.

As Mackintosh observes - the attentional process in mammals is selective; I will provide evidence that it is drawn to certain aspects of the external world, such as pattern/form or movement, and it is this disparity of attraction to which Mackintosh attributes the notion of object 'salience'. This notion of salience is not consistent with the concept of a cue as 'neutral' prior to conditioning, playing no part in its acquisition. Rather Mackintosh is asserting that some property of a cue, by virtue of its particular ability to attract an animal's attention, will determine how readily it is acquired as a conditioned stimulus, or whether it *is* acquirable.

There is experimental evidence to suggest that although attention and emotion may be treated as conceptually separate and – to a useful extent – neurologically discrete processes (Vuilleumier & Driver 2007, Raftopoulos 2014), there is also evidence indicating that these processes interact. Their interaction may be summarised thus: attention is a process by which the world is divided into the objects of perception, and emotion is the process by which those objects are assigned value and acted upon. My purpose going forward will be to investigate this interaction of emotional and attentional processes as nonintentional phenomena.

12.2 Mammalian Attentional Processing

The main experimental obstacle to establishing the extent to which mammals without language are able to discriminate objects in their environment is verification. Without some confirmatory behaviour, it is difficult to determine whether, say, a rat can distinguish a nail from a blade of grass. Neither have value for the rat and hence neither will generate a behaviour.

In recent years, a number of researchers have devised experiments to quantify the extent to which visual cues are processed and retained by attentional mechanisms.

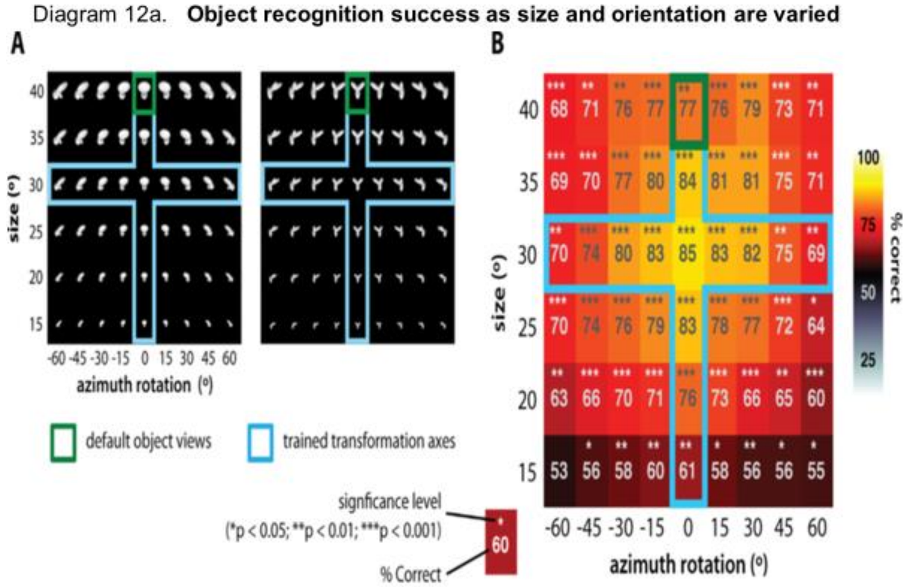
1. *The Fixing of Patterned Visual Cues by Attention in Mammals*
   In the early twenty-first century, two schools of thought emerged regarding the intricacy of detail which a rat is able to discriminate in characterizing and retaining the form of an object. Some researchers (Minini and Jeffreys 2006) maintained that there are 'low level' characteristics of a pattern or a shape such as brightness (of an object or some component of an object), contrast, size and area. These properties may be discriminated but will not allow a shape to be reliably identified. Conversely, another group argued that there are higher level properties which might reliably allow an object to be detected in a retinal image such as local straight and curved boundaries, oriented edges and corners, and oriented and non-oriented local contrast patterns (patterned fields) - plus image fragments.

   What scientists were attempting to verify is whether such high-level data can be extracted and processed reliably against the 'noise' of lower level visual information (e.g. the same object may be close or distant and hence present on a larger or smaller retinal area, or it may be more or less luminous). This ability to *hold* the basic elements of a shape against variable lower level parameters is referred to as 'transportation-tolerant recognition'.

   To resolve this dispute, Zoccolan (2009) devised a complex apparatus which constrained the rat to view a screen at a fixed distance. In the experiments the rats were rewarded if they were able to identify a target object (by head-pointing) in a wide range of configurations. The object was displayed in a number of different orientations by rotation about its axis, and its size was varied systematically to determine whether the rat was still able to identify the object following these transformations. Volumes of data obtained (500 per rat per day) were high, allowing reliable statistical data to be obtained (Diagram 12a.).

Zoccolan's research confirmed the rats' ability to tolerate variation in an object's appearance at different degrees of rotation and size [42]. This faculty derived from a 'generalisation process' which enabled the rat to pick out the similarity of the object perceived with some other object perceived previously, even though the two views were not identical. He concludes:
"*In fact, given the large number of tested conditions, it was unlikely that rats succeeded in the task by learning and memorizing the correct association between each newly presented view and the corresponding reward port." (2009 p.8572)*

Diagram 12a. **Object recognition success as size and orientation are varied**



Zoccolan, D., Oertelt, N., DiCarlo. J.J., Cox, D.D. 2009. A rodent model for the study of invariant object recognition. *Proceedings of the National Academy of Sciences* Vol 106, 21, pp 8748-8753

[42] The reduced ability to discriminate the smallest objects was most probably caused by the rat's relatively poor visual resolution)

Discussion

Zoccolan's work provides good evidence that rats can discriminate novel and complex visual patterns or shapes and are able to identify those shapes when they are presented in different orientations and at varying distances. This same attention to pattern has been found in infants. In a 1961 paper Fantz proposed that the early interest which infants show in form and in particular kinds of pattern play an important role in the development of behaviour by drawing attention towards those stimuli which have adaptive significance. But while pattern preference was established (with an increasing attention to fine detail with infant age), the variations of pattern used (gratings, bullseyes and checkerboards) were such that no overarching explanation of the relationship between the patterns used in different experiments could be found.

In 1985 Banks and Ginsberg re-examined the findings of several of these studies, based upon responses to a variety of patterns, and found that if the phase and amplitude of the various patterns were mathematically encoded and reanalysed using a linear systems preference model, a clear correlation could be found between the age of a child and the complexity of pattern preferred.

2. *Attention to Movement*

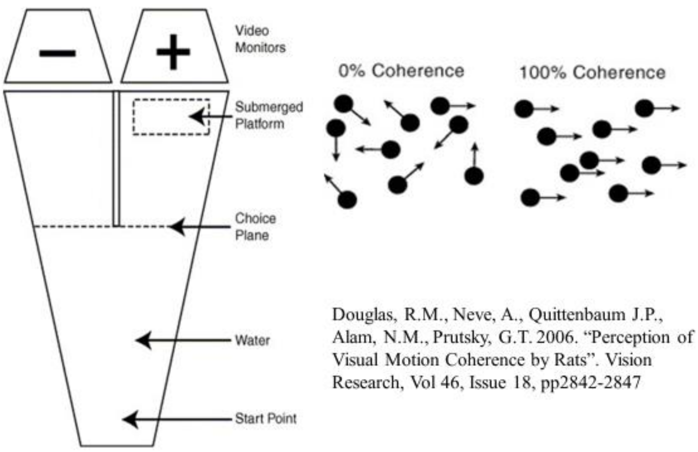
The previous experiments offer confirmation that mammals will preferentially attend to and retain patterned information in their surroundings. This is by no means the only attentional mechanism which mammals are able to deploy; for example, Douglas (2006) has carried out experiments which confirm that both rats and humans are able to discriminate a coherent moving pattern of dots from a random, 'noise-type' background of moving dots.

The neurobiological faculty for perceiving and interpreting objects in motion has been found to be particularly acute and complex in humans and other primates but Douglas *et al.,* (2006) was interested in in the attentional salience of motion for mammalian species generally:

“*It is [ ] an open question whether primates have unique cortical abilities (regarding motion perception) or whether such a functional organisation is a fundamental property of mammalian visual systems. If extrastriate analysis of global visual motion is common to mammals, this would have implications for its evolution and biological utility* (2006 p.2842)”

Douglas carried out a series of tests in which rats were found able to discriminate between two screens populated with moving dots: on one screen the dots are moving more or less coherently in a particular direction (left or right) whereas on the second screen the dots were moving randomly. Differentiated on-screen movement patterns will not, of themselves, cause the rats to have any behaviour, rather rats are forced to choose between the two screens by swimming in a tank of water in which a hidden submerged platform is placed in front of the screen showing coherent as opposed to random motion. The rat, in order to avoid drowning, was required to detect and swim toward coherent movement patterns (Diagram 12b.).

Diagram 12b. **Design of an experiment to measure a rat's ability to detect motion coherence**



> Using this methodology, Douglas discovered that rats (and mice) are able successfully to discriminate coherent motion of dots (by swimming towards it) when dot coherency is as low as c.30% (humans are successful down to 7%[43]). Subsequent investigation into the brain location activated during the experiments indicate that the anterolateral visual area (AL) of the rat's brain serves the primary role in motion detection and a similar brain function has been discovered in cats.
>
> Douglas's findings point strongly to the existence of general specialised motion detection systems in mammals and not only this, mammals seem to be able to detect coherent as opposed to random movement. But this ability is not predicated upon the notion that the object detected has any homeostatic value for the animal, rather it seems that any moving object will draw the animal's attention preferentially.

Having established that mammals are able to attend to and discriminate complex patterns of form and movement against a noisy background, I shall now investigate the relationship between visual attention and emotion.

12.3 SEEKING and Attention

Tolman's Maze Experiments

Laboratory rats have been found to make use of visual cues and to employ visual cues preferentially (over olfactory and auditory cues and path integration) in spatial navigation

The navigational process which I shall now describe entails that the subject is engaged in purposeful forward movement – a behaviour which Panksepp associates with the basic emotion SEEKING. Panksepp observes that animals in a SEEKING state also display strong sensory arousal; he has further described rats in this state as

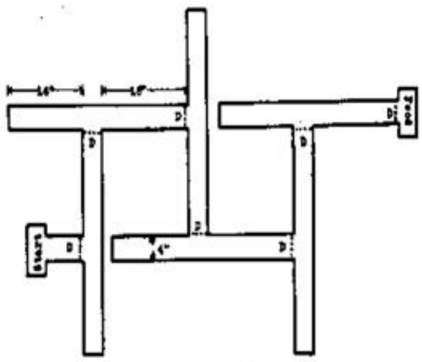
[43] Presumably not under threat of drowning.

‘eager’, ‘anticipatory’ or ‘curious’. The appearance of rats as ‘anticipatory’ or ‘eager’ relate to the behaviours which Panksepp observed when rats were pulling levers in order to self-stimulate the SEEKING emotional brain state, however the association of curiosity with SEEKING has not thus far been explained. A good example of this relationship is observed in the ability of a rat to navigate a maze.

This ability was extensively studied and documented by Tolman and others in the early twentieth century. He describes a series of simple and elegant experiments designed to shed insight into this faculty in his 1948 paper “*Cognitive Maps in Rats and Men*”.

In an experiment by Blodgett (1929), a six-unit alley maze baited with food in the ‘goal’ box was tested with a control group of rats for seven days (Diagram 12c.).

Diagram 12c.



6-Unit Alley T-Maze

Fig. 4

(From H. C. Blodgett, The effect of the introduction of reward upon the maze performance of rats. *Univ. Calif. Publ. Psychol.*, 1929, 4, No. 8, p. 117.)

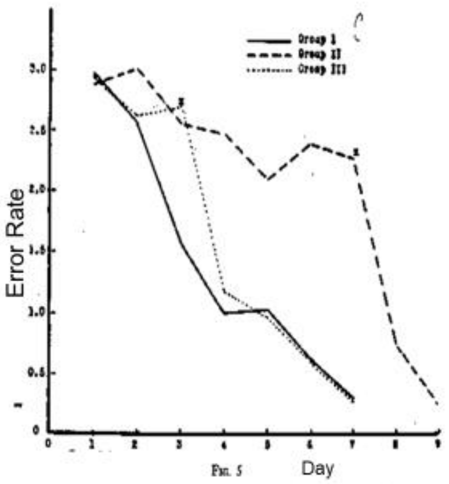


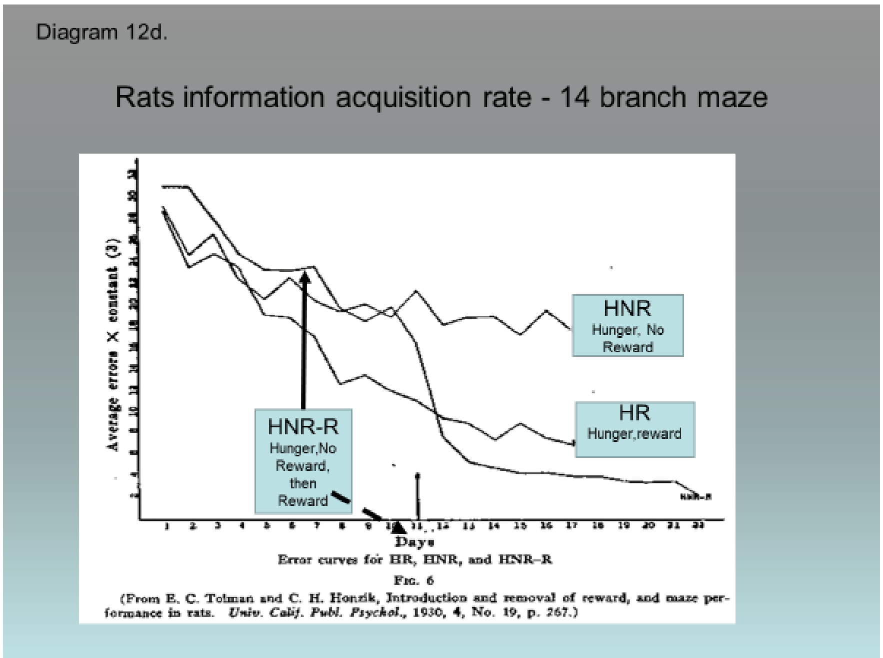
Fig. 5

(From H. C. Blodgett, The effect of the introduction of reward upon the maze performance of rats. *Univ. Calif. Publ. Psychol.*, 1929, 4, No. 8, p. 120.)

The rate at which the group was able to acquire knowledge of the maze was expressed in in the decline their error rate (i.e. choosing a false path) for each session (see solid line) in selecting the correct path to the bait box. Group II was placed for six days in the maze without food, but on the seventh day, food was placed in the bait box. After two days, the Group II animals were able to locate the bait box with the same efficiency as Group I.

As a final test, Group III animals were offered food after three days and again the error rate fell. Within one day the Group III animals were on the learning curve of Group I.

Tolman describes a subsequent experiment with a 14 unit maze (Diagram 12d.) and found an even more remarkable result. Group HNR-R (Hunger No Reward/Reward) was placed for 10 days in the box without food but on the day 11 they found food in the bait box, and Group HNR (Hunger No Reward) were allowed to explore the maze but were never offered food. The rate at which any group was able to acquire information about the maze was expressed in the decline in their error rate (i.e. choosing a path which did not lead to food) for each session. The chart below demonstrates that Group HNR-R, on being offered food, appeared to acquire the route to the bait box very much more rapidly and with more accuracy than Group HR animals who were offered food on day 1.



For Group HNR-R animals in an unbaited maze, it is not obvious what constitutes a 'wrong' decision during the first ten sessions. Panksepp's SEEKING theory offers an explanation: a foraging rat in the SEEKING E-state has a strong impulse to move forwards[44] and in this event, a dead end would frustrate the rat. If Panksepp is correct, successful movement to the furthest maze element would constitute the route through the maze offering the longest uninterrupted forward movement.

Such exploration is accompanied by the progressive acquisition of a spatial map of the maze. We can imagine this spatial information as accumulating with each session so that when the Group HNR-R rats eventually discovered food in the bait box, their more extensive exploration of the maze, having enabled them to map the maze more thoroughly, served them well when the opportunity for food presented itself. They subsequently deployed this superior spatial information to enable them to locate the food in the goal box with greater accuracy than the rats who were in a baited maze from day 1 (Group HR).

In sum, during the first ten days, the unrewarded rats spontaneously explore and map the maze in the absence of any goal and yet the evidence indicates that the rat is learning to negotiate the maze more efficiently than it would if food were on offer.

We can draw several conclusions from the maze experiments:

1. Rats possess the ability to construct neural maps of their environment. As Tolman puts it: "*Although we admit that the rat is bombarded by stimuli, we hold that his nervous system is surprisingly selective as to which of these stimuli it will let in at any given time".* (1948 p.2)

2. The time required to map a maze is a function of the maze complexity.

3. The presence of a reward object in the maze has no evident effect upon the rate at which the rat is able to map the maze.

[44] Panksepp notes that it is virtually impossible to induce a foraging rat to move in reverse

4. That in moving forwards through the maze with its senses aroused, the rat's general behaviour is one we would associate with SEEKING-induced foraging.

Attending to Affect-Neutral Objects

The manner by which rats acquire information in a maze without reward might not be indicative of a rat's propensity to attend to and retain unfamiliar objects in general, and I shall briefly describe an experiment by Gaskin *et al.* (2003) which demonstrates that rats will preferentially attend to any unfamiliar object in their surroundings, irrespective of their homeostatic value.

Gaskin describes a novel object recognition experiment to assess the role of the hippocampus in object retention. The objects they employed, (a stainless steel cup and a black porcelain statuette) had no homeostatic value. They were used interchangeably so that one group of rats were familiarised with the two identical cups [45] for five sessions of five minutes and the other with two statuettes. When the control rats were subsequently exposed to the novel object alongside the familiar object, they spent significantly more time exploring the novel object (i.e. c.65% of total exploration time). The attentive behaviour of the rats was associated with sensory arousal, and in acquainting themselves with the novel object, the rats would constantly move around it, or even climb over it in a manner characteristic of SEEKING behaviour.

Exploration time is described as time spent directing the nose at a distance of < 2cm to the object and/or touching it with the nose. However, this was not the case for rats with hippocampal lesions, who spent pretty much the same time exploring both objects, suggesting that the hippocampus plays a role[46] in retaining novel object information[47].

[45] Two similar cups were used so that the rats behaviour could subsequently be assessed when exposed to two objects – one familiar and one unfamiliar.
[46] Though as Gaskin demonstrates, if the hippocampus is lesioned, the rat's brain is able to access other neural systems and hence regain object recognition ability.
[47] Similar research has also been carried out by Antunes and Biales (2012)

Discussion

Tolman's observations are indicative of SEEKING behaviour. Rats move forward through the maze with senses aroused[48] and will do so without any motivation other than a desire to forage. During this process, the rats acquire extensive spatial information about the maze, and they will deploy this information efficiently to locate reward objects which have been subsequently placed in the maze.

This co-occurrence of SEEKING behaviour and the acquisition of spatial information does not of itself demonstrate a relationship between the SEEKING and the acquisition of spatial information, even though it is supported by research which reports a similar SEEKING-type behaviour exhibited in the preferential direction of attention towards novel objects. It may well be that attentional processes allow the rat to discriminate and retain novel information in the absence of SEEKING or other primitive emotional states. For this reason, Panksepp's claim that rats in a SEEKING state exhibit curiosity cannot be a claim that curiosity co-occurs exclusively with SEEKING. However, the evidence does tend to support a claim that SEEKING intensifies the attentional process and in so doing accelerates information acquisition.

What these experiments have demonstrated however, is that the SEEKING emotional state is unusual: during the arousal of a SEEKING state, an object may be characterized and retained *without* its being conditioned. When the initially unfamiliar object is encountered subsequently, it will be decreasingly likely that the SEEKING E-state is aroused, in contrast to the effects of conditioned stimuli in arousing other E-state types. In sum, the more an object is explored and retained, the *less* likely that object is to be associated with a SEEKING state.

I will use the term *passive* for object information which is characterized and retained in this manner and I contrast this effect with objects which are retained in a process of conditioning.

[48] Panksepp describes the failure of attempts to induce rats to move backwards in a maze of their own accord.

12.4 Attention and Non-SEEKING Emotions

LeDoux has demonstrated that an unconditioned FEAR-inducing stimulus can cause a previously affect-neutral object to be acquired and retained in a single encounter, but rather than being held passively, the object so retained becomes a conditioned stimulus, arousing FEAR when encountered on subsequent sessions.

I will illustrate this effect of FEAR: Tolman (1948), in his description of an experiment carried out by Hudson, describes how a rat is given an electric shock via a small food bowl attached to a patterned screen. Immediately following the shock, the rat was seen to attend closely to the screen and to avoid it in subsequent sessions.

However, when the experiment was altered so that the food bowl and patterned screen were removed instantly after the shock was administered, the rat did not subsequently avoid the patterned screen. Tolman comments:

"Learning what object to avoid may occur exclusively during the period after the shock. For if the object from which the shock was actually received is removed at the moment of the shock, a significant number of animals fail to learn to avoid it, some selecting other features in the environment for avoidance, and others avoiding nothing." (1948 p.7)

Tolman, in claiming that the rat has attended to and memorised the patterned screen only *after* receiving a shock, is expressing the view of many researchers who believe that FEAR causes an animal to attend to and retain neutral cues present at the time of a fear-inducing event - objects which had not been attended to previously. But it may also be the case that in attending to the screen, the animal is conditioning to the pattern which has been passively acquired prior to the shock.

12.5 Summary

Attentional processes select and retain information received by the senses, employing specialised neural mechanisms. These mechanisms are so adapted that they are preferentially directed towards aspects of the animal's surroundings which have visual, olfactory or auditory salience for that species.

Panksepp's research into the subcortical brain processes which instantiate basic emotions provides no evidence of functions which will enable objects to be so discriminated and retained.

According to these two accounts, attentional and primitive emotional processes are independent brain processes. But there is further evidence to indicate that an interaction of these brain processes occurs:

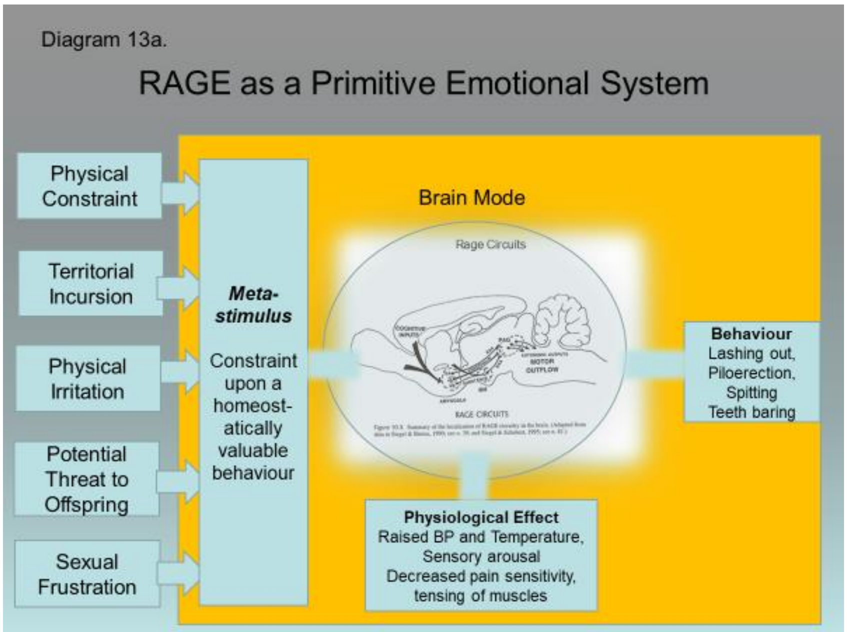
- Through SEEKING, attentional processes are catalysed, but the objects of attention are acquired and retained passively. An object so retained does not subsequently arouse the SEEKING emotion, i.e., it is not conditioned.
- The arousal of non-SEEKING primitive emotions may cause conditioning. In this case, local objects are selected for conditioning by attentional salience:
    - *i.* If an object has been previously attended and retained passively, through conditioning it is retained in a manner which will cause that object to evoke a primitive emotion in subsequent encounters.
    - *ii.* If objects have not been passively retained, the arousal of a primitive emotion will cause them to be attended and conditioned as emotional cues according to their salience.

Chapter 13: Metastimuli and Homeostatic Imperatives

Introduction

An organism will respond to objects which have homeostatic value and it will respond in a manner which tends to promote its survival and wellbeing. But homeostatically valuable objects do not fall into a single class, and I have proposed that adaptive processes have enabled organisms to develop progressively more sophisticated mechanisms by means of which each class of homeostatically valuable objects is addressed by a behaviour appropriate for the exploitation of its value.

In mammals, this evolutionary process has given rise to primitive emotional systems whereby clusters of valuable stimuli are able to activate an appropriate primitive emotional response. Some of these clusters do not represent any coherent whole - that is, by knowing how one token of a stimulus type activates a primitive emotion, we could not predict the existence of other stimulus tokens able to activate that same emotion. To exemplify: knowing that a threat to offspring would cause RAGE in a female does not predict that the same animal will display RAGE in response to a thwarted attempt to flee (i.e. a ‘cornered animal’ behaviour) (Diagram 13a.). However, both event types can be characterized as *constraints* upon other emotionally motivated behaviours - in this case CARE and FEAR.



The explanation that a constraint upon the enactment of some behaviour motivated by a primitive emotional system will cause RAGE offers a more useful predictive tool for the occurrence of primitive 'RAGE' states than that of any single token of RAGE-evoking stimulus. In the same way, the association of SEEKING with *urges*, or the arousal of FEAR in response to *threats* offer better general predictors of these emotional states than any of the stimuli to which they respond singly.

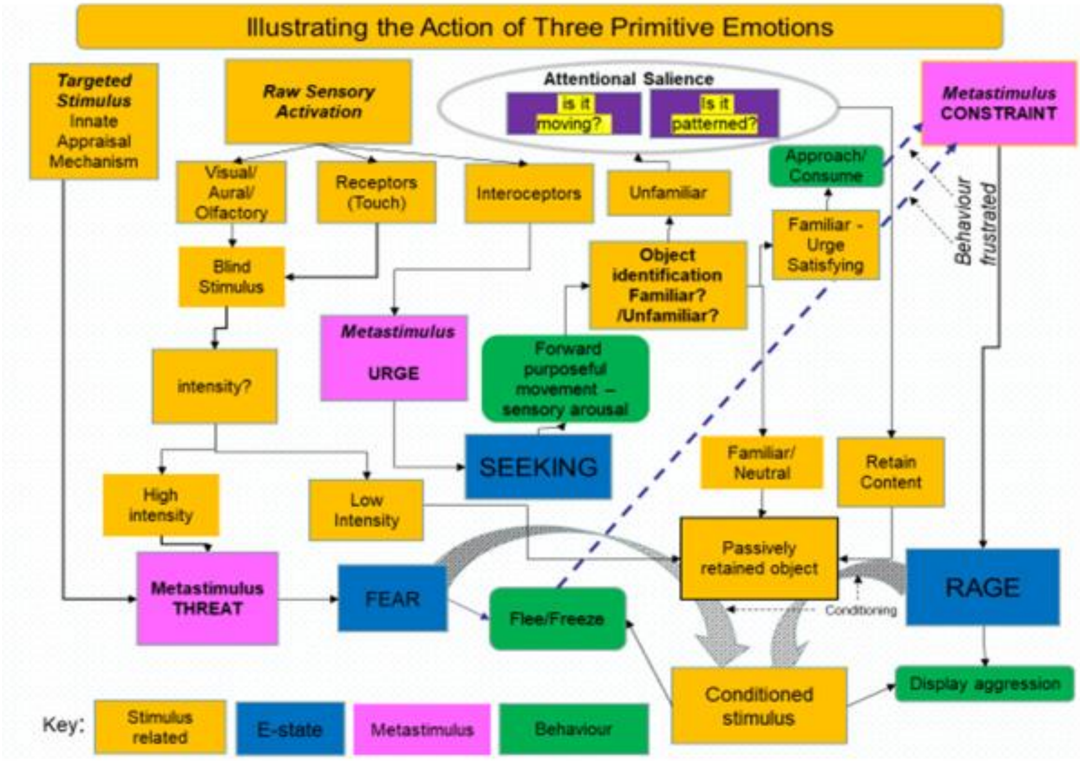
This might lead us to propose that the subject is able to reason, say, that a burning sensation is a threat to its wellbeing or that a territorial incursion represents a constraint upon its ability to exploit its territory. But in responding to a primitive emotional stimulus, a primitive mammal acts without intention and hence without reasons. Yet we cannot reduce the aetiology of an E-state to one of straightforward cause and effect: for example, a primitive RAGE response does not necessarily result if a potential competitor is encountered in neutral territory, nor will an animal avoid objects that it has not been conditioned to fear.

As a first step in explaining the general relationship between complex arrays of primitive emotional stimuli and their evoked responses, I will introduce the concept of a *metastimulus*, an explanatory term which identifies some shared feature of a diverse group of stimuli able to trigger a particular primitive emotion.

The Concept of a Metastimulus in Primitive Emotional Explanation

In the schematic below, I illustrate the points at which metastimuli can be introduced as explanations for three types of primitive emotion: FEAR, RAGE and SEEKING. The schematic below (Diagram 13b.) is based upon the action of primitive emotional systems provided in previous chapters.

Diagram 13b.



In the following paragraphs, I will outline the action and interaction of these emotions and identify the concept of a metastimulus with respect to each emotion.

FEAR

I have described two broad stimulus classes which will cause the arousal of FEAR; the first is *targeted*, in which some inborn interpretative mechanism will cause the animal to experience FEAR directly, the second is *blind* in which a broad spectrum of sensory receptors, in response to sensory overload, will cause the animal to flee or freeze. Both these stimulus classes may be interpreted as threats to the animal, causing avoidance behaviours. The concept uniting targeted and blind stimuli therefore. is that both offer threats to the organism, hence *threat* is the metastimulus for FEAR.

SEEKING

The SEEKING state is triggered by one of an array of sensors (interoceptors) internal to the organism, which detect homeostatic imbalances and will cause the animal to forage for the objects necessary to correct such imbalances. The metastimulus for SEEKING therefore is an internally-driven *urge* to correct a homeostatic imbalance.

RAGE

The metastimulus for RAGE is a *constraint* upon a homeostatically-driven behaviour so that, say, if an animal is constrained from flight, it will attack. According to this principle, a constraint upon SEEKING would cause the subject to evoke RAGE. However, Panksepp has argued from observation that this is not the case; rather animals display RAGE only after SEEKING brings them into the presence of urge-satisfying objects, in which event, they switch to consummatory or predatory behaviours. Under these conditions, if, say, another animal competes for the subject's prey or food, the subject will display RAGE in response to this more explicit constraint.

Object Acquisition

It will be useful to extend my account of the interaction of the three emotional processes I have described to explain the acquisition of new stimulus objects.

1. *Passive Acquisition*

I have previously explained how, under the influence of SEEKING, attentional processes are enhanced. When a SEEKING animal encounters a familiar object (i.e. previously attended and retained), it will display no behaviour; however, if the object is novel, the animal will display attentive behaviour, moving around the object with its senses aroused. In this way, it is able to characterize and retain the object passively.

A second mode of passive acquisition, requiring less complex attentive processing, occurs in response to low level blind stimuli such as intermittent white lights or tones.

2. *Acquisition by Conditioning*

We can think of the attentional processes as accumulating a library of passively-acquired object information for access by the conditioning process. When the passively-acquired object becomes associated with the arousal of an emotion (particularly FEAR) this object becomes conditioned, arousing the same emotion on future occasions.

The Function of Metastimuli in Emotional Explanation

On the face of it, the metastimuli I have described constitute nothing more than superior explanations for the effects of a group of stimuli than those which could be devised by considering each stimulus singly. However, I will argue that more significance can be ascribed to metastimuli than their function as superior descriptive terms. To pursue this end, I shall initially consider such explanations separately from the action of primitive emotion, so that *any* neurological mechanism for effecting a homeostatically beneficial outcome might be explained as a response to a metastimulus.

I have previously offered a general account of emotionally motivating stimuli as objects of homeostatic value and I have proposed that such objects may constitute both impediments to an animal's survival and opportunities for the animal to flourish (Chapter 4, p.96). What I now propose is that the selection and exploitation of homeostatically valuable objects by any species may be represented as a set of motivating principles for promoting the wellbeing of the subject which I will term *homeostatic imperatives*. I will take as an example the homeostatic imperative requiring resistance to constraint: if some homeostatically valuable activity is constrained, then an organism's wellbeing is promoted by its opposing such a constraint and in doing so with all its physical resources engaged. In primitive mammalian species, this opposition is manifested as RAGE.

Rage, therefore constitutes a physiological and behavioural state in mammals, which in other species might manifest differently. In each species, the homeostatic imperative that a constraint upon a valuable behaviour must be resisted, will be addressed by the most appropriate response given the biological resources available to that species. For example, in response to the same homeostatic imperative, the sea hare will emit a purple ink when disturbed.

In Table 13(i) I have provided an overview of the seven primitive emotions shown alongside the metastimuli which activate those emotions and the homeostatic imperatives which each metastimulus addresses. The early primitive emotions, SEEKING, RAGE, FEAR and LUST, mediate a certain type of engagement between the subject and its environment. Set apart from these stimuli are the more recently evolved 'social emotions' CARE, and PLAY which, on Panksepp's account, represent phylogenetic elaborations of LUST[49] for mediating interactions between individuals within species groupings. In these interactions we can detect homeostatic imperatives driving nurture and play which were absent in earlier species.

Table 13(i)	**Primitive Emotions: their Metastimuli and Homeostatic Imperatives**	
Primitive Emotion	**Metastimulus**	**Homeostatic Imperative**
SEEKING	**Physiological Urge**	**If Urge, Forage!**
RAGE	**Constraint upon some homeostatically-driven impulse**	**If Constraint, Resist!**
FEAR	**Threat to Wellbeing/Survival**	**If Threat, Avoid!**
LUST	**Potential Partner**	**If Potential Partner, Mate!**
CARE	**Offspring**	**If Offspring, Nurture!**
PANIC	**Parental absence**	**If Isolated, Exhibit Distress!**
PLAY	**Young Member of Same Species**	**If Young Adult, Play!**

Homeostatic imperatives are the neurobiological realisation of a set of motivating principles which apply to all animal species. Such motivating principles exert influence in the phylogenetic processes which shaped both primitive emotions in mammalian species *and* the reflexive stimulus-response behaviours which preceded them, and in Chapter 19 I shall develop this view by proposing that they determine the selection of emotionally potent contexts in cognitive evaluations.

[49] LUST is the prototypical behaviour for interaction within a species group

Chapter 14: Competing Primitive Emotions

14.1 Introduction

In an earlier discussion contrasting reflexive and primitive emotional models of behavioural motivation (Chapter 5), I proposed that there exists some theoretical boundary below which behaviours arise as 'reflex' responses to stimuli so that any intervening neural circuitry, though potentially complex, can be understood as generating an inflexible chain of causation between stimulus and response.

Above this boundary, I have proposed that the neural entities intervening between stimulus and response have these features:

1) They exist as a taxonomy of neural systems, each able to generate a behaviour type in response to an expanding array of stimuli.

and

2) When two or more of these neural systems are aroused simultaneously, some further process takes place by which a prioritization of behaviours is effected.

For each of these features, intervening neural entities – E-state brain modes - function as systems for mediating between stimulus and response.

In previous chapters I have argued that E-state brain modes arise in response to the detection of tokens of particular types of metastimulus and that each brain mode functions as a core component of the primitive emotional system. I have described how such brain modes respond, not only to a range of unconditioned stimulus classes but also, through conditioning, to promote the acquisition of new stimuli, which will extend the range of valuable stimuli to which the subject is able to respond.

I will now investigate condition 2): that a prioritization of E-state brain modes will occur in response to the presentation of multiple stimuli, when each is associated with an action of a different E-state.

The concept of a primitive mammal postulates the existence of a period in the evolutionary history of mammals[50] when an animal was able to respond to homeostatic imperatives only by evoking the primitive emotions I have listed. But difficulties immediately become apparent. For example, even if a mother is motivated to nurture offspring by CARE, then for CARE to be successful, there must exist a set of conditions whereby, say, the nurturing impulse is subdued by an urge prompting the mother to feed herself. What remains to be explained is the mechanism by which a primitive mammal will adopt a certain behaviour in the presence of these competing stimuli.

Cognitive science has generated some evidence of the action of multiple competing stimuli in inducing primitive emotional responses, but such evidence will not suffice to verify any proposal I might make for the interaction of primitive emotions in its entirety owing to aspects of primitive emotional systems which have been presented in my previous explanation: first, assuming that, as a minimum, there are seven of Panksepp's basic emotions and that these may commonly occur in combinations of two or even three, there is insufficient experimental evidence to verify the outcome of every potential combination of primitive emotions.

But even if such evidence existed, I have described how the intensity of an emotion can be a function of stimulus presentation: because of this, I will argue that the behaviour resulting from the interaction of emotions cannot be predicted solely as a function of the nature of the E-states aroused but must also take into account the intensity to which those E-states are aroused.

And as a further feature influencing the interaction of primitive emotions, I will demonstrate that it is not the case that E-states stand upon an equal motivational footing. Aversive emotions such as FEAR, even at relatively low intensities, will reliably suppress more pleasant emotions such as PLAY.

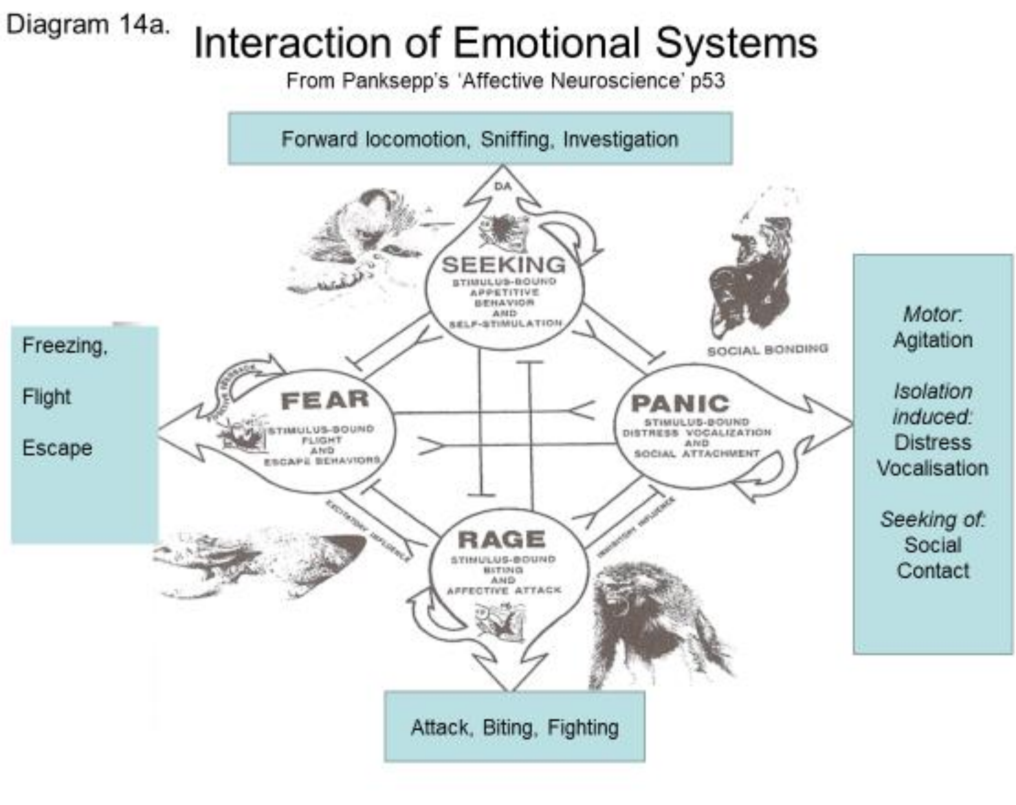
These factors, taken together, make the behaviour of a primitive mammal in the presence of multiple stimuli a complex function of the interaction of brain modes. But this complexity obscures the underlying relationships between primitive emotions.

[50] I am not asserting that such a time or an animal existed.

To reach a better understanding of emotional interactions, my approach will be to use Panksepp's schematic (Diagram 14a.) as a straw man in order to develop an alternative 'competitive' hypothesis for the interaction of emotions, and then to test this hypothesis against experimental and neuroscientific evidence entailing the interaction of emotions.

14.2 Challenging Panksepp's Model for the Interaction of Emotions

The diagram below is taken from one of Panksepp's earlier papers on emotion (Panksepp,1982) and reproduced in *Affective Neuroscience.* It outlines the nature of interactions between four basic emotions and as far as I can ascertain, it is based upon no more than deduction from intuition and everyday observation.



Panksepp's model takes four basic emotions and represents the relationships between them as either inhibitory or excitatory. Initially, our intuition suggests that the relationships described reflect reality. Panksepp proposes that FEAR will excite RAGE and RAGE will inhibit FEAR, and that PANIC and RAGE share this same relationship of excitation and inhibition. Again, Panksepp proposes that FEAR excites

PANIC and PANIC excites FEAR, a relationship which our observation of these emotions seems to support.

But not all Panksepp's deductions appear to be equally justified: it is not clear why FEAR should excite SEEKING or why SEEKING should inhibit FEAR. And in Panksepp's depiction of the interaction of SEEKING and RAGE, it seems likely that an animal in a state of RAGE would not forage but it is less clear that SEEKING inhibits RAGE.

Similarly, there are problems with Panksepp's depiction of SEEKING and FEAR: imagine that an animal foraging for water (SEEKING) is confronted by a predator (FEAR). It is very probable that the animal will flee from the predator rather than continuing to search for water. On this account FEAR inhibits SEEKING rather than exciting it. But FEAR will not always prevail: an animal in a state of thirst may risk approaching a waterhole in the absence of predators (even if it associates predators with the waterhole) but will break off the SEEKING behaviour if predators approach, hence intensifying FEAR.

In summary, Panksepp's model of the interaction of emotions as mutually exciting or inhibiting does not fully account for the behavioural outcomes observed, which manifest as discrete responses, characteristic of one of the stimuli presented.

14.3 An Investigation of a Competitive Model of Primitive Emotions

The explanation I am about to provide rests upon two premises:

1) That primitive emotional behaviours are the products of E-states which arise in response to unconditioned and conditioned stimuli.
2) That multiple E-states, when aroused, will separately compete for control of the behaviour of a primitive mammal.

The theory of primitive emotions as E-states entails some characteristic behaviour as a constituent of that state, so that when multiple E-states arise, the behavioural outcome must be characteristic of *one* of those E-states. To clarify: it cannot be some behaviour which is not a constituent of an E-state, nor can it be some hybrid of more than one E-state behaviour.

Therefore, if a number of E-states are aroused in response to multiple stimuli and only a single E-state behaviour may be evoked, and if intentional cognitions are excluded, some process must occur whereby a particular E-state behaviour is evoked whilst other E-states are suppressed.

I will now propose a mechanism by which one E-state behaviour is suppressed whilst another is evoked: only one behaviour may be manifested in response to multiple stimuli, whereas emotions are elaborated as separate neural pathways with distinctive brain chemistries which I have termed 'brain modes', allowing multiple brain modes to co-occur and compete. In this competition I propose that two features of brain modes determine behavioural outcomes: the first is the *intensity* of the E-state evoked and the second is its *nature.*

1) *Intensity:* I have previously proposed that E-states have an intensity which is a function of the presentation of the unconditioned stimulus, or, in the case of a conditioned stimulus, will be some function of the intensity of an unconditioned stimulus with which the conditioned stimulus was originally paired. If E-states are aroused by stimuli which signify the presence of some homeostatic imperative, it would seem probable that a process of evolutionary adaptation, *ceteris paribus,* would favour behaviours constituent of higher intensity E-states over lower intensity states. For this reason, I am proposing that the relationship between E-states is *competitive* with higher intensity states winning control of the behavioural 'levers' from states of lower intensity.

2) *Nature:* In comparing the competitive power of E-states, an equivalence between the homeostatic imperatives which motivate those states cannot be assumed. Rather, I will argue from experimental evidence that in the competition between emotions, there exists a general bias against those emotional states which promote long-term physiological homeostasis, providing pleasure or relief, such as CARE, PLAY, LUST and SEEKING, and in favour of states such as RAGE and FEAR which are directed toward those objects,

> events and circumstances which tend to act directly against the animal's homeostatic goals and/or offer immediate threats to its survival.

In the following paragraphs, I will offer behavioural research and neuroscientific evidence for my hypothesis.

FEAR and RAGE

In his discussion of the characteristics of FEAR, Panksepp devotes a good deal of space to the differentiation of the respective neural anatomies and neurochemistries of FEAR and RAGE and I reproduce some of his description below:

"there are distinct sites in the brain where electrical stimulation will provoke a full fear response in all mammalian species, and these are locations where the executive system for FEAR is concentrated [ ]Of course this highly interconnected network interacts with many other emotional systems discussed in this book, especially RAGE circuits (which contribute to the balance between flight and fight." (1998 p.207)

and

"It makes good evolutionary sense for FEAR and RAGE circuits to be intimately related, for one of the functions of anger is to provoke fear in competitors, and one of the functions of fear is to reduce the impact of angry behaviours from threatening competitors." (1998 p.208)

Our observation of other mammalian species when presented with multiple emotional stimuli is that they evoke recognisable 'single' emotional behaviours. There are apparent exceptions to this rule: we note that cats and dogs will often 'face off' against one another rather than fighting, displaying behaviours characteristic of both FEAR and RAGE. In these confrontations behaviours seem to alternate, with each E-state being intermittently in control until the balance finally shifts towards aggression or flight. The interplay of these two emotions, therefore, is not manifested as some new behaviour, nor as a hybrid behaviour characteristic of both, but rather as an alternation between behaviours characteristic of the two E-states.

Panksepp has proposed that RAGE suppresses FEAR and that FEAR excites RAGE but such an assumption is not required to explain the behaviours observed. Confrontations of the type I have described above may be for territory or for dominance; they occur more frequently between males and carry the risk of harm. Given these circumstances, if the opponents are roughly evenly-matched, then both FEAR and RAGE are equally excited and compete for behavioural control.

We can imagine this as a sort of arm wrestling competition. If the two competitors are of equal strength, then the two arms will move from side to side as each opponent summons his strength in pursuit of a win. If there is a mismatch, then one opponent will win immediately and the arms will come down rapidly in one direction or another.

Panksepp notes that FEAR and RAGE circuits constitute a highly interconnected network suggesting that the two emotions often act simultaneously. This level of interaction is explained by the circumstance that the homeostatic imperatives causing FEAR and RAGE frequently originate in a single stimulus: so it will often be the case that 1) any constraint upon a drive to carry out some homeostatically valuable activity, e.g. sexual, territorial or nurturing will arise in the form of some creature which in itself poses 2) a risk to the survival of the subject. The prioritisation of fight or flight in these circumstances may have an existential outcome, making it important that each E-state possesses the ability, within a normal range of intensities, to prevail over the other. Under these circumstances the balance between these two behaviours would benefit from extensive neural interconnectivity.

PANIC and CARE

The weight of Panksepp's concept of PANIC lies some distance from the common understanding of the word. It finds its origin in the state of distress which is exhibited when a young mammal is separated from its mother. In later infancy, for species which display cooperative behaviours, the same emotion arises when the animal is isolated from the group. In expanding his explanation, Panksepp claims that PANIC finds an expression in the form of loneliness, grief and social isolation. The PANIC/CARE relationship constitutes an exception to my claim that emotions are competitive. For an infant, an absence of CARE, will cause PANIC, and the provision of CARE will relieve PANIC, supporting Panksepp's claim that emotional interactions entail excitation or inhibition rather than competition[51].

In the early stage of infancy, the stimulus for PANIC will be the absence of the carer and the stimulus for CARE will be a distress vocalisation by the young animal. For extended nurture to occur, both emotions are necessary, each complementing and supporting the other, so that separation causes an increased parental urge to nurture and the offspring to evoke distress behaviours. From this perspective, a correspondence of emotional intensities exists, in which competent nurture and a satisfied offspring represent one extreme, and a failure to nurture and a distressed offspring represents the other.

In the event that parent or offspring are separated, the length of separation will indicate the intensity of the emotions CARE and PANIC and either of these emotions will act competitively in the presence of other emotions.

FEAR and PLAY

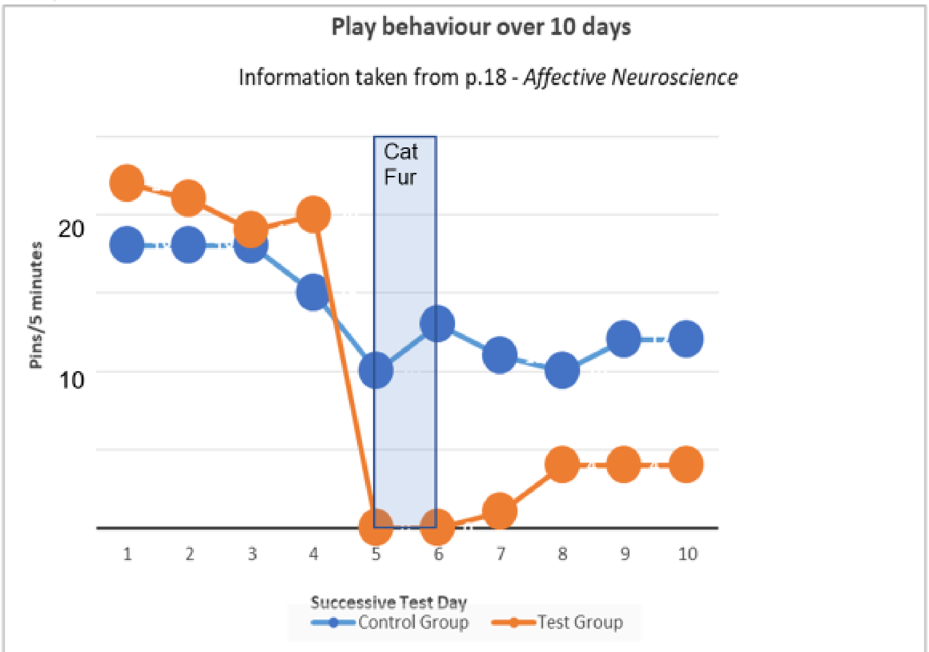
Panksepp noted that young rats placed in a chamber together would regularly solicit each other to play by making a characteristic dorsal contact, and in subsequent play behaviour they would attempt to 'pin' one another rather like wrestlers. The number of dorsal contacts and 'pins' per five minutes, reflect the amount of play occurring. In the experiment, two groups of young rats (one experimental and one control) were placed in separate play chambers for five minutes on four successive days and their play behaviour was measured. On the fifth day a tuft of cat fur was placed in one of the play chambers and for that group, play behaviour immediately ceased. The rats 'moved furtively' and cautiously sniffed the fur and other parts of the play chamber in a behaviour characteristic of FEAR.

[51] For a more extensive description of this emotional symbiosis see Panksepp pp 260-274

Following this single exposure, the cat fur was removed and the chamber thoroughly cleaned but on subsequent days, play was strongly inhibited and even after five days, frequency of play was at 30% of the level of the control group.

In understanding the rats' behaviour, the experiment can be considered in four stages. In the first, the presence of another young rat acts as an unconditioned stimulus, causing the rats to play; in the second stage, the smell of the fur induces FEAR which fully suppresses play behaviour, and in the third stage, all traces of the FEAR stimulus have been removed, but the young rats are now conditioned to behave fearfully as a response to being placed in the experimental chamber, suppressing play behaviour. In the final stage, play behaviour gradually re-establishes itself. (Diagram 14b.)

Diagram 14b.



In sum, rats who are accustomed to playing in an experimental chamber and receive a one-time exposure to cat fur in that chamber are reluctant to play on the subsequent occasion. In later sessions however, play behaviour will slowly re-establish itself if the unconditioned stimulus is not repeated. Our own emotional experiences make this gradual re-establishment of play intuitively reasonable, yet it does not speak of a process in which PLAY is solely in control of the rat's behaviour, but rather one of a competition between PLAY and FEAR in which each intermittently exerts control over behaviour, so when the rats play intermittently but less frequently in subsequent sessions, the shortening interludes of inactivity indicate the regression of the FEAR-conditioned behaviour in the absence of reinforcement.

PLAY and SEEKING

In 1981 Anne Humphreys and Dorothy Einon carried out a series of experiments attempting to discover what factors would induce young rats to play, how the rats valued play, and whether rats could learn when motivated by play. They make an interesting observation at the commencement of the paper with regard to the findings of earlier researchers:

"[Play] *tends to be characterized by a number of largely negative properties, e.g. play has no goal, no immediate result, no overall structure and happens only when the animal has nothing more important to do."* (1981 p.259).

Initially the researchers employed a 'T-maze' format in which a young rat was placed in one arm and food in the other. Even after 12 hours of food deprivation, the experimental subject, another young rat, showed a preference for play when offered a choice between food or play in the maze. Their subsequent analysis of this and several other play-related learning behaviours in rats led Humphreys and Einon to conclude (1981)

"Comparison of the social choice experiments with a food/no food experiment shows that the reinforcing value of social factors for a rat deprived of company is similar to that for a food-deprived rat. Rates of learning were similar for the two tasks. Rats will run [a maze] *faster for social rather than for food reinforcement*." (1981 p.269).

My previous discussion of SEEKING calls into question Humphrey and Einon's association of maze learning with goal preference. Rats will learn a maze without a reward, motivated by its unfamiliarity and unlike Panksepp, Humphreys and Einon have not calibrated PLAY behaviours but rather the preference for play. They discovered that a rat available for play was preferred to a rat who was not and that the opportunity to play was preferred to an opportunity to eat, even after mild food deprivation.

14.4 Summary

Of the two emotions FEAR and RAGE, FEAR is the most appropriate for experimental purposes, being more straightforward to induce and control. The difficulty of reliably arousing and measuring the effects of RAGE means that it is rarely measured under experimental conditions and never, so far as can be ascertained, in competition with other emotions. Our experience of mammalian behaviours indicates strongly, for example, that an animal in an extreme state of RAGE would not play or seek food. The only emotion which can impose itself under such circumstances is FEAR. But non-predatory encounters between and within species most frequently end in the flight of one combatant, indicating a rough equivalence, with FEAR usually determining the outcome.

In a hierarchy of emotions, FEAR and RAGE therefore will tend to subdue states such as SEEKING, PLAY, LUST and CARE but once again, experimental measurements comparing these more congenial states are rare. The Humphreys and Einon experiment suggests that the effects of low level homeostatic urges are suppressed by the impulse to play.

If competition between emotions occurs, this competition is best explained as arising between the E-state brain modes. For such a competition to occur, even if one emotion is dominant, and the other suppressed, providing both emotional stimuli are present, the suppressed emotion retains its latency as a characteristic brain mode and a behavioural disposition.

There is a single exception to this hypothesis which is found in the mutually supportive roles of CARE and PANIC, each of which evoke behaviours necessary to promote the survival of mammalian offspring prior to maturity. But again, we have no evidence to characterize the behaviours in these emotional states as outward-facing emotions: we do not know, for example, how a young animal, when separated from its parent and in a state of PANIC, will respond to external ‘non-CARE’ emotional stimuli, or whether a parent when separated from its offspring is influenced in its responses to new stimuli by the state of CARE.

In the absence of such evidence, the virtue of a competitive model derives from its simplicity. It does not require that emotions ‘interact’ as Panksepp proposes but only that they compete for precedence and that such competition is between E-states, having as its outcome the adoption of the dominant E-state behaviour. This competition can take two forms:

1) When one E-state brain mode is dominant, the dominant behaviour is evoked.
2) When E-state brain modes are each of an intensity insufficient to suppress the other, the behaviours evoked will alternate as a function of the relative E-state intensities.

Chapter 15: Primitive Emotions - Summary

My aim has been to demonstrate the existence of a framework of subcortical mechanisms - *primitive emotions* - which support the important life-sustaining, reproductive and social/nurturing functions we observe in mammalian species.

Each primitive emotion evokes a characteristic behaviour (or behaviours) in response to the detection of one of two general stimulus types:

1) ***Unconditioned stimulus*** directly inducing a primitive emotion which can be understood as consisting of these components:
   - An inborn mechanism able to detect a particular stimulus object, or class of stimuli, which will arouse a characteristic brain mode:
   - The brain mode, consisting of subcortical neural circuits and associated neurochemistries, causes:
     i. a behaviour which addresses the stimulus detected, or a disposition to evoke such a behaviour.
     ii. A physiology – both musculoskeletal and visceral – which supports that behaviour.
2) ***Acquired stimulus*** in which a primitive emotion, when aroused by an unconditioned stimulus, may cause the subject to acquire, or act upon new, information about its environment spontaneously, either:
   - passively, in association with SEEKING, or
   - by classical conditioning in association with non-SEEKING emotions.

Processes by which Stimuli are acquired

SEEKING and the Passive Acquisition of Information by Attention

Neuroscientific research into the brain processes which instantiate primitive emotional processes provide no evidence of a function which will enable a stimulus object to be discriminated. Conversely, research into attention indicates an absence of functions which would enable acquired stimulus information to be acted upon. However, these two processes appear to interact in a relationship by which an animal in a SEEKING state displays an enhanced state of sensory arousal, catalysing those attentional processes which discriminate and retain objects as passive cues.

<u>*The Acquisition of Conditioned Stimuli*</u>

A non-SEEKING emotion generated by an unconditioned stimulus may cause an associated passive cue to be conditioned, so that the primitive emotion is aroused when that cue is subsequently detected in the absence of the unconditioned stimulus. From this account, it may be inferred that when a primitive emotion causes the subject to acquire information by conditioning, the process of conditioning is triggered by – and functions as a component of - the primitive emotional mechanism.

Primitive Emotional Responses to Multiple Stimuli

Simultaneous presentation of multiple stimuli – either conditioned or unconditioned – will arouse diverse primitive emotions, with each brain mode characteristic of an emotion acting as a proxy for its arousing stimulus, with each brain mode competing for control of the behaviour of the primitive mammal. The behavioural outcome of competing emotions will be a function of the nature and intensity of the emotions aroused – a competition biased in favour of emotions generated by constraining or life-threatening cues and against those emotions which promote the longer-term welfare of the subject, such as PLAY or SEEKING.

The Concept of a Homeostatic Imperative

The manner in which each primitive emotion evokes a behaviour in the presence of particular unconditioned and conditioned stimuli constitutes one component of a more extensive relationship between the animal and its environment, in which the animal is able to detect and respond to objects of homeostatic value in order to promote its survival or wellbeing. For example, SEEKING can be understood as a response to internal *homeostatic imbalances*; RAGE is a response to any *constraint* upon the subject's pursuit of other homeostatically-motivated behaviours, whilst FEAR arises as a response to *threats* to its survival or wellbeing. I have called these overarching stimulus classifications ‘metastimuli’ but such a description fails to address the totality of the concept. Each metastimulus is not simply a description of a class of stimuli which cause characteristic behaviours; it derives its explanatory power from its correspondence with ancient phylogenetically established motivational principles for the achievement of homeostasis within the organism, which are realised for each species as a set of *homeostatic imperatives*.

General Findings

My stated purpose in developing a primitive emotional model of emotion was to develop an account of emotionally-induced behaviours which could be clearly differentiated from the sort of reflexive behaviours found in species such as the common toad, hence providing a lower boundary between behaviours occurring as reflexes and those which are the outcome of primitive emotion.

In order to achieve this, I have offered an account of a primitive mammal, motivated solely by primitive emotional mechanisms in which brain modes intervene between stimulus and response to determine behaviour.

In the primitive emotional hypothesis I have presented, the response of a primitive mammal to a single unconditioned stimulus may be reliably predicted, but its response to conditioned stimuli will correspond to the history of the acquisition of those stimuli. In a natural environment, that history will be the outcome of accidental correlations between external objects, events or circumstances and the status of the animal at the time of an encounter[52] - a history which will differ between individuals. It will also be dependent upon the number of emotion-inducing stimuli present, each of which may induce a separate competing emotional state.

Unlike Ewert’s account of the behaviours of the toad, we could not know with certainty which objects would cause a primitive mammal to express fear or rage or how it would behave when confronted with multiple stimuli, even though the animal is acting without intention. On the basis of the explanation I have offered, the behaviours of a primitive mammal are not a reliable function of a single stimulus, or a

[52] Such as whether it is afraid, hungry or angry.

fixed array of stimuli; rather its behaviours are the product of a cluster of inherited and acquired stimuli able to arouse a primitive emotion. This unpredictability of response is increased when multiple stimuli are present, in which case the nature and intensity of the competing brain modes aroused will determine behaviour.

According to this account, the E-state brain mode and its associated conditioning processes mediate between stimulus and response in primitive emotional systems; they are *cognitive* processes conforming to my earlier description (see page 29).

PART III – EMOTION AS A DUAL PROCESS

Introduction

Primitive emotional systems are aroused in mammals when conditioned or unconditioned stimuli are detected, causing subcortical circuits and neurochemistries characteristic of an emotion to be activated. If all mammals are subject to primitive emotions, then humans will experience primitive emotions in response to certain types of stimulus.

Despite this, some of the emotions generally acknowledged by humans, such as guilt, or resentment are not explained as either the stimulus classes or the basic responses which characterize primitive emotional systems as I have described them. These emotions take as their cues a much broader scope of objects, events and circumstances and have as their outcomes a more complex set of responses to externalities than those encompassed by primitive emotional theory - some so distant that our designation of both states as 'emotions' could be regarded as accidental.

But even if we accept that some manifestations of emotion in humans differ from the primitive emotional states found in animals, there is potential common ground: in Chapter 3, I have described a Commonsense View of emotion in which, say, the terminology I employ to describe my response to losing my job is also used to explain the behaviour of a rat in a footshock chamber; so, just as I say *"I am afraid of losing my job",* I would say *"That rat is afraid of the chamber."*

The use of such terminology could be construed as implying an underlying correspondence between primitive emotions and cognitive-evaluative emotional states. This introduces a dilemma: the commonsense terminology I have described assumes that there exists some aspect of both examples -being afraid - which is shared; yet in previous chapters I have presented these two accounts of emotion as independent in their functioning. In Part I, I have described how cognitive-evaluative theory postulates that emotion is the outcome of an evaluation of some object, event or circumstance as having significance for the goals or wellbeing of the subject; in consequence, cognitive-evaluative theory holds that my fear that I will lose my job is an *intentional* phenomenon, conforming to Nussbaum's theory that my emotion is the result of an evaluation that this circumstance constitutes a threat to my wellbeing. In Part II - and contrasting with this view - I have described primitive emotions as *non-intentional* phenomena arising spontaneously and activated by a conditioned or unconditioned stimulus. According to this account, the rat in the footshock chamber exhibits fear as an automatic response, having a characteristic neurophysiology. In short, these different accounts of emotion lead me to conclude that my *fear* of losing my job is not the *fear* of a rat in a footshock chamber.

The dilemma may be summarised thus: I have presented two apparently independent accounts of emotion, yet neither of these accounts is able to explain the commonsense view that certain aspects of emotion - both cognitive-evaluative and primitive - are shared by humans and other mammals.

My intention going forward is to answer this question: *can these three accounts of emotion be brought together into a single explanation in such a way that each is vindicated*? In pursuit of this goal, the framework for the theory I intend to advance is a ‘dual process’ model. Dual process theories are used in psychological explanations of mental phenomena as diverse as memory (Jacoby 1991), reasoning (Frankish 2009) and decision-making (Klaczynski 2004).

The outline methodology I will adopt will be to explore a number of experiments carried out by psychologists and neuroscientists which describe an interaction between primitive and evaluative states of emotion, with the object of generating a new account of emotion which is constituted of primitive and evaluative states acting as mutually supportive elements of the human emotional process in a relationship typical of a dual process explanation.

My approach will be to assemble and discuss the evidence for this explanation in stages:

- *Step1*: Chapter 16 will employ evidence from a set of experiments by Murphy and Zajonc and another from Hess. Both experiments support the view that brain states, characteristic of primitive emotions, introduce affective biases into evaluative states.

- *Step 2*: Chapter 16 will examine further evidence from Murphy and Zajonc's findings in which cognitive evaluations act to regulate primitive emotions.
- *Step 3:* Chapter 17 will consider the neuroscientific evidence of Vuilleumier, Driver *et al.,* in which measurements of the neurological states of attention and emotion are compared. From these measurements it is claimed that evaluative responses to affective images are associated with the automatic arousal of brain processes which bias the perception of the image in a manner analogous to that of attentional processes.
- *Step 4:* In Chapter 18 This claim is argued to be consistent with the findings of Smith and Lazarus's psychological studies in which certain patterns of appraisals are found to be strongly associated with the subjects' reports of their emotional states. In explaining this connection, Lazarus claims that emotions are the result of a process whereby appraisals signal the presence in external contexts of issues of adaptive significance for the subject, resulting in the arousal of underlying stimulus/response reflexes, causing physiological changes and states of action preparedness. This account is argued to fail adequately to account for the connection between emotional appraisals and co-occurring physiological changes and action impulses - effects which are more completely explained as the action of primitive emotions.
- *Step 5:* In chapter 19, based upon the foregoing accounts, an explanation for the interaction of primitive and cognitive-evaluative states is proposed in which patterns of appraisal occurring in cognitive-evaluative states cause the arousal of primitive emotions and these, in turn, bias the appraisal process
- *Step 6:* Chapter 20 will further develop this explanation, creating a model of emotion which conforms to the requirements of a class of psychological phenomena known as 'dual process'. This model describes the interaction of intentional cognitive-evaluative states with nonintentional primitive emotional states in which the feelings associated with cognitive evaluation are attributable to neurodynamic and neurochemical brain conditions generated by an underlying primitive emotional system – explaining their role in emotion as experienced.
- *Step 7*: Chapter 21 explains the influence of primitive emotion upon cogni tive-evaluative processes as the effects of emotional feelings

Chapter 16: The Influence of Primitive Emotional States upon Cognitive Evaluation

16.1. *Murphy and Zajonc's Comparative Investigation of Conscious and Nonconscious Affect*

In a 1993 paper *"Affect, Cognition, and Awareness: Affective Priming with Optimal and Suboptimal Stimulus Exposures"* Sheila Murphy and Robert Zajonc (M&Z) describe a set of experiments designed to determine whether affect can arise nonintentionally in humans and if so, whether such manifestations of affect are able to influence cognitive evaluation. I will briefly outline the experimental design and procedures below:

- The researchers employed 'affective primes' - slides of ten male and ten female faces expressing happiness or anger which had been assessed by Ekman to induce positively and negatively valenced affect states in humans. (examples below from Lawrence 2015)

- Each emotion-inducing slide was followed by an example from another set of slides consisting of 45 Chinese ideographs which acted as 'target stimuli'. Chinese ideographs were used because the images carried no affective content, being bland, novel and ambiguous. To ensure this, the ideographs were tested initially without primes and then in association with 'irrelevant' primes (polygonal shapes) to ascertain that, both in themselves, and in association with other neutral objects such as polygonal shapes, the ideographs were neither inherently liked or disliked.

- In each study, a group of subjects were exposed to slides of ideographs followed by either positive or negative affective primes, or displayed separately (i.e. without primes) and were asked to what extent they 'liked' or 'disliked' the ideographs.

- Two exposure times were employed:

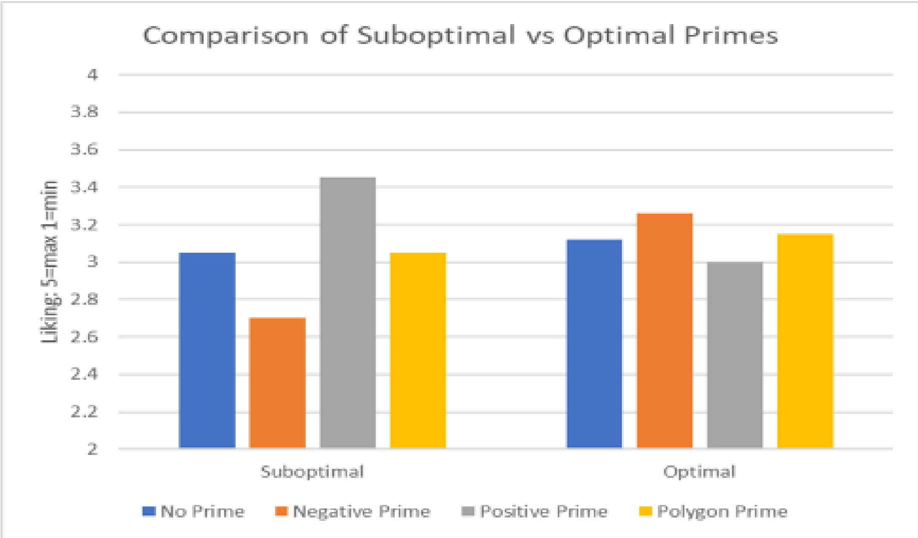
    - Suboptimal - 4 milliseconds
    - Optimal – 2 seconds

  The primes (both optimal and suboptimal) were presented immediately prior to the target stimulus and students were prepared attentionally for the image by a warning image (a dot in the centre of the screen). The same session was repeated twice for each student.

- Subjects were then asked how 'liked' the target images were on a scale of 1 – 5 where 1 is strong disliking, 5 is a strong liking and 3 is neither liking nor disliking.

The experimental results are shown in Diagram 16a. below:

Diagram 16a. Mean Liking Ratings for 10 key ideographs when preceded by positive as opposed to negative affective primes.



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Statistical analysis of the results led researchers to conclude that when the affective primes were presented suboptimally they caused the target ideographs to be liked or disliked to an extent which differed significantly from each other. Moreover, the liking or disliking of any ideograph differed significantly from the evaluations of the same ideographs when viewed in the absence of the suboptimal prime, or in combination with a suboptimally presented neutral stimulus (a polygon); in these latter experiments the ideographs were neither disliked or liked.

The results shown demonstrate a well-researched and replicable phenomenon (see also Murphy *et al* 1995*)* in which subjects who had been exposed to the affective prime suboptimally expressed liking or disliking for associated target stimuli which had previously been confirmed by two independent methodologies (polygon prime and no prime) to evoke no affective response. Since the exposure time of the suboptimal prime had been too brief for the subjects to register consciously, their liking or disliking of the target stimuli could only be explained by the subliminal detection of the affective stimulus which in turn, spontaneously triggered the action of nonconscious states, causing nominally neutral target stimuli to be evaluated as liked or disliked.

In contrast, when the affective prime was presented optimally, but immediately preceding, an ideograph, the influence of the affective prime failed to produce a significant influence on the liking or disliking of the associated stimulus.

Discussion

The results obtained point to important differences in expressions of affect towards target stimuli depending upon whether the associated affective primes were presented suboptimally or optimally:

i. Affective primes, when viewed for very short exposures, cause significant expressions of liking or disliking in the evaluation of images which, in the absence of affective priming, were evaluated as neutral.

ii. This induced bias disappears as the exposure time of the affective prime is increased.

I will treat these two effects separately because I will argue they illustrate different aspects of the interaction of cognitive-evaluative and primitive emotions. In (i), M&Z have designed an experiment in which a primitive affect system is aroused in the absence of evaluation by exposing the affective stimulus for a timespan which is too brief for the subject to register and process intentionally; whereas in (ii), as the affective stimulus is prolonged, I will argue that the subject is increasingly able to evaluate the affective and neutral stimuli independently, hence inhibiting the affective biasing of the neutral stimulus.

I will consider initially M&Z's experiments using suboptimal primes in (i) above, these will be considered in two stages: first when the initial presentation of the suboptimal prime is immediately succeeded by the optimal presentation of a target stimulus; second, when the same target stimulus is presented in a subsequent session to the same subject but *in the absence of* an affective prime.

16.2 M&Z Effect (i): Target Stimulus Evaluation is influenced by Suboptimal Prime

The description below relates only to the 'suboptimal' affective prime experiments which are displayed in the left hand cluster of results displayed in Diagram 16a.

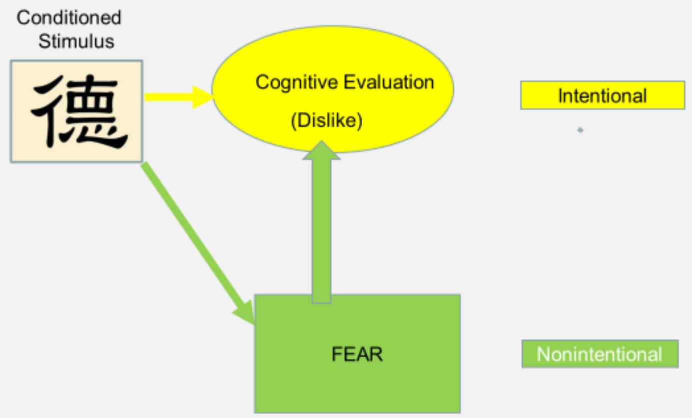
- When the Chinese ideograph is presented immediately (1ms) following a suboptimal prime, the subsequent intentional evaluation reveals a liking or disliking of the ideograph which is consistent with affective character of the associated prime. The affective prime has been presented for only 4 milliseconds; this interval is too brief for the subject to attend to and evaluate the prime. Therefore, whatever liking or disliking is reported must be caused by some mechanism whereby the ideograph, which would separately be evaluated as neutral, is influenced by the affective character of the preceding suboptimal prime - a process which cannot entail evaluation. M&Z describe this effect as one in which the affective character of the suboptimal stimulus 'diffuses' into the cognitive evaluation of the target stimulus, causing liking or disliking of that stimulus.

- The nature of the mechanism which biases the evaluation is clarified when the subject is shown a target stimulus which has previously been presented in association with a suboptimal prime. In these experiments, it was discovered that the target stimulus remained 'liked' or 'disliked'. If the original cognitive bias had been caused by some neural conflation in the temporary aftermath of the suboptimal stimulus presentation, we should expect that upon later presentation, the effect would disappear, whereas the experiment demonstrates that the affective bias is retained. M&Z attribute this effect to the action of conditioning. They appeal to the findings of LeDoux *et al*,. in which a stimulus induces an affective response more rapidly than can be explained by the brain's ability to retrieve and assess that stimulus. *"This neuroanatomical architecture thus allows us to like something without knowing what it is."*. (1993 p.737).

LeDoux proposes (see Chapter 11, p.160) that when an unconditioned stimulus (normally a fear-inducing stimulus) is presented in association with a neutral cue, having no affective potential, then a spontaneous process will occur in which the neutral cue will assume the affective status of the unconditioned stimulus. In this state the neutral cue is *conditioned*. When the conditioned stimulus is subsequently presented, it acts as a proxy for the (now absent) unconditioned stimulus, causing aversion (Diagram 16b.). In LeDoux's experiments, it is proposed that the mechanism which most readily causes conditioning is fear. In M&Z's experiments, Chinese ideographs serve as neutral cues and the unconditioned fear stimulus is an Ekman facial image.

Diagram 16b.

Illustrating the Effect of a Conditioned Target Stimulus in Inducing Affective Bias in Murphy and Zajonc's Experiment



A Note Regarding The Persistence of Primitive Emotions in the Presence of Related Conscious States

In Part I, I have reported the cognitive evaluative responses to the subliminally induced affective states I have described above. Lazarus states that they "*seem to disappear or at least go underground with an ontogenetic shift to higher mental processes"* whilst Solomon is dismissive *"Joe LeDoux and Jaak Panksepp, and Antonio Damasio,* [sometimes present] *an emotion* [ ] *as if it is more or less over and done in 120 milliseconds, the rest being mere aftermath of cerebral embellishment."* (2004 p.78)

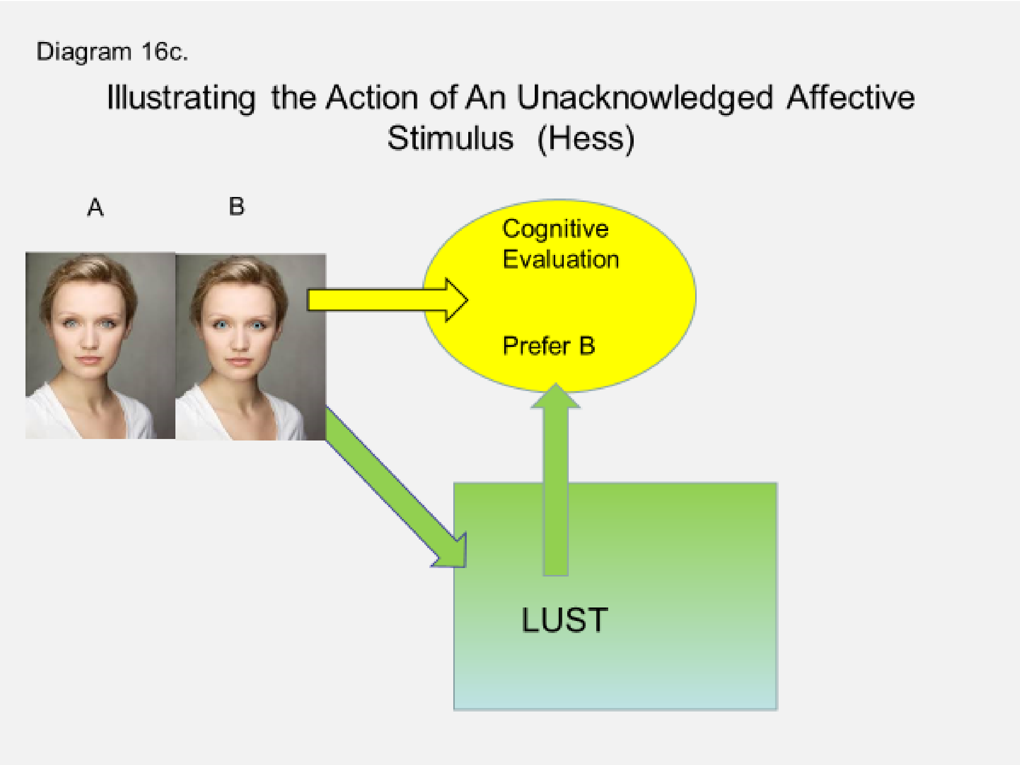
Contrasting with this view, Seamon *et al.* in their research into the action of subliminal affect upon a neutral stimulus, observe *"When the judgment task was delayed for one hour or one week after the study stimuli were shown, only target selection by affect* [i.e. targets which had been presented in association with a suboptimal stimulus] *remain greater than chance".* (1984 p.465). On this account, a liking or disliking of an initially neutral target stimulus which has been suboptimally conditioned is a persistent phenomenon.

These results demonstrate that we cannot assume that the action of primitive emotion on human evaluation is a fleeting phenomenon; and we cannot assume from Hess's experiment (see below) that to have an effect upon evaluation in humans, the origins of an unconditioned stimulus must be obscure. With these particular examples, we can differentiate nonintentional states from cognitive evaluations *just because* the biases generated seem irrational, making them useful for experimentation by revealing the action of these underlying states. In doing so, these experiments provide rare examples of the unregulated effects of primitive emotions upon evaluation; they do not represent the action of primitive emotions generally.

16.3 The action of Primitive Emotional Systems other than FEAR

Murphy and Zajonc also speculate as to whether experimental stimuli could induce responses other than aversion or liking. One such example has been provided by E.H. Hess (1975) who described an experiment in which male subjects were presented with a pair of almost identical photos of a young woman, with the single difference that the pupils in one of the photos were artificially enlarged. Whilst subjects were unable to identify any specific differences between the photos, the 'larger pupil' image was preferred to an extent which was statistically significant.

Hess's experiment may be explained as the action of a primitive emotion: the preference observed is caused by an unconditioned stimulus, dilated pupils[53], which is sexually attractive to males, inducing the primitive emotion LUST, causing preference for that image (Diagram 16c.).



[53] In Renaissance Italy, young women would put drops of belladonna extract in their eyes to induce pupil dilation and enhance sexual attractiveness.

16.4. Some Observations Regarding the Nature of Nonintentional Emotional States

16.4.1 Primitive Emotions as Subdoxastic States

In his 1978 paper Stephen Stich concludes from Hess's experiment that there is plainly some unknown mechanism which gives rise to a preference for the larger pupil size – a mechanism which I have attributed to the action of the primitive emotion LUST. The mechanism is able to detect and react to small discrepancies in the two images which remain hidden from the evaluative process.

Because the experimental subjects were unable to identify the difference between the two images, the stated preference was claimed by Stich to *"play a role in the proximate causal history of beliefs, but there is a strong intuitive inclination to deny that they are beliefs themselves."* (1978 p.503). Stich termed these types of mental phenomena 'subdoxastic states'. These states support active belief-driven processes, which Stich describes as occurrent beliefs:

"In this case, the state which serves to represent the information that one pupil is larger than another is analogous to quite unexceptional cases of belief. For we are ordinarily quite unaware of most of our beliefs, and the experience of having the belief occurrently is provoked when our attention is directed to the content of the belief." (1978 p.506)

It is only when prompted that we employ an inferential process to identify the mental states which support occurrent beliefs, and it is here that the distinction between beliefs and subdoxastic states may be examined. To exemplify: I will find when prompted that when I express a preference for ice in my whiskey, I can support this preference with the belief that ice will cool the whiskey. However, in Hess's experiment, the subject will be unable to employ an inferential process to access the origins of his stated preference for one image over the other when prompted.

Stich points out that if we were to draw the subject's attention to the effect of pupil size, he would become able to form an inferential basis for his belief, yet despite this, we would generally be unwilling to treat the origin of the initial expression of preference as a belief. Stich asks:

"*What is it about the state in the Hess example that makes us reluctant to treat it as a belief? I think the answer is that this state* [has] *a sort of inferential isolation from the body of our accessible beliefs*" (1978 p.506).

Stich argues that our unwillingness to attribute the stated preference to the action of the unknown mechanism in the role of a belief stems from our inability to *infer* (in the absence of further explanation) that the preference has been caused by dilated pupils. It might be claimed that in Hess's experiment, such a chain of inference extends seamlessly down through the substrates which support our intentional inferential processes to the unknown mechanism which causes the preference. But whilst acknowledging that some underlying mechanism exists, Stich argues that we are unable to account for its function, nor are we able to explain the manner in which preference is generated in the evaluative process. For these reasons, such mechanisms are inferentially isolated.

16.4.2 Covert or Implicit Beliefs

In claiming that certain stimuli, by arousing emotional states spontaneously, can influence intentional processes and particularly expressions of preference[54], I wish immediately to contrast this effect with the action of covert or implicit beliefs. Amelia Rorty, in her paper, *Explaining Emotions,* argues that in making certain evaluations, our motivating beliefs may be hidden from us:

"Constructing the causal history often involves reconstructing a rationale: the problem is to determine at what point in that history to apply some modified version of charity. Often it is accurately applied only quite far back in the person's psychological history to explain the formation of pre-propositional but intentional habits of salience, organisation and interpretation. It is these which through later intervening beliefs and attitudes - many of them false and inappropriate – explain the conservation of emotions." (1978 p.140).

[54] Zajonc summarized this phenomenon: 'preferences need no inferences'

What Rorty is describing is an important class of emotional evaluations, formed intentionally and motivated by beliefs which, over time, have become forgotten by the experiencing subject or have been suppressed for other unacknowledged motives. The presence of such beliefs is generally signalled by systematic biases in our appraisals which appear to others to be irrational, or to act against the perceived interests of the subject. Rorty proposes that such beliefs may be traced back through the psychoanalytic method of regression to some forgotten historical event in which such a belief would constitute a comprehensible, though not necessarily optimal, response to a set of circumstances.

To illustrate the type of bias she has in mind, Rorty imagines a case in which a male subject has an irrational dislike of women in authority. He reacts to instructions from women in such roles in a resentful manner which he would not adopt if those same instructions were given by a man. And in justifying his behaviour, he falsely emphasises aspects of the women's demeanour and behaviour as causing his resentment. During the process of regression, the subject is found to have a rather distant relationship with his mother and a closer relationship with his uncle, who encouraged him to regard women in this way.

In expressing an irrational preference, the subject is acting intentionally and may invent plausible reasons for his feelings, but the underlying beliefs which cause these preferences, though initially inaccessible to him, are not Stich's subdoxastic states. Such beliefs may, with support from a therapist, be traced via an inferential process to some underlying belief, based, perhaps, upon false premises. These beliefs are not – to use Stich's term - 'inferentially isolated' in the manner of the affective biases induced by conditioning in Murphy and Zajonc's experiments, or the inborn neural mechanism of response to dilated pupils in Hess's investigation. Both mechanisms remain to be fully explicated as neural phenomena and neither is accessible via an inferential process entailing regression.

Summary

The evidence from Murphy and Zajonc's 'suboptimal prime' experiment allows me to take a first step towards my goal of bringing together cognitive evaluative and primitive emotional theories in a single explanation: it describes an interaction of states in which a primitive emotional state, when aroused by the subliminal detection of an affective stimulus, causes the subject to evaluate a stimulus - which, in the absence of the affective prime, would be evaluated as neutral – as liked or disliked. Moreover, whether the stimulus is liked or disliked corresponds to the affective nature of the associated suboptimal prime.

16.5 M&Z Effect 2: Target Stimulus is not Biased by Optimal Prime

My account going forward relates only to M&Z's 'optimal' affective prime experiments which are displayed in the right-hand cluster of results displayed in Diagram 16a. on p.209.

In the second stage of M&Z's experiment, the affective prime is presented for 2 seconds followed by the target stimulus. In these experiments, affective biasing of the target stimulus is not observed[55] - target stimuli are appraised as neutral. This finding is in conformance with Lazarus's cognitive-evaluative explanation. But M&Z argue that this neutrality might be the effect of increasing the exposure of the affective stimulus, a process in which:

"the subsequent information contradicts or dilutes the primary affective reaction, [creating] *the possibility that the two sources of influence could nullify each other, thus cancelling the priming effect."* (1993 p.727)

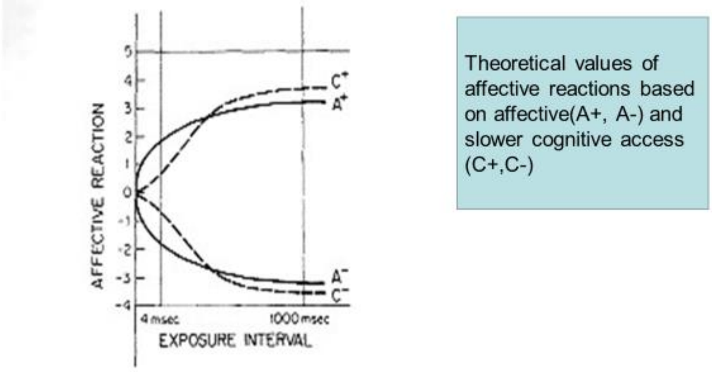
[55] On the face of it, it could be argued that the affective influence is even slightly reversed (Diag. 16a RHS) but M&Z maintain that this reversal is statistically non-significant.

Murphy and Zajonc are postulating that as affective prime exposure is progressively increased, a separate cognitive evaluation of the prime is enabled which inhibits the influence of the prime upon the target stimulus[56]. More specifically, they propose that as prime exposure times increase, two mental processes are activated: first – and most rapidly - a raw expression of affect (which they term 'A') *"unencumbered by other more complex information"* (1993 p.727); second - but in parallel with this process - they propose a delayed cognitive response 'C' in which: "*the individual is capable of accessing not only the primitive and gross affective significance of the stimulus but is also able to glean additional affective input from a more extensive cognitive appraisal. At longer exposures then, the stimulus is likely to activate a more complex network of associations allowing for feature identification and recognition."* The arousal of both these neural processes is charted by M&Z below.

In order to illustrate the operation Effect 2, M&Z combine their experimental results with those from a separate study by Seamon *et al.,* which measured affective and cognitive processes over a 0 – 48ms range of exposure times, they have constructed the chart to represent the interaction of processes 'A' and 'C' shown in Diagram 16d.

Diagram 16d.

Arousal Times of Affective and Cognitive Processes, where + = Liked and - = Disliked



Sheila T. Murphy and R.B. Zajonc. 1993. Journal of Personality and Social Psychology. Vol 64. No 5, p 727

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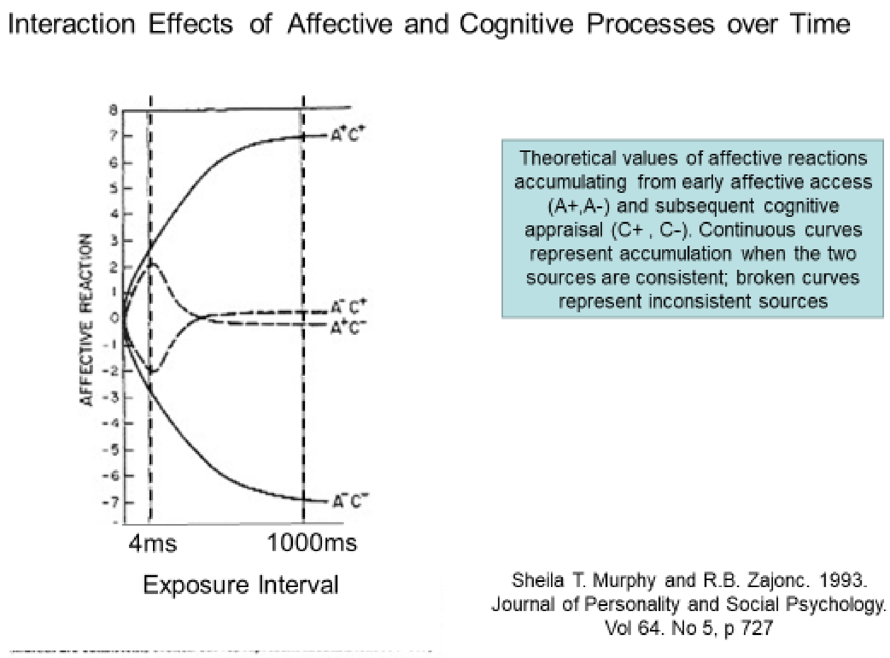
[56] Panksepp supports this view: "*Cortical control of primitive behaviours and basic emotions has been achieved in several ways. One way was for the cortex to extend emotions in time by allowing organisms to dwell on past and future events. Another pervasive solution was for the cortex to inhibit the actions of primitive instinctual systems situated in subcortical areas"* (Panksepp p74)

These two processes interact. As the cognitive response becomes established over time, it may either be consistent or inconsistent with the initial raw affective response, hence reinforcing (exciting) or nullifying (inhibiting) its initial effect. This constitutes a different claim to that made for Effect 1 (the claim that a cognitive evaluation can be influenced by a primitive emotion); it is a proposal that a cognitive evaluation of an affective stimulus, in association with a neutral stimulus, will tend to suppress the initial evaluative biasing of the neutral stimulus, which has ‘diffused’ from the subliminally-presented affective prime, as the prolonged evaluation time allows the separate ‘neutral’ status of the ideograph to be progressively established.

In these results (Diagram 16e), M&Z depict the interaction of cognitive and affective stimuli as a function of exposure: for example, C+ will continue to excite (i.e. reinforce) A+ if the initial affective biasing is confirmed by the delayed cognitive evaluation, whereas C- will inhibit (i.e. tend to nullify) A+ if the delayed cognitive evaluation conflicts with the initial affective biasing. Similarly A-,C- conditions are reinforcing whereas A-,C+ are nullifying.

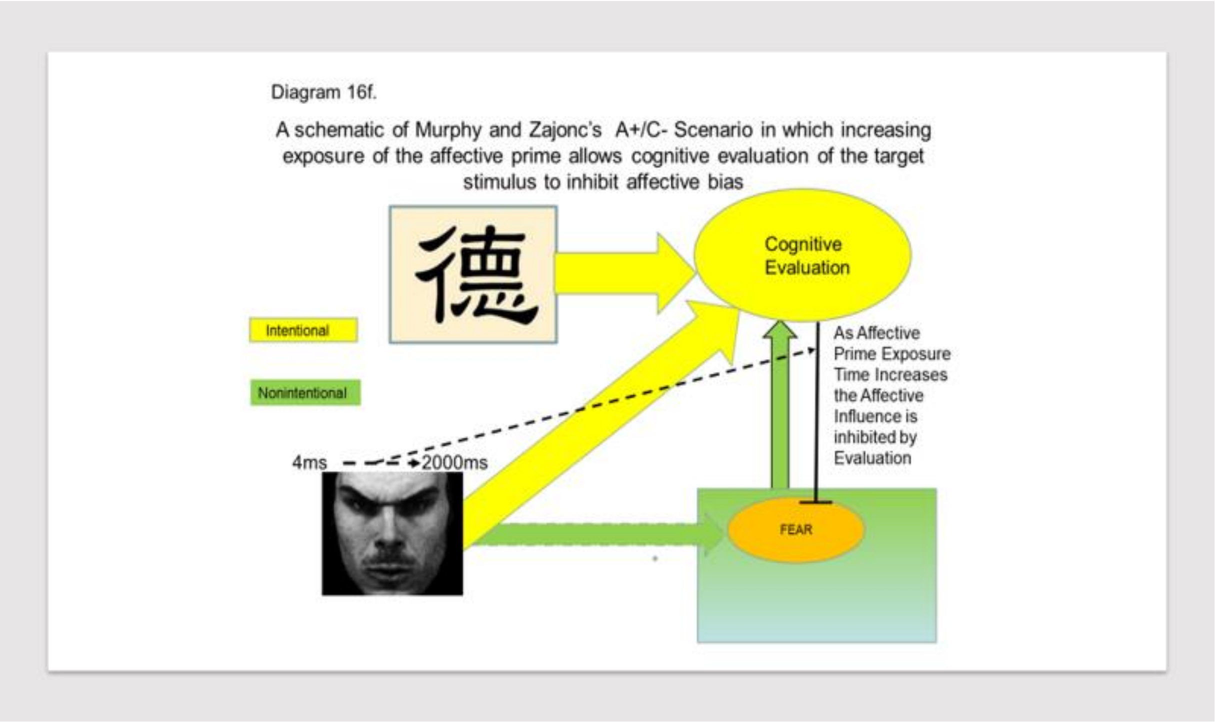
Diagram 16e.



16.6 Discussion

- *Inconsistent Affective Prime and Target Stimulus*

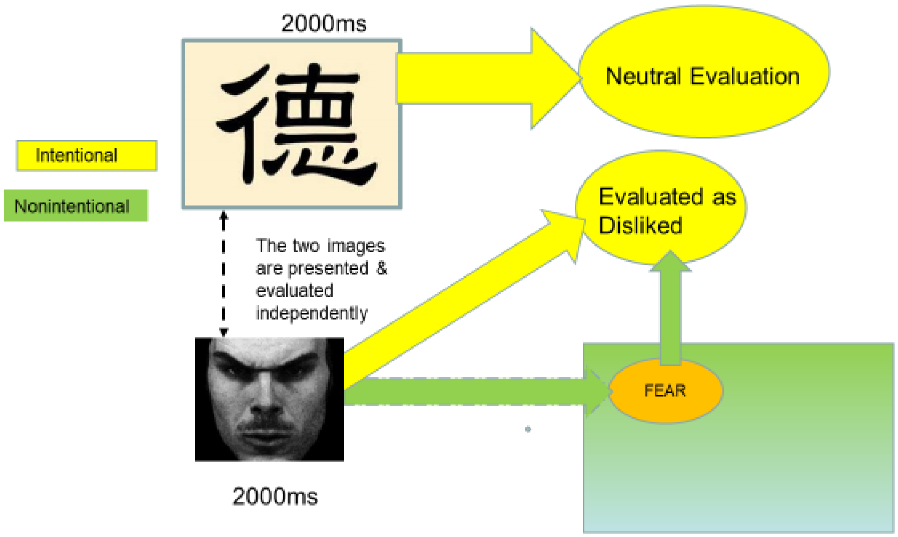
In Murphy and Zajonc's optimal prime trials, the power of the affective prime to induce an affective bias towards the neutral stimulus diminishes as the affective prime exposure time is increased. This process is attributed to the action of the cognitive evaluation, in which a developing apprehension of the separate nature of the affective prime causes a corresponding inhibition of its effect. When the affective prime is initially presented at very limited exposures, cognitive evaluation is overridden by the affective influence of the prime, but as affective prime exposure is extended, cognitive-evaluative processes progressively intervene to suppress the initial affective preference, as the separateness and neutrality of the target stimulus is gradually *re-cognized*. Diagram 16f. below provides a schematic of this process.



The process described above will reach a conclusion when the affective prime has been exposed for a sufficient length to allow the subject to apprehend that the two images are separate and unconnected as in Diagram 16g. below.

Diagram 16g.

A schematic of Murphy and Zajonc's A+/C- Scenario (2000ms) in which the affective prime and the target stimulus are assessed independently



M&Z do not investigate the separate evaluation of the optimal prime in their study. However, experiments by Vuilleumier *et al*. in the next chapter will demonstrate that the prime is evaluated as disliked, and that this evaluation is supported by neural processes which are typical of primitive emotions.

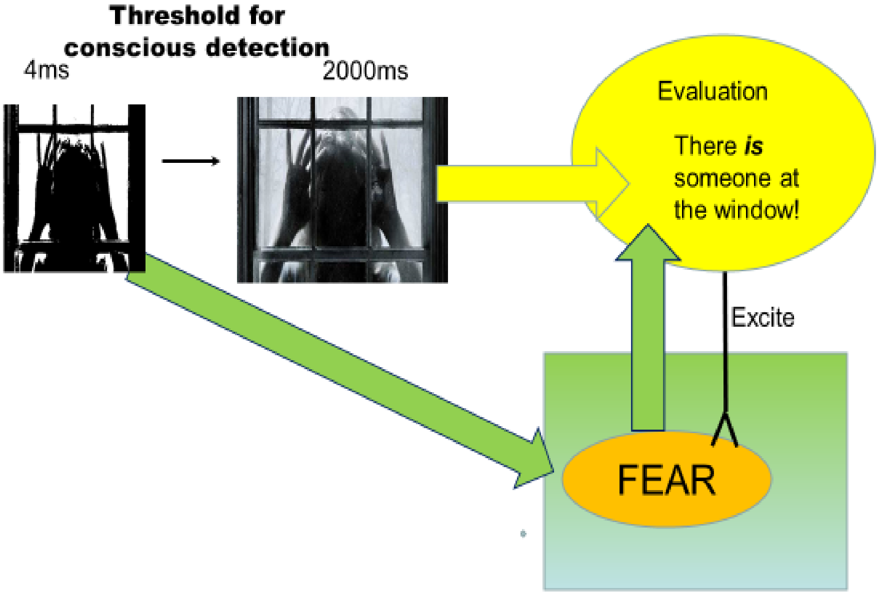
- *Consistent Affective Prime and Target Stimulus*

Murphy and Zajonc's research is concerned with affective and cognitive processes which induce opposing effects so that the initial affective reaction becomes nullified. Consider now the predicted A-/C- interaction, where delayed evaluation reinforces a suboptimal aversive response.

Assume that at the periphery of my vision I glimpse a strange figure at the window, producing an early-onset FEAR response. This immediately causes me to turn my attention to the window and I discover that indeed, there *is* a strange figure (Diagram 16h). Unlike my evaluation of the Chinese ideograph, this evaluation confirms and supports the initial primitive emotional impulse, exciting and prolonging the physiological and neurological states already aroused.

Diagram 16h.

A schematic of the Murphy's A-/C- model in which evaluation of the target stimulus is consistent with early arousal of primitive emotion



16.7 Summary

The evidence from Murphy and Zajonc's experiments allows me to take two steps towards my goal of bringing together cognitive evaluative and primitive emotional theories in a single explanation:

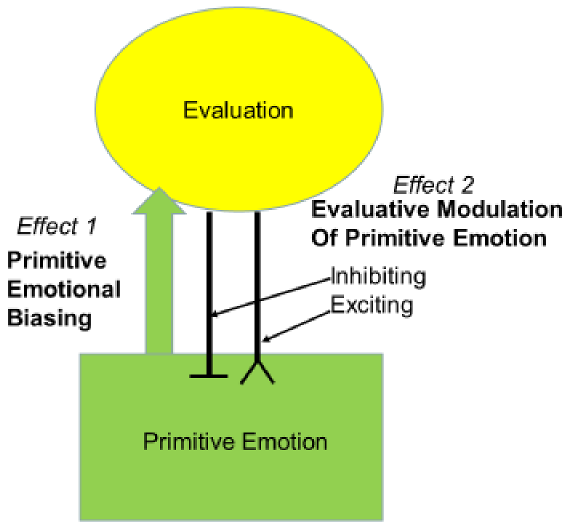
- M&Z's suboptimal prime experiments describe the biasing effect of spontaneously-aroused nonintentional states, which I have identified as primitive emotions, upon cognitive-evaluative states. In the M&Z experiments the subliminal detection of an unconditioned stimulus (either directly or by conditioning) causes an associated, but neutral, stimulus to be evaluated as liked or disliked, whereas in Hess's example the covert action of an unconditioned stimulus activates an inherited interpretative mechanism, causing a preference for one of two images (when prompted), which subjects had evaluated as identical.

- In M&Z's optimal prime experiments, as the exposure time of the affective stimulus is increased, further information with respect to the prime becomes available. If this new information is inconsistent with the primitive emotional biasing effect, that effect is inhibited, whereas if it is confirmed, the impulse is further excited. This progressive inhibition or excitation demonstrates the ability of cognitive evaluation to regulate the primitive emotional intensity.

The interaction of cognitive-evaluative and primitive emotional states described above may be depicted schematically (Diagram 16i).

Diagram 16i.

Proposed Interaction of Evaluative and Primitive Emotional States



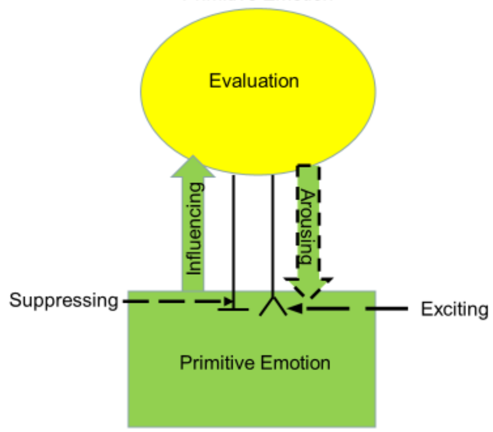
Chapter 17: Vuilleumier and Driver's Research into Attention and Emotion

17.1 Introduction

The evidence offered by Murphy and Zajonc has allowed me to characterize the interaction of evaluative and primitive states as one in which evaluation may regulate primitive emotions, whilst primitive emotions, when aroused, will influence evaluation. My goal now will be to complete my explanation of the interaction of evaluative and emotional states by offering an account of a process by which a primitive emotion is aroused by evaluation, as outlined in Diagram 17a. below. In this and the following chapters I will investigate respectively, neuroscientific and psychological accounts of emotion which provide some insights into this relationship, and I will subsequently offer an explanation - drawn from this evidence and previous findings - concerning the interaction of primitive emotion and cognitive evaluation which is consistent with both the neuroscientific and psychological evidence.

In this chapter I will open with a description of research into the neural processes by which the intention to carry out an attentional task causes the spontaneous arousal of specialized visual functions appropriate for that task. This model of attention is subsequently compared with similar experiments in which the action and interaction of attentional *and* emotional processes are described, and similarities between the functions of attentional and emotional mechanisms are proposed.

Diagram 17a.
An Expanded Model of the Interaction of Primitive and Evaluative Emotion In which the Evaluative Process arouses Primitive Emotion



17.2 Selective Attention and Modulation[57] of Sensory Processing

Over the past twenty years, advances in the number of technologies available for the measurement of brain activity[58] have enabled an improved visualisation of the functional components of brain structure and their locations. And more recent advances in these technologies have permitted a preliminary investigation into the causal relationships which exist between components of that structure.

I will now outline some findings of research into attention which have been informed by this approach.

Early psychological research into human attention indicated that for any individual, the extent of attention available to distribute between tasks at any particular time can be treated as finite; so that when, say, a subject is tasked to listen to two streams of audible information simultaneously, one of those streams is attenuated at a sensory level, allowing attention to be directed towards the preferred stream. (Triesman 1964)

Similar patterns of attenuation in response to attentional tasking have been identified for feature-selective responses in visual areas for colour versus motion (Corbetta *et al*,1990); words versus objects (Rees 1999); or faces (in the fusiform face area (FFA)) versus houses (in the Parahippocampal Place Area (PPA)) (Wojciulik *et al*). Each visual module, acting as an element of an integrated network, brings some new

[57] For clarification, I shall generally refer to 'modulation' as 'regulation'. I do this because modulation, whilst sharing the same sense as regulation (by which I indicate the regulation of the intensity of some mental process), is separately interpreted as a transition to some new musical key, or as an electronic process for mixing a signal with a sinusoid to produce a new signal. However, since Vuilleumier and Driver refer exclusively to modulation in their text when describing processes of attenuation or excitation of some underlying state (that is, in the same sense that I would describe 'regulation'), I shall retain this use when discussing their work.

[58] Techniques such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), magnetoecephalography (MEG), Transcranial magnetic simulation (TMS), or the study of focal lesions.

function to the act of attending, which may be more or less required, given the nature of the task in hand.

The source of attentional regulation has been identified as the product of distributed networks located in the superior and inferior circuits of the fronto-parietal cortex, (Corbetta and Shulman 2002) and in the medial regions of the frontal and parietal lobes.

Vuilleumier and Driver (2007) have made a survey of research into the neurological processes which arise in emotional and attentional processes and in summarising, note:

"Findings from both human and animal neuroscience provide abundant evidence that top down modulations of sensory processing play a key role in selective attention and perceptual awareness." and that *"these attentional modulations can have strong corresponding effects on perceptual judgments and awareness."* (2007 p.839).

What is being claimed here is that my intention to discriminate one object category rather than another will affect which autonomously-functioning visual modules are allocated to carry out the task, and that once selected, these modules will affect *how we look* for the objects specified in the attentional tasking.

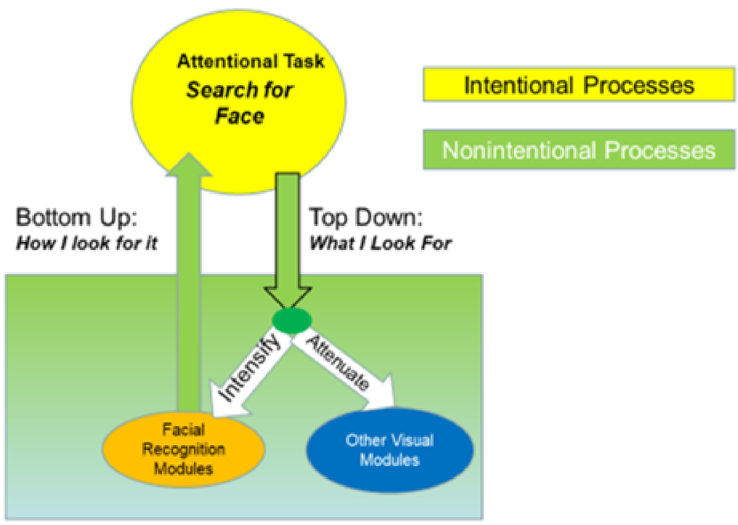
According to this account, an intention to perform an attentional task causes the spontaneous activation of visual modules appropriate for supporting that intention; so that, say, an intention to identify and select a certain type of face from a set of face and house images will bring into action a visual module favouring face selection and will attenuate the module supporting house selection. Therefore, whilst tasking is intentional and the functioning of visual modules is not, at some level, the attentional tasking must inform the selection and modulation of visual modules.

The way I intend to perform a task therefore, - looking for one stimulus rather than another - will affect which attentional modules are brought to bear upon the task. But the mechanisms which instantiate such neural processes entail both *feed back* and *feed forward* circuits. So, when Vuilleumier and Driver describe the direction of attention as a *top down* process, they are describing, not the entire attentional process, but rather the initiating tasking intention which motivates that process. However, the entire attentional process entails that while the initiating attentional tasking is intentional, how we perceive the target object and other objects in our field of vision is, in turn, adjusted - hence influenced - by a reciprocal process of exchange of information between the performance of the task in hand and the visual modules allocated to perform that task.

This explanation of the mental processes which constitute attention is outlined in Diagram 17b. below.

Diagram 17b.

A Schematic of the Top Down Role of Attentional Tasking in prompting Allocation of Attentional Modules



Vuilleumer and Driver have advanced a hypothesis for emotional states which is analogous to that of the attentional processes outlined above, and it is this research which I shall now discuss.

17.3 Emotion and Attention

Much of the evidence provided in the following paragraphs will relate to the assessment of mental causation by either visualisation using fMRI, a neuroimaging technique, or the by the use of electroencephalography (EEG) which tracks the inception, duration and intensity of a mental event measured as an electrical potential, called the event-related potential (ERP).

When viewed by a human, an expressionless or 'neutral' face will evoke a certain amplitude of visual evoked potential in the fusiform face area, but when the same face is observed to have a fearful expression, the amplitude is increased (Eimer and Homes; Pizzigali *et al*.) and the amygdala is also activated. Similar effects have been measured in the fusiform body area (FBA) and amygdala for emotional versus neutral body movements, and for the emotional prosody of voices relative to neutral prosody.

From these results Vuilleumier and Driver observe: *"One interpretation might be that emotional stimuli are simply more 'attended'. But we argue [ ] that findings for emotional stimuli may typically reflect modulation imposed by different circuits to those typically involved in modulations due to selective task relevance (cf. the frontal and parietal results above)"* and *"different areas have been hypothesised to play a crucial role for emotional influences, such as limbic regions involved in affect and memory (e.g. the amygdala) instead of the parietal or frontal cortex."* (2007 p.845)

What is being proposed above is that emotional neural pathways influence certain visual modules in the manner of the attentional processes already described. V&D advance and consider three possible explanations for this effect:

a. That emotion is simply enhanced attention.
b. That emotion 'captures' attention (i.e. the super-activated brain locus is entirely given over to emotion).

c. That emotion and attention act independently in influencing visual processing.

Vuilleumier and Driver argue for option ‘c’ and produce several pieces of evidence in support of their claim. In assembling this evidence, they compared the responses of subjects with brain lesions or dysfunction with the responses of uninjured (*normal*) subjects. I shall briefly summarise their findings.

From neuroimaging studies of normal subjects presented with affective images, it is initially demonstrated that modulation of the FFA (fusiform face area) is accompanied by dense feedback connections between the amygdala and the cortical sensory areas, an effect which did not occur when the FFA was activated by attention alone. (Amaral *et al.* 2003).

To confirm this separate mode of ‘amygdala’ activation, Vuilleumier and Driver (2004) observed patients who suffered amygdala dysfunction and found no differential responses in the pattern of fMRI responses for facial processing (FFA). That is, when fearful were compared to neutral faces, subjects exhibited a normal ‘attention only’ response for both images (Vuilleumier *et al.*, 2004). This effect has been confirmed in ERP studies by Rotshtein, who measured the P1[59] component for fearful relative to neutral faces for patients with damage to the amygdala.

To establish the counterpart of this effect, patients with brain lesions causing visual attention deficit or neglect/extinction, whilst having a normally functioning amygdala, were studied. In fMRI studies this group, even in cases where subjects appeared unaware of unemotional face images, showed activation of the fusiform cortex in response to emotional face images. (Driver & Vuilleumier 2001, Driver *et al* 2004).

[59] P1 is the measure of an electrical voltage measured on the scalp relating to visual stimuli, known as an event related potential or ERP. C1 is the first recorded potential peak at approximately 60ms. Followed by a P1 event, typically recorded after 100ms which may be modulated by attention or emotion.

Vuilleumier and Driver further investigated amygdala response to fearful expressions in normal subjects when attention was directed elsewhere. They concluded that emotional FFA arousal occurred independently of attention to that stimulus; but they note:
"*some other studies have suggested that, under sufficiently attention demanding conditions, the amygdala response to fearful faces might be reduced*." (2007 p.848)

The independence of emotional and attentional modulation is supported by other research: Raftopoulos confirmed that the P1 for face processing as an attentional task occurs at 170-180ms after stimulus presentation, whereas for emotional faces, the earliest component of modulation for emotional face processing arises at 120ms after stimulus onset, indicating (as per the findings of Murphy and Zajonc) that emotional arousal precedes, and is separate from, attentional arousal.

17.4 Discussion

Unlike Murphy and Zajonc's suboptimal prime experiment[60], Vuilleumiier and Driver's evidence indicates that even when the affective stimulus itself is available for cognitive evaluation, this evaluation is accompanied by enhanced neural activity in locations dedicated to visual processing, in association with the activation of the amygdala.

These findings are consistent with the view that when the affective stimulus is appraised, neural pathways are activated which cause primitive emotional arousal and stimulate visual processing centres at a greater intensity than would be observed for normal attentional purposes.

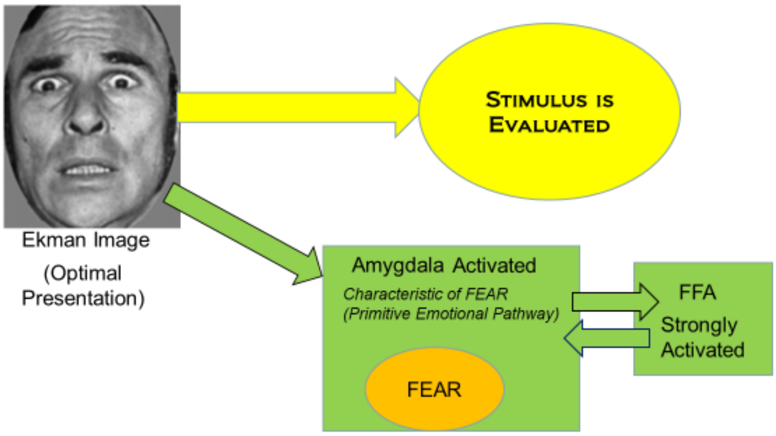
The evidence which Vuilleumier and Driver provide demonstrates that when the affective stimulus (Diagram 17d.) is presented optimally, brain circuits associated with

[60] In M&Z's suboptimal primes experiments an associated Chinese ideograph is evaluated, not the affective stimulus.

FEAR processing are aroused in parallel with the intentional processes which occur in evaluating that stimulus. This observation provides an important confirmation: cognitive evaluation of an affective stimulus does not exclude the synchronous arousal of a primitive emotional response.

Diagram 17d.

Synchronous Occurrence of Evaluative and Primitive Emotion (Vuilleumier and Driver)



17.5 Vuilleumier and Driver's Proposed Analogy Between Attentional and Emotional Modulation of Perception.

What remains to be demonstrated is the nature (if any) of a relationship between primitive and evaluative states when aroused synchronously. V&D propose that:

" *just as attentional modulation of visual processing* ***(due to task relevance)*** *can have major consequences for perceptual awareness* ***by providing top-down biases*** *that affect sensory representations of currently task-driven information,* ***emotional modulations may also analogously affect perception and awareness*** *by imposing a distinct source of bias upon sensory representations, but now based upon signals of* ***affective relevance****."*[the emphases are mine] (2007 p.848)

In identifying the source of emotional modulation, they offer a range of brain locations:

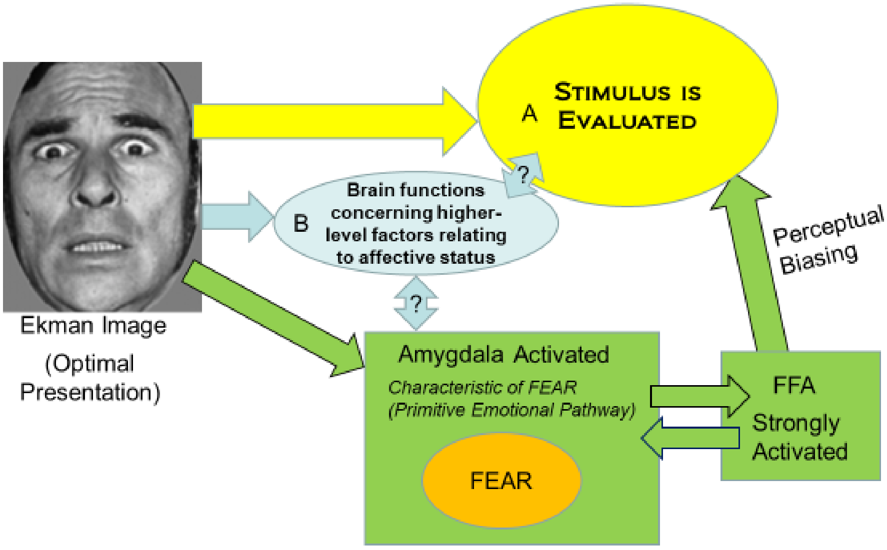
"For both parietal and sensory cortex, it seems likely that the effective reward signals would probably be conveyed to neurons in parietal or sensory areas by remote brain processes implicated in emotional and motivational processes such as OFC [orbitofrontal cortex]*, striatum and/or amygdala."* (2007 p.849)

Vuilleumier and Driver conclude that basic perceptual processes may be substantially influenced by higher-level processes concerned with affective status. Such higher-level processes are associated with the arousal of amygdala and lower-level fear-related neural processes. Neither of these conclusions are sufficient to support the claim that they concern evaluation - only that they represent some aspect of the affective status of the stimulus.

Vuilleumier and Driver take the arousal of the amygdala as indicative of higher-level processing, but this need not be the case. I have presented evidence for the effects of perceptual biasing upon evaluation previously: Murphy and Zajonc have established that evaluation of a neutral stimulus may be biased by the subliminal arousal of primitive emotional states, and LeDoux's work (see p 160) confirms that such primitive fear states entail the arousal of the amygdala, indicating that the arousal of the amygdala is not exclusively a product of the higher-level processing of an affective stimulus (Diagram 17e.). Therefore, the observation that the amygdala is activated, provides no warrant that it has been activated by higher-level processes (B). Nor has it been demonstrated that the higher-level processes relating to affective status are – or comprise elements of – cognitive evaluation (A).

Diagram 17e.

Vuilleumier and Driver's Explanation of the Action of Affective Status upon Perceptual Biasing



From this perspective, V&D's proposed analogy between attentional and emotional processes - in which the role of attentional task relevance is treated as equivalent to the function of emotional modulation in response to affective status in the biasing of visual perceptions - does not demonstrate (and perhaps, was not intended to demonstrate) an equivalence between attentional tasking and emotional evaluation.

But if Vuilleumier and Driver's higher-level brain processes relating to the affective status of a stimulus are not concerned with evaluation, we might reasonably enquire what else they might be. In looking at the image presented in the diagram, my only thoughts – other than it is a face – are judgments ("this is an image I do not like and would prefer not to be seeing"). No other thoughts seem to be present. But, even if the evaluative options are limited, this does not confirm an assertion that the higher-level processes were evaluations.

Vuilleumier and Driver's work has provided us with evidence for the co-occurrence of primitive and evaluative emotional states and confirms M&Z's conclusion that emotional states may cause perceptual biasing of intentional states concerned with evaluation; but their proposal that the affective relevance of a stimulus may cause the emotional modulation of perception and awareness has not been demonstrated.

Whilst neither claim has been demonstrated by the evidence, nor is it disproved: Vuilleumier and Driver's research does not indicate what higher-level processes are instantiated by the brain locations identified. Given the methodology employed, it is difficult to understand how emotional cognitions of affective relevance *could* reliably be demonstrated by neuroscientific explanation[61]. The arousal of subcortical affect mechanisms of the type identified by Panksepp have a systematicity and predict ability which invites confirmation by experimentation, but an experimental process in which human evaluative mental states of the scope and complexity described in Part I could be successfully identified as neurological processes is difficult to envisage. More likely, emotional cognitions would manifest neurologically as a range of complex and diverse neocortical functions of the sort found for any deliberative process.

If this is the case, the exploration of emotion as a neuroscientific phenomenon cannot currently provide further information with respect to the nature of emotion as experienced. To advance our understanding of the relationship between primitive and evaluative emotions, it will be necessary to shift the focus of this enquiry towards a review of psychological research into emotion. This research aims to identify the constituents of human evaluation which arouse emotions, and to provide explanations as to why the presence of such constituents should mark them as emotional.

[61] The distinction I make here is one of mind as opposed to brain.

Chapter 18: Psychological Explanations of Emotion as Appraisals

18.1 Introduction

In their opening description of the benefits of emotional appraisal theory, Craig Smith and Leslie Kirby outline the broad view taken by psychologists who support appraisal theories of emotion (1999 p.121).

- *"most contemporary emotions theorists view emotion as a coherent organized system that largely serves adaptive functions".*
- *"there is assumed to be a rhyme and a reason to emotion. Specifically, emotions are posited to be evoked under conditions having adaptive significance to the individual and to physically prepare and motivate the individual to contend with the adaptational implications of the eliciting situation".*
- *"appraisal has been proposed as the mechanism that links one's emotional reactions to the adaptational implications of one's circumstances. On this view appraisal is an evaluative process that serves to 'diagnose' whether the situation confronting an individual has adaptational relevance, and if it does, to identify the nature of that relevance and produce a response to it".*

Smith and Kirby propose that events and/or circumstances, when appraised as relevant to the goals, needs and wellbeing of the subject, may arouse emotion. They assert that appraisals of this type generate motivations and a state of physical preparedness. Such preparedness may be the outcome of an intentional process (I may reason that some circumstance has important implications for myself and hence requires my action) but also may have 'adaptive' origins, ancient mechanisms which give rise to changes to a number of somatovisceral and motor subsystems which cause a disposition by the subject to act.

My approach going forward will be to investigate appraisal theory in three stages:

- I will review psychological research which investigates the correlation of emotion with patterns of appraisal drawn from causal attributions of events or circumstances when they are assessed to have relevance for the subject's wellbeing.

- I will investigate psychological explanations for the co-occurrence of emotionally-arousing appraisals and alterations to the subject's somatovisceral and motor systems and I will argue that these explanations fail to explain adequately the nature or the relationship between these two aspects of emotion.

- I shall propose that psychological accounts of these phenomena are better explained as an interaction of evaluative and primitive emotional processes.

18.2 Psychological Appraisal Theories

Weiner (1986) argues that a connection can be demonstrated between inferences concerning the occurrence of emotion and the perceived causes of an event or circumstance when they relate to the self. Such inferences are *causal attributions*. Lazarus further proposes that such attributions cause emotions when the subject appraises the implications of an event as having relevance for his/her wellbeing.

Psychologists (Scherer 2001, 2005, Smith, Lazarus *et al* 1993) who wish to investigate the relationship between appraisals and emotion attempt to establish a correlation between some features of the appraisal and the nature and intensity of emotion which subjects report as a response to that appraisal.

Smith, Lazarus *et al.* describe some characteristics of appraisals which cause emotions: "*Relevant issues include, Do I care about what is happening? Is it good or bad for me? Can I do anything about it? Can I accept it? Will it get better or worse? We suggest that this latter type of evaluation provides the emotional "heat" in an encounter"* (1993 p.917)

Smith & Lazarus propose that different types of emotions arise initially in a two-stage appraisal of causal attributions which they call the 'molecular' level: the first appraisal stage (confusingly) also has two components acting consecutively: first, appraisal of motivational relevance (does it concern my survival or wellbeing as it is expressed in my values and/or goals?); second, appraisal of motivational congruence (is this consistent or inconsistent with those needs, goals?)

The second stage of appraisal is also comprised of two components. The first concerns the individual's view of their resources when considered in terms of their ability to cope; that is, the extent to which the experiencing individual believes that he can exert control over the emotionally-arousing event, making it conform with his/her needs and goals (can I handle this?). The second component concerns the locus of the event (who or what is accountable/responsible?) This may have an external locus (pertaining to a person or group), an internal locus (pertaining to the self) or it may be assessed as a chance happening, or the working through of some inanimate process - in which case, its emotional potential may be diminished.

Following this 'molecular' two stage process of appraisal, Lazarus proposes the existence of an organising 'molar' stage, in which these appraisals are brought together into one of a number of *core relational themes*. So, for example, some potentially harmful circumstance (say, an angry dog) will be appraised to have motivational relevance (it has implications for my wellbeing) but is also motivationally incongruent (it is potentially bad for my wellbeing); the accountability for this circumstance lies in something external to myself (the dog) and my coping potential is low or uncertain (It's big dog; I'm not sure I can deal with it). Such a circumstance i.e. "I am in danger and might not be able to handle it." might further be interpreted as a threat, one of Smith and Lazarus's core relational themes.

18.3 Smith and Lazarus's Investigation into the Relationship between Appraisal and Emotion

18.3.1 Experimental Procedure

In order to measure the occurrence and strength of an emotion as reported by an individual in response to some situation, and its correlation with 1) causal attributions, or 2) patterns of appraisal, made with respect to that situation, Lazarus, Smith *et al*. have carried out a number experimental studies.

In one of these (Study 1), 136 male and female subjects were prompted to recall situations which would normally be associated with the arousal of either a positive or negative emotion. Some of the examples they were prompted to recall are - *Positive*:

"you found out you had received an important honour" or, "your parents had a meaningful discussion with you about something you cared about." *Negative*: "you received a low grade on an exam in a course that mattered to you." or, "the person you were dating criticised you about something you cared about."

Subjects were asked to imagine these situations and to answer five questionnaires regarding them. Two of these related to causal attributions drawn from the subject's view of this situation; another listed features of appraisals made, followed by a separate questionnaire listing core relational themes which best summarise these appraisals; finally, the subjects were requested to identify the emotion experienced as a response to the situation described.

The experimental methodology is described below:

- Subjects were first asked to make *categorical attributions* (Table 18(i)) with respect to the situation described (on a nine-point scale) for each of the following[62]:

Table 18(i)

Categorical Attributions

Please indicate how much the cause(s) was related to each of the following things:

Mood:	My mood.
Physique:	My physique.
Personality:	My personality.
Ability:	My ability (or lack of it) to deal with the situation.
Effort:	The amount of effort I put into the situation.
Difficulty:	The difficulty of what needed to be done.
Luck:	Luck (good or bad)
Someone Else:	
	a) The actions of someone else.
	b) Someone else's personality.

[62] The lists of questions used in Study 1 are not presented in the research paper cited and have kindly been provided by Professor Smith.

- These initial causal attributions were extended by use of a second questionnaire ‘dimensional attributions’ (Table 18(ii) - a modified version of Russell’s Causal Dimensions Scale (1982) to assess causal locus, controllability, stability and intentionality and causal globality (nine-point scale)

Table 18(ii)

Dimensional Attributions

Locus:*
a) Reflects and aspect of yourself [to] Reflects an aspect of the situation
b) Outside of you [to] Inside of you
c) Something about you [to] Something about others

Controllability:*
a) Controllable by you or other people [to] Uncontrollable by you or other people
b) No one was responsible [to] Someone was responsible
c) Nobody could control [to] Somebody could control

Stability:*
a) Permanent [to] Temporary
b) Variable over time [to] Stable over time
c) Changeable [to] Unchanging

Intentionality:*
a) Intended by you or other people [to] Unintended by you or other people.
b) Completely accidental [to] Completely intentional

Globality:
Relevant to just this situation [to] Relevant to all areas of your life

Justifiability:
Completely unfair/Not at all justifiable [to] Completely fair/Extremely justifiable

- In the second stage of the study Table 18(iii), subjects were asked to consider the *appraisal* components. (eleven- point scale). The first two express motivational relevance, whereas the next four concern secondary appraisal issues.

Table 18(iii)

Appraisal Components

Motivational Relevance: How important was what was happening in this situation to you?

Motivational Congruence:
a) Think about what you DIDN'T WANT in this situation. To what extent were these UNDESIRABLE elements present in the situation?
b) Think about what you WANTED in this situation. To what extent were these DESIRABLE elements present in the situation?

Self-Accountability:
To what extent did you consider YOURSELF responsible for this situation?
Other-Accountability:
To what extent did you consider SOMEONE ELSE responsible for this situation?

Problem-Focused Coping Potential:
At the time you described, how certain were you that you would be able to influence things to make (or keep) the situation the way you wanted it to be?

Emotion-Focused Coping Potential:
At the time you described, how certain were you that you would be able to deal emotionally with what was happening in this situation, however it turned out?

Future Expectancy:
Think about how you wanted this situation to turn out. When you were in this situation, how consistent with these wishes (for any reason) did you expect this situation to become (or stay)?

- Subjects were then requested to assess their view of the situation as relating to one of the core relational themes in Table 18(iv) below:

Table 18(iv)

Core Relational Themes

Other-Blame:
- a) Some asshole is interfering with my goals.
- b) I've been cheated or wronged.
- c) Someone else is to blame for the bad situation I'm in.
- d) Some jerk is trying to take advantage of me.
- e) This bad thing would have been prevented if the other person had been worthy of respect.
- f) I've been dealt with shabbily.

Self-Blame
- :a) I have done something bad.
- b) Things are bad because of me.
- c) I am to blame for this bad situation.

Threat:
- a) I feel threatened by an uncertain danger.
- b) I am in danger and might not be able to handle it.
- c) I don't know whether I can handle what is about to happen.

Loss/helplessness:
- a) I feel a sense of loss.
- b) I feel helpless.
- c) Nothing can ever be done to fix this bad situation.
- d) Something I cared about is gone.
- e) This situation is hopeless.
- f) I don't see anything I can do to improve this bad situation.
- g) Just now I seem to be powerless to make things right in this situation.
- h) This bad situation is never going to improve.
- i) Something important to me has been destroyed.

Effortful Optimism:
- a) Somehow things might work out in this situation.
- b) If I try hard enough I can get what I want in this situation.
- c) In the end, there's a chance that everything will be OK.
- d) With some effort I can make things better in this situation.
- e) I can handle this difficult task.
- f) I feel that things are going to get better in this situation.

Success:
- :a) Things turned out great.
- b) I've gotten what I've wanted in this situation.
- c) Things have gone wonderfully well in this situation

- Finally, subjects were asked to identify the emotion they would experience as it relates to the core relational theme identified.

Emotions

Anger:
a) Angry b) Resentful c) Scornful d) Annoyed e) Disdainful f) Contemptuous.

Guilt:
a) Guilty. b) Regretful c) Remorseful

Anxiety:
a) Frightened. b) Scared. c) Afraid.

Sadness:
a) Sad. b) Sorrowful. c) Downhearted.

Hope/Challenge:
a) Hopeful. b) Eager. c) Optimistic. d) Challenged. e) Determined.

Happiness:
a) Happy. b) Joyful. c) Lighthearted.

18.3.2. *Discussion of Results*

In evaluating the data provided, the researchers were attempting to compare the efficacy of causal attributions (both categorical and dimensional attributions) as opposed to appraisal components and/or core relational themes in explaining the emotions which subjects reported.

The statistical technique used to discover correlations between emotions and appraisals entailed multiple regression/correlation analyses of two or more independent variables in which partial variances between classes were investigated. (Cohen and Cohen 1983)

From this analysis the researchers concluded that appraisals and causal attributions of the situations described were correlated with the reported emotion but that the pairings between emotion and attributions are more effectively represented as correlations between emotion and appraisals or as core relational themes measured separately, or as both of these in combination (Table 18(v))

Table 18(v)				
	Percentage emotion variance accounted for by variables type			
Emotion	Appraisals (components and themes combined)	Attributions	Appraisals (components only)	Appraisals (core relational themes only)
Anger	66***	30***	42***	53***
Guilt	55***	28***	27***	48***
Fear-anxiety	40***	23**	14***	39***
Sadness	59***	26***	46***	52***
Hope-challenge	50***	20**	29***	34***
Happiness	66***	48***	55***	60***
Mean	56	29	36	48
**p <.05 **p<.01 ***p < .001*				
Smith & Lazarus (1993 p.920)				

In commenting on these findings, S&L observe:

" simply knowing that an agent caused a specific event, or that the event is likely to have certain consequences, is insufficient to define the event's personal implications. To establish relevance for well-being, the event must be appraised in terms of additional issues such as whether they are consistent or inconsistent with one's goals (i.e. reflect benefits or harms); whether one has the resources to contend with any harms; whether extenuating circumstances justify the causal agent's role in producing those harms; what the event implies for the future; and so on. For emotion to result, the attribution about an event must be synthesised, and this synthesis must be evaluated for its implications for personal well-being." (1993 p.927)

According to this account, the causal attributions which occur in response to some situation are further mediated by appraisal into a pattern corresponding to some core relational theme which more effectively represents the emotional potency of that situation.

Before subjecting these conclusions to further examination, it will be noted that the researchers have reservations:

"*although the appraisal variables proved to be powerful and efficient promoters of emotion, the results indicate considerable room for improvement in the assessment or conceptualisation of the appraisal components."* (1993 p.927)

An indication of the conceptualisation difficulties might be gained by considering how an appraisal that I am experiencing the emotion 'guilt' would differ from that of 'regret'. The pattern of appraisals assigned to guilt (motivationally relevant, motivationally incongruent, coping potential - minimal, locus -myself) might equally apply to regret, but the researchers make the extra distinction that guilt would result from an intentional act on my part, whereas regret need not – something which would not be picked up by the experimental questionnaires. And this might not be the only subsidiary condition necessary to define the nature of an emotion as experienced. If we were to think of the appraisal process algorithmically, further extension to the choices on offer might be necessary to discriminate the patterns of appraisal which differentiate say, shame from guilt.

Moreover, subjects were asked to consider historical examples of emotionally potent events rather than current experiences, which allows that the accounts given and the emotions reported could have been made by subjects reconstructing their responses in accordance with implicit theories of emotion, rather than their being descriptions of the mental states which would be experienced if subjects were actually encountering the events described.

In summarising, the researchers concede that *"they* (the experimental findings) *do not definitively prove that appraisal is the causal antecedent of emotion."* (1993 p.927)

Despite the challenges described, Smith & Lazarus's findings indicate a relationship between certain patterns of appraisals concerning events or circumstances of significance for the self and reports of such events as emotional. Their research supports a hypothesis that appraisals occur in two phases, the first phase entailing appraisals of causal attributions of circumstances as they pertain to the self, and a second in which these attributions are synthesised into core relational themes, which are predictive of the type of emotion which subjects report as experiencing.

18.4 Smith and Lazarus's Explanation for the Co-occurrence Physiological Changes and Action Impulses with Appraisals in Emotional Events

The evidence that particular patterns of appraisal relating to the self are associated with emotion does not, of itself, explain how this association comes about. In addressing this explanatory gap, Smith and Lazarus propose that core relational themes:

"synthesise the pattern of evaluation outcomes across the appraisal components into the central meanings underlying the various emotions. That is, the themes represent

the patterns of answers to the appraisal questions that have ***special adaptive significance*** [my emphasis]. *Each emotion is hypothesized its own core relational theme, which represents a distinctive type of harm or benefit"* (1993 p.918).

In explaining the association of appraisals of adaptive significance with instances of emotion, Smith and Lazarus in their earlier paper, *Emotion and Adaptation* (1991), propose that emotional appraisals have evolved from reflexes in a process by which the rigid stimulus-response mechanisms which characterize reflexes have gradually loosened to allow more flexible responses to a broader range of stimulus types.

This gradual decoupling of stimulus and response has resulted in a mental process by which:

"*because there is no simple mapping between objective stimulus properties and adaptive significance, the task of detecting significant events becomes quite formidable, and to accomplish this the organism must be able to somehow classify what is being confronted into a relatively small number of categories, corresponding to the various kinds of harm and benefit it may face."* (1991 p.614).

The way in which S&L propose that this diversity is to be simplified is that causal attributions drawn from the organism/environment relationship are further appraised as falling into one of a limited set of configurations which are supportive of - or detrimental to - the subject's wellbeing. But S&L go on to state:

"However, the adaptive solution has not been merely to produce a cold cognitive process of detection and evaluation. Instead it comprises a complex psychobiological reaction that fuses intelligence with motivational patterns, action impulses, and physiological changes that signify to both actor and observer that something of significance for wellbeing is at stake in the encounter with the environment." (1991 p.615)

In expanding their account of the processes which drive this relationship, Smith and Lazarus compare the position of psychologists such as Ekman (1984), who argue that there is an innate affect program for each emotion which triggers pre-programmed action tendencies and physiological changes, with the views of psychologists (Izard 1984; Levenson 1988) who argue that emotions are socially defined phenomena which vary between cultures.

In considering these alternative views, Smith and Lazarus conclude: "*By tracing its evolution to the sensorimotor reflex we have assumed a substantial biological influence on the emotion process. Yet by emphasising the loosening of reflexive ties between stimulus and reaction, and the importance of both cognitive activity and sociocultural learning factors, we have left much room for the influence of personality in emotion, which in turn is partially a developmental experience."* (1991 p.622)

S&L take the source of the physiological changes and behavioural impulses to be reflexes - presumably of the sort described by Ekman *et al.*- without characterising those reflexes - whilst presenting appraisals as comprised of both an intentional component, in which causal attributes of external circumstances are appraised as having relevance for the self, and an innately determined element, enabling us to detect patterns in these appraisals which correspond to some core relational theme. In humans, S&L predict that the range of circumstances we are able to detect as emotionally potent will expand as we gradually master the sociocultural values which pertain to our particular circumstances.

The relationship between these two aspects of emotion is described as one in which humans and other animals are continually engaged in appraisals of their environment, employing "*a relatively small set of innately determined appraisal issues*" (1991 p.622) so that *"If a person appraises the conditions being confronted in a manner that corresponds to a particular core relational theme [ ] the pre-programmed emotion is automatically generated as a feature of our biological heritage"* (1991 p.623)

S&L are proposing that the products of intentional appraisal processes are screened by inborn appraisal mechanisms to identify the presence of core relational themes.

They assume that when such a theme is distinguished, it automatically generates a ‘pre-programmed’ emotional state in which intelligence is fused with the motivational patterns, action impulses, and physiological alterations, characteristic of a reflex.

But this description does not appear to have moved us a great deal forward in our task of understanding the nature of the relationship between appraisals and co-occurring physiological changes in an emotional event.

In order to address this relationship more fully, Smith and Lazarus further interpret the function of each core relational theme in terms of its characteristic emotion, its adaptive function and the key appraisal components involved. In Table 18(vi) below they provide some illustrative examples of emotions together with the adaptive function they provide and the appraisals which cause that emotion.

Table 18(vi) (Smith and Lazarus 1991 p619)

Adaptive functions and appraisal components by core relational theme

Core Relational Theme	Emotion	Proposed Adaptive Function	Important Appraisal Components
Other Blame	Anger	Remove source of harm from environment and undo harm	Motivationally relevant Motivationally incongruent Other-accountability
Self Blame	Guilt	Make reparation for harm to others – motivate socially responsive behaviour	Motivationally relevant Motivationally incongruent Self-accountability
Ambiguous Danger Threat	Anxiety	Avoid potential harm	Motivationally relevant Motivationally incongruent Low/uncertain (emotion focused coping potential
Irrevocable loss	Sadness	Get help and support in the face of harm – disengage from a lost commitment	Motivationally relevant Motivationally incongruent Low (problem-focused) coping potential Low future expectancy
Possibility of amelioration/success	Hope	Sustain commitment and hoping	Motivationally relevant Motivationally incongruent High future expectancy

I have difficulty in identifying the connection between the adaptive functions which Smith and Lazarus propose and the arousal of underlying neurobiological changes.

On the face of it, the explanation should reside in the adaptive function, and while I accept that some reflexive process might cause me to avoid harm, all the other adaptive functions described seem to involve intentional processes which are difficult to represent as stimuli for inborn neurobiological response mechanisms associated with reflexive behaviours. For example, S&L's identification of appraisal issues characteristic of *sadness*, does not explain how it comes about that the proposed adaptive functions *"Getting support in the face of harm* or, *disengaging from a lost commitment."* may be interpreted in such a manner that they give rise to primitive reflexes, causing neurophysiological alterations, which signal to us that we are experiencing an emotion.

Failing this, it might be that Smith and Lazarus are arguing that the appraisal components generate the underlying neurophysiological changes. This would entail, say, that there are some low-level reflexive neurobiological changes associated with sadness which would be activated by my appraising an external object as motivationally relevant, motivationally incongruent, my having a low (problem-focused) coping potential and low future expectancy. Once again, it seems hard to understand, on the basis of the evidence provided, how such appraisal components could be related to, hence activate, neurobiological states associated with reflexive behaviours.

In the absence of such explanations, I accept S&L's account of emotion as the outcome of a reduction by appraisal of a potentially unlimited number of causal attributions into a finite set of core relational themes, each of which is associated with the arousal of a characteristic emotion. I also accept that such appraisals appear, in some way, to be associated with the neurophysiological changes and action impulses observed to co-occur with such emotions; but the explanatory gap between appraisal and the co-occurrence of physiological changes and action impulses remains.

In sum, S&L fail to explain how it comes about that certain appraisals trigger physiological changes which in turn invest those appraisals with adaptive, hence emotional, significance, where others do not. To exemplify: S&L's account does not explain why a raised heartbeat and trembling, when accompanying my appraisal of a dog as dangerous, signifies fear, whereas, say, the sudden sensation of being cold and shivering carries no significance when co-occurring with the appraisal that I need to buy petrol. From this example we may infer that it is not just any goal-related appraisal which will cause an emotion and it is not just any physiological change which will invest that appraisal with emotional significance; it is only by means of some relationship between appraisals and associated neurophysiological changes that the subject is able to experience an emotional response to an external event or circumstance.

I will now advance an account of emotion which addresses this explanatory gap. In the explanation I shall offer primitive emotions are aroused by the emotional appraisal issues identified by Smith and Lazarus. And I shall argue that this relationship has arisen because primitive emotions and emotional appraisals are responsive to a shared set of motivating principles.

Chapter 19: Emotion as the Interaction of Cognitive-Evaluative and Primitive Processes

I will propose that cognitive-evaluative and primitive emotions interact in a process whereby appraisal processes, when they identify core relational themes, will trigger primitive emotions, while primitive emotions, when so aroused, generate feelings which influence the appraisal process. To do this, I modify Smith and Lazarus's account by substituting primitive emotional systems (described in Part II) for the preprogrammed biological mechanisms which Smith and Lazarus have identified as reflexive responses of the general type proposed by Ekman.

The interactive process I will advocate is consistent with neuroscientific accounts offered by Vuilleumier and Driver and the findings of Murphy and Zajonc. It describes a relationship between the action of neural processes in the limbic system, which I have ascribed to the performance of primitive emotions, and the intentional processes of evaluation which occur predominantly in the neocortex. These neural centres cooperate in a 'feed-back/feed-forward' relationship in which evaluative states will arouse and modulate primitive states, and the primitive states so aroused will influence evaluative states.

Earlier in this thesis I proposed the existence of two processes for detecting and responding to objects of homeostatic value: the first and simplest is one in which a reflex evokes an invariant response to a valuable stimulus type without cognitive mediation; in the second, primitive emotional mechanisms mediate between stimulus and response, allowing the organism to instantiate one of a set of behaviours as responses to a much greater range of potential stimuli – in which stimuli are detected by both inborn mechanisms and by means of conditioning. This mediating process (which occurs in the absence of intentionality), distinguishes primitive emotions from reflexive mechanisms, which require no mediation.

In their claim that appraisals allow the subject to identify complex events or circumstances as having significance for the subject's wellbeing, I will now argue that

Smith and Lazarus have identified a third category of mental processes for the detection of value whereby a subject may experience emotion in virtue of its ability to appraise events or circumstances in the external world.

In Chapter 4 I proposed that all animal species possess, in some degree, the ability to detect and exploit external objects of homeostatic value; hence, for any animal, there exists a set of external objects which possess homeostatic value. In Chapter 13 I have proposed that, for any given species, the state of homeostasis is achieved by an animal's conformance to a set of core motivating principles whereby a class of stimulating objects is addressed by a particular mode of response.

In mammalian species, these core motivational principles are realised as primitive emotions in which categories of stimulus objects directly arouse characteristic brain modes, causing behaviours.

I now intend to argue that the patterns of thought which Smith and Lazarus have identified with emotionally-arousing appraisals stem from the same set of core motivating principles which inform primitive emotions, and that appraisal has this advantage over primitive emotion: it allows the subject to discriminate an extended array of external circumstances as valuable and to act upon them by intention.

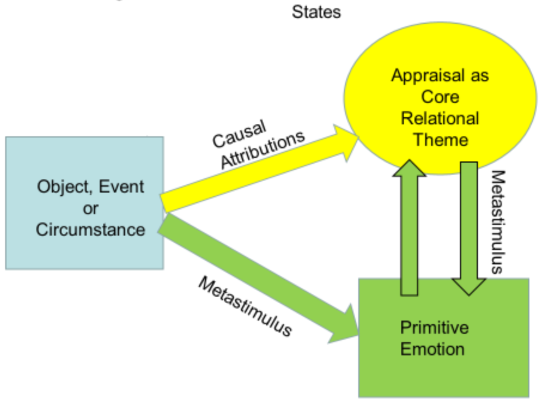
The adaptational forces which determine core motivating principles may be inferred from the observation of arbitrary conditions imposed by the environment upon any land-based organism capable of voluntary movement. For a species to persist, its members must reproduce; in order to reproduce, an animal must survive: survival requires that the animal seeks nutrients and water. In searching, the animal may encounter threats, which it must avoid, and obstacles which it must overcome. None of these conditions is optional: natural selection will ensure, say, that an animal which does not avoid threats will perish; or that an animal which exerts its maximum physical resources to overcome obstacles will persist, where one that does not will fail.

According to this account, for any animal species, homeostasis is achieved by conformance to a set of *homeostatic imperatives* – behavioural strategies performed by the species in conformance with the core motivating principles: each strategy consists of two components, so that when some class of stimulus - a metastimulus - is detected, it is addressed with a mode of response appropriate to that class of stimuli. e,g, Threat>Avoid!; Constraint>Resist!; Nutrient Deficiency >Seek/Consume Nutrients!. In primitive mammalian species, homeostatic imperatives[63] are realised as primitive emotions, in which species-specific configurations of stimulus detection mechanisms generate appropriate behavioural responses to metastimuli: e.g. Threat> FEAR!; Constraint>RAGE!; Urge>SEEKING!

Evaluation constitutes an advance upon primitive emotional systems in satisfying the demands of a homeostatic imperative. For an event or circumstance to cause an emotion, the evaluative process must detect patterns of appraisal drawn from causal attributions with respect to that state of affairs as significant for its wellbeing. The innovation introduced by evaluative processes is this: when the appraisal of causal attributions relating to external events or circumstances falls into a pattern corresponding to a core relational theme, it acts in the role of a metastimulus, causing the arousal of a primitive emotion (Diagram 19a).

Diagram 19a.

Illustrating the Interaction of Intentional and Nonintentional Emotional States



[63] Sets of homeostatic imperatives may vary between clades; for example, care of offspring and aversion to social isolation are psychological motivations which occur in mammals but not in amphibians, who respond to a more limited set of homeostatic imperatives..

In sum, when a pattern of appraisal is detected as having the characteristics of a core relational theme, this pattern serves as a token of a generic type of stimulus - a metastimulus – arousing a characteristic primitive emotion. The primitive emotion so aroused causes the subject to experience the physiological and neurochemically-induced experiential states associated with the primitive emotion as a constituent of the evaluative process.

My proposal that core relational themes serve as metastimuli for the arousal of primitive emotions requires a correspondence between core relational themes and metastimuli and I compare the taxonomies of each in Table 19(i) below:

Table 19(i)

Emotion	Core Relational Theme	Metastimulus
Anger	Other-blame	Constraint
Guilt	Self-blame	Constraint
Fear-anxiety	Threat	Threat
Sadness	Loss/helplessness	
Hope-challenge	Effortful Optimism	Urge/Goal
Happiness	Success	
Care		Offspring
Lust		Potential Mate
Panic/Distress		Separation from Parent/Group
Play		Young adult/same species

There are differences between these taxonomies which I shall now discuss:

Other-Blame/Self-Blame vs Constraint. In both cases which Smith and Lazarus ascribe to blame, my assignation of blame requires initially that some desire has been frustrated. In the case of other-blame, the locus of frustration lies elsewhere, whereas in self-blame it lies with myself. In self-blame, either some desired state of affairs has failed to arise because of my inaction, or some state of affairs which is unfavourable for myself has arisen because of actions for which I am responsible. According to this account, both other-blame and self-blame may be expressed as examples of *constraint.* I will provide a more extensive account of the effects of constraint as ‘self-blame’ below.

In previous accounts I have described how external states of affairs such as territorial incursion or threats to offspring constitute constraints upon the subject’s ability to perform homeostatically valuable behaviours. But for humans, there exists an important sub-category of constraint in which the subject directs a primitive emotion towards him/herself – a mode of attribution which is not observed to occur in other species - and for that reason may well be a distinctively human emotional experience.

As an example of a self-directed emotion involving constraint, I will investigate regret. To experience regret it is first necessary that I desire an event, and that some subsequent failure to act on my part has caused that event not to occur; for example:

1. My mother and I had a standing disagreement which I hoped to resolve.
2. My mother died suddenly and my desire to resolve our disagreement was frustrated.
3. The frustration of my desire to reconcile with my mother was caused by my own inaction.

Conclusion: My mother’s death has frustrated my desire to resolve our differences, This frustration has been caused by my own inaction, resulting in a feeling of self-directed RAGE.

The emotion regret is caused by the primitive emotion RAGE directed towards myself, arising from a frustration of my desire to reconcile with my mother. But regret might equally be coupled with a goal-associated emotion of a different type: I might regret my late arrival at an auction in which I intended to buy some desired object.

However, it cannot be argued that the emotions which arise in each example are solely those of *regret*. In order to experience self-anger at my failure to win the item at auction, I must also experience the anticipation associated with purchasing the item (SEEKING); whereas for me to experience self-anger at my failure to reconcile with my mother, my regret in response to my failure to achieve my aim of reconciling with my mother requires first, that I have feelings of affection towards my mother (CARE). These primitive emotions are not separate from the occurrence of regret, but it is self-directed RAGE alone, aroused as a consequence of my inability to achieve some desired end, which constitute the necessary conditions for my use of the term *regret* to describe both occasions.

Similar contextual patterns could be constructed for self-directed emotions such as shame and guilt. These terms pick out the common component of an emotion as a frustration of some goal, they need not describe the entirety of emotions experienced.

Effortful Optimism vs Urge. In primitive emotional theory, SEEKING is triggered by some physiological urge acting as a stimulus, generating Panksepp's state of *eager anticipation*, an experiential quality, expressed in an intentional form as Smith & Lazarus's *effortful optimism*. Panksepp envisages a much broader role for SEEKING in human behaviour than that of a response to urges. He describes this role in *The Archaeology of Mind* (2012 pp. 95-103): "*The SEEKING system impels the neocortex to find ways of meeting our needs and goals."* (2012 p.103). In describing the core relational theme accompanying the emotion 'hope/challenge' as 'effortful optimism', S&L are describing the quality of the mental state which characterizes the SEEKING behaviour, rather than describing the stimulus for effortful optimism, which is some need or goal towards which the effortful optimism is directed.

Care, Lust, Play. The situations described in Smith and Lazarus's study were not designed to identify the core relational themes corresponding to these metastimuli. No situations were described which involved nurture. Nor were situations offered which involved sexual themes. No play-associated situations were presented, although these have been employed in the experiments of Schacter and Singer in which the playful actions of a stooge aroused a state of 'euphoria' in the experimental subjects.

Separation from Parent or Group. Maternal or social separation stimulate the arousal of PANIC. Panksepp describes the associated behaviours and sensations of 'distress vocalisation, lachrymation, and lassitude'. These would serve as instances of 'loss/helplessness' in Smith and Lazarus's study, where 'loss/helplessness' determines the core relational theme for the emotion 'sadness'. However, I will presently propose that separation distress would constitute only one instance of 'sadness' which embraces a more general failure of emotionally-driven activity.

Happiness. Panksepp proposes that each primitive emotion is associated with its own 'release sensation' (Chapter 21). These various rewarding sensations signal the achievement of some homeostatically beneficial task. Their effects are experienced when the actions necessary to achieve our goals are either proceeding successfully, or are accomplished. But the success of a single emotionally-motivated behaviour, though accompanied by a pleasurable sensation, need not signify happiness.

I have accepted, in common with cognitive-evaluative advocates, that emotionally-motivated behaviours are directed towards the promotion of our wellbeing. This claim, which is not descriptive of any particular emotion, has an intentional expression (reflected in the Utilitarian view): the notion of some optimal state of an individual's affairs - happiness - towards which all actions are directed. According to this account, happiness is a measure of the collective effect of our actions, whether emotionally-motivated or otherwise, as they are judged to have *succeeded* in meeting our goals or supporting our wellbeing. This condition, *success*, also determines the core relational theme which is associated in S&L's theory with the *emotion* 'happiness'. The appraisal of happiness therefore, is not necessarily associated with the achievement of any single emotionally-driven behaviour, but is proportionate to the success of the entirety of our actions in promoting our wellbeing, or in fulfilling our goals.

Sadness. When we fail to achieve our goals in the face of irresistible threats, insurmountable obstacles, or losses, then that which was either explicitly or implicitly beneficial or desirable for our wellbeing is no longer accessible to us. In these circumstances the appraisal of our powerlessness to achieve some desired goal in the face of a counteracting reality is characteristic of sadness - a state in which the primitive emotion persists, whereas its futility is acknowledged.

Discussion

The failure of the separate taxonomies of metastimuli and core relational themes to agree fully is unsurprising, given that neither Panksepp, nor Smith and Lazarus had this aim in view. Despite this, where Smith and Lazarus have tested for emotionally-potent themes, it is possible to reconcile the two approaches: where they have not, we can readily envisage additional studies which employ emotionally-arousing situations for CARE (harm/benefit to a child), LUST (situations involving someone we find sexually attractive) or PANIC (such as the loss of a close relative).

The two exceptions to this claim are happiness and sadness. I have argued that these states do not emerge from an appraisal of a single emotional event, but from a broader appraisal of the success or failure of the subject’s goal-directed actions. In cases where the success of any single emotional project occurs, the occasion is marked by a particular release sensation such as gratification (urge/desire fulfilment), exultation (overcoming an obstacle), relief (threat release) – each representing a different manifestation of pleasurable sensation. In my explanation any of these sensations occurring singly signifies a step toward the achievement of happiness, rather than happiness itself.

Summary

The evaluative and emotional states I have described conform generally to the requirements of a class of mental phenomena which have been identified by psychologists as ‘dual process’ and my intention going forward will be, first, to explain the features of mental states which characterize dual process models generally, and then to elaborate the interaction of the evaluative and primitive components as an explanation of a range of human emotional experiences.

Chapter 20: The Dual Process Explanation of Emotion

20.1 The Status of Dual Process Theories

Before advancing more detailed proposals for the action of emotion as a dual process phenomenon, I will briefly outline the current status of dual process theories.

In their joint paper *Dual-Process Theories of Higher Cognition: Advancing the Debate*, Jonathan Evans and Keith Stanovich claim that between 1999 and 2004, the number of such theories in the scientific literature had approximately doubled to 23 (2011 p.228). Many of these researchers were working in separate fields and arrived at their theories independently.

The notion that humans employ more than one mode of cognition is not a neuroscientific or psychological innovation. Most of us would accept that there is a distinction to be made between our intuitive and reflective mental processes, or that our actions can be classed as considered, habitual or impulsive, but researchers in this field claim to have evidence that many of these cognitions and behaviours are explained by the action of two separate modes of mental process and are sometimes able to assign to each process its own brain locus.

Evans and Stanovich provide three categories of distinguishing criteria for these processes, which they term *Type 1* and *Type 2:*

- *Defining Features:* Evans (2010) believes that in order to reflect or form inferences, we require the ability to hold information in a working memory - available for immediate access - from which we deploy beliefs or concepts which pertain to an event or circumstance under consideration, in a process of mental simulation. Such processes are described as Type 2. In contrast Evans proposes that Type 1 processes act autonomously and require no working memory.

- *Correlates* are properties which frequently but not invariably attach to each process type.

- *Old Mind/New Mind:* Type 1 processes are often, but not invariably associated with earlier stages of brain evolution and can be found in all animal species. Type 2 emotions are associated with more recent evolution in brain development

Table 20(i) below is reproduced from Evans and Stanovich's paper (in which the final inclusion of 'Basic Emotions' as opposed to 'Complex Emotions' is not explained)

Table 20(i)

Type 1 and Type 2 Processes

Evans, J.S.B., Stanovich, K.E. 2011. Dual Process Theories of Higher Cognition: Advancing the Debate. *Perspectives on Psychological Science.* Vol 8(3) p225

Type 1 process (intuitive)	*Type 2 process (reflective)*
Defining features	*Defining features*
Does not require working memory *Autonomous*	*Requires working memory* *Cognitive decoupling* *Mental simulation*
Typical correlates	*Typical correlates*
Fast *High capacity* *Parallel* *Nonconscious* *Biased responses* *Contextualized* *Automatic* *Associative* *Experience-based decision-making* *Independent of cognitive ability*	*Slow* *Capacity limited* *Serial* *Conscious* *Normative responses* *Abstract* *Controlled* *Rule based* *Consequential decision-making* *Correlated with cognitive ability*
System1 (old mind)	*System2 (new mind)*
Evolved early *Similar to animal cognition* *Implicit knowledge* *Basic emotions*	*Evolved late* *Distinctively human* *Explicit knowledge* *Complex emotions*

Earlier descriptions of these modes of cognition used the terms System 1 and System 2, where System 1 described broadly nonconscious and intuitive mental function and System 2 was concerned with conscious and reflective processes. However, Evans and Stanovich employ the terms 'Type 1' and 'Type 2' processes'. I think this is better; the view that the brain functions as two systems invites the notion of a single dual system theory which describes the operation of any psychological dual process mechanism; but, as the evidence from research across a broad spectrum of dual process phenomena accumulates, the difficulties encountered in explaining all these phenomena as the products of a single theory suggest that it is unlikely that this will prove to be the case[64]: the psychological literature supporting dual process theory indicates a scenario in which there are multiple 'autonomous' Type 1 processes and a less diverse range of 'reflective' Type 2 processes, with the two process types exhibiting a range of interactive mechanisms.

Even with these heavy qualifications, dual process theories are challenged. These challenges tend to fall into two classes: first, that there need be no discontinuity between the two types of processing – for example, Harman (1973) proposes that mind can be understood as integrating nonconscious and reflective elements without inferential discontinuities such as those claimed by Stich; second, that mind is massively modular (Carruthers (2006), Mithen (1996)) and that our mental states can be understood in terms of the combined or individual action of these modular elements. And depending upon how modularity is determined, these two objections may be brought together as a single objection – that interpreting the mind as a dual process mechanism requires that we create a distinction between 'lower level' intuitive processes and 'higher level' reflective processes, which introduces a separate and unhelpful level of complexity into our considerations of mind without offering a theory of any explanatory or predictive value.

My response to such objections is straightforward: I will not appeal to any evidence from dual process literature as support for my account of emotion as a dual process, which I offer as a *sui generis* explanation of the action and interaction of intentional and nonintentional states. In claiming that the model I propose conforms in structure to the two types of process characteristic of dual process theories generally, my purpose is to provide confirmation that in characterizing my account as dual process, I am not advancing a theory of mind which is unique in its conformation, but rather I

[64] Richard Samuels offers a more detailed discussion of this issue (2009).

am offering my theory of emotion as an example of a class of mental processes designated as 'dual process' in which nonintentional and intentional affective functions are present.

20.2. Emotion as a Dual Process

Emotional Constituents serving as Elements of a Dual Process Mechanism

The explanation of emotion which I have developed in Chapters 16 - 20 envisages an interaction of evaluative with primitive emotions. For any mental state to be emotional, requires that a primitive emotion must be active, triggered either by a conditioned or unconditioned stimulus, or as the outcome of an evaluation.

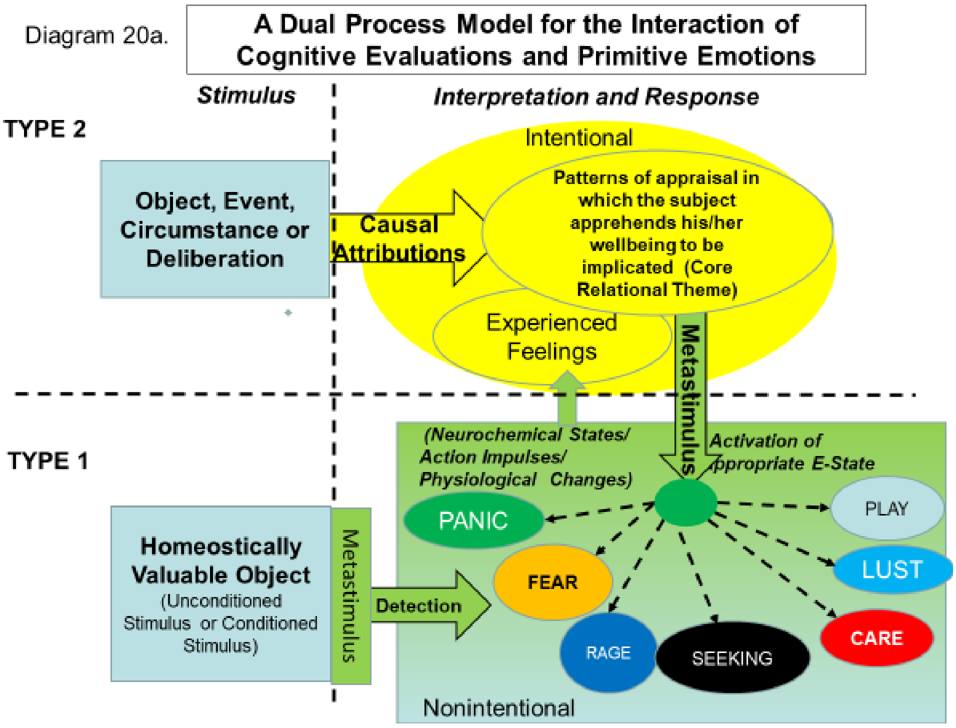
Type 1 components have these constituents:

- The states (E-states) which I have characterized as primitive emotions, together with processes by which homeostatically valuable objects are detected.
- The conditioning processes which are initiated by primitive emotions.
- the processes by which E-state brain modes compete for control of the organism's behaviour.
- the processes by which patterns of appraisals[65] drawn from causal attributions are detected as core relational themes.
- the mechanisms by which primitive emotions – when aroused – influence 'Type 2' states

Type 2 mental states of emotion originate in causal attributions relating to the self and may take the form of appraisals, or judgments of a more rudimentary nature, relating to such attributions.

This outline of the interaction of emotional processes allows me to offer a schematic summary of emotion as a dual process (Diagram 20a.):

[65] What Smith and Lazarus call 'appraisal issues'.



The schematic I have presented is not representative of any single emotional condition; rather it displays the explanatory scope of emotion as a dual process in which valuable stimuli may be detected by appraisal and/or nonintentional processes.

What remains to be explained in this model is the role of feelings in the experience of emotion, which I attribute to the action of primitive emotions.

Chapter 21: The Role of Feelings in the Dual Process Model of Emotion

21.1 Cognitive-Evaluative Explanations of the Effects of Primitive Emotional Neurophysiologies upon Emotional Appraisals

Philosophers who take a broadly cognitive-evaluative stance accept that bodily alterations occur during emotion but argue that emotional feelings are generated by an evaluative process in which some state of affairs is appraised as having significance for the self. In accepting that bodily alterations occur during an emotional experience, cognitive-evaluative advocates argue that those alterations play no role in the emotional process, which is inherently evaluative hence, intentional.

In Chapter 3 of this thesis, I have described cognitive-evaluative accounts of emotion which adopt this view. These theories acknowledge the presence of emotion-associated feelings, but the sources, the nature and the effects of such feelings are subject to differing explanations. Nussbaum claims that appraisals assume the character of emotions when they have import for the values of the experiencing subject. When emotions occur, they occur as the outcome of an appraisal process, in which we access networks of beliefs and values (which are potentially complex and diffuse) in a dynamic mental process, drawing us further into a web of emotional revelations which arise from the implications of the initial emotion-inducing event. It is these processes, particularly their urgency, and their assault upon – or reinforcement of – this network of values, which furnish the emotion with its characteristic affective quality, rather than the physiological changes which accompany the emotion. Nussbaum argues that these physiological accompaniments are incoherent, bearing no relationship to the emotion as experienced, and she cites experimental evidence from Schachter and Singer, and Cannon, to support this view.

I have reviewed this research and have concluded that neither of these experiments support Nussbaum's claim, but nor do they support a counter-claim that the alterations in physiological states which occur will vary consistently with the emotion which the subject believes he/she is experiencing.

Lazarus, drawing his conclusions from other experimental sources, takes the broad view of Nussbaum in claiming that evaluation triggers an emotional state by identifying appraisal issues which have ‘adaptive significance’ for the experiencing individual. The sorts of issues he identifies have significance for the wellbeing and survival of the subject and/or the ability of the subject to cope. But in his treatment of feelings, Lazarus differs from Nussbaum. He proposes a relationship whereby certain patterns of appraisal automatically trigger underlying somatic alterations and states of action preparedness. In making this proposal, Lazarus is allowing for some correspondence between the appraisal issues identified and the neurophysiological alterations occurring, without proposing a role for such phenomena. Rather, he argues that the co-occurring physiological changes signal to the subject that some object or state of affairs have significance for the subject; whereas our determination of its being good/bad for the subject, or being beyond the subject’s capacity to handle, arises separately, as the product of appraisal. According to this account, the physiological changes co-occurring with emotion are sensations which signal the importance of an appraisal for the wellbeing of the subject.

Solomon argues that emotions are processes involving systems of judgments as opposed to the ‘single summary judgments’, which might be associated with propositional attitudes. He maintains that such processes are dynamic, having the quality of actions, but in developing his position on feelings he makes this statement:

“*Much of what makes up emotional experience, of course, are the complexes of our experiences of the world (including ourselves), shaped and colored by appraisals and judgments of the peculiarities of this or that particular emotional perspective. I used to think that this was* ***all*** *that was essential to emotional experience, and again, I treated the feelings of arousal and the like as experiential marginalia, of little importance to the phenomenological experience that could only be understood via the cognitive complexes that shaped emotional experience as such. But what led me to an increasing concern about both the role of the body and the nature and role of bodily feelings in emotion was the suspicion that my judgment theory had been cut* *too thin. [ ] I am now coming to appreciate that accounting for bodily feelings (not just sensations) in emotion is not a secondary concern and not independent of appreciating the essential role of the body in emotional experience"* (2004 p.85)

In his argument for the introduction of bodily feelings into his account of emotion, Solomon maintains that the bodily experiences which characterize emotion constitute the immediate expression of an emotion:

"These are not mere incidentals, and understanding them will provide a concrete and phenomenologically rich account of emotional feelings in place of the fuzzy and ultimately content-free notion of 'affect'" (2004 p.85).

Solomon argues that the term 'bodily states' as described by James and Lange paints too restricted a picture of emotion as an experienced neurophysiological phenomenon. To this somatovisceral account he adds the workings of the autonomic nervous system, "*the whole range of bodily preparations and postures*" (including changes in facial expression), and the release of hormones.

Solomon accepts that a theory of emotion must account for the presence of these neurophysiological alterations. His view is consistent with point (1) raised in my summary of Chapter 3; like Solomon, I have proposed that cognitive-evaluative theory does not account for certain aspects of the emotional experience - aspects which Solomon describes as *judgments of the body*. In explaining his use of this term, Solomon distinguishes between knowledge which takes the form of 'knowing that', which he describes as broadly propositional, from 'knowing how' such as avoiding obstacles, building shelter or hiding food, which is observed in other animal species. To illustrate how Solomon frames his notion of judgments of the body, I shall use the example he provides:

*"Anger often involves feelings of discomfort but to be anger [ ] the emotion must be further directed by way of some sort of **blame** , which in turn involves feelings of ag-*

gression and hostility that may themselves be readily traced (as James did) to specific modes of arousal in the body (the tensing of muscles etc.,). So too, shame is, at least in part, a feeling of discomfort with other people, a feeling of rejection [ ]. Feelings are not just sensations, nor are they mysterious 'affects', but felt bodily engagements with the world." (2004 p.88)

Solomon provides further examples of these judgments: comfort and discomfort, frustration, low-level anxiety, joy and panic.

In offering this account, Solomon intends to expand his notion of 'emotion as judgments' to explain the physiological and phenomenological aspects of the emotional experience, arguing that these effects constitute a different class of judgments which *"may not be analysable in the mode of propositional analysis but neither are they simple manifestations of the biological substratum*." (2004 p.88).

The physiological and neurological effects Solomon has described as judgments of the body are typical of primitive emotions. In keeping with Solomon's description, primitive emotions are not simple manifestations of the biological substratum; I have previously described them as cognitive, but nonintentional, processes (Chapter 15). Primitive emotions are the products of adaptation whereby behaviours, arising spontaneously as responses to external objects and events, have been affirmed through an adaptive process as being supportive of the wellbeing or survival of the subject. Primitive emotions are found in all mammals and may be triggered by the detection of homeostatically valuable objects, or by the discrimination of value by means of a set of inborn appraisal issues as I have described in Chapters 13 and 19. They arise in the form of E-states, neurophysiological states, in which a characteristic brain mode - a neural pathway in the subcortex - is activated, causing the release of particular brain neurochemicals (neurotransmitters), producing somatovisceral states (bodily alterations) and motor arousal (behavioural dispositions). In advanced species, these states are largely regulated, but not replaced, by higher cortical processes involving intentional appraisals.

Where my account differs from Solomon's is that primitive emotions may be understood as a set of separate, internally coherent, autonomous processes. As such, primitive emotions may be aroused by appraisals and provide neurobiological confirmation of the significance of an appraisal for the experiencing subject, but they are not *bound up* with those appraisals; they do not necessarily support the appraisal made and they may arise independently of appraisals.

Murphy and Zajonc have provided an example of the way in which primitive emotions influence appraisals as 'judgments of the body'. An object (an ideograph) which in ordinary circumstances would not be appraised as having significance for a subject's wellbeing, becomes disliked when associated with a subliminal fear-inducing primitive emotional stimulus. The primitive emotion has influenced the subject's evaluation of the object, causing what was previously regarded as bland and unthreatening to be disliked. According to this account, appraisals are the products of an intentional process but the appraisal process, if it co-occurs with the arousal of a primitive emotion, may be influenced by that primitive emotion.

This concept of the influence of neurophysiological states upon appraisals supports Solomon's proposal that the neurological and physiological changes occurring during an emotion act as 'judgments of the body' directed towards the emotional object. These effects find their origins, not in beliefs, but as spontaneous responses towards the object of emotion. The existence of such responses must entail this consequence; that such judgments, though nonintentional, *play some role* in the emotional process, acting separately from the appraisal processes described by cognitive-evaluative advocates, and it is this role I shall now describe.

21.2 The Role of Primitive Emotions in Influencing Appraisals

Murphy and Zajonc observed, from an analysis of their optimal and suboptimal experiments, that from a very early stage in the visual observation of an emotionally exciting object, two distinct brain processes are active: the most rapidly-acting is a process whereby the affective content (in this case the fearful conformation of the face) is detected. Trailing this effect by about 20/30 milliseconds, the research of neuroscientists such as Vuilleumier and Raftopoulos demonstrates that the emotionally exciting image is progressively elaborated in a parallel process with access to a network of cognitive processes. This process derives from the subject's initially *attending* to the object, allowing the subject to progressively apprehend that what he/she is viewing is merely an image - and not a threat. fMRI studies of subjects who are viewing these images, indicate that although the subject reports that the image is neither liked nor disliked, associated subcortical neural circuitry, consistent with an expression of the primitive emotion FEAR remains active, and is present as long as the image persists.

This recent neuroscientific research is important. It reveals that primitive emotion and attention are rapidly instantiated as two mental processes, the earliest of which is a spontaneous response to the emotionally exciting nature of the stimulating object, generating a range of neurophysiological effects, which (particularly in humans) may be regulated by later-emerging attention-based processes. These delayed attention-based processes, which are described by Murphy and Zajonc as initiating the activation of complex networks of associations, allow (*inter alia*) feature identification and recognition, which regulate or suppress 'the primitive and gross affective significance' of the stimulus. Nothing found in this research suggests that these regulating processes contain affective elements, only that they have the ability to control or suppress underlying affective impulses.

These findings indicate that for any emotional event, two separate mental processes occur; the first is affective and nonintentional, whereas the second is evaluative and intentional.

I will provide an example of the interaction of these processes. When I receive a tax demand, I make a calculation and find that the demand is incorrect. Based on this calculation, I decide to challenge the demand. When reflecting upon my reaction to this demand, I find that it has caused me to feel angry. Additionally, the demand has caused me to have thoughts about the broader implications of this potential financial loss, with the result that I feel anxious. In the dual process model I have proposed, when I describe myself as feeling *angry* or *anxious*, my acknowledgement of these two emotional states does not arise as a consequence of my calculation that the demand is incorrect. Rather, I am reporting the effects of underlying primitive emotional states triggered by the tax demand in response to my identification of appraisal issues corresponding to two core relational themes: 1) that they constitute a potential *constraint* (upon my previously anticipated financial circumstances) and 2) a potential *threat* (that I will be unable to meet my obligations). These feelings are attributable to the effects of primitive emotions in which appraisals are interpreted as core relational themes which, acting as metastimuli, will trigger primitive emotions, so that if I suffer a financial constraint, the primitive emotion aroused is RAGE, causing characteristic physiological and neurochemical alterations and behavioural impulses which I experience as feelings of anger; and similarly, if I am threatened, I experience a different set of physiological and neurochemical effects characteristic of the primitive emotion FEAR, causing me to report that I feel afraid.

In the above example, the impulses generated by the primitive emotional states experienced are *consistent* with the rational course of actions I decide to take: that is, by deciding to challenge the demand I will *avoid* the threat of being unable to meet my obligations by *resisting* the tax claim - removing the potential constraint upon my finances.

This consistency of primitive emotion and appraisal is not assured; the primitive emotion aroused in response to an appraisal may generate behavioural dispositions and attitudes towards the emotional object which are *inconsistent* with the appraisal outcome. To illustrate: imagine now that I receive the same tax claim with the same implications for my finances, but I am additionally aware that any challenge would lead to an investigation of my entire finances, which might reveal a genuine, and much greater, underpayment by myself. In consequence, I decide that any challenge to the tax demand carries too great a risk for my finances, and that the correct course would be to pay the unjustified tax demand in order to avoid an investigation. But by accepting the financial penalty, my appraisal of these circumstances, as now constituting the certainty of constraint, would persist and intensify, causing me to experience increasing feelings of RAGE. So, even though I have, by a process of appraisal, determined the path which constitutes the smallest risk and the lesser constraint upon my finances, this judgment need not be decisive. The decision I ultimately take might pit my feelings of RAGE, which entail a disposition to resist the tax demand and hence to be free of all constraint, against my feelings of FEAR that such an action could ruin me. In this example, the role of feelings in influencing the cognitive-evaluative process is expressed as the effects of competition between underlying primitive emotional brain modes (Chapter 14). We cannot predict which brain mode would prevail; this would depend upon the intensity of each feeling. If the intensity of FEAR was greater than that of RAGE, then my decision to pay would be consistent with my feelings, but if RAGE were to predominate, then my final decision would rest upon the outcome of a conflict between my appraisal that I should pay the unjustified tax demand and an underlying disposition to resist the constraint.

In sum, my claim is that the feelings I experience during an emotional event are attributable to the arousal of primitive emotions, either as a direct consequence of an appraisal having the conformation of a core relational theme, or as the result of the detection of a homeostatically valuable object. Such feelings constitute a separate attitude towards the object of emotion which is not necessarily consistent with the initial appraisal.

21.3 The Cognitive-Evaluative Response to the Dual Process Account

Nussbaum challenges this view, arguing that when the subject appraises a situation as threatening or promoting her wellbeing, any values and beliefs appertaining to this situation may also require re-evaluation, and that it is this inexorable process of re-evaluation, being typical of appraisals which concern the self, which imbues the experience of emotions with a separate distinctive character, rather than the effects of co-occurring somatovisceral changes. She illustrates her argument with a description of the experience of grief.

"When I grieve, I do not first of all coolly embrace the proposition 'My wonderful mother is dead' and then set about grieving. No, the real, complete, recognition of

that terrible event (as many times as I recognise it) **is** *the upheaval. It is as I described it: like driving a nail into the stomach. [ ]If I embrace the death image, if I take it into myself as the way things are, it is at that very moment, in that cognitive act itself that I am putting the world's nail into my insides. That is not a preparation for upheaval, that is upheaval itself. That very act of assent is itself a tearing of my self sufficient condition. Knowing can be violent, given the truths that are there to be known."* (2001 p.195)

I think Nussbaum's description of grief is a powerful evocation of one of the most significant and complex emotional events in the human experience. She is arguing that the appraisal process itself, in virtue of its engagement with the profound implications of the death of a close and valuable family member constitute a necessary and sufficient account of the process of grieving, without requiring any support from the co-occurring physiological changes:

"Reason here moves, embraces, refuses: it moves rapidly or slowly, surely or hesitantly. I have imagined it entertaining the appearance of my mother's death and then, so to speak, rushing towards it, opening itself to absorb it. So why would such a dynamic facility be unable to house, as well, the disorderly motions of grief? And this is not just an illusion: I am not infusing into thought kinetic properties that properly belong to arms and legs or imagining reason as accidentally colored by kinetic properties of the bloodstream." (2001 p.194)

Nussbaum's claim that the kinaesthetic accompaniments of emotion bear no verifiable relationship to the emotion which the subject acknowledges he/she is experiencing, supports her assertion that such effects can play no role in the reasoning process itself. This account of the nature of feelings stands opposed to the dual process account I have offered, in which the feelings she is describing are caused by the arousal of primitive emotions. In a dual process account, each feeling entails a separate stance towards the emotional object, which may be either consistent or inconsistent with the appraisal.

21.4 A Comparison of the Treatment of Feelings in Dual Process and Cognitive Evaluative Accounts of Emotion

I will now consider the force of Nussbaum's arguments in the light of a dual process model of emotion. In beginning this review, I will take Nussbaum's claim that other species experience emotions as intentional phenomena. I have previously discussed her treatment of LeDoux's research in which she allows that a rat may experience fear only to the extent that it is able to have some subjective experience of fear (p. 38). According to Nussbaum's account, if we observe that a rat, having received a shock in an experimental chamber, freezes when reintroduced to that chamber, we can only describe this behaviour as caused by 'fear' if the rat carries out that behaviour as the result of some apprehension that the chamber is dangerous. If Nussbaum's claim is correct, there may be a behaviour 'freezing' in rat A which is caused automatically by neural mechanisms of the sort LeDoux and Panksepp have described. It may also be the case that there is an identical behaviour in rat B, which is able to apprehend that the chamber is dangerous and freezes in response to this threat; but what marks rat B's condition as *emotional* is its ability to evaluate its situation as threatening, rather than the co-occurring changes in bodily states, or the action of freezing itself.

This invites a question I have raised previously in a more general form. If mammalian species exhibit emotion-like behaviours, and Nussbaum argues that emotion arises only as an intentional phenomenon, how do we distinguish emotional from non-emotional behaviour in other mammals? Elephants appear to demonstrate grief-like behaviours when one of the herd dies. But it may be that these behaviours (which involve staying by and attempting to rouse the dead animal) rather than being manifestations of evaluation, are the product of inherited stimulus-response mechanisms similar to those which generate freezing behaviours in rats.

The dual process model directly addresses this question. For an event to be described as emotional, some primitive emotion must be active, either as an autonomously functioning primitive emotional response to a homeostatically valuable object, or as the outcome of appraisal patterns which arouse a primitive emotion. It is this latter sort of engagement at its most intense which would cause Nussbaum, whenever she thinks of her mother's death, to feel as if the world has driven a nail into her insides.

This account in its simplest form would ascribe the human experience of grief to the effects of separation distress, typical of the primitive emotion PANIC. Such an explanation would be refuted by Nussbaum. She argues that the experience of grief is not one of relative equanimity punctuated by moments of pain when she thinks of her absent mother: in grief, many of the benefits which flow from her relationship with her mother are re-evaluated, not as a voluntary process but with 'urgency', in a process which requires her constantly to return to the supremely painful thought of her mother's death, from which these connected thoughts flow.

I want to make a distinction here between Nussbaum's conception of grief as an entity, as opposed to its component parts. I take first the latter concept, in which Nussbaum evaluates the various consequences implicit in the termination of her relationship with her mother. The death of a close relative will generally entail changes to the life of the experiencing individual, many of which are inferentially interconnected[66]. Each change element is likely to involve appraisal issues which trigger unpleasant primitive emotions. In passing from one unpleasant thought to another it seems to Nussbaum as if her previously tranquil mental landscape has been entirely disrupted. The feelings which arise in this emotional journey are explicable as the effects of primitive emotions which are aroused in response to the successive appraisals made.

I move now to Nussbaum's concept of the dynamic character of the grieving process. In the process of grieving, she describes herself as being drawn into this painful process of judgment. She claims that there are no elements necessary for grief that are

[66] To exemplify. My mother owned the house; I live in the house; I have brothers and sisters who also inherit; the house must be sold and its value shared; I will need to find a new home.

not elements of the process of judgment, fused with the concomitant mental upheaval that this process entails. According to this account, the presence or absence of this or that physiological state would not enable me to conclude that I am – or am not - grieving; only the process of judgment itself can describe the emotional experience of grieving and its attendant feelings. On the face of it, the necessary conditions which Nussbaum lays down for emotion, are not explained as the effect of primitive emotions. And her claim is difficult to disprove because it is a description of Nussbaum's own experience of grief. I can only address such a claim by reference to my own experience of the deaths of my parents.

The grieving process is an immersive experience, something into which one seems to enter suddenly, reside, and exit gradually, in a manner quite different to the transient fears and frustrations of our everyday lives. In grief, I discovered that many of the assumptions which had formed the core of my quotidian beliefs no longer applied. Most important amongst these was the assumption that I had a parent and that we held a mutual affection for each other. It was the ending of this relationship, together with the alteration to all the circumstances which attached to it, which I progressively reappraised. And it is the reappraisal of each of these states of affairs, accompanied by the various and often intensely unpleasant feelings triggered by those reappraisals, which occupied the foremost place in my thoughts at the time. This explanation accounts for the urgency of my thoughts, not as an experiential quality of the appraisal process, but as a rational response to my need to contemplate the consequences of the absence of this relationship in the light of its previous centrality to my view of the world. These thoughts would, as Nussbaum proposes, tend to return constantly to the death of the parent and the ending of a relationship which in its former complexity and richness, constituted its value for me. And whenever my thoughts return to the death, they would cause me to experience the most intense form of separation distress, not simply as physiological alterations, but as a change in the neurochemical balance of the brain associated with the arousal of underlying neural circuitry which disposes us to exhibit distress behaviours.

Recognising and re-evaluating complex relationships of this type requires an ability to comprehend a broad range of circumstances or events as valuable, generating feelings towards those circumstances which will extend the reach of emotionally potent events and circumstances experienced by humans well beyond those of other animal species. This then, might constitute a claim regarding the human experience of emotion: that our superior reasoning abilities allow us to feel the significance of objects, events and circumstances which are not apparent to other creatures.

The dual process account of emotion requires only that for an emotion to occur, some primitive emotional state must be present, arising either as a response to the detection of homeostatic value, or by means of an evaluative process. In this respect Nussbaum's claim that other animals may experience emotion as intentional states is not excluded, but intentionality is not required as a necessary condition for emotion[67]. This allows us to apply a greater flexibility in our view of emotions as they are manifested by different species. If, say, grieving requires the ability to reappraise complex social relationships over time, we need not assume that animals such as rats, who do not appear to have the capacity to support extended inferential processes, are capable of grief, whereas the grieving processes which Nussbaum describes in chimpanzees (2001 p.89) are verified if we accept that chimpanzees are capable of inferential thought processes not dissimilar to those found in humans.

21.5 The Nature and Function of Feelings in a Dual Process Model

i) *Feelings as action preparedness*

In the dual process explanation of emotion, feelings are not merely attitudes of a positive or negative valency directed towards the objects of emotion. They cause the subject to adopt dispositions towards the emotional object such as 'resist y' or 'avoid

[67] It should be noted here that primitive emotions may also be aroused automatically by unconditioned or conditioned stimuli.

z' which may influence appraisal processes. Moreover, they generate impulses towards the objects of emotion consistent with those dispositions such as: "strike out, attack, confront y", or: "flee z".

Some of the intentional manifestations of emotion may be usurped by these impulses: without primitive emotional intervention, it is not clear why, say, an expression of anger which comes from appraisal should be attended by the physical impulses often exhibited. For example, if I were to tell you that "when *x* said I was lying, I wanted to punch him on the nose." you would immediately comprehend why I had this impulse, without reference to any consideration of my wellbeing, or anything but the most circuitous rationalisation as to why such an impulse could constitute a response to an appraisal.

This seems to be extending the boundaries of cognitive-evaluative theory to the point where it embraces an impulse, even though that impulse seems to have arisen in the absence of any intentional appraisal concerning my wellbeing. My expression of a desire to attack my accuser is better understood as a RAGE-generated impulse which constitutes an active element of the emotional event, based upon the detection of a metastimulus within my appraisal: that my opponent's refusal to accept my statement constitutes a *constraint,* both upon my intention to persuade him and upon my status with others with regard to my honesty[68]. The acknowledgement of the primitive emotional source of this impulse allows a clearer distinction to be made between the appraisal and the impulses which accompany that appraisal.

ii) *Feelings as physiological alteration*

The somatic changes which we undergo in response to an emotion are perhaps the least revealing manifestations of emotion in humans, whilst being the most straightforward to measure. In response to fear, the body is prepared for flight; in anger, we are readied for physical aggression – as a minimum, both involve the preparation of

[68] So that if such an assertion was made publicly, my anger would be more intense.

the body for intense activity. Social solecisms[69] will cause the subject to blush involuntarily, but in human behaviour generally, certain physiological alterations associated with emotion may be controlled or extended by experience. In early infancy, crying is a typical distress response to parental absence but as children mature, we observe that as they learn that crying attracts sympathetic attention, they will extend their repertoire of ‘cry-response’ events as a means of asserting their needs. Therefore, while ‘somatic disturbances’ are generally indicative of emotional as opposed to non-emotional states, our history of complex social interaction suggests that through learning, their original functions may sometimes be extended, suppressed or overwritten in favour of a more general utility.

iii) *Feelings as psychological states*

More important - but less discussed - are the alterations in the experiential quality of mental states occurring during an emotional event. In a dual process model these changes can be attributed to alterations in the balance of the neurochemical constituents of the brain during the arousal of a primitive emotion, which in turn will affect my interpretation of the events around me. If, say, I have an accident in my car, I am conditioned to fear driving and will drive defensively for some days afterwards, being particularly concerned about the threats from other drivers or failures of attention in myself - an effect which is generally reported.

The experiential quality of an emotion induced by changes in brain chemistry may ultimately be a more reliable indicator of a primitive emotion than its somatic counterpart. We know *what it is like* to experience fear, which is different to the psychological qualities of anger, anticipation, or play, yet these qualities are so much a part of the emotional state as experienced that we may fail to mark the changes in mental stance which they express.

[69] When the subject becomes aware that he/she has moved beyond the pale of accepted social convention.

21.6 Feelings Originating in Primitive Emotional 'Release' Mechanisms

Primitive emotional release neurophysiologies present as emotional feelings but are distinguished from the sensations associated with the onset of a primitive emotional response by arising only when we are accomplishing, or have successfully accomplished, a homeostatically valuable task [70]

So, for example, when a threat to my job is lifted, I feel relief; and when I win an important competition or pass a difficult exam, I feel exultant; or again, my care for my child is attended by mutual feelings of affection. These pleasant feelings are the brain's mechanisms for rewarding - and hence reinforcing – some homeostatically valuable behaviour. They are not primitive emotions; rather, their occurrence is dependent upon the arousal and successful performance of some primitive emotional function and in this respect, each can be understood as concomitant of a primitive emotional state. (Table 21(i))

Table 21(i)

Homeostatic Imperative	**Primitive Emotion**	**Reward Sensation**
If Urge – Seek	SEEKING	Gratification
If Threat – Avoid	FEAR	Relief
If Constraint - Resist	RAGE	Exultation
If Offspring - Nurture	CARE	Maternal Affection
If Isolated – Show Distress	PANIC	Belonging
If Potential Partner - Mate	LUST	Sexual Satisfaction
If Young Adult - Play	PLAY	Playfulness

[70] . "*Although people use many different adjectives to describe the states of satisfaction they experience, most of our feelings of sensory pleasure arise from the various stimuli that signal the return of bodily imbalances toward an optimal level of functioning*." (Panksepp 1991 p.183).

Emotional Feelings - Summary

The dual process model of emotion assigns a role to the feelings which attend emotional appraisals. If, as the result of a cognitive evaluation, some pattern of thoughts occurs which arouses an emotion, then that pattern of thoughts has attributes characteristic of a class of stimuli – metastimuli - each corresponding to one of a number of drives embedded in mammalian species, which I have called homeostatic imperatives. When this occurs, a primitive emotion is triggered which can be understood as manifesting in our mental processes as *feelings toward* the emotional object, realised in the form of altered neurochemistries and physiologies, together with behavioural impulses.

These effects, arising independently of mind, cause us to adopt an attitude toward the object of an emotion, independently of the evaluative processes which gave rise to it. This attitude is exhibited as both chemical states of the brain and physical alterations which support states of action preparedness towards the object of emotion. The collective effects of such changes, as Solomon has proposed, act as 'judgments of the body', biasing the originating cognitive evaluation in a manner consistent with the expression of the primitive emotion.

Chapter 22: The Interaction of Feelings and Evaluations in the Dual Process Emotional Model

Introduction

Although cognitive-evaluative theory will provide an explanation for the origins of most emotional occurrences in humans, certain manifestations of emotion imply the existence of a separate non-evaluative emotional dimension. Goldie is concerned with the problem of recalcitrant emotions in which our emotional intuitions provide a separate perspective of the emotional object – what Goldie calls introspective knowledge – which sometimes conflicts with the evaluative judgment.

Joel Marks cites cases in which we experience emotions unexpectedly, as a genuine revelation. From this he speculates that in some way our feelings lie dormant -unfelt – seeming to arise spontaneously, calling into question the notion of feelings as bound up in the evaluation itself.

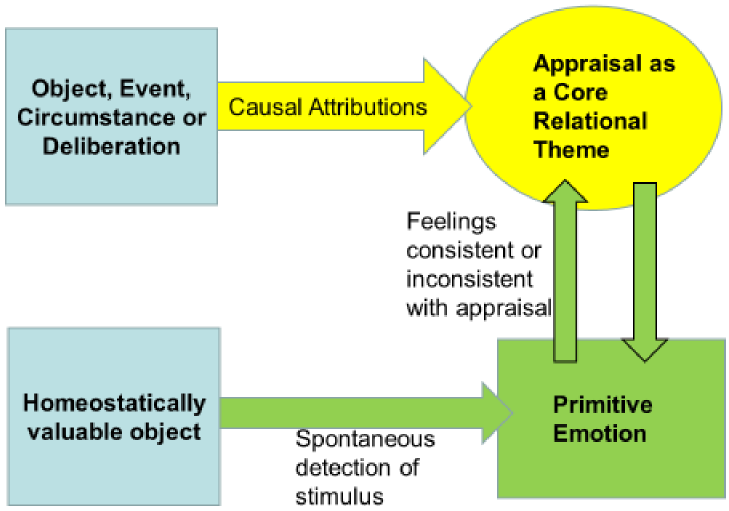
And separately, there is the problem of the expression of raw emotions, occurring more predominantly in infants, often observed in cases of fear, panic or rage, in which the subject, being unable to suppress the primitive emotional impulse, becomes possessed by it, irrespective of the consequences for its wellbeing.

The dual process model, by offering separate accounts of primitive and cognitive-evaluative emotion, both as independent but internally coherent processes and as interacting processes may enable us to explain the effects described.

The dual process model of emotion allows that emotional events may be activated directly by the detection of homeostatically valuable objects, or indirectly via an evaluative process. This account does not exclude that the same stimulus may cause an alignment of primitive and cognitive-evaluative states, which I have described as ‘consistent’. Neither does this exclude the possibility that the homeostatically valuable stimulus detected differs from the stimulus which is detected by appraisal, causing a combined stimulus presentation which is ‘inconsistent’ (Diagram 22a.).

Diagram 22a.

Illustrating the Interaction of Intentional and Nonintentional Emotional States as Consistent or Inconsistent



This aspect of the dual process model allows the classification of emotional events into four broad categories, which I shall call 'configurations' each describing the emotional effects generated by particular combinations of intentional and nonintentional stimuli, which are tabulated below (Table 22(i)):

Table 22(i)	**Homeostatically Valuable Object Present?**	**Core Relational Theme Detected?**	**Interactive Mode of Primitive Emotional and Cognitive Evaluative Emotion Types**
Configuration 1	Yes	No	P.E. Driven
Configuration 2	Yes	Yes	Consistent
Configuration 3	Yes	Yes	Inconsistent
Configuration 4	No	Yes	C.E. Driven

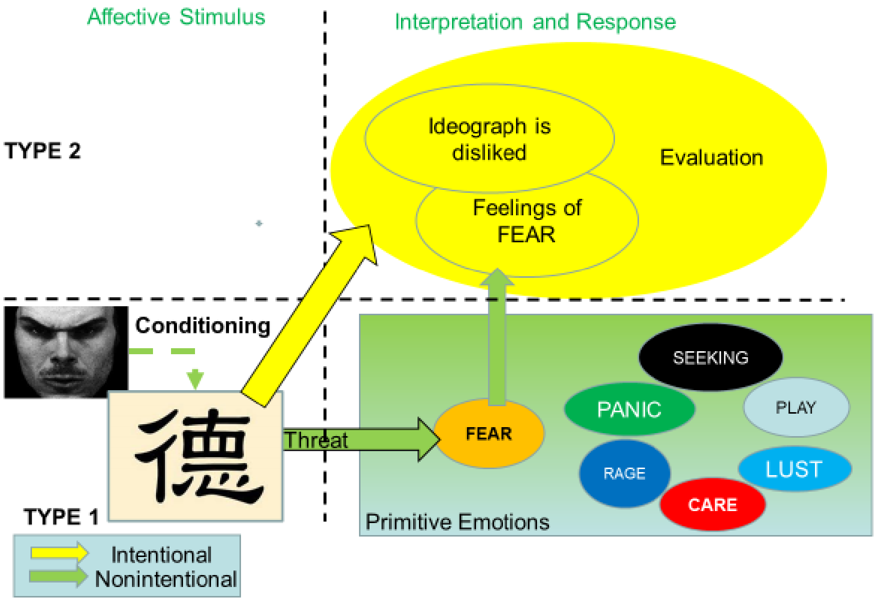
I will provide examples of each configuration type to illustrate the explanatory scope of this emotional model.

Configuration 1

Murphy and Zajonc's 'suboptimal prime' experiments describe a Configuration 1 emotional state in which the presentation of a homeostatically valuable but subliminal stimulus causes biasing of evaluation.

In Murphy and Zajonc's example, a Chinese ideograph, though separately appraised 'neutral' as regards affective content[71], is appraised as disliked, when an immediately preceding *affective* stimulus is presented too briefly to be detected consciously (Diagram 22b.). However, the underlying primitive emotional system, with its ability to respond more rapidly to the affective stimulus, detects the suboptimal prime. The primitive emotion so generated biases the cognitive evaluation of the ideograph through conditioning, causing the ideograph to be disliked, whereas the cognitive evaluation, being unable to process the affective stimulus, is unable to detect and regulate its suboptimally detected affective content.

Diagram 22b. Configuration 1: Primitive Emotional Stimulus Only



[71] The ideograph, under normal circumstances, is evaluated as 'affect neutral' and hence does not qualify as a Type 2 affective stimulus. However, when subliminally associated with - and conditioned by - a Type 1 affective stimulus, it acts as a proxy for that stimulus, having homeostatic value. In this form it is disliked in the absence of any causal attribution or core relational theme.

Configuration 2

We frequently encounter stimuli which activate sympathetic cognitive-evaluative and primitive emotions. When this happens, each state excites and reinforces the other, so that I experience feelings which are validated by my evaluation of the circumstances (Diagram 22c.). We might think of this as the normative mode for the interaction of intentional and non-intentional states of emotion.

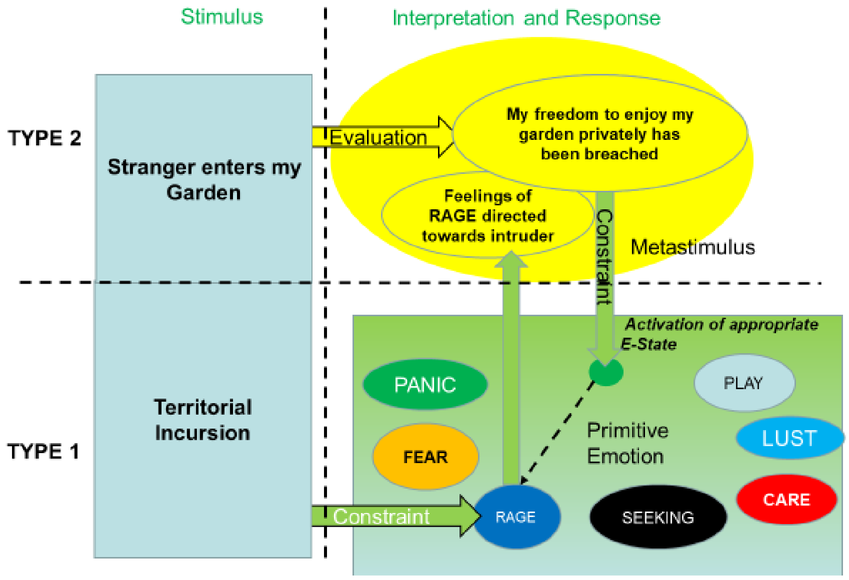
Example:

A stranger with children enters my garden and begins to play on the swings and slide.

- Primitive emotion: Territorial incursion> constraint, causing RAGE.
- Cognitive-evaluative: I own the property and have a right to privacy. That right has been contravened, hence frustrated. (Core relational theme – *Other Blame*)

In an encounter with the stranger, my insistence that the stranger must leave because she is trespassing will be supported by my aggressive demeanour and impulses, signalling to the stranger that my intention that she should leave is resolute.

Diagram 22c. Configuration 2: Cognitive-Evaluative and Primitive Emotional Stimuli are Reinforcing



Configuration 3

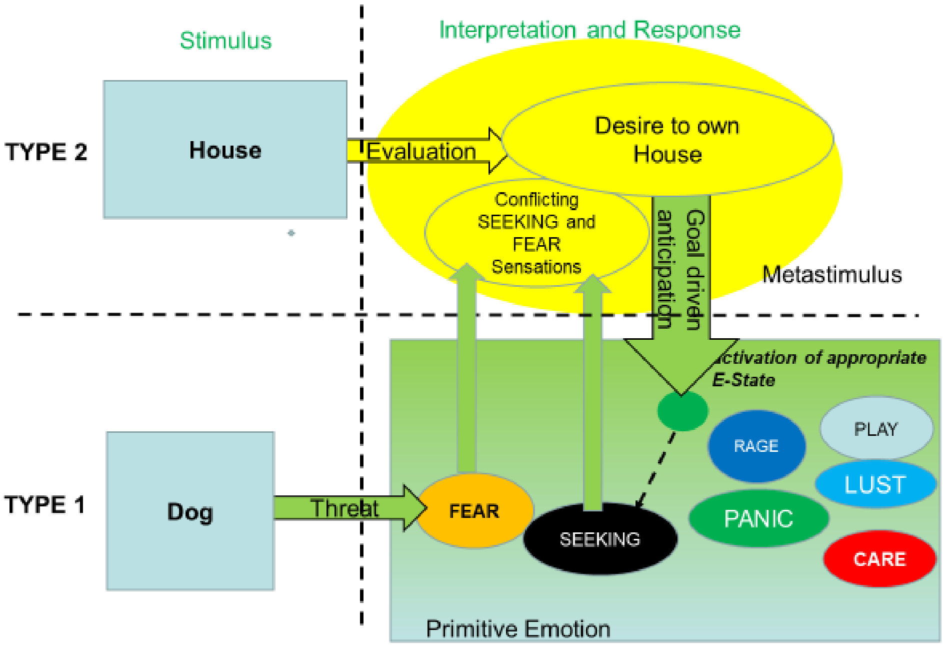
Configuration 3 emotions occur when the primitive emotion aroused conflicts with evaluation, generating an inconsistency of thoughts and feelings (Diagram 22d.).

This accords with Goldie's observation that in some cases of emotion our appraisals and feelings conflict. On the face of it, Goldie's objection might be construed as a challenge to any claim that human emotional processes derive benefit from the interplay of intentional and autonomous mechanisms – that if our feelings disrupt the rational pursuit of our interests, then such conflicts constitute a failure of the dual process mechanism. But this is to ignore the evolutionary process by which cognitive evaluations have come to exist in humans and other species. If our appraisals did no more than confirm our primitive emotional impulses, they would serve no obvious purpose. It is *just because* primitive emotions sometimes fail to offer optimal survival solutions that evaluative processes – in accessing a much more extensive array of environmental and social circumstances which affect our wellbeing may regulate or suppress the primitive emotional impulses which act against these better judgments.

> *Example:*
> A house is for sale that I have hoped to buy for some time. When I look over the house I find I am less inclined to make an offer than I expected[72]. The owner had a dog and I dislike dogs.
>
> The desirability of the house causes me to experience anticipatory feelings (SEEKING/Consummatory) but these are opposed by my feelings of aversion towards dogs (FEAR).

[72] I took this example from a lifestyle website (www.kiplinger.com): "*Buyers may be frightened, allergic or distracted by pets, even if your animal is well-behaved. It's best if you can remove your dog from your home during a showing*."

Diagram 22d. Configuration 3: Conflicting Primitive and Cognitive-Evaluative Stimuli



Before the visit I expected the visit to confirm my desire for the house, however I find that I did not like the house as much as I expected. My appraisal of the event has been altered by my fear of dogs, which conflicts with my desire to own the house.

Configuration 4

Configuration 4 describes a class of emotion for which no external primitive emotional stimulus is present. The primitive content of such emotions finds its origins in our thoughts or in our appraisals of proposals which others make to us, either directly or through some intermediate process of communication. On such occasions, the arousal of primitive emotions relies entirely upon the identification of patterns of thought pertaining to the stimulus object.

Example:

I receive a letter from my daughter's new school containing the following:

Dear Mr….

The headmaster of St ….Primary School has advised us that your daughter was one of a small group of able students who were, at least for some lessons, offered courses which were normally only available to students who were in higher classes and he has proposed that we should continue with this practice. We have given the matter a good deal of thought and, on reflection, have decided that we must abandon this approach. This will mean that your daughter will, in effect, be required to repeat some of the work she has already done and for this we apologise.

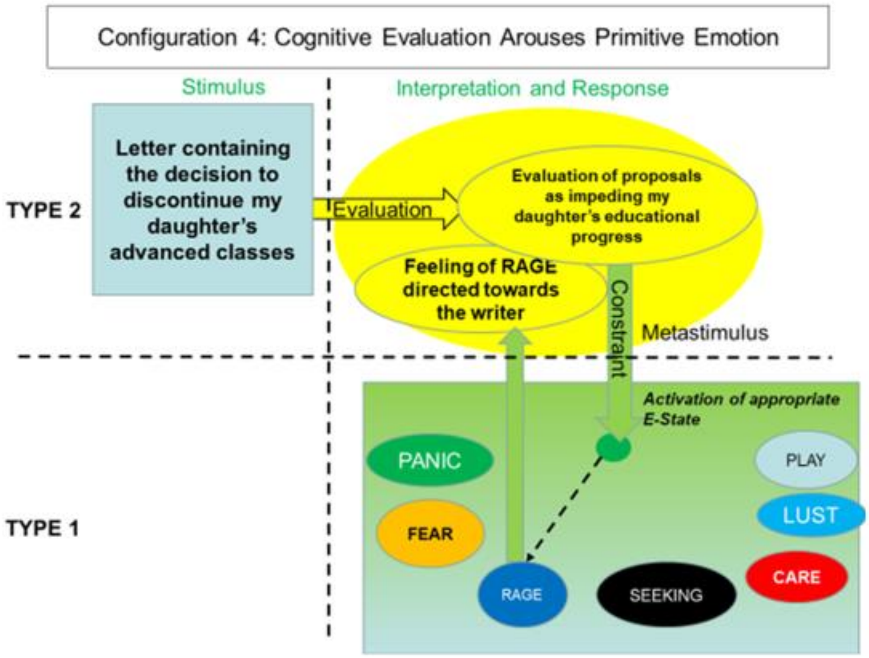
We have a number of reasons for taking this step. First, we believe that children's abilities should be recognised and catered for in the collective process of education. Secondly, we cannot find evidence that such methods contribute to the child's progress in the longer term and finally (and - unfortunately - decisively) we do not believe we have the financial or staff resources to support such a programme.

Yours etc..

My first thought upon reading this letter is that this will impede the progress of my child, and this apprehension of constraint will be detected, causing the arousal of RAGE directed at the writer of the letter. As Panksepp writes: *"human brains are evolutionarily prepared to externalize the causes of anger and to "blame" others."* (1998 p.189)

An angry state will influence my beliefs regarding the motives of the writer - that the justifications offered are sophistries designed to obscure an underlying motive of institutional indolence. I have no basis for this judgment. It might well be that what the school is saying is correct. And I might be wrong in my choice of target. The individual writing the letter need not be the decision maker. To summarise, although the reasons provided may be genuine, my feelings induce me to judge differently (Diagram 22e).

Diagram 22e.



I have not fully explored the important effects of multiple emotional stimuli arising concurrently in Configuration 4-type emotional events, where such circumstances will most frequently occur (See my example in Chapter 21 p.268). It seems probable that as our powers of appraisal expand to encompass an increasing number of physical and abstract entities as important for our wellbeing, the likelihood of our evaluations resulting in the arousal of multiple primitive emotions, must similarly expand, giving rise to an increasing complexity of emotional feeling.

This view is reflected in Damasio's account of emotion which I offer as the Appendix to this thesis. In this explanation, the elements of complex decisions are simplified by the action of what Damasio terms 'somatic markers' which he attributes to the visceral and non-visceral sensations co-occurring with the evaluation. In being aroused by the evaluation of complex circumstances relating to ourselves, and having visceral and non-visceral elements, somatic markers share the neurophysiological characteristics of primitive emotions.

Summary

The dual process model of emotion envisages the existence of a core set of primitive emotions in all mammalian species which may be triggered by homeostatically valuable or conditioned stimuli, or by the revelation of value through appraisal. According to this account, all emotional states in mammals are supported by primitive emotions, but the extent to which these primitive states dictate our actions is a function of the development of higher cortical processes in each species. These higher processes allow the subject either to regulate or suppress the intensity of primitive emotional feelings in a manner proportionate to the appraised level of threat or opportunity, and to adopt an alternative approach to some state of affairs other than that prompted by the primitive emotional impulse.

The account I have presented might be challenged by philosophers such as Rorty who argue that our emotions have a much richer and more complex nature than I have described, playing a central role in fields of human activity as diverse as art, justice and religion. They might claim that such phenomena cannot be accommodated by the interplay of appraisals and ancient emotional mechanisms.

But the purpose of this thesis has not been to explain the role of emotion in these unique fields of human experience – a role which I accept. My intention has been to provide a model which would account for both the distinctive character of emotional appraisals and associated neurophysiological alterations.

This model is complex: emotions may be aroused by stimuli which cause intentional or nonintentional responses. The range of objects, events or states of affairs to which we may respond emotionally is unlimited, and the primitive emotional states aroused may be simple or complex, each having a particular intensity and quality. In creating this explanation, I have attempted to identify the constituents of emotion and their modes of interaction, rather than the social and artistic edifices into which these constituents may have been constructed.

The dual process model assumes the existence of a shared set of primitive emotional processes in humans and other mammalian species. This assumption implies an equivalence between emotional states as experienced by humans and other species.

According to this account, the feelings of a primitive mammal abandoned by its parent are no less intense than that of a human in the same circumstances, but the implications of that abandonment are more extensively appraised and hence *felt* by the human.

In humans, the connection between appraisal and primitive emotion implies that our lives will tend to involve more frequent and more complex emotional events than would be encountered by other species, unless our everyday thoughts are directed primarily towards matters which have no relevance for ourselves. With this exception, the dual process account entails that however far our thoughts take us, feelings will follow.

Chapter 23: Summary

Overview

In the introduction to Part III, I referred to three accounts of emotion which I had described previously: Cognitive-evaluative, Primitive, and what I have called the Commonsense View, and I set out to provide an answer to this question: *can these three accounts of emotion be brought together into a single explanation in such a way that each is vindicated*?

The model of emotion advanced in Part III offers a potential solution to this question. It describes an interaction of evaluative and primitive states in which certain patterns of appraisals identified during the evaluative process arouse primitive emotions and regulate their intensity. When so aroused, those primitive emotions, will, in turn, influence the evaluation as feelings. The feelings aroused have a particular quality, allowing us to experience what it is like to be say, affectionate or afraid, separately from the appraisal of context. Our experience of these feelings allows us to attribute, from observation or inference, the presence of such emotional states to others. This concept of emotion is the Commonsense View, which I have described in Chapter 3.

The explanation I have provided has elements in common with the accounts of psychologists such as Smith and Lazarus who claim that emotional appraisals are the product of an adaptive process whereby the rigid stimulus-response mechanisms characteristic of reflexes have been progressively overwritten, but not replaced, by appraisal processes, which permit a more extensive interpretation of the relevance of external circumstances and events as they bear upon our wellbeing.

In explaining the physiological changes and states of action preparedness which co-occur with emotional appraisals, Smith and Lazarus claim that when patterns of appraisals are identified which trigger an emotion, certain appraisal issues have been identified which carry ‘adaptive significance’. In claiming adaptive significance, they postulate that the appraisal issues identified have attributes of stimuli which have signified potential harms and benefits throughout our evolutionary history. When such patterns are identified, they claim that a convergence occurs between the appraisal and underlying reflexes. In this convergence, the reflexes aroused are atavisms – ancient responses to the issues detected by appraisal. These reflexes are evoked as states of action preparedness together with the neurophysiologies which would support such actions, and it is our experience of the arousal of these underlying reflexive states, which causes us to describe the appraisal as emotional. (Chapter 18)

In addressing Smith and Lazarus's claim that the physiological alterations and states of action preparedness associated with emotion are reflexes, I have argued that the evolutionary transition between a reflex and an evaluative state of emotion would have entailed an intermediate stage in which unconditioned and conditioned stimuli could be detected spontaneously and addressed by an appropriate behaviour, and I have proposed that the mechanisms which mediate this process are a set of subcortical brain modes corresponding to Panksepp's 'basic emotions'. (Chapters 5, 6 and 7)

In the evolutionary process I describe, reflexes, as invariant neural mechanisms coupling stimuli with response behaviours, were gradually replaced by these subcortical processes enabling multiple stimuli to be detected and addressed by a single response. Such processes, in mediating between stimulus and response, (hence meeting my requirement for cognitive processes) are spontaneously aroused by the detection of particular stimuli. In acting in this way, their function may be described as nonintentional. I have proposed that it is these processes, which I have called *primitive emotions*, rather than Smith and Lazarus's reflexes, which generate the physiological alterations and the states of action preparedness associated with emotion.

Primitive emotions may be aroused directly by the spontaneous detection of stimuli. But additionally, as per Smith and Lazarus's theory, when appraisal processes detect some pattern of events or states of affairs which carry beneficial or harmful implications for our wellbeing, that pattern of appraisal will conform to one of a number of core relational themes, each theme having features in common with categories of stimuli, which I have termed ‘metastimuli’. Exciting objects, events or states of affairs which have the characteristics of a core relational theme, acting as a token of a metastimulus, will excite corresponding primitive emotions, and the intensities of the primitive emotions so aroused become, in turn, subject to regulation by the appraisal. But, although a primitive emotion may be aroused and regulated by appraisal, it is the arousal of a primitive emotion through appraisal which marks an appraisal as emotional.

Yet this is only part of the picture: primitive emotions play no intentional role in the evaluative process, but they nonetheless influence evaluation. Primitive emotions, when aroused in response to appraisals, are experienced as feelings directed towards the objects of emotion, realised biologically as behavioural dispositions, neurochemical brain states and altered physiologies.

In proposing an interaction of primitive emotions and appraisals, I am not claiming that appraisals are intentional expressions of primitive emotional states: indeed, it is just because primitive emotions serve our wellbeing more effectively when regulated by appraisal processes, that these higher[73] cortical responses to primitive emotions exist. Yet, appraisals, as regulators of primitive emotions, cannot stand apart from these phenomena. The ability of an appraisal to regulate the intensity of a primitive emotion requires that the appraisal is responsive to the effects of the co-occurring primitive emotional condition; in responding, the appraisal is influenced by the neurophysiological alterations and behavioural dispositions towards the object of emotion, which are characteristic of the primitive emotion.

The effects of primitive emotional influences upon human thought processes are extensive, but to understand them fully, it is necessary to explain how primitive emotions present in the human psyche. A primitive emotion has a characteristic neurophysiology consisting of a subcortical brain state and distinctive neurochemistry

[73] I am using this term ‘higher’ here as it is often applied in psychological and neuroscientific descriptions, referring only to some differentiated process for the control of primitive emotion.

which cause behavioural dispositions and alterations to our visceral and musculo-skeletal condition. In this way, primitive emotions directly engage the subject with external events and states of affairs by providing a physical intimation of their significance for the self. This separate disposition towards the emotional object may be regulated - but not extinguished - by co-occurring appraisal processes. It is the combined effects of these neurophysiological changes which allow us to experience what it is like to be, say, threatened, constrained, isolated, loving, or anticipating. This experience draws its power from the coherence of the primitive emotional disposition toward the object – a disposition which would be expressed as a behaviour in the absence of evaluation.

General Findings

In Part I of the thesis, I have described the cognitive-evaluative view of emotion which holds that for an emotion to occur, the subject must have some apprehension of the implications of an object or state of affairs for its wellbeing, and I have argued that this account is inconsistent with experimental evidence that certain manifestations of emotion in human and other mammalian species appear to arise spontaneously (Chapter 2). In accounting for this separate mode of emotional arousal, which I have described as nonintentional, I have postulated the existence of primitive emotional mechanisms, which are taken from Panksepp's description of basic emotional processes.

In Part II of this thesis I have assembled the evidence for primitive emotional systems as a neurological architecture (Chapters 8-13). In constructing this account of primitive emotion, my aim has been to demonstrate that primitive emotions generate characteristic neurophysiologies and behaviours, functioning in the absence of evaluation. Solely by means of primitive emotional mechanisms, a primitive mammal would be able to carry out survival tasks such as detecting threats, responding to physiological urges and isolation, acquiring new stimuli, reproducing, nurturing, playing and – importantly - resisting external constraints upon its propensity to perform these behaviours. And in establishing the organism's response to multiple stimuli, I have set out a process whereby primitive emotional brain modes compete for control of behaviour (Chapter 14).

In Part III, I have provided evidence from psychological and neuroscientific research for the interaction of cognitive-evaluative and primitive emotional states.

Experiments into the effects of subliminally-presented affective stimuli provide evidence of the action of primitive emotion in biasing evaluative states (Chapter 16). They demonstrate that an object which would normally be evaluated as having no affective content may be liked or disliked when associated with subliminally-detected affective images of corresponding valencies. The biasing of a normally neutral cue by the affective character of the subliminally detected affective stimulus is argued to support the view that a primitive emotion may influence evaluation.

But the ability of primitive emotional processes to influence evaluation is only one component of this relationship. I have also presented evidence for the regulation of primitive emotion by evaluation. To demonstrate this effect, I have described a set of experiments in which affective images, when exposed for a sufficient time to be appraised, reveal the role of evaluation in regulating primitive emotional states. In these experiments, prolonged affective stimulus exposure allows the subject to regulate the underlying primitive emotion in response to evaluation, either suppressing the primitive emotional response, or pitching its intensity at the most effective level (Chapter 16).

Solomon challenges the notion that the type of spontaneously-aroused emotional phenomena I have described play a role in the mental processes of evaluation, asserting that they constitute: *"a brief, preconscious, precognitive, more or less automatic excitation of an affect program* (2004 p.78). According to this account, Solomon accepts that spontaneous 'non-evaluative' effects may exist but he argues that they are short-lived preludes to emotions, which he claims are subjective engagements with the world. In addressing Solomon's objection, I have presented neuroscientific evidence which demonstrates that neurological activity consistent with the arousal of primitive emotions co-occurs with emotional evaluation, which accompanies but does not replace primitive emotions (Chapter 17). And Seamon *et al.*, have confirmed that the biasing effects of subliminal affective images upon neutral images persist for hours or even weeks after the experiment has taken place.

Taken collectively, these experiments are important in demonstrating the sustained effects of primitive emotions in influencing evaluative processes, and the role of evaluation in regulating primitive emotional processes. However, such processes cannot explain the observation that appraisals are often associated with the arousal of feelings in the absence of primitive emotional stimuli: some mechanism for the arousal of primitive emotion by evaluation remains to be identified.

In addressing this question, in Chapter 18 I have described Smith and Lazarus's psychological experiments in which subjects were asked to evaluate various descriptions of situations, representing states of affairs with potentially affective contents. In analysing their findings, the researchers concluded that the causal attributions relating to each situation were synthesised by the subjects into patterns of appraisals pertaining to their wellbeing, and that these patterns could be significantly correlated with the identification by the subjects of particular emotional responses to the situations described.

In distinguishing the patterns of appraisals which evoke emotions from those which do not, the researchers propose the existence of a process whereby the subject is able to identify - from patterns of appraisals - a relatively small number of emotionally arousing issues, which they describe as core relational themes. The researchers propose that these themes detect harms and benefits which arouse ancient reflexive responses to the general conformation of the appraisal issues detected.

Whilst accepting that emotion is partially explained as a response to the identification of core relational themes, I have argued that the researchers do not adequately characterize the relationship between an appraisal and the neurophysiological changes observed to co-occur with that appraisal; more specifically, that they fail to describe the manner by which appraisal is able to trigger the neurophysiologies and action impulses they ascribe to reflexes.

In addressing this deficiency, the explanation I have advanced - based upon the action of primitive emotions - more fully describes the interaction of emotional appraisals and accompanying neurophysiological changes. I have argued that although the primitive and evaluative components of emotion differ fundamentally - both as neurological mechanisms and in terms of the mental acts which they are able to support - each subserves a shared set of motivating principles for mediating the relationship between the subject and its environment in order to achieve some balanced state of the organism or the persistence of its species. This state, often described as promoting the organism's 'survival' or 'wellbeing', is more completely described as homeostasis (Chapter 4). For this reason, I have called the common motivations pertaining to both intentional cognitions and primitive emotional mechanisms *homeostatic imperatives*. (Chapter 19)

A homeostatic imperative is the biological realisation of one of a set of core motivating principles which animal species are disposed to enact when certain broad classes of stimulus -which I have termed *metastimuli* - are detected. A metastimulus might occur as, say, a threat, or a constraint - either of which will trigger a characteristic primitive emotion in mammalian species. (Chapter 13)

The organism's survival chances are improved as mechanisms evolve to augment the detection of cues which fall under any class of metastimulus, thus extending the scope of contexts which are identifiable as having significance for its wellbeing. In mammals, this evolutionary process is manifested as evaluations - intentional processes which allow mammals to detect the presence of issues in external events or circumstances which bear upon their needs and goals.

I have proposed that the patterns of appraisal which psychologists have identified as core relational themes draw their significance from the same homeostatic imperatives and classes of metastimulus as primitive emotions (Chapter 19). This association is not accidental: appraisals address the same core motivating principles as primitive emotions but allow the subject to identify a much greater range of external circumstances as important for its wellbeing.

My explanation of emotion in mammals as the outcome of two processes - appraisals and primitive emotions - shares characteristics of psychological explanations of mental phenomena as diverse as memory, reasoning, rule-learning and decision-making which fall under the general classification of 'dual process' theories (Chapter 20). Psychologists have proposed that each of these faculties may be explained as the action of two distinct mental functions: the first (Type 1) being nonconscious and intuitive, in which information is processed rapidly and automatically; and the second (Type 2) is generally described as conscious and involves intentional processes requiring mental simulation and inference, typically entailing the retention of information in a working memory.

For mammalian species, primitive emotions may be characterised as Type 1 processes, arising and functioning spontaneously in response to the detection of stimuli, whereas appraisal processes possess both intentional and inferential attributes characteristic of Type 2 processes. The balance in dependence upon primitive as opposed to evaluative processes will vary between species. Less advanced mammals, such as rats, will acquire new stimuli principally through conditioning, whereas humans are able to respond to a much broader range of emotional stimuli, by appraisal *and* conditioning, making the probability of multi-stimulus encounters greater in humans than in other mammals.

In the evaluation of complex external events or states of affairs, appraisal issues may be identified corresponding to more than one core relational theme, causing the arousal of multiple primitive emotional brain modes, each of which will compete for control of behaviour (Chapter 14). These competing brain modes will cause the arousal of complex feelings – expressed as behavioural dispositions and their supporting neurophysiologies - directed towards the object of appraisal (Chapter 21).

The notion that the neurophysiological states which accompany emotions play any role in emotions is challenged by cognitive-evaluative advocates who claim first, that the bodily changes which co-occur with an emotion are incoherent, bearing no relationship to the emotion which the subject believes he/she is experiencing. I have examined the evidence for this claim and found that it neither supports nor disproves the cognitive-evaluative view. But even if the claim were to be disproved, and synchronously-occurring bodily changes *were* found to be characteristic of the emotion expressed, this would not, of itself, indicate a role for bodily changes in an emotion if it is understood as the outcome of evaluation. For this reason, cognitive-evaluative advocates argue that that the feelings which arise during the emotion are the products of the appraisal itself, rather than the effects of bodily changes.

The role which I have proposed for bodily changes is that they comprise a component of a primitive emotion, instantiated as a complex state of the organism in which a brain mode having both neurodynamic and neurochemical characteristics will give rise to a behavioural disposition and the physiological states necessary to support that behaviour. The state described can be understood as a separate nonintentional response of the organism directed towards the emotional object - what Solomon has described as a ‘judgment of the body’ (Chapter 21).

I have provided evidence that the intensity of primitive emotional states may be regulated by evaluative processes, and in regulating the primitive emotion, the processes which have caused an appraisal of the emotional object, must be sensitive to the primitive emotional state which is separately directed towards that object, which may conform or conflict with the initial appraisal. In this way the appraisal is influenced by the primitive emotion (Chapter 22).

By this account, the feelings which arise during emotion are the effects of the primitive emotional neurophysiologies and behavioural dispositions as they present in the evaluative process. This separate ‘primitive’ impression allows us to comprehend the objects of value as physical or abstract entities through evaluation, whilst at the same time feeling, not only the importance of those objects, but some quality attaching to that importance. It is as if the object of our thoughts becomes illuminated from a separate source, permitting us to view aspects of that object which our rational processes have not revealed to us. And this perspective, whether it supports or opposes our initial appraisal of an object, seems no less authentic to us than the appraisal itself.

The Implications of a Dual Process Model of Emotion

Advocates of the cognitive-evaluative theory of emotion claim that while physiological changes accompany emotions, it is not the effects of such changes which cause appraisals to have the character of an emotion; rather, they assert that the experiential quality of emotion, which is argued to be distinct from that of everyday cognitions, is bound up in the appraisal process itself. But the need to account for the characteristic turbulence of emotional thought causes the proponents of appraisal theories to distance themselves from more formal theories relating to beliefs, desires and intentions, claiming variously that emotions cause *upheavals of thought* (Nussbaum) or are judgments which *should not be something deliberative, articulate or fully conscious* [rather, they are] *a way of cognitively grappling with the world* (Solomon) or a way of *interpreting one's plight* (Lazarus). But these descriptions, in distinguishing emotional appraisals from more conventional theories of mind do not satisfactorily explain why there should be a corner of our thought processes – the thoughts relating to external matters concerning ourselves – to which this treatment must be applied.

The dual process model directly addresses this problem. It requires nothing more from appraisal processes than that they originate in beliefs. Such beliefs may be explicit, implicit, or concealed as Rorty has described. According to this account, when we make appraisals of external events and states of affairs, certain patterns relating to matters concerning our wellbeing will trigger physiological changes and behavioural impulses. In making such appraisals, we identify core relational themes which carry significance for our wellbeing. These appraisal issues, having the conformation of metastimuli trigger primitive emotions, entailing characteristic neurochemical and neurophysiological changes and behavioural dispositions, which may - or may not - align with an appraisal.

By separating the intentional and nonintentional aspects of emotion in this way, important aspects of emotional experience: the irrational impulses; the alterations in physiology and states of mind; and the sense that we are in some way involved in emotionally exciting states of affairs - all these things are explained by the action of primitive emotions.

The model I have proposed offers a way forward for psychologists and neuroscientists in the study of emotion. Psychologists such as Smith and Lazarus have proposed that certain patterns of appraisal will cause emotions but concede that the conditions they have described as generating emotional cognitions require further investigation and refinement. I have argued that the patterns of appraisal which Smith and Lazarus describe conform to the same categories of metastimuli which trigger primitive emotions. Such an interpretation indicates that a review and re-framing of their research based upon the similarities between core relational themes and metastimuli might provide even greater correlation between emotion and the appraisal issues identified. Benefitting from such a project, philosophers may develop a model of emotional appraisal which may be accommodated more readily within existing theories of mind.

Again, from Panksepp’s text, it is clear that the neuroscience underpinning emotional mechanisms is by no means complete. We know that emotions are accompanied by changes to the neurochemical balance of the brain and that these effects are dauntingly complex. We also know that there are extensive connections between the subcortical circuits which instantiate primitive emotions and mental processes in the neocortex which interpret and regulate these effects; but we have yet to identify neural mechanisms in which appraisal issues are detected as core relational themes having the conformation of metastimuli, which in turn will trigger a primitive emotion.

And it is by no means certain that Panksepp has detected all the primitive emotions. In humans, for example, we observe disgust responses which may upon investigation be found to reflect the strong long-term aversive reactions which mammals display when exposed to poisons or bad food. Again, the distress responses to maternal separation could be argued to be adapted in advanced mammalian species such as primates and cetaceans, so that separation distress has become a primitive emotion which has expanded to encompass the individual and its social group.

The model of emotion I have described, if accepted, makes the explication of all these matters more relevant to a general understanding of the emotional process, because to explain how such mechanisms function is to explain how the behavioural impulses, neurochemistries and physiological alterations associated with primitive emotional states influence appraisals. And by examining the appraisal process, we are able to predict not only the arousal of a particular primitive emotion, but also feelings and dispositions of the subject towards the emotional object as arising separately from the appraisal.

In the preceding paragraphs I have cited aspects of my theory for which there is an absence of confirmatory evidence and I accept that in acquiring such evidence, the theory might be confirmed, refuted or perhaps modified. But I maintain that a theory which has the potential to explain a wide range of emotional experience, whilst being readily refutable, is preferable to a theory which is so constructed that its explanatory elements may not be separately examined and contested.

APPENDIX

Complex Decisions

The effects of feelings - both consistent and inconsistent with an evaluation - are argued by Damasio to provide an indispensable role in complex decision making. He provides evidence for a hybridized system in which we apply ‘somatic markers’ to the evaluative processes which accompany complex decisions, particularly when the matters to be decided involve situations which have implications for ourselves or our interests. In so doing, the judgments concerning elements of the decision-making process which may be inferred rationally are accepted, whilst those elements which evoke strong affective responses are treated as emotionally rather than rationally potent. When this happens Damasio proposes that somatic markers act in this way:

“before you reason toward the solution of a problem something quite important happens: when the bad outcome connected with a given response option comes into mind, however fleetingly, you experience an unpleasant gut feeling. Because the feeling is about the body, I give the phenomenon its technical term ‘somatic’ state [ ] *and because it ‘marks’ an image, I called it a marker.* [ ] *I include both visceral and nonvisceral sensation when I refer to somatic markers.”* (1994 p.172)

In this way, somatic markers act to promote or disqualify some of the constituent elements of complex decisions which seem insoluble by normal inferential processes, hence simplifying the decision-making process. I will provide an example: I receive a more lucrative job offer which requires me to relocate. In making this decision, I take into consideration, *inter alia:*

- relative house prices and costs; removal costs
- my wife’s ability to get an equally good job
- whether I will enjoy the new job as much as my existing one
- whether the new location has as much to offer socially
- my wife’s attitude towards leaving her existing job
- the relative quality of local schools
- our travel costs to and from work

- the attitude of my children upon learning that they must leave their school and friends.

Such decisions, even if we are in full possession of all the facts and the various opinions relating to the present and proposed scenarios, cannot be arrived at by exclusively rational processes. Ultimately, the outcome of the decision will rest - at least in part - upon my feelings about these things: Are my worries about the slightly poorer schools outweighed by the feelings I associate with a potential improvement in wealth and status? How attached are the children to their schools and friends? How concerned does my wife seem about leaving her job? Will she blame me if it goes wrong and how heavily would that weigh upon our relationship? These are matters which must be settled emotionally, even as I embark upon a more rational consideration of the financial and practical aspects of the decision. My feelings might indicate that the children's dismay is transient but my wife's attachment to her current job will cause her to resent me if I pursue this course. And the final decision might weigh a paramount emotional consideration against a financial one; such as a demonstrable improvement in our financial circumstances in the light of my wife's settled feelings against the change.

In support of this argument, Damasio cites cases where brain damage has caused interruption to those pathways in the brain which allow evaluative processes to be influenced by the neural states which generate the underlying sensations he describes. This effect is most noticeable when the decisions taken relate to the subject's private affairs, or his relations with others, often with unfavourable, and sometimes disastrous, results. (1994 pp.33-51).

In support of this account, Damasio cites an example of a patient in which damage to the prefrontal area of the cortex meant that his evaluative processes operated without the support of these visceral and non-visceral sensations:

"I was discussing with the same patient when his next visit to the laboratory should take place. I suggested two alternative dates, both in the coming month and a few

days apart from each other. The patient pulled out his appointment book and began consulting the calendar. The behaviour that ensued, which was witnessed by several investigators, was remarkable. For the better part of half an hour, the patient enumerated reasons for and against each of the two dates: previous engagements, proximity to other engagements, possible meteorological conditions, virtually anything that he could reasonably think about concerning a simple date. [ ] *he was now walking us through a tiresome cost-benefit analysis, an endless outlining and fruitless comparison of options and possible consequences. It took enormous discipline to listen to all of this [ ] but we finally did tell him, quietly, that he should come on the second of the alternative dates. His response was equally prompt and calm. He simply said*: *"That's fine." Back went the appointment book in his pocket and then he was off."* (1994 p.193).

The role which Damasio attributes to the intervention of feelings in life-altering human decisions has profound implications for any concept of mind. It implies that our reasoning processes, if they are based solely upon inferences from facts, will tend to fail us at the moments in our lives when they are most required. At these moments, it is our feelings, when taken into consideration with the feelings of others which often assume a decisive importance.

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